Northeast Residential Lighting Hours-of-Use Study

DRAFT

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Submitted to:

Connecticut Energy Efficiency Board

Cape Light Compact

Massachusetts Energy Efficiency Advisory Council

National Grid Massachusetts

National Grid Rhode Island

New York State Energy Research and Development Authority

NSTAR Electric

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Western Massachusetts Electric

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Contents

Appendix A HOU by Room Type by Income and by Home Type

This appendix presents HOU data by room type, income, home type, and combined income and home type.

Table A-1: HOU for Low-Income Households by Room

Room	CT	MA	RI	UNY	Overall	MHT	DNY	NYSERDA
Bedroom	3.0 (2.3, 3.6) g	2.3 (2.1, 2.6) gh	2.0 (1.1, 3.0) g	1.8 (1.2, 2.4) gh	2.3 (2.1, 2.5) gh	4.0 (2.2, 5.8)	5.0 (4.1, 6.0) abcde	3.8 (3.0, 4.6) bde
Bathroom	2.2 (1.4, 3.0)	2.2 (1.8, 2.5) gh	1.6 (0.5, 2.6) gh	2.6 (1.9, 3.3)	2.2 (1.9, 2.5) gh	2.4 (1.1, 3.7)	5.2 (2.7, 7.7) bce	4.4 (2.7, 6.2) bce
Kitchen	5.1 (4.2, 6.0) c	4.2 (3.9, 4.5) cfgh	2.4 (1.0, 3.8) abefgh	3.9 (3.1, 4.6) fgh	4.2 (3.9, 4.5) cfgh	7.0 (4.8, 9.2) bcde	9.1 (6.0, 12.3) bcde	7.2 (5.2, 9.2) bcde
Living Space	3.8 (2.9, 4.6)	3.1 (2.8, 3.4) g	3.5 (2.4, 4.6)	3.4 (2.7, 4.1)	3.2 (2.9, 3.5) g	5.0 (3.2, 6.8)	5.7 (3.7, 7.7) be	4.6 (3.2, 6.0)
Dining Room	3.5 (2.4, 4.6) f	3.0 (2.5, 3.5) f	2.5 (0.6, 4.5) f	3.2 (2.3, 4.0) f	3.1 (2.6, 3.5) f	7.1 (4.8, 9.5) abcdegh	2.9 (1.3, 4.6) f	2.8 (1.9, 3.7) f
Exterior	5.5 (4.7, 6.4) g	4.5 (4.1, 4.9) g	5.0 (3.7, 6.4) g	4.4 (3.9, 4.9) g	4.5 (4.1, 5.0) g	--	0.6 (0.0, 1.1) abcdeh	3.9 (2.4, 5.5) g
Other	1.8 (1.3, 2.3) g	1.6 (1.4, 1.8) gh	1.4 (0.8, 2.1) gh	1.8 (1.4, 2.3) g	1.6 (1.4, 1.8) gh	3.8 (1.2, 6.5)	4.5 (2.6, 6.3) abcde	3.5 (2.3, 4.8) bce
Overall	3.2 (2.9, 3.5) bcg	2.7 (2.6, 2.8) afgh	2.2 (1.7, 2.7) afgh	2.8 (2.6, 3.1) fgh	2.8 (2.7, 2.9) fgh	4.6 (3.4, 5.8) bcde	5.7 (4.3, 7.0) abcde	4.3 (3.4, 5.2) bcde

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[d] – Statistically different at the 90% confidence level from Upstate NY
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[g] – Statistically different at the 90% confidence level from Downstate NY
[h] – Statistically different at the 90% confidence level from NYSERDA Overall

Table A-2: Sample Sizes, Low-Income Households

Room	CT	MA	RI	UNY	Overall	MHT	DNY	NYSERDA
Bedroom	46	338	16	54	454	18	50	104
Bathroom	32	197	12	50	291	24	49	99
Kitchen	33	258	12	52	355	20	43	95
Living Space	32	243	13	48	336	19	37	85
Dining Room	17	101	1	29	148	7	15	44
Exterior	5	83	1	19	108	1	3	22
Other	44	361	18	60	483	13	41	101
Overall	209	1581	73	312	2175	102	238	550

Table A-3: HOU for Non Low-Income Households by Room

Room	CT	MA	RI	UNY	Overall	MHT	DNY	NYSERDA
Bedroom	2.3 (1.7, 3.0)	1.6 (1.1, 2.0) fg	2.8 (2.0, 3.7)	1.7 (1.0, 2.3) fg	1.9 (1.5, 2.2) fg	3.2 (2.8, 3.7) bdeh	2.9 (2.5, 3.2) bde	2.3 (2.0, 2.6) f
Bathroom	1.3 (0.6, 2.0) f	1.3 (0.8, 1.8) fg	1.3 (0.4, 2.2)	1.5 (0.8, 2.2)	1.3 (1.0, 1.7) fg	2.8 (2.2, 3.5) abe	2.5 (2.0, 2.9) be	2.1 (1.7, 2.4)
Kitchen	4.3 (3.5, 5.0) f	3.8 (3.3, 4.4) fg	4.4 (3.4, 5.4)	4.2 (3.5, 4.8) fg	4.1 (3.7, 4.4) fg	6.1 (5.4, 6.8) abde	5.9 (4.9, 6.9) bde	5.0 (4.4, 5.7)
Living Space	3.7 (3.0, 4.4)	3.5 (2.9, 4.0)	3.6 (2.6, 4.6)	2.9 (2.3, 3.6)	3.4 (3.0, 3.8)	3.5 (2.7, 4.4)	3.9 (2.9, 5.0)	3.7 (2.9, 4.4)
Dining Room	3.0 (2.2, 3.9)	2.5 (1.9, 3.2)	3.6 (2.4, 4.8)	2.3 (1.5, 3.0) g	2.7 (2.2, 3.1)	3.8 (2.6, 4.9)	4.1 (3.1, 5.2) d	3.3 (2.5, 4.1)
Exterior	6.4 (5.9, 7.0) g	5.9 (5.5, 6.3) cg	7.4 (6.7, 8.0) bdegh	6.1 (5.7, 6.6) cg	6.2 (5.8, 6.6) cg	--	3.9 (2.4, 5.4) abcde	4.9 (3.7, 6.1) c
Other	1.7 (1.4, 2.0)	1.9 (1.5, 2.3)	1.9 (1.4, 2.4)	1.6 (1.3, 1.9)	1.8 (1.5, 2.0)	3.3 (1.7, 4.8)	2.4 (1.7, 3.1)	1.9 (1.5, 2.3)
Overall	2.7 (2.4, 2.9) fg	2.6 (2.4, 2.8) fg	2.9 (2.6, 3.3)	2.5 (2.2, 2.7) fg	2.6 (2.5, 2.8) fg	3.7 (3.0, 4.3) abde	3.4 (3.0, 3.7) abde	2.9 (2.5, 3.2)

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Table A-4: Sample Sizes, Non Low-Income Households

Room	CT	MA	RI	UNY	Overall	MHT	DNY	NYSERDA
Bedroom	54	113	31	73	271	90	138	211
Bathroom	47	95	25	57	224	95	136	193
Kitchen	46	93	21	68	228	84	125	193
Living Space	53	106	22	65	246	83	123	188
Dining Room	35	70	15	43	163	44	75	118
Exterior	9	31	6	14	60	0	13	27
Other	96	86	39	89	310	46	117	206
Overall	340	594	159	409	1502	442	727	1136

Table A-5: HOU for Multifamily[1] Households by Room

Room	CT	MA	RI	UNY	Overall	MHT	DNY	NYSERDA
Bedroom	2.7 (2.1, 3.4)	2.3 (1.8, 2.8) f	3.1 (2.1, 4.2)	2.0 (1.5, 2.5) fg	2.3 (2.0, 2.6) fg	3.4 (2.9, 4.0) bde	3.1 (2.7, 3.5) de	2.9 (2.5, 3.2)
Bathroom	2.1 (1.3, 2.8)	1.9 (1.3, 2.4)	2.6 (1.5, 3.7)	2.1 (1.6, 2.7)	2.0 (1.7, 2.4)	2.7 (2.2, 3.3)	2.6 (2.1, 3.0)	2.6 (2.1, 3.0)
Kitchen	4.9 (4.1, 5.6) d	4.0 (3.5, 4.6) fg	3.2 (1.8, 4.5) fgh	3.0 (2.4, 3.7) afgh	3.8 (3.5, 4.2) fgh	6.3 (5.6, 7.1) bcde	6.3 (5.2, 7.4) bcde	5.5 (4.6, 6.3) cde
Living Space	3.6 (2.9, 4.4)	3.3 (2.8, 3.8)	3.1 (2.0, 4.2)	3.3 (2.7, 3.9)	3.4 (3.0, 3.7)	3.9 (3.3, 4.6)	4.1 (2.9, 5.3)	3.9 (3.0, 4.8)
Dining Room	2.9 (2.1, 3.7)	2.6 (2.0, 3.3) fg	1.9 (0.5, 3.3) fg	2.7 (2.0, 3.3) fg	2.7 (2.3, 3.1) fg	4.5 (3.6, 5.3) bcde	4.6 (3.4, 5.8) bcde	4.1 (3.1, 5.0)
Exterior	6.3 (3.9, 8.3) c	6.7 (4.4, 8.5) c	11.3 (8.8, 13.5) ab	--	7.5 (5.3, 9.2)	--	--	--
Other	1.4 (0.9, 1.8) fgh	1.4 (0.9, 1.8) fgh	1.4 (0.5, 2.3) f	2.1 (1.6, 2.7)	1.5 (1.2, 1.8) fgh	3.4 (2.4, 4.5) abce	2.9 (2.1, 3.7) abe	2.8 (2.1, 3.5) abe
Overall	2.8 (2.6, 3.1) fg	2.7 (2.4, 2.9) fgh	2.8 (2.3, 3.4) f	2.5 (2.3, 2.8) fgh	2.7 (2.5, 2.8) fgh	4.0 (3.5, 4.4) abcde	3.8 (3.3, 4.3) abde	3.5 (3.1, 4.0) bde

[1] – Includes multifamily properties with five or more units
[a] – Statistically different at the 90% confidence level from Connecticut
[b] – Statistically different at the 90% confidence level from Massachusetts
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Table A-6: Sample Sizes, Multifamily Households

Room	CT	MA	RI	UNY	Overall	MHT	DNY	NYSERDA
Bedroom	42	89	13	82	226	108	151	233
Bathroom	31	70	10	62	173	119	155	217
Kitchen	38	83	9	64	194	104	139	203
Living Space	36	80	11	58	185	102	133	191
Dining Room	19	35	3	33	90	51	65	98
Exterior	1	3	1	0	5	1	1	1
Other	55	70	8	39	172	59	101	140
Overall	222	430	55	338	1045	544	745	1083

Table A-7: HOU for Single Family[1] Households

Room	CT	MA	RI	UNY	Overall	MHT	DNY	NYSERDA
Bedroom	2.6 (2.0, 3.2)	2.0 (1.7, 2.2)	2.4 (1.7, 3.1)	1.5 (0.8, 2.1)	2.0 (1.8, 2.3)	--	2.3 (1.7, 2.9)	1.9 (1.5, 2.2)
Bathroom	1.4 (0.8, 2.0)	1.7 (1.4, 2.1)	0.9 (0.2, 1.6)	1.7 (1.1, 2.3)	1.6 (1.3, 1.9)	--	1.4 (0.9, 2.0)	1.8 (1.3, 2.3)
Kitchen	4.5 (3.8, 5.2)	4.0 (3.7, 4.4)	3.9 (3.1, 4.8)	4.7 (4.1, 5.3)	4.2 (3.9, 4.5)	--	5.2 (4.0, 6.5)	5.1 (4.4, 5.8)
Living Space	3.8 (3.2, 4.4)	3.3 (2.9, 3.7)	3.5 (2.7, 4.4)	2.9 (2.3, 3.5)	3.3 (3.0, 3.6)	--	5.2 (3.5, 6.8)	3.5 (2.8, 4.3)
Dining Room	3.4 (2.6, 4.1)	2.8 (2.3, 3.2)	3.8 (2.7, 4.9)	2.3 (1.7, 3.0)	2.8 (2.5, 3.2)	--	3.5 (1.2, 5.8)	2.9 (2.0, 3.8)
Exterior	6.0 (5.4, 6.5) [g]	5.4 (5.1, 5.8)	6.0 (5.4, 6.6) [g]	5.4 (5.0, 5.8)	5.5 (5.1, 5.8)	--	3.8 (2.3, 5.3) [ac]	4.7 (3.7, 5.7)
Other	1.9 (1.6, 2.2)	1.8 (1.5, 2.0)	1.6 (1.2, 2.0)	1.6 (1.3, 1.9)	1.8 (1.6, 1.9)	--	1.7 (0.9, 2.4)	1.7 (1.3, 2.0)
Overall	2.9 (2.6, 3.1)	2.7 (2.6, 2.8)	2.5 (2.2, 2.8)	2.6 (2.4, 2.9)	2.7 (2.6, 2.8)	--	2.9 (2.0, 3.8)	2.6 (2.3, 3.0)

[1] – Includes multifamily properties with four or fewer units
[a] – Statistically different at the 90% confidence level from Connecticut
[b] – Statistically different at the 90% confidence level from Massachusetts
[c] – Statistically different at the 90% confidence level from Rhode Island
[d] – Statistically different at the 90% confidence level from Upstate NY
[e] – Statistically different at the 90% confidence level from Overall
[f] – Statistically different at the 90% confidence level from Manhattan
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[h] – Statistically different at the 90% confidence level from NYSERDA Overall

Table A-8: Sample Sizes, Single Family Households

Room	CT	MA	RI	UNY	Overall	MHT	DNY	NYSERDA
Bedroom	58	362	34	45	499	0	37	82
Bathroom	48	222	27	45	342	0	30	75
Kitchen	41	268	24	56	389	0	29	85
Living Space	49	269	24	55	397	0	27	82
Dining Room	33	136	13	39	221	0	25	64
Exterior	13	111	6	33	163	0	15	48
Other	85	377	49	110	621	0	57	167
Overall	327	1745	177	383	2632	0	220	603

Table A-9: HOU for Multifamily[1] Low-Income Households by Room

Room	CT	MA	RI	UNY	Overall	MHT	DNY	NYSERDA
Bedroom	2.8 (1.9, 3.7)	2.6 (2, 3.1) gh	3.6 (1.9, 5.4)	2.0 (1.2, 2.7) gh	2.5 (2.0, 2.9) gh	4.0 (2.2, 5.8)	4.6 (3.5, 5.7) bde	4.0 (3.2, 4.8) bde
Bathroom	2.3 (1.1, 3.4)	2.0 (1.2, 2.7)	2.2 (0.7, 3.8)	2.4 (1.5, 3.3)	2.2 (1.6, 2.7)	2.4 (1.1, 3.7)	3.7 (2.2, 5.2)	4.1 (2.5, 5.8)
Kitchen	5.5 (4.2, 6.9)	4.2 (3.5, 5.0) gh	3.4 (1.3, 5.3) g	3.6 (2.5, 4.6) fgh	4.2 (3.7, 4.8) gh	7.0 (4.8, 9.2) d	8.3 (6.1, 10.6) bcde	7.4 (5.3, 9.5) bde
Living Space	3.9 (2.8, 5.0)	3.5 (2.8, 4.2)	3.6 (2.0, 5.2)	3.8 (2.8, 4.8)	3.7 (3.1, 4.2)	5.0 (3.2, 6.8)	5.4 (3.9, 6.9)	5.1 (3.7, 6.4)
Dining Room	3.2 (1.8, 4.6) f	2.6 (1.7, 3.6) f	--	3.3 (2.3, 4.3) f	3.0 (2.2, 3.6) f	7.1 (4.8, 9.5) abdeh	5.4 (3.3, 7.6)	3.4 (2.2, 4.6) f
Exterior	--	1.8 (0.2, 4.1)	--	--	1.8 (0.2, 4.1)	--	--	--
Other	1.6 (0.9, 2.2) gh	1.4 (0.9, 1.9) gh	1.5 (0.3, 3.1)	2.3 (1.6, 3.0)	1.6 (1.3, 2.0) gh	3.8 (1.2, 6.5)	4.3 (2.7, 5.9) abe	4.0 (2.6, 5.5) abe
Overall	3.1 (2.7, 3.6) g	2.8 (2.5, 3.1) fgh	3.0 (2.1, 3.9) g	2.8 (2.4, 3.2) fgh	2.9 (2.6, 3.1) fgh	4.7 (3.4, 6.0) bde	5.1 (4.1, 6.0) abcde	4.5 (3.6, 5.4) bde

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Table A-10: Sample Sizes, Multifamily Low-Income Households

Room	CT	MA	RI	UNY	Overall	MHT	DNY	NYSERDA
Bedroom	22	67	4	36	129	18	39	75
Bathroom	15	48	4	31	98	24	43	74
Kitchen	18	61	4	28	111	20	38	66
Living Space	17	58	5	26	106	19	33	59
Dining Room	7	22	0	18	47	7	12	30
Exterior	0	3	0	0	3	1	1	1
Other	23	50	2	23	98	13	32	55
Overall	102	309	19	162	592	102	198	360

Table A-11: HOU for Multifamily[1] Non Low-Income Households by Room

Room	CT	MA	RI	UNY	Overall	MHT	DNY	NYSERDA
Bedroom	2.6 (1.8, 3.4)	1.5 (0.8, 2.3) fg	2.8 (1.6, 4.0)	2.0 (1.4, 2.6) f	2.1 (1.7, 2.5) f	3.2 (2.7, 3.7) bde	2.9 (2.5, 3.3) b	2.6 (2.3, 3.0)
Bathroom	1.9 (1.0, 2.8)	1.6 (0.8, 2.4)	3.0 (1.6, 4.6)	1.8 (1.1, 2.6)	1.9 (1.4, 2.4)	2.8 (2.3, 3.4)	2.5 (2.1, 3.0)	2.4 (1.9, 2.8)
Kitchen	3.9 (3.0, 5.0) f	3.4 (2.5, 4.3) fg	3.6 (2.0, 5.3) f	2.9 (2.1, 3.6) fgh	3.3 (2.8, 3.8) fgh	6.1 (5.4, 6.8) abcde	6.0 (4.9, 7.0) bde	5.1 (4.1, 6.1) de
Living Space	3.3 (2.4, 4.3)	2.8 (1.9, 3.6)	3.0 (1.5, 4.4)	2.9 (2.2, 3.6)	3.0 (2.4, 3.5)	3.5 (2.9, 4.2)	3.8 (2.6, 4.9)	3.7 (2.5, 4.8)
Dining Room	2.7 (1.6, 3.8)	2.6 (1.7, 3.6)	1.9 (0.5, 3.4)	2.1 (1.1, 3.0)	2.4 (1.8, 3.0)	3.8 (3.0, 4.5)	4.2 (3.0, 5.4)	3.9 (2.7, 5.1)
Exterior	12.2 (10.5, 14) c	--	17.7 (15.8, 19.6) a	--	15 (13.3, 16.6)	--	--	--
Other	1.2 (0.8, 1.7) f	1.3 (0.7, 1.8) f	1.4 (0.6, 2.2) f	1.9 (1.3, 2.5)	1.4 (1.1, 1.7) f	3.3 (2.3, 4.3) abce	2.6 (1.7, 3.5)	2.4 (1.5, 3.2)
Overall	2.6 (2.2, 2.9) f	2.2 (1.8, 2.5) fgh	3.0 (2.4, 3.7)	2.3 (2.0, 2.6) fg	2.4 (2.2, 2.6) fg	3.6 (3.1, 4.1) abde	3.5 (2.9, 4.0) bde	3.1 (2.6, 3.6) b

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Table A-12: Sample Sizes, Multi Family Non Low-Income Households

Room	CT	MA	RI	UNY	Overall	MHT	DNY	NYSERDA
Bedroom	20	22	9	46	97	90	112	158
Bathroom	16	22	6	31	75	95	112	143
Kitchen	20	22	5	36	83	84	101	137
Living Space	19	22	6	32	79	83	100	132
Dining Room	12	13	3	15	43	44	53	68
Exterior	1	0	1	0	2	0	0	0
Other	32	20	6	16	74	46	69	85
Overall	120	121	36	176	453	442	547	723

Table A-13: HOU for Single Family[1] Low-Income Households by Room

Room	CT	MA	RI	UNY	Overall	MHT	DNY	NYSERDA
Bedroom	3.1 (2.2, 4.0)	2.2 (1.9, 2.6)	1.5 (0.4, 2.6)	1.7 (0.7, 2.7)	2.2 (2.0, 2.5)	--	3.9 (1.7, 6.0)	2.6 (1.7, 3.4)
Bathroom	2.3 (1.2, 3.4)	2.2 (1.8, 2.7)	1.5 (0.3, 2.7)	2.7 (1.6, 3.8)	2.2 (1.8, 2.6)	--	2.7 (0.6, 4.8)	2.8 (1.8, 3.9)
Kitchen	4.4 (3.1, 5.6)	4.2 (3.7, 4.6)	2.7 (1.0, 4.2)	4.3 (3.2, 5.4)	4.1 (3.8, 4.5)	--	9.8 (2.5, 17.2)	5.6 (3.9, 7.3)
Living Space	3.5 (2.3, 4.8)	3.0 (2.5, 3.4)	3.2 (1.8, 4.7)	2.9 (1.8, 3.9)	3.0 (2.6, 3.4)	--	2.2 (0.0, 4.4)	2.6 (1.8, 3.5)
Dining Room	3.7 (2.2, 5.2)	3.1 (2.4, 3.8)	2.5 (0.5, 4.8)	2.9 (1.4, 4.3)	3.1 (2.5, 3.8)	--	3.1 (3.0, 3.3)	3.4 (1.5, 5.3)
Exterior	6.0 (5.2, 6.8) bdeg	4.6 (4.3, 5.0) ag	5.4 (4.1, 6.7) g	4.4 (3.9, 4.9) ag	4.7 (4.3, 5.0) ag	--	0.7 (0.1, 1.4) abcdeh	3.9 (2.3, 5.5) g
Other	2.0 (1.5, 2.6)	1.6 (1.4, 1.8)	1.4 (0.8, 2.1)	1.5 (1.1, 2.0)	1.6 (1.4, 1.8)	--	1.9 (0.9, 3.0)	1.8 (1.3, 2.4)
Overall	3.2 (2.8, 3.6) c	2.7 (2.6, 2.8) c	1.9 (1.4, 2.5) abe	2.8 (2.4, 3.2)	2.7 (2.6, 2.8) c	--	3.7 (2.3, 5.0)	2.8 (2.3, 3.3)

[1] – Includes multifamily properties with four or fewer units
[a] – Statistically different at the 90% confidence level from Connecticut
[b] – Statistically different at the 90% confidence level from Massachusetts
[c] – Statistically different at the 90% confidence level from Rhode Island
[d] – Statistically different at the 90% confidence level from Upstate NY
[e] – Statistically different at the 90% confidence level from Overall
[f] – Statistically different at the 90% confidence level from Manhattan
[g] – Statistically different at the 90% confidence level from Downstate NY
[h] – Statistically different at the 90% confidence level from NYSERDA Overall

Table A-14: Sample Sizes, Single Family Low-Income Households

Room	CT	MA	RI	UNY	Overall	MHT	DNY	NYSERDA
Bedroom	24	271	12	18	325	0	11	29
Bathroom	17	149	8	19	193	0	6	25
Kitchen	15	197	8	24	244	0	5	29
Living Space	15	185	8	22	230	0	4	26
Dining Room	10	79	1	11	101	0	3	14
Exterior	5	80	1	19	105	0	2	21
Other	21	311	16	37	385	0	9	46
Overall	107	1272	54	150	1583	0	40	190

Table A-15: HOU for Single Family[1] Non Low-Income Households by Room

Room	CT	MA	RI	UNY	Overall	MHT	DNY	NYSERDA
Bedroom	2.1 (1.2, 3.1)	1.6 (1.0, 2.3)	2.6 (1.5, 3.8)	1.4 (0.5, 2.4)	1.8 (1.4, 2.3)	--	2.1 (1.5, 2.7)	1.7 (1.3, 2.1)
Bathroom	1.2 (0.4, 2.1)	1.3 (0.6, 2.0)	1.1 (0.2, 2.1)	1.3 (0.4, 2.3)	1.2 (0.7, 1.7)	--	1.3 (0.8, 1.9)	1.6 (1.0, 2.1)
Kitchen	4.4 (3.3, 5.5)	4.0 (3.2, 4.7)	4.4 (3.1, 5.7)	4.7 (3.7, 5.6)	4.3 (3.7, 4.8)	--	4.9 (3.7, 6.2)	5.0 (4.2, 5.8)
Living Space	3.7 (2.7, 4.7)	3.6 (2.8, 4.3)	3.7 (2.3, 5.0)	3.0 (2.0, 4.1)	3.5 (2.9, 4.1)	--	5.4 (3.6, 7.1)	3.7 (2.8, 4.5)
Dining Room	3.0 (1.9, 4.3)	2.6 (1.7, 3.5)	3.5 (1.9, 5.2)	2.4 (1.3, 3.5)	2.7 (2.1, 3.4)	--	3.5 (1.1, 5.9)	2.8 (1.8, 3.8)
Exterior	6.0 (5.6, 6.5) [g]	6.0 (5.6, 6.4) [g]	6.2 (5.7, 6.7) [g]	5.8 (5.3, 6.2)	6.0 (5.5, 6.4)	--	3.9 (2.3, 5.5) [abc]	4.9 (3.7, 6.1)
Other	1.8 (1.5, 2.2)	2.0 (1.7, 2.4)	1.9 (1.4, 2.3)	1.6 (1.3, 2.0)	1.8 (1.6, 2.1)	--	1.7 (0.9, 2.5)	1.6 (1.2, 2.1)
Overall	2.7 (2.3, 3.0)	2.7 (2.4, 3.0)	2.8 (2.3, 3.2)	2.5 (2.2, 2.8)	2.7 (2.5, 2.9)	--	2.7 (1.7, 3.6)	2.5 (2.0, 2.9)

[1] – Includes multifamily properties with four or fewer units
[a] – Statistically different at the 90% confidence level from Connecticut
[b] – Statistically different at the 90% confidence level from Massachusetts
[c] – Statistically different at the 90% confidence level from Rhode Island
[d] – Statistically different at the 90% confidence level from Upstate NY
[e] – Statistically different at the 90% confidence level from Overall
[f] – Statistically different at the 90% confidence level from Manhattan
[g] – Statistically different at the 90% confidence level from Downstate NY
[h] – Statistically different at the 90% confidence level from NYSERDA Overall

Table A-16: Sample Sizes, Single Family Non Low-Income Households

Room	CT	MA	RI	UNY	Overall	MHT	DNY	NYSERDA
Bedroom	34	91	22	27	174	0	26	53
Bathroom	31	73	19	26	149	0	24	50
Kitchen	26	71	16	32	145	0	24	56
Living Space	34	84	16	33	167	0	23	56
Dining Room	23	57	12	28	120	0	22	50
Exterior	8	31	5	14	58	0	13	27
Other	64	66	33	73	236	0	48	121
Overall	220	473	123	233	1049	0	180	413

Appendix B Additional Maps

Figure B-1: Income Category

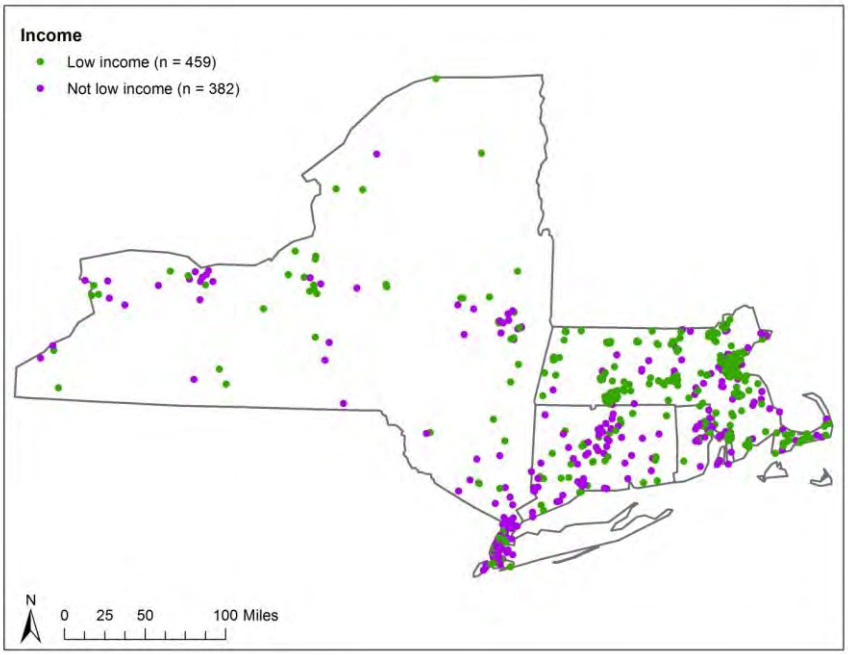


Figure B-2: Housing Type

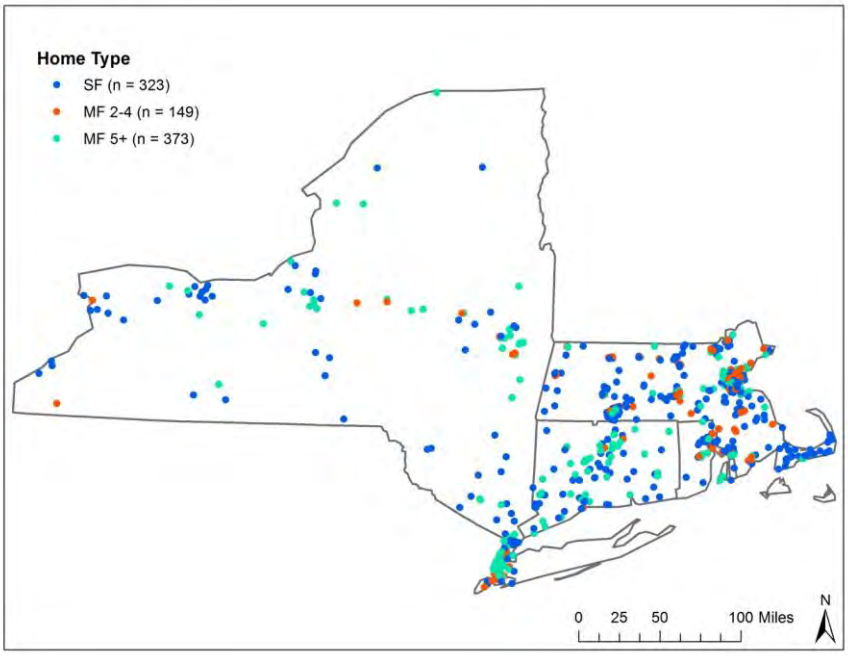


Figure B-3: Bathroom Lighting Logger Locations

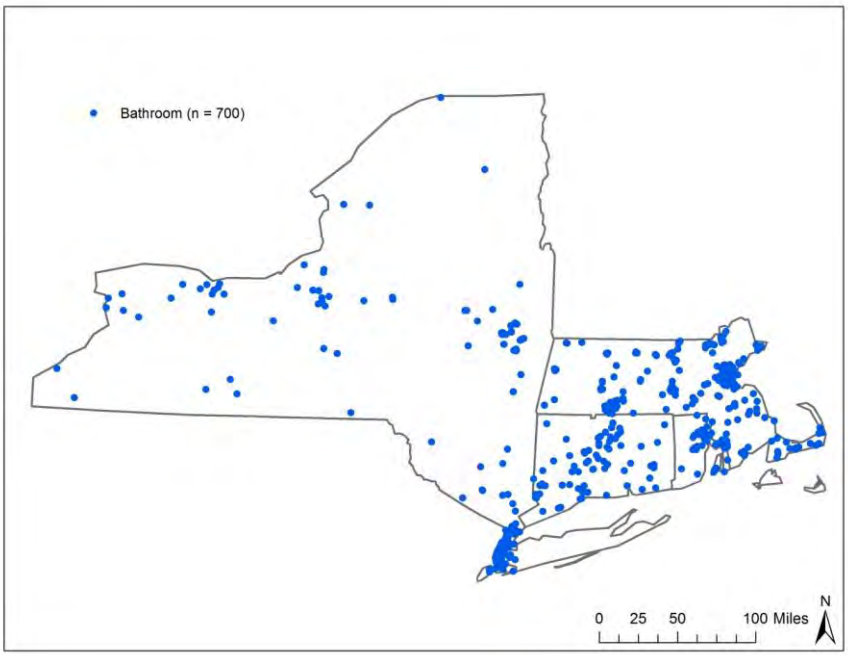


Figure B-4: Bedroom Lighting Logger Locations

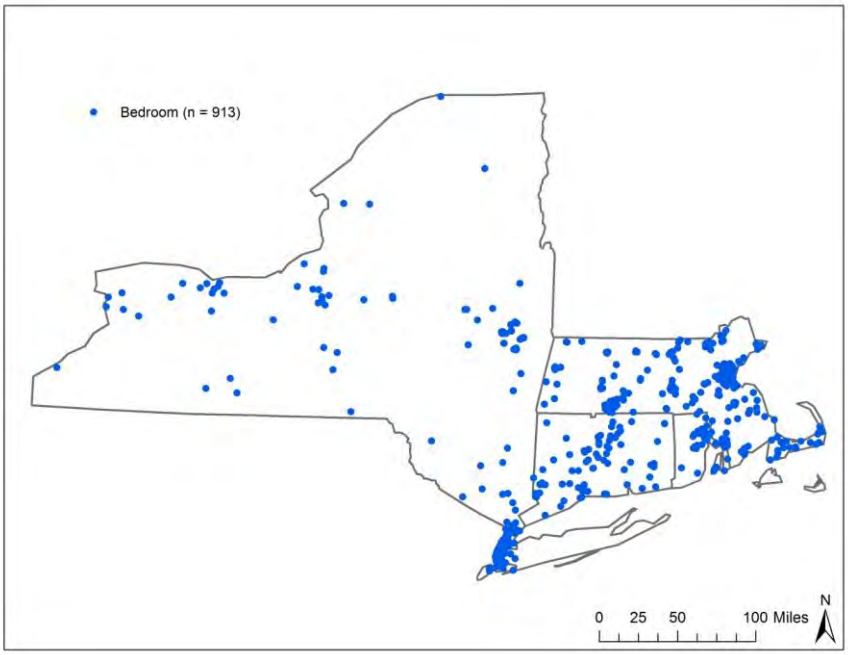


Figure B-5: Dining Room Lighting Logger Locations

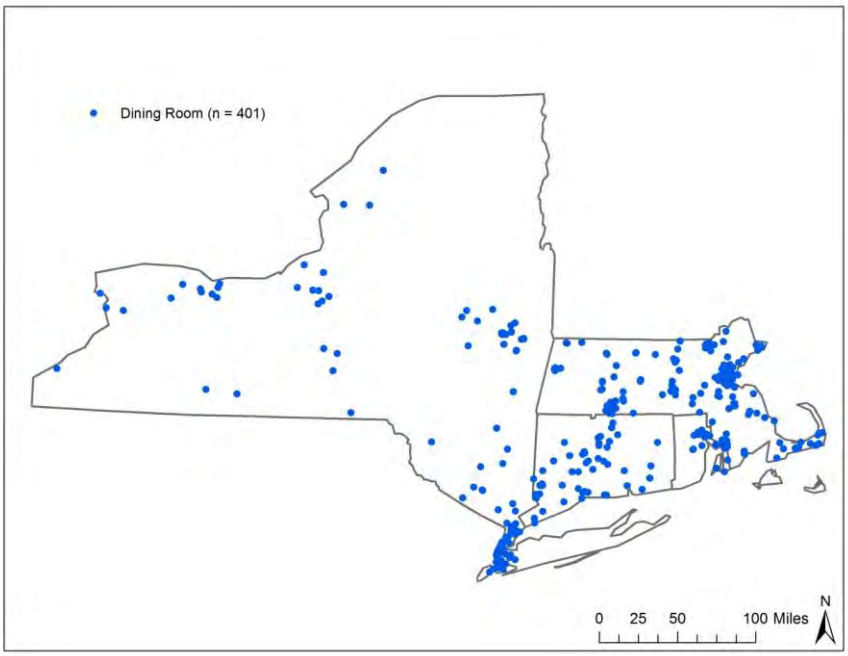


Figure B-6: Exterior Lighting Logger Locations

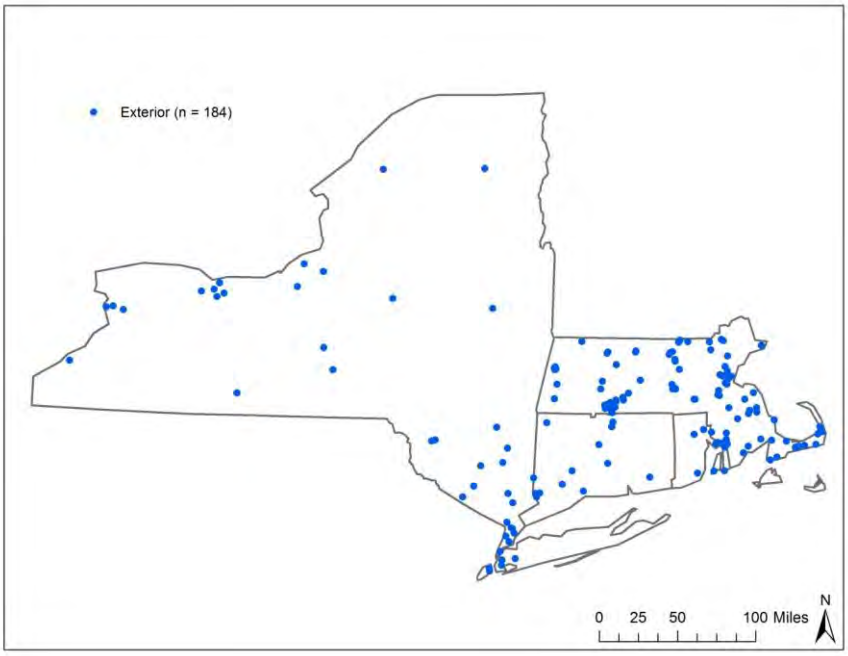


Figure B-7: Kitchen Lighting Logger Locations

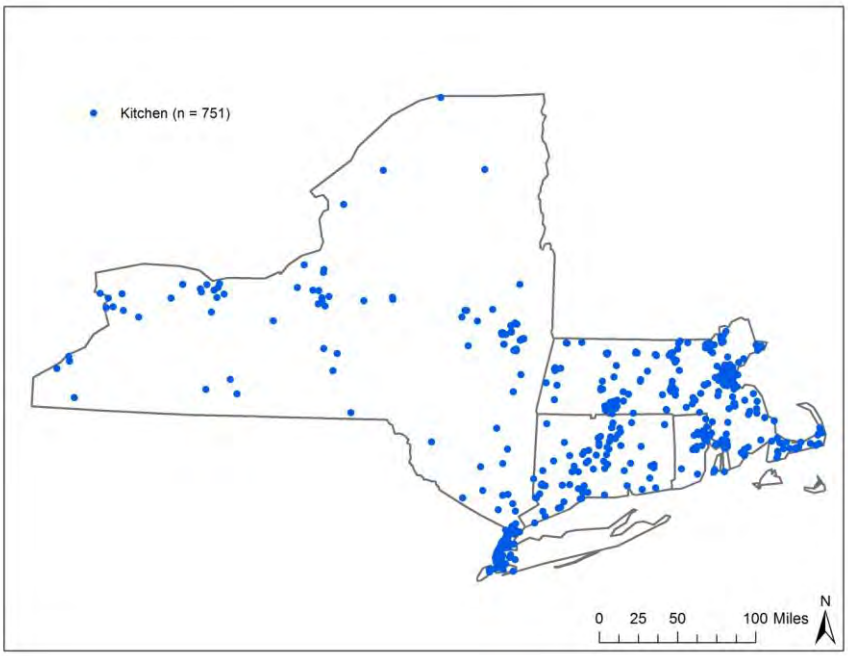
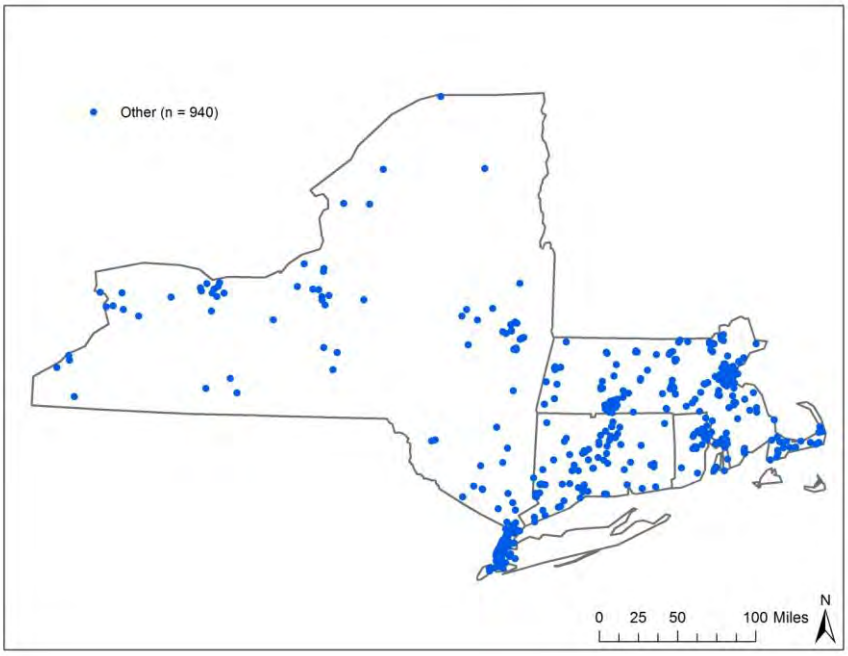


Figure B-8: Other Room Types Lighting Logger Locations[1]



[1] "Other" room types include: Basement, Closet, Den, Foyer, Garage, Hall, Office, Utility, and Other

Appendix C **Additional Load Curves**

Figure C-1: Overall Summer and Winter Weekday vs. Weekend

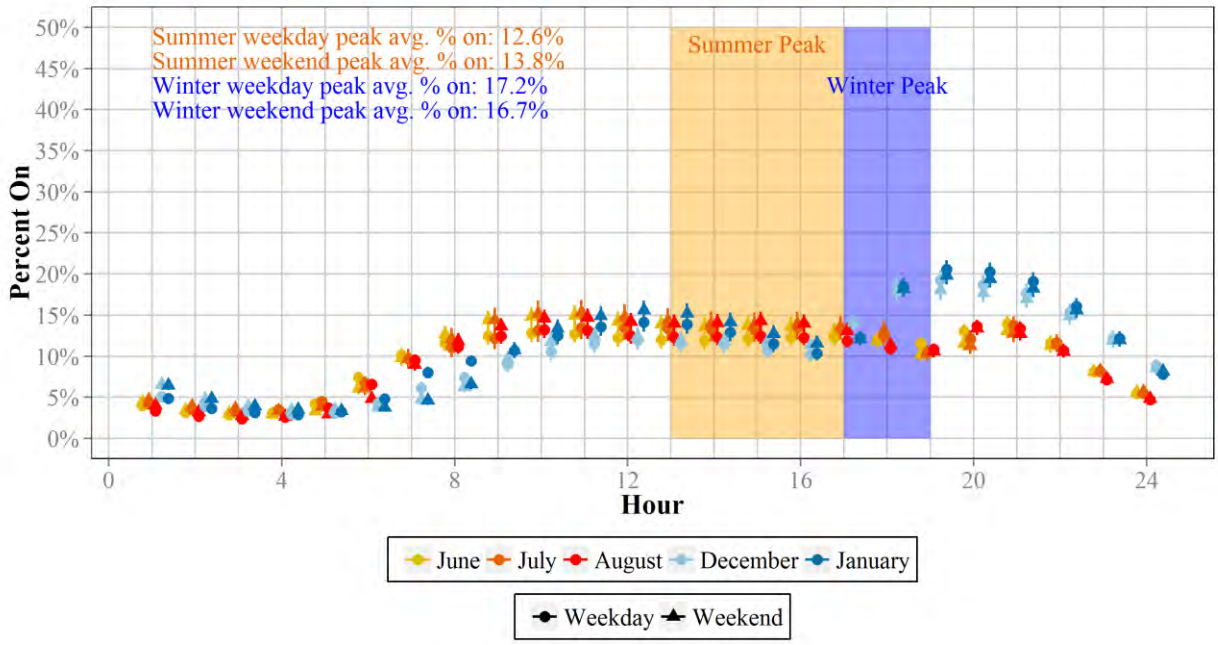


Figure C-2: Connecticut – Weekday by Month

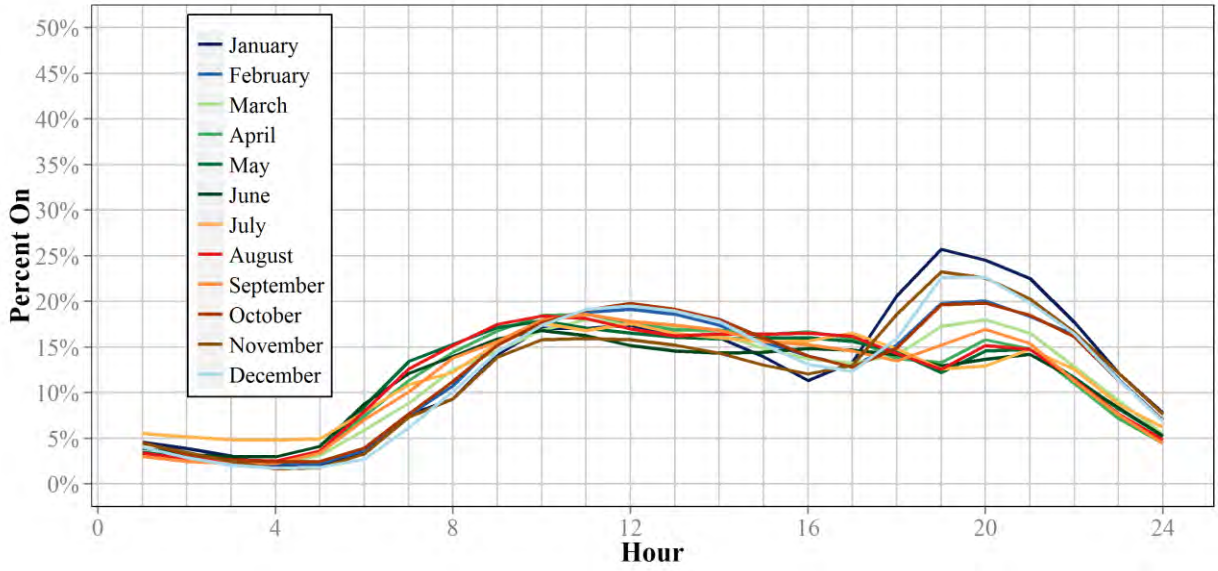


Figure C-3: Massachusetts – Weekday by Month

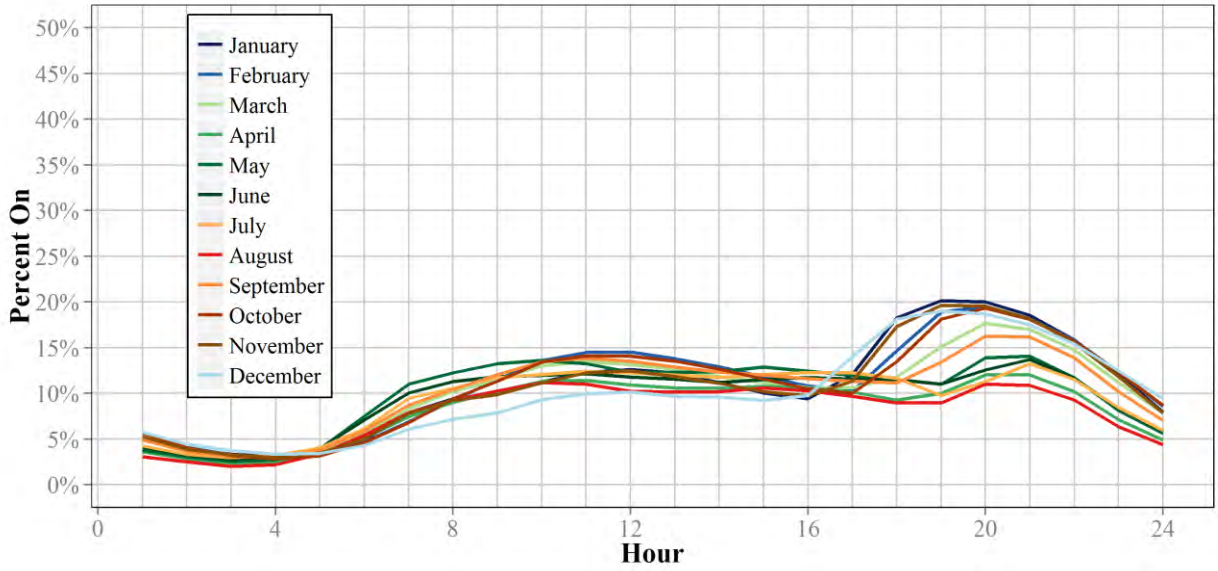


Figure C-4: Rhode Island – Weekday by Month

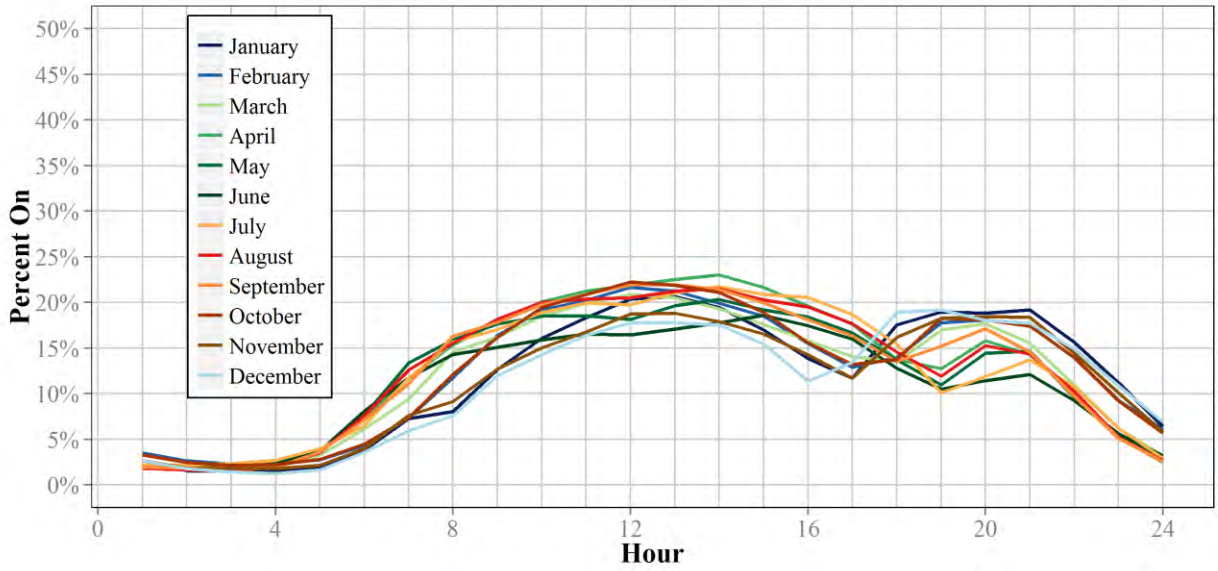


Figure C-5: Upstate New York – Weekday by Month

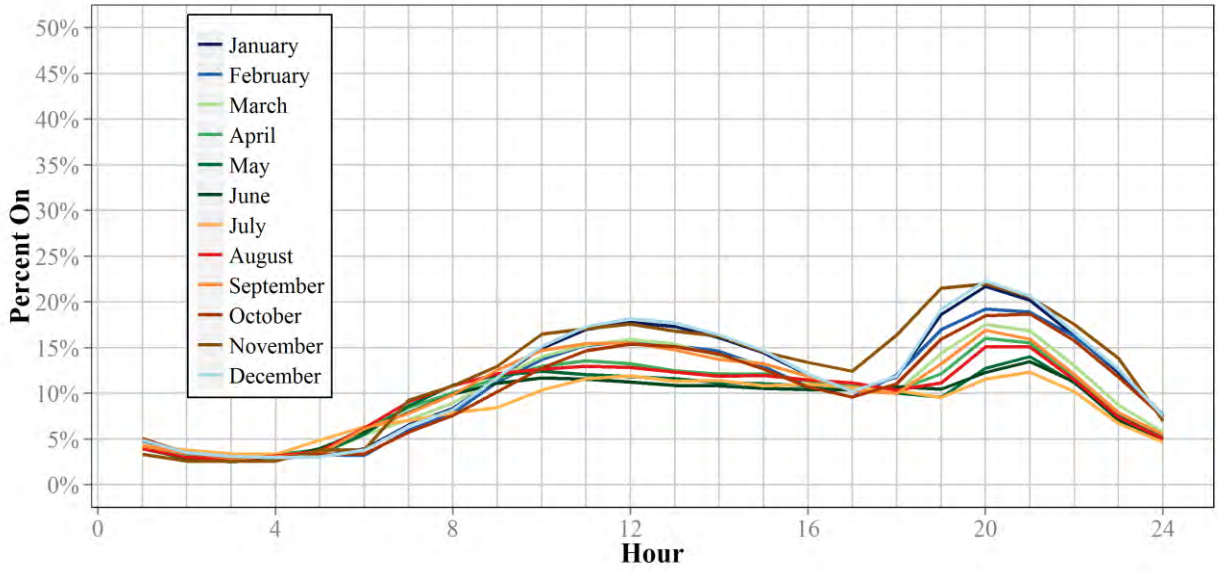


Figure C-6: Overall – Weekday by Month

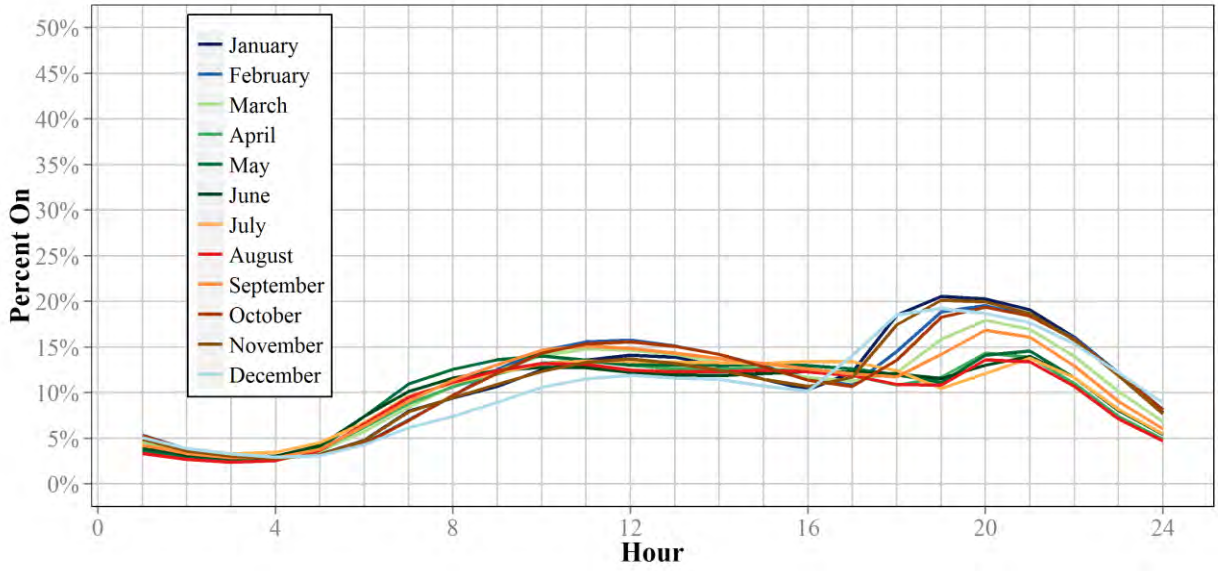


Figure C-7: Manhattan – Weekday by Month

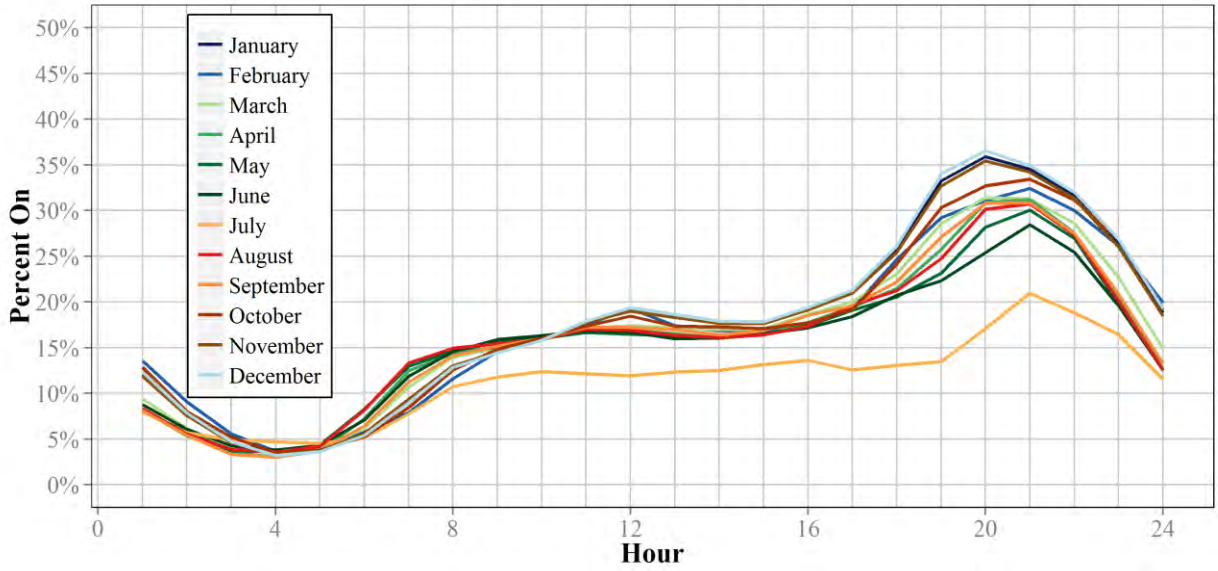


Figure C-8: Downstate New York – Weekday by Month

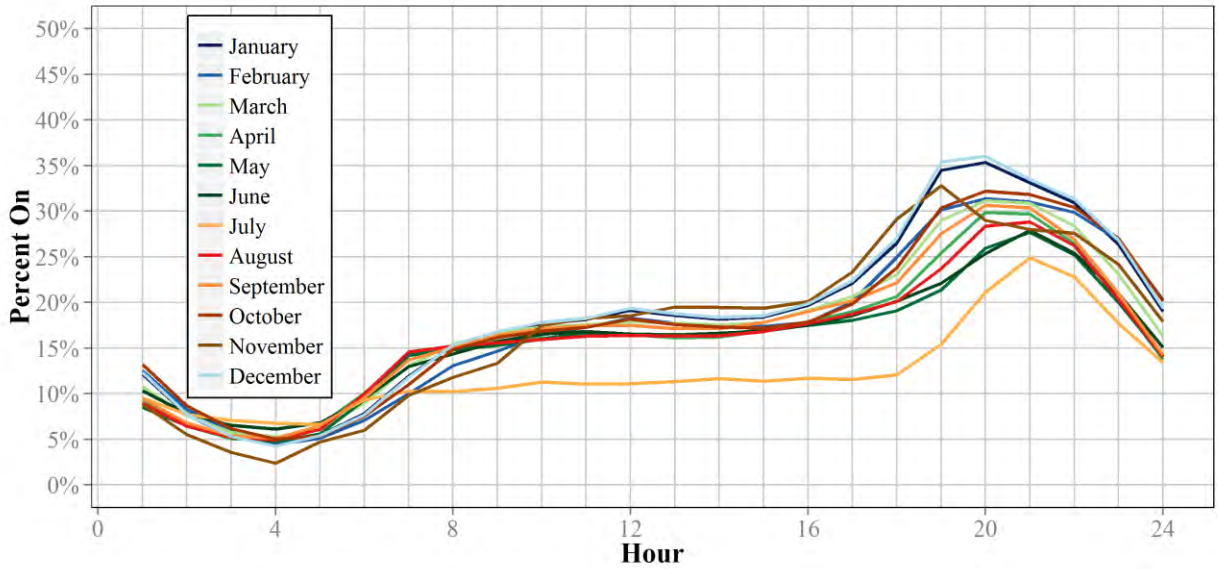


Figure C-9: NYSERDA – Weekday by Month

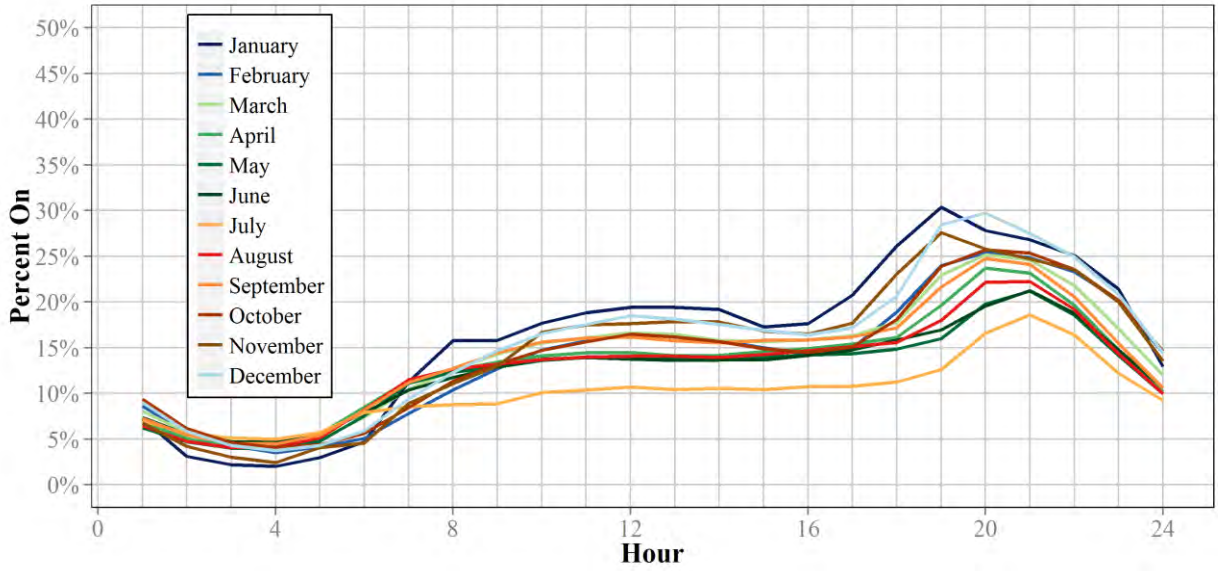


Figure C-10: Connecticut – Summer and Winter Weekend

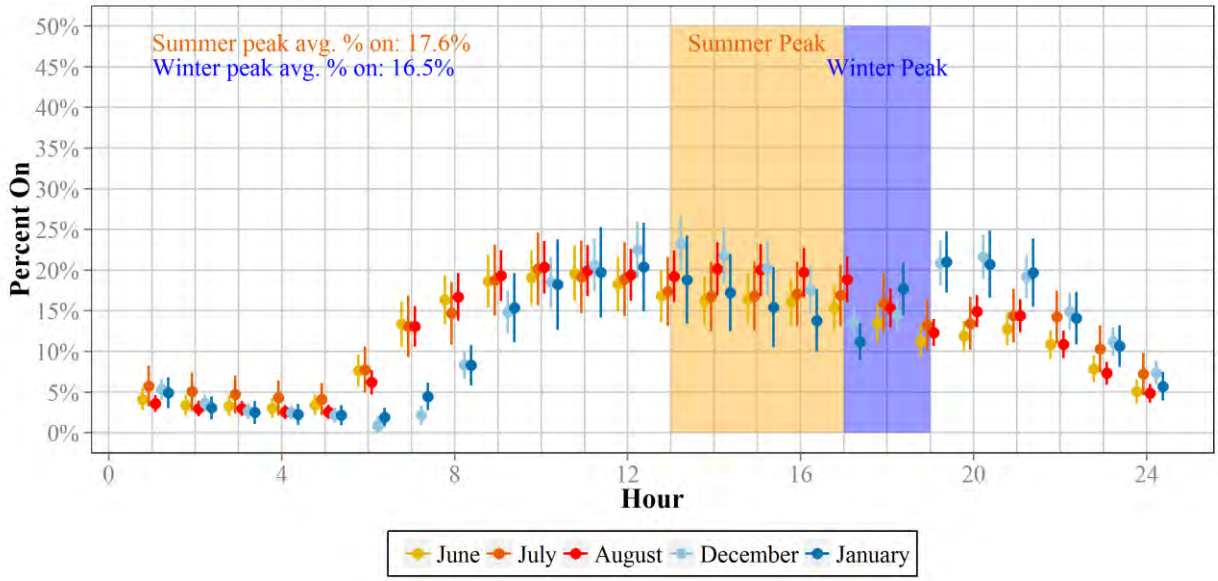


Figure C-11: Massachusetts – Summer and Winter Weekend

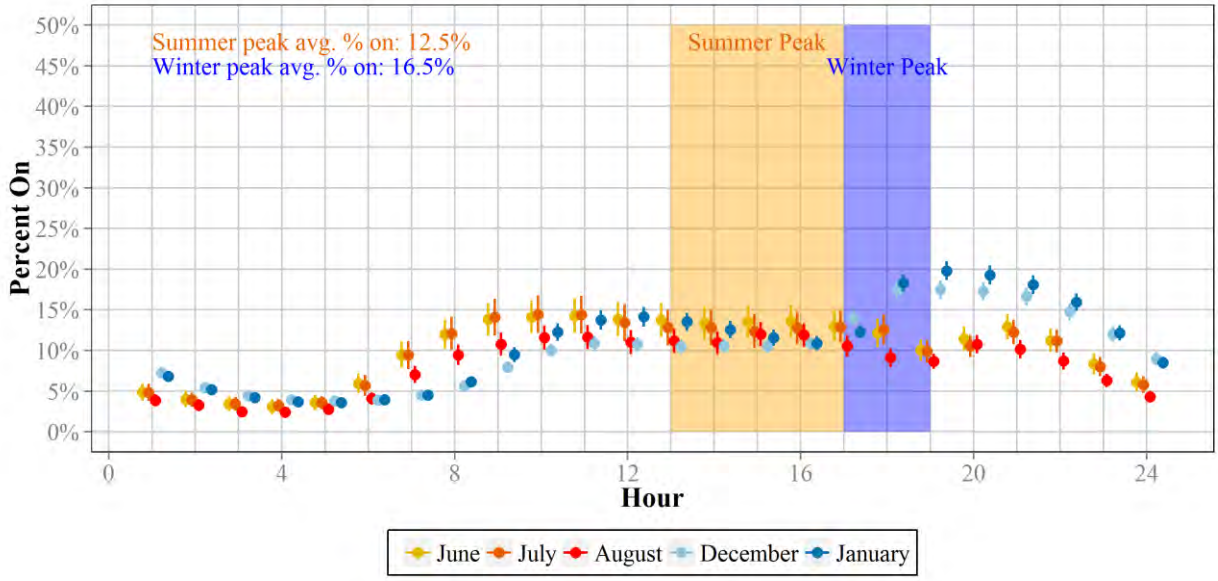


Figure C-12: Rhode Island – Summer and Winter Weekend

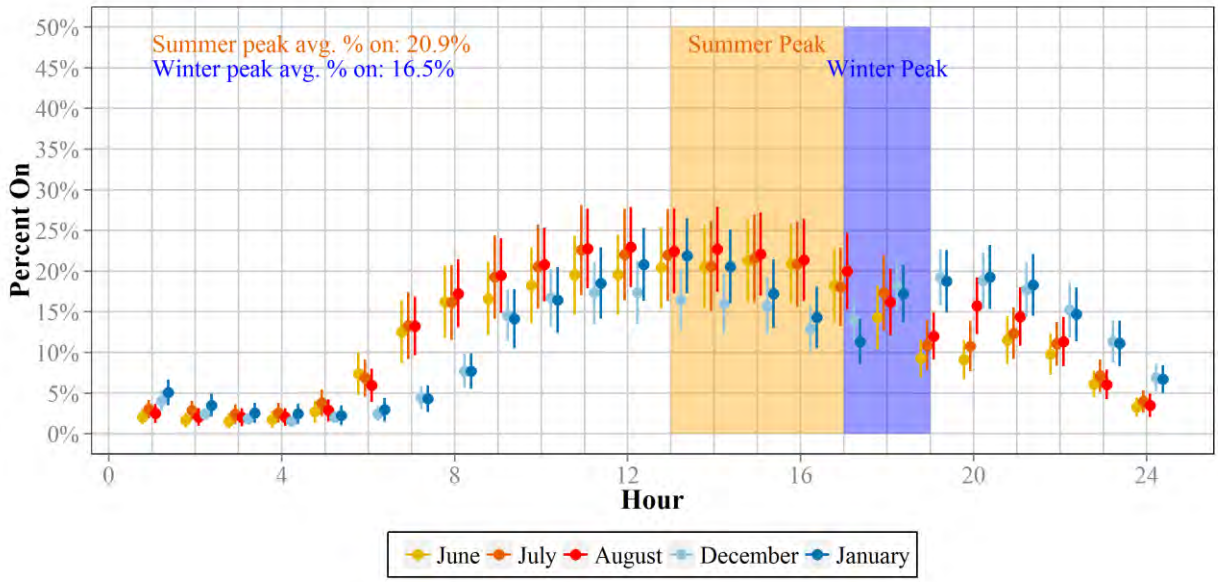


Figure C-13: Upstate New York – Summer and Winter Weekend

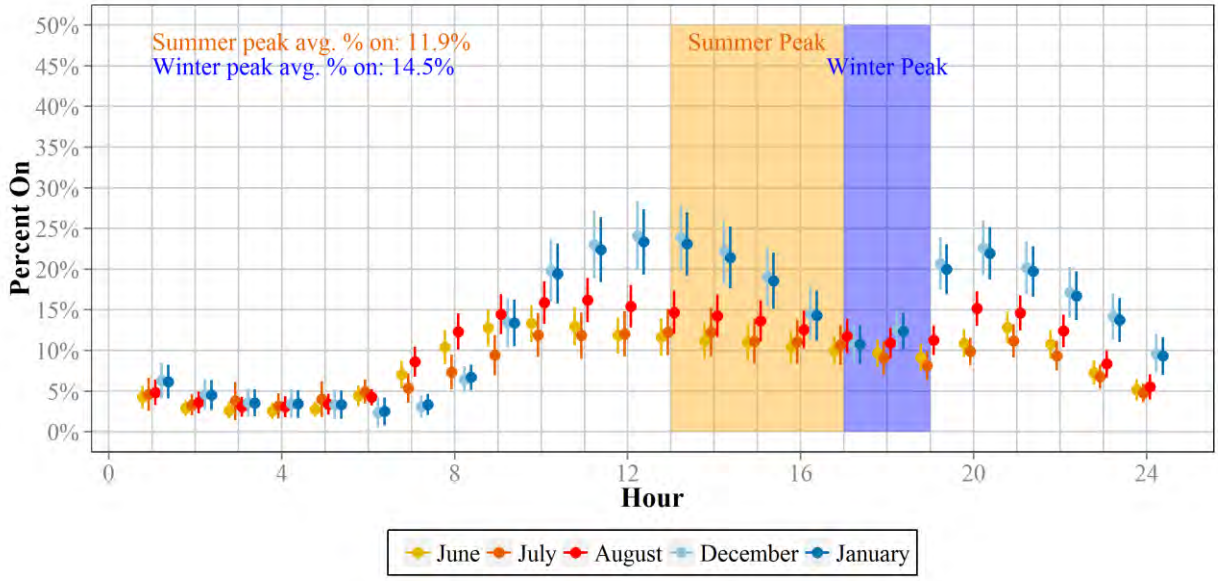


Figure C-14: Overall – Summer and Winter Weekend

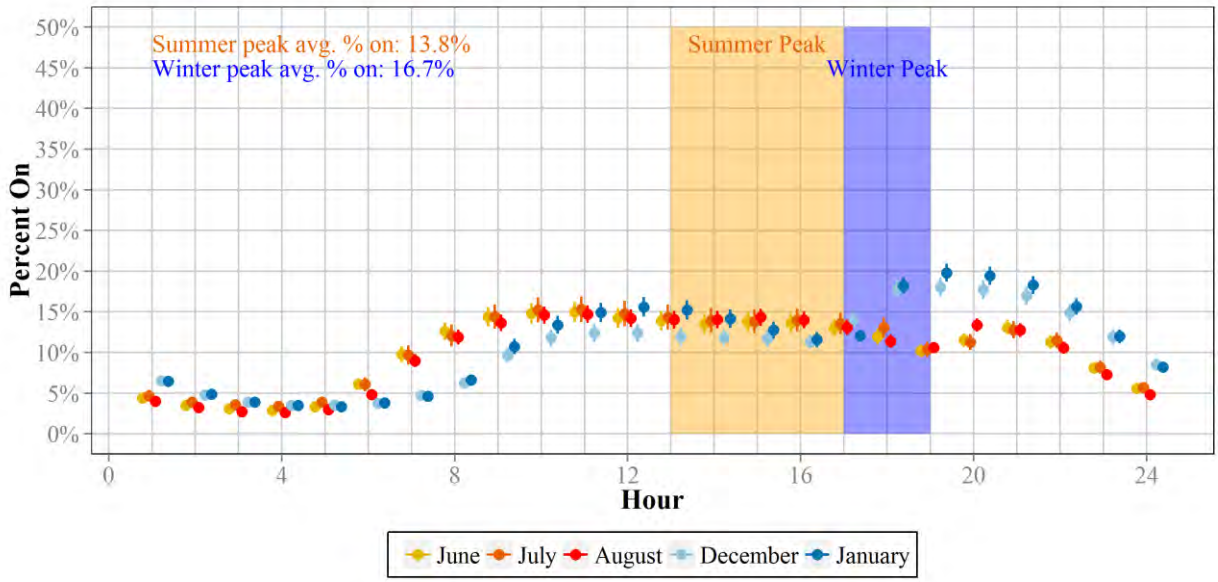


Figure C-15: Manhattan – Summer and Winter Weekend

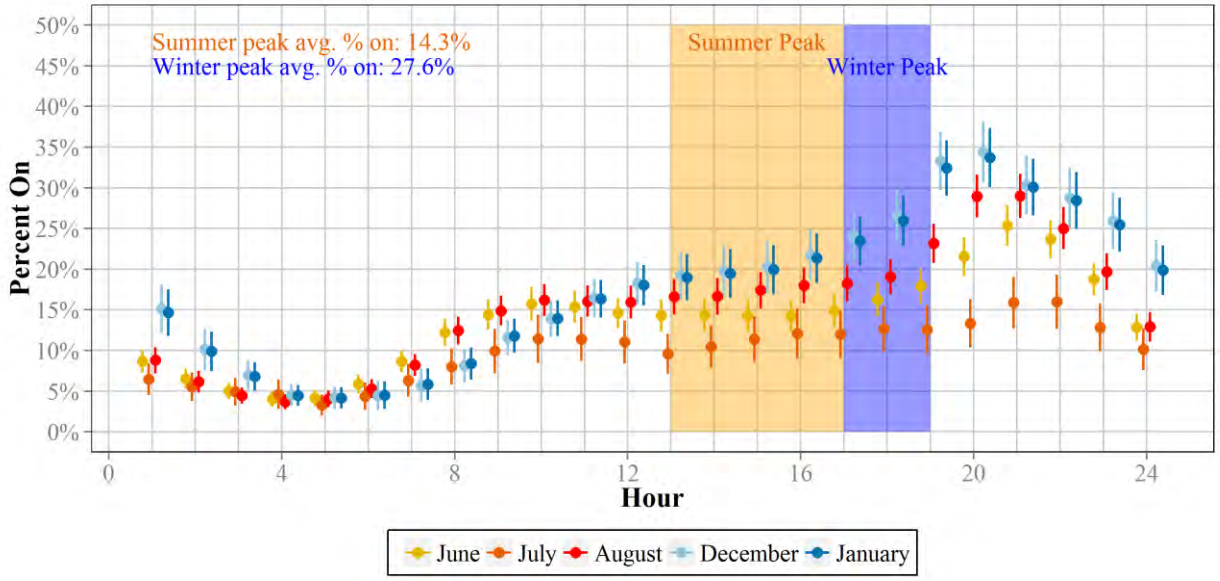


Figure C-16: Downstate New York – Summer and Winter Weekend

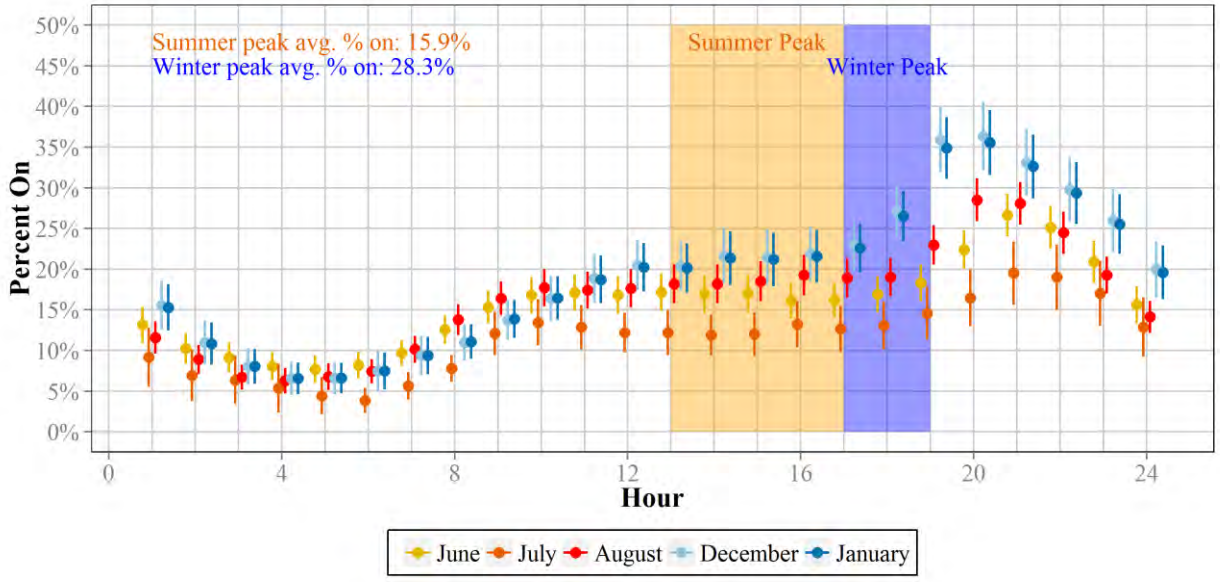


Figure C-17: NYSERDA – Summer and Winter Weekend

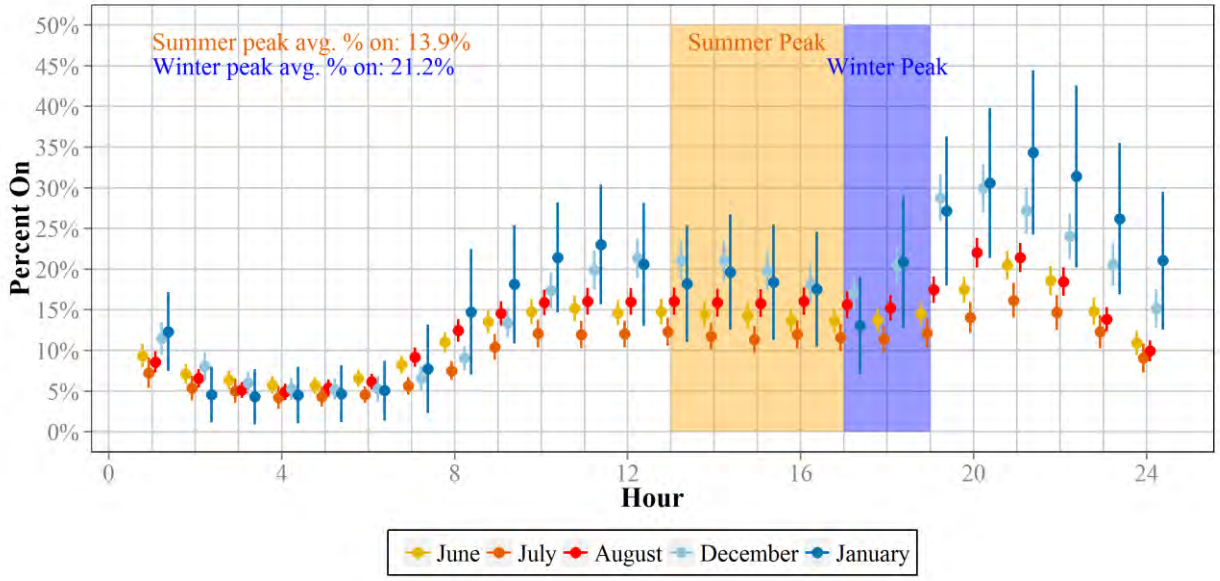


Figure C-18: Connecticut – Summer and Winter Weekday by Income

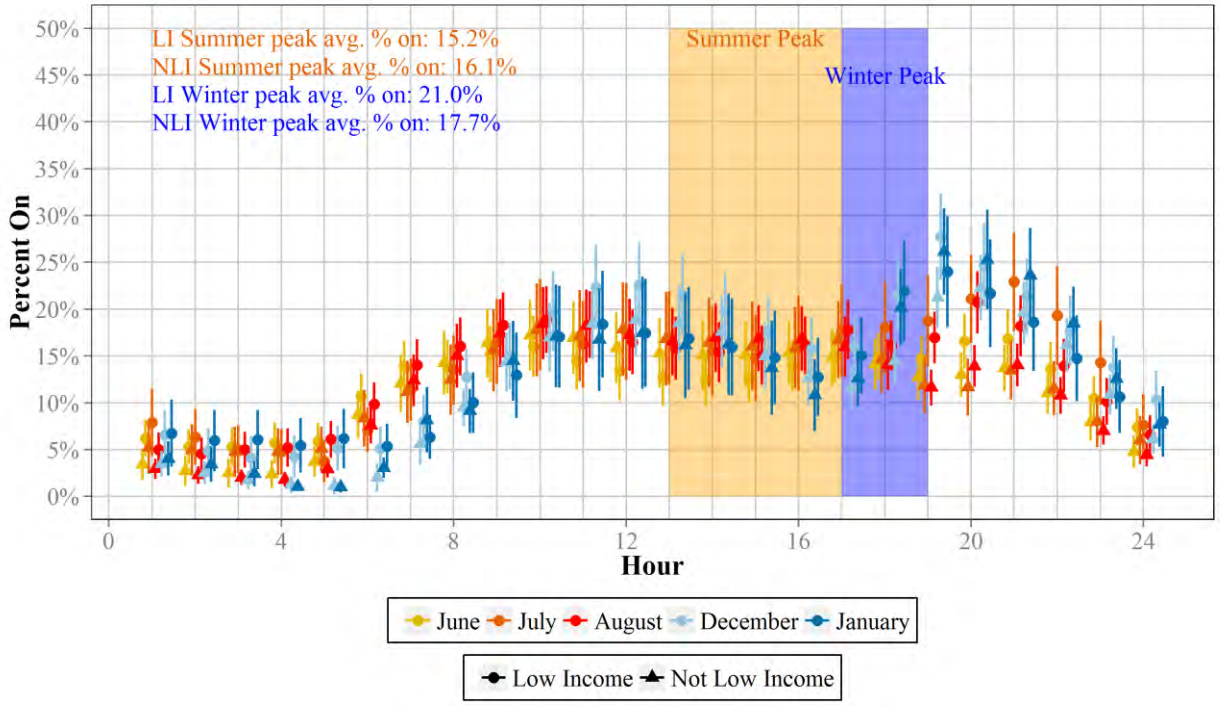


Figure C-19: Massachusetts – Summer and Winter Weekday by Income

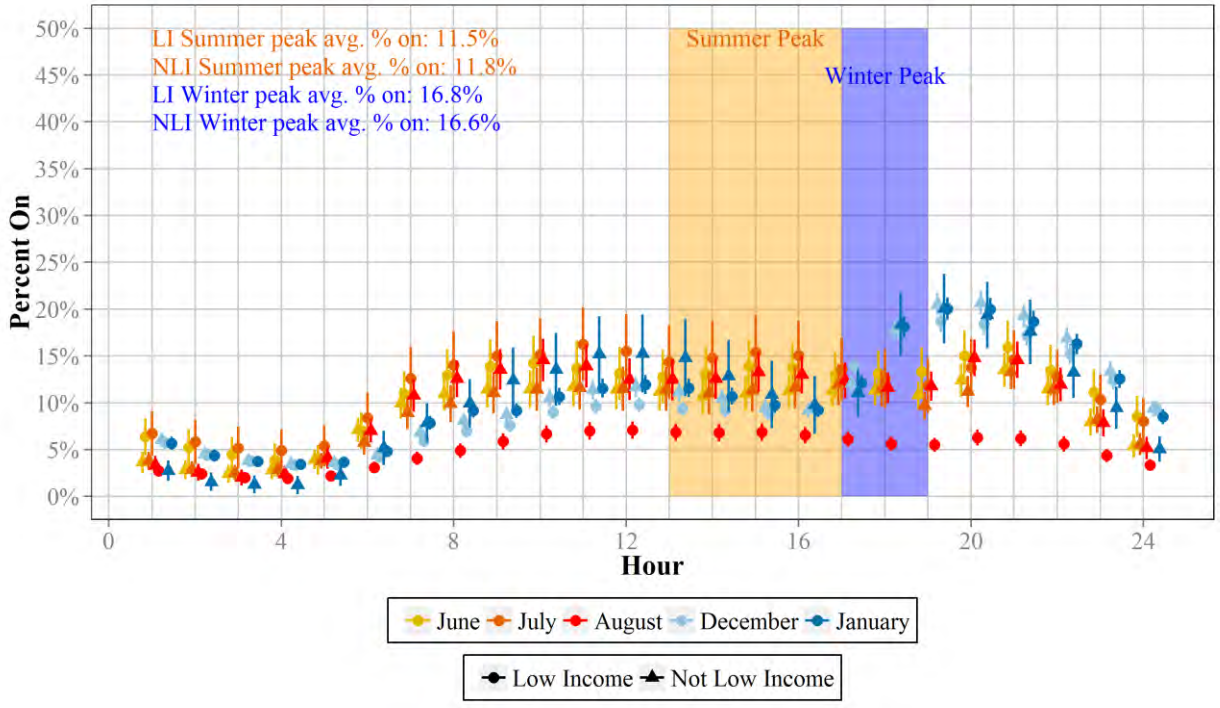


Figure C-20: Rhode Island – Summer and Winter Weekday by Income

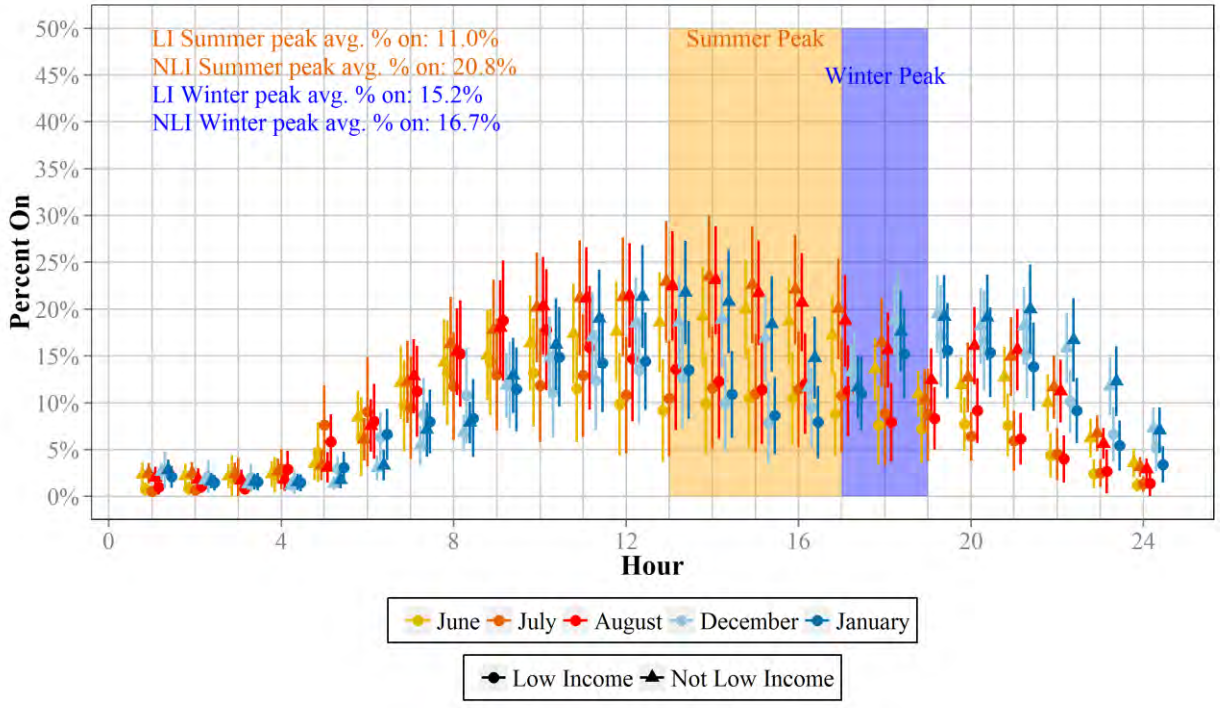


Figure C-21: Upstate New York – Summer and Winter Weekday by Income

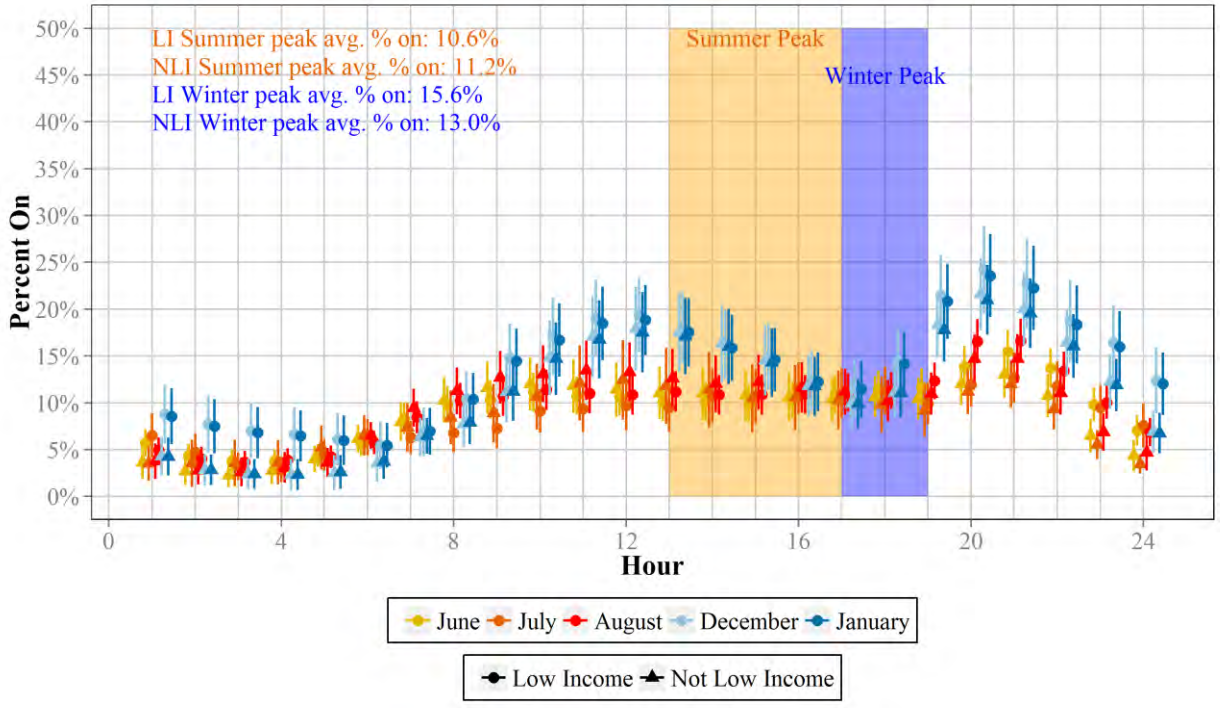


Figure C-22: Overall – Summer and Winter Weekday by Income

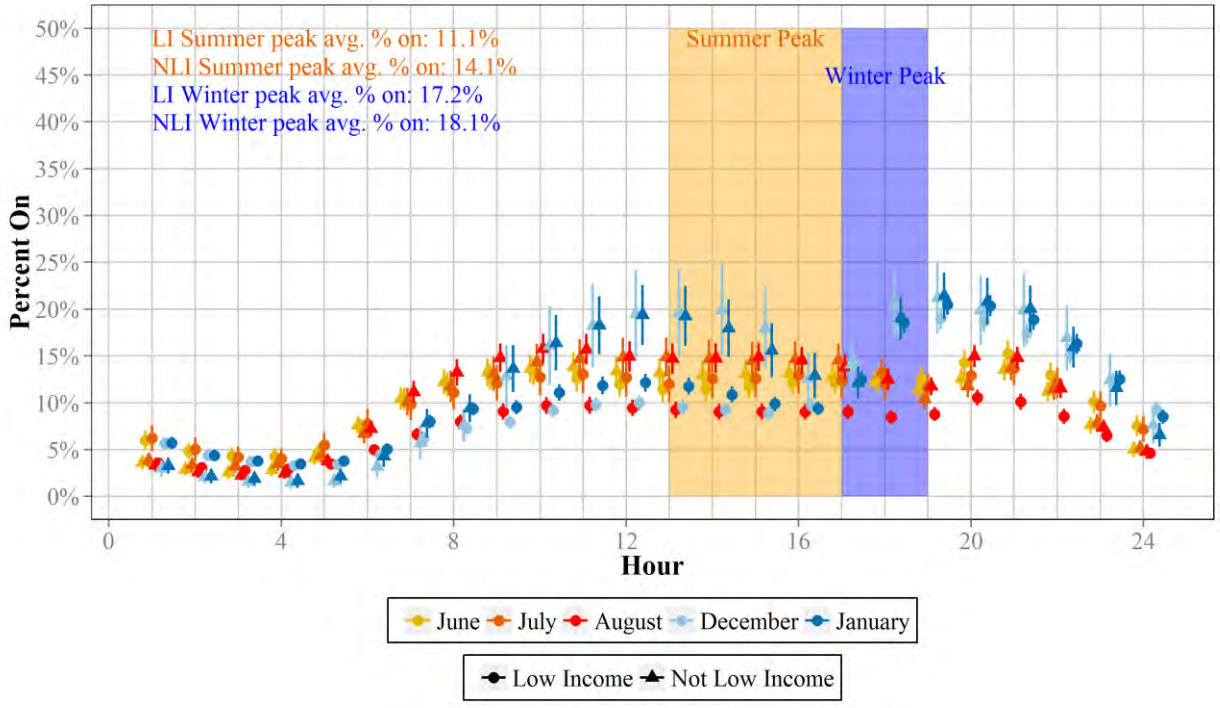


Figure C-23: Manhattan – Summer and Winter Weekday by Income

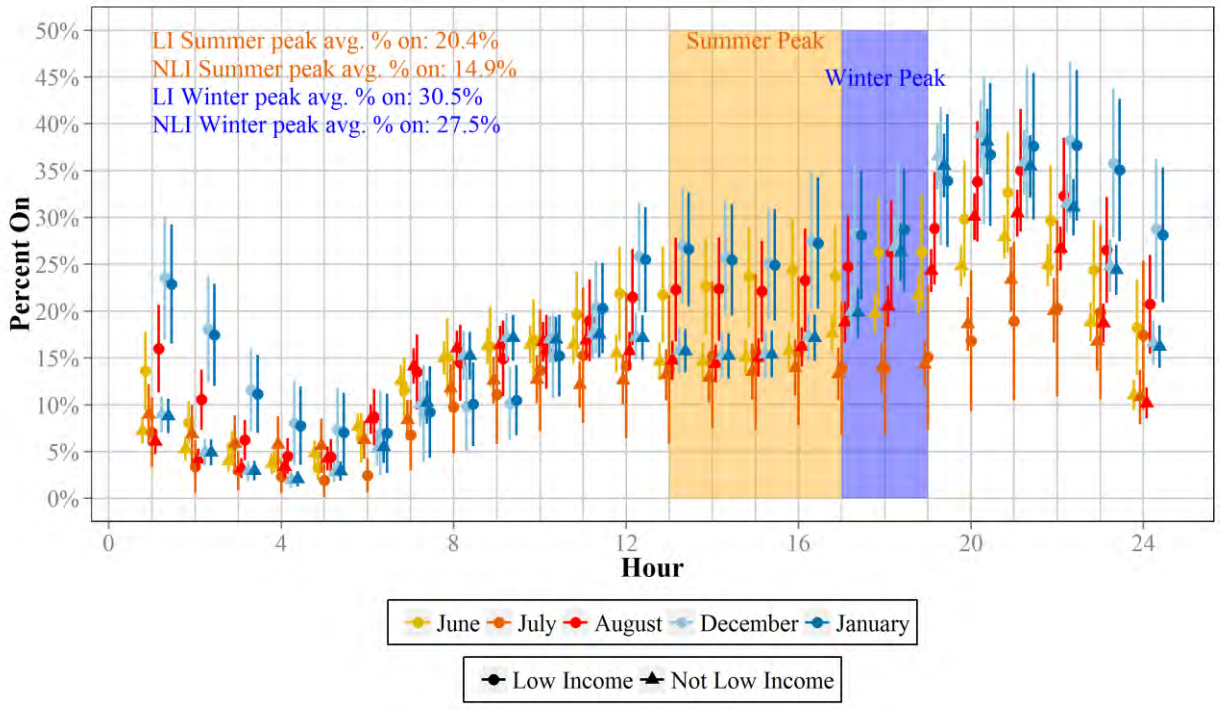


Figure C-24: Downstate New York – Summer and Winter Weekday by Income

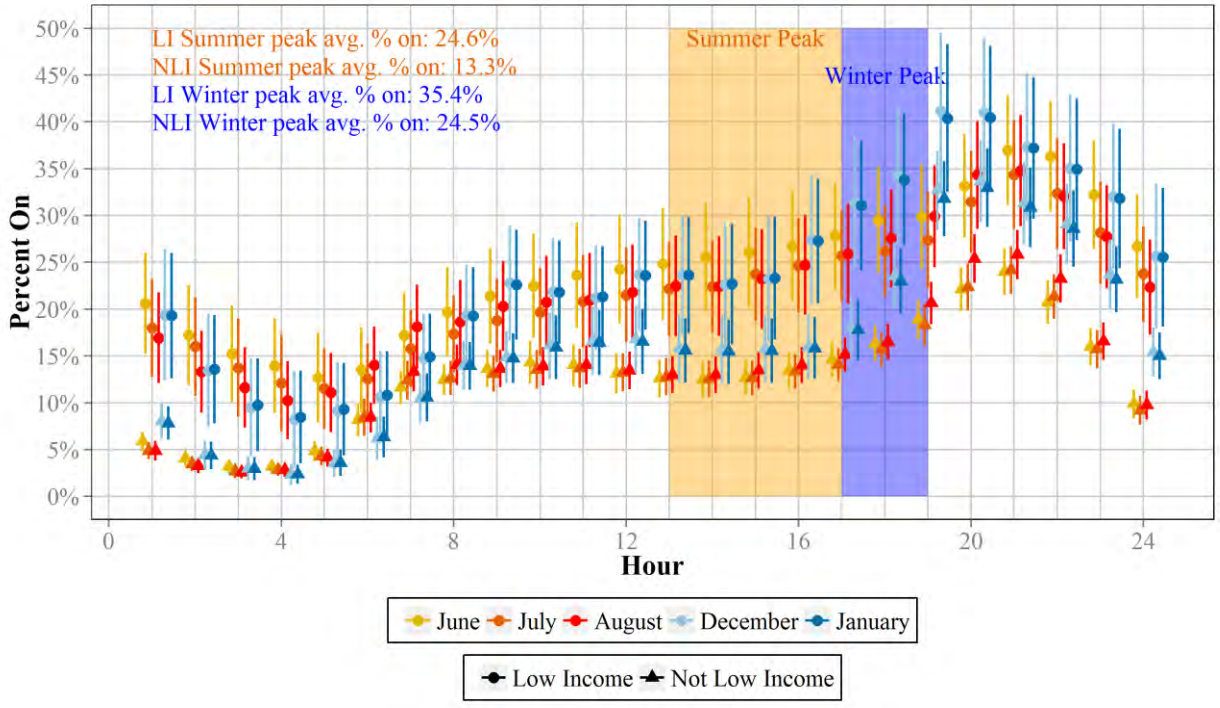


Figure C-25: NYSERDA – Summer and Winter Weekday by Income

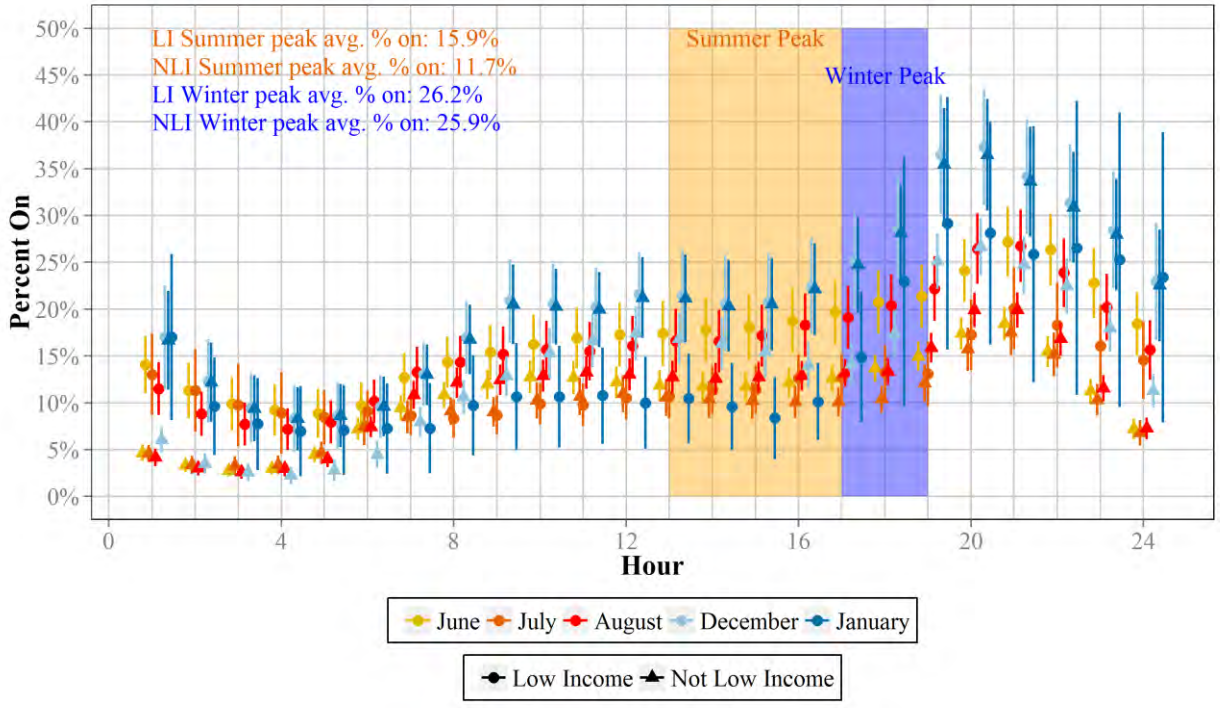


Figure C-26: Connecticut – Summer and Winter Weekday by Housing Type

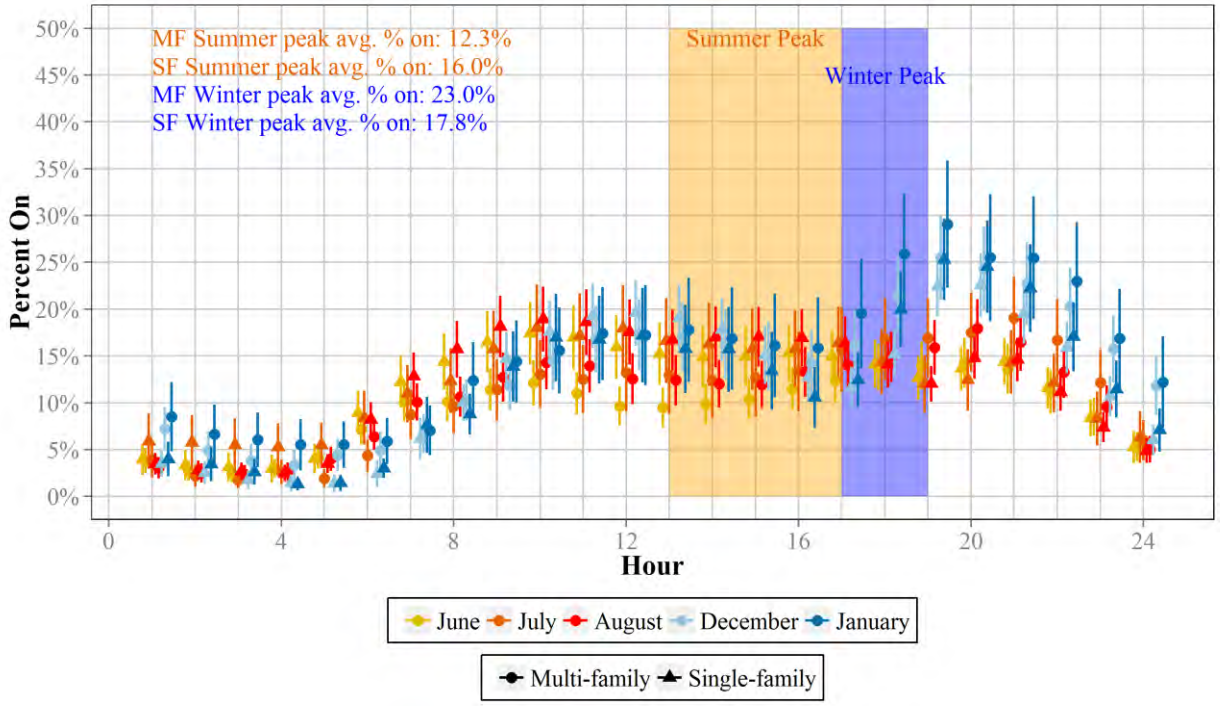


Figure C-27: Massachusetts – Summer and Winter Weekday by Housing Type

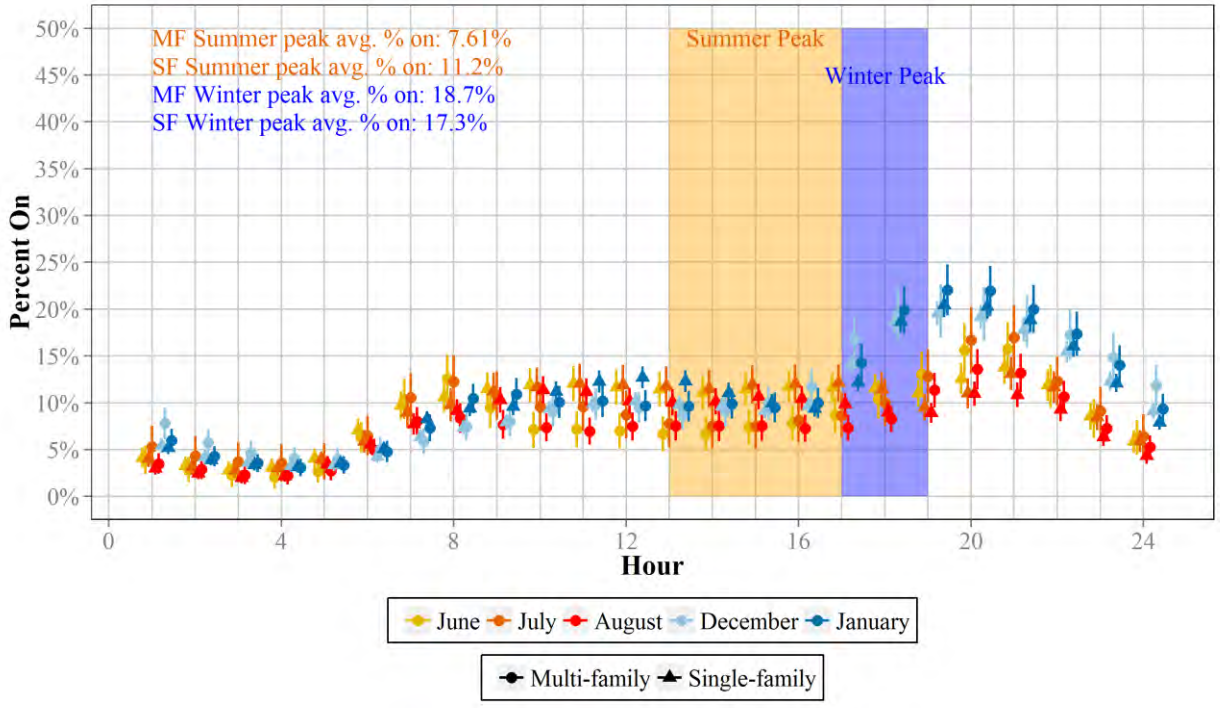


Figure C-28: Rhode Island – Summer and Winter Weekday by Housing Type

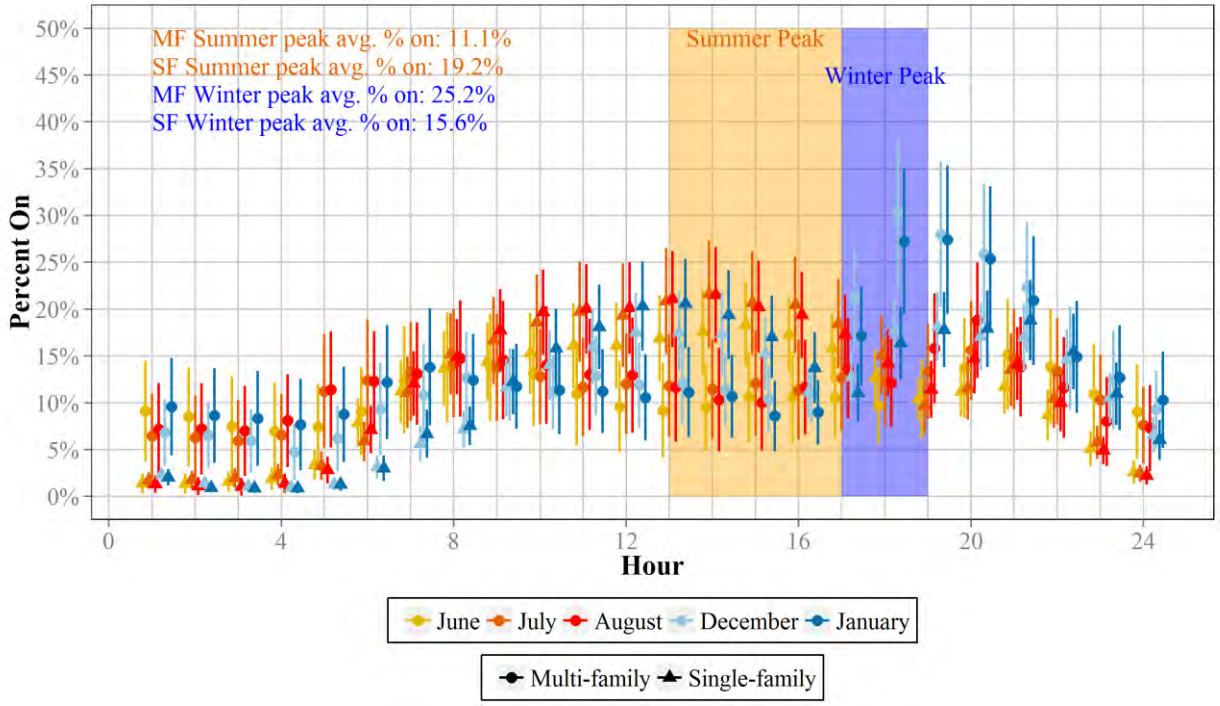


Figure C-29: Upstate New York – Summer and Winter Weekday by Housing Type

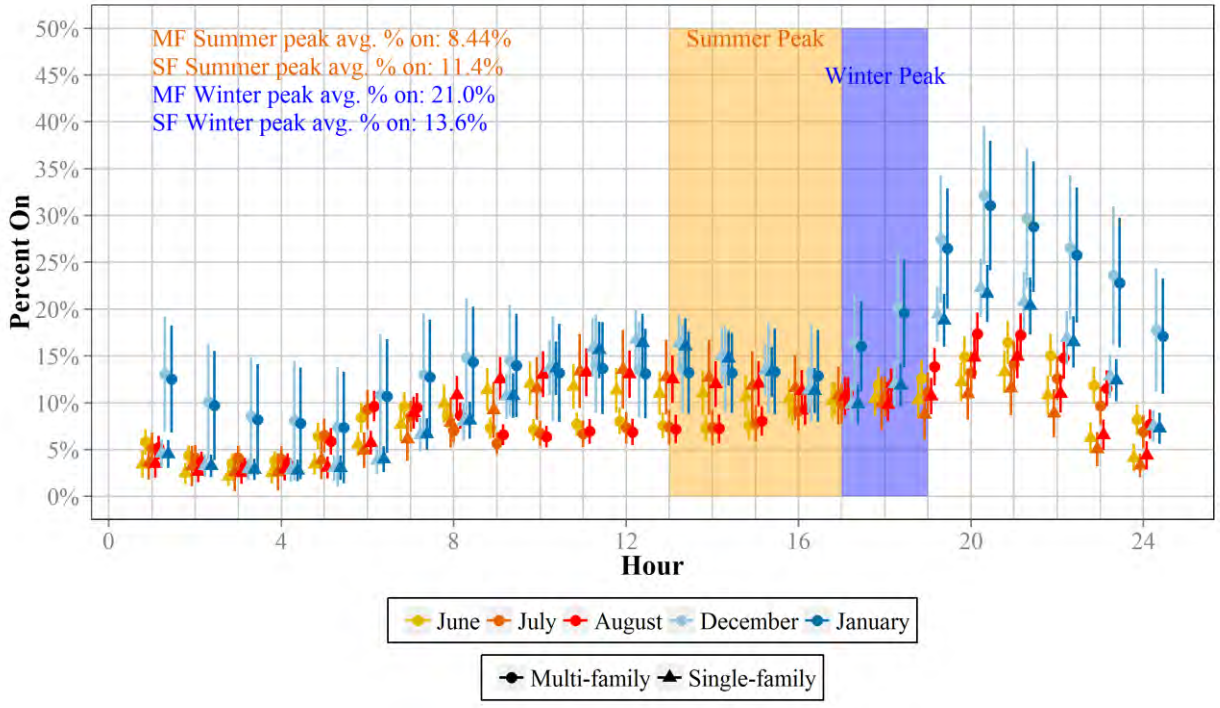


Figure C-30: Overall – Summer and Winter Weekday by Housing Type

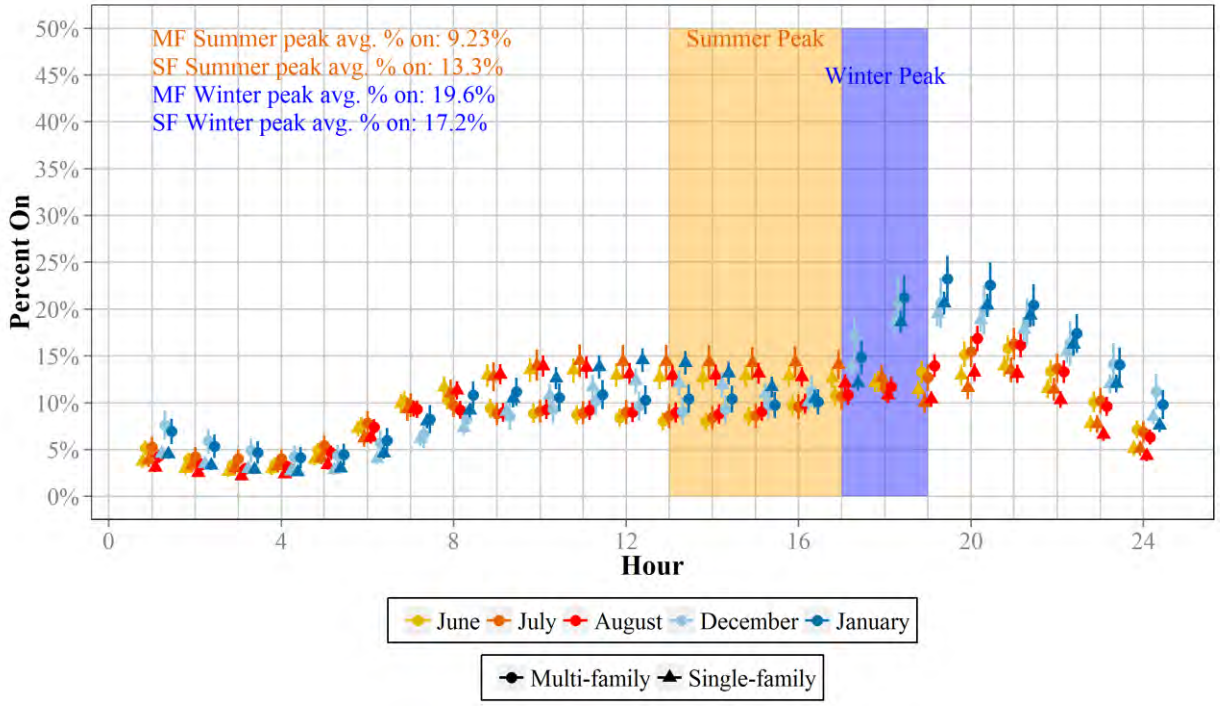


Figure C-31: Downstate New York – Summer and Winter Weekday by Housing Type

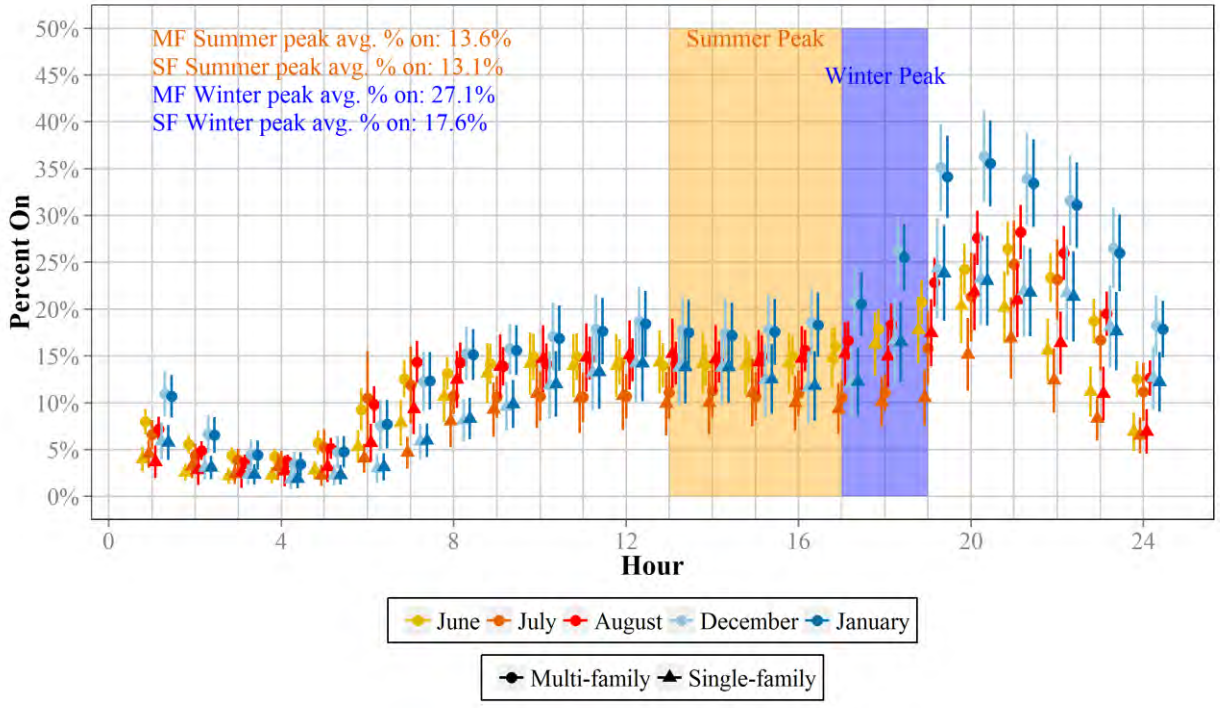
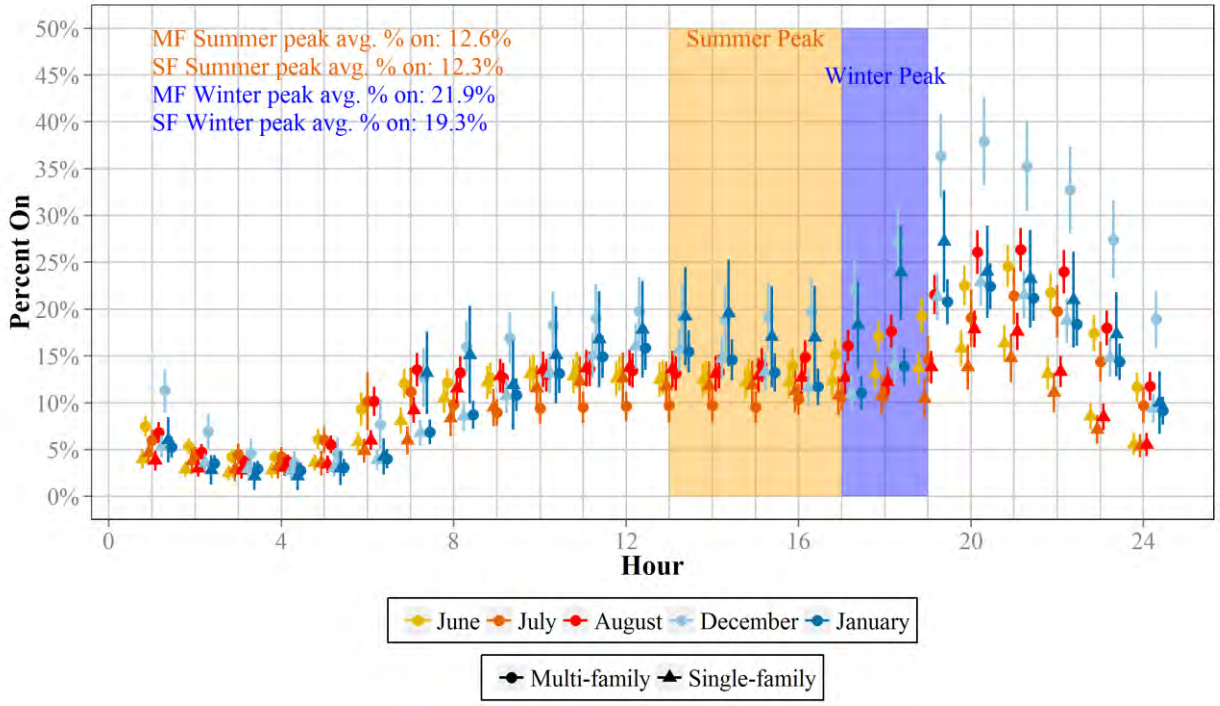


Figure C-32: NYSERDA – Summer and Winter Weekday by Housing Type



Appendix D Detailed Premise and Room Weights by Area

Table D-1: Northeast Premise Weights

Base Type	Population	Sample Size	Weight
Northeast Premise Total	**10,208,049**	**737**	
Single Family Low Income	2,097,625	226	0.67
Single Family Non-low Income	5,111,073	180	2.05
Multifamily Low Income	1,224,576	118	0.75
Multifamily Non-low Income	1,129,409	97	0.84
High Rise Low Income	189,074	23	0.59
High Rise Non-low Income	456,292	93	0.35

Table D-2: NYSERDA Premise Weights

Base Type	Population	Sample Size	Weight
Northeast Premise Total	**6,792,399**	**737**	
Single Family Low Income	1,089,242	226	0.52
Single Family Non-low Income	2,703,806	180	1.63
Multifamily Low Income	739,966	106	0.76
Multifamily Non-low Income	635,127	85	0.81
High Rise Not Manhattan Low Income	484,610	12	4.38
High Rise Not Manhattan Non-low Income	494,282	12	4.47
High Rise Manhattan Low Income	189,074	23	0.89
High Rise Manhattan Non-low Income	456,292	93	0.53

Table D-3: Upstate NY Premise Weights

Base Type	Population	Sample Size	Weight
Northeast Premise Total	**2,745,346**	**621**	
Single Family Low Income	680,814	226	0.68
Single Family Non-low Income	1,699,448	180	2.14
Multifamily Low Income	207,468	118	0.40
Multifamily Non-low Income	157,616	97	0.37

Table D-4: Downstate NY Premise Weights

Base Type	Population	Sample Size	Weight
Northeast Premise Total	**3,247,717**	**761**	
Single Family Low Income	408,428	226	0.42
Single Family Non-low Income	1,004,358	180	1.31
Multifamily Low Income	88,003	118	0.17
Multifamily Non-low Income	122,670	97	0.30
High Rise Not Manhattan Low Income	484,610	12	9.46
High Rise Not Manhattan Non-low Income	494,282	12	9.65
High Rise Manhattan Low Income	189,074	23	1.93
High Rise Manhattan Non-low Income	456,292	93	1.15

Table D-5: Manhattan Premise Weights

Base Type	Population	Sample Size	Weight
Northeast Premise Total	**645,366**	**116**	
Multifamily Low Income	189,074	23	1.48
Multifamily Non-low Income	456,292	93	0.88

Table D-6: Connecticut Premise Weights

Base Type	Population	Sample Size	Weight
Northeast Premise Total	**1,335,839**	**621**	
Single Family Low Income	317,267	226	0.65
Single Family Non-low Income	792,967	180	2.05
Multifamily Low Income	123,738	118	0.49
Multifamily Non-low Income	101,867	97	0.49

Table D-7: Rhode Island Premise Weights

Base Type	Population	Sample Size	Weight
Northeast Premise Total	**400,338**	**621**	
Single Family Low Income	100,159	226	0.69
Single Family Non-low Income	234,625	180	2.02
Multifamily Low Income	40,377	118	0.53
Multifamily Non-low Income	25,177	97	0.40

Table D-8: Massachusetts Premise Weights

Base Type	Population	Sample Size	Weight
Northeast Premise Total	**2,478,809**	**621**	
Single Family Low Income	590,957	226	0.66
Single Family Non-low Income	1,379,675	180	1.92
Multifamily Low Income	280,380	118	0.60
Multifamily Non-low Income	227,797	97	0.59

Table D-9: Northeast Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Bathroom	3,446	36,865	700	4,642	0.6199
Bathroom Efficient Bulb	1,304	17,345	333	2,427	0.5479
Bathroom Inefficient Bulb	2,142	19,490	367	2,215	0.6633
Bedroom	4,929	36,865	913	4,642	0.6798
Bedroom Efficient	1,980	17,345	436	2,427	0.6354
Bedroom Inefficient	2,949	19,490	477	2,215	0.7026
Dining Room	1,788	36,865	401	4,642	0.5615
Dining Room Efficient	463	17,345	174	2,427	0.3723
Dining Room Inefficient	1,325	19,490	227	2,215	0.6634
Exterior	1,838	36,865	184	4,642	1.2578
Exterior Efficient	490	17,345	76	2,427	0.9021
Exterior Inefficient	1,348	19,490	108	2,215	1.4185
Kitchen	3,313	36,865	751	4,642	0.5555
Kitchen Efficient	1,803	17,345	500	2,427	0.5046
Kitchen Inefficient	1,510	19,490	251	2,215	0.6837
Living Room	3,294	36,865	742	4,642	0.5590
Living Room Efficient	1,329	17,345	376	2,427	0.4946
Living Room Inefficient	1,965	19,490	366	2,215	0.6102
Other	8,092	36,865	951	4,642	1.0714
Other Efficient	4,018	17,345	532	2,427	1.0568
Other Inefficient	4,074	19,490	419	2,215	1.1050
High Rise Bathroom	636	34,202	700	4,642	0.1233
High Rise Bathroom Efficient	153	13,579	333	2,427	0.0821
High Rise Bathroom Inefficient	483	20,593	367	2,215	0.1416
High Rise Bedroom	745	34,202	913	4,642	0.1107
High Rise Bedroom Efficient	219	13,579	436	2,427	0.0898

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
High Rise Bedroom Inefficient	526	20,593	477	2,215	0.1186
High Rise Dining Room	335	34,202	401	4,642	0.1134
High Rise Dining Room Efficient	67	13,579	174	2,427	0.0688
High Rise Dining Room Inefficient	268	20,593	227	2,215	0.1270
High Rise Exterior	51	34,202	184	4,642	0.0376
High Rise Exterior Efficient	10	13,579	76	2,427	0.0235
High Rise Exterior Inefficient	41	20,593	108	2,215	0.0408
High Rise Kitchen	528	34,202	751	4,642	0.0954
High Rise Kitchen Efficient	206	13,579	500	2,427	0.0736
High Rise Kitchen Inefficient	322	20,593	251	2,215	0.1380
High Rise Living Room	592	34,202	742	4,642	0.1083
High Rise Living Room Efficient	206	13,579	376	2,427	0.0979
High Rise Living Room Inefficient	386	20,593	366	2,215	0.1134
High Rise Other	849	34,202	951	4,642	0.1212
High Rise Other Efficient	235	13,579	532	2,427	0.0790
High Rise Other Inefficient	614	20,593	419	2,215	0.1576

Table D-10: NYSERDA Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Bathroom	744	10,131	700	4,642	0.4870
Bathroom Efficient Bulb	284	7,383	333	2,427	0.2804
Bathroom Inefficient Bulb	460	5,411	367	2,215	0.5131
Bedroom	982	10,131	913	4,642	0.4928
Bedroom Efficient	376	3,617	436	2,427	0.5787
Bedroom Inefficient	606	6,514	477	2,215	0.4320
Dining Room	562	10,131	401	4,642	0.6422
Dining Room Efficient	156	3,617	174	2,427	0.6016
Dining Room Inefficient	406	6,514	227	2,215	0.6082
Exterior	425	10,131	184	4,642	1.0583
Exterior Efficient	81	3,617	76	2,427	0.7151

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Exterior Inefficient	344	6,514	108	2,215	1.0831
Kitchen	763	10,131	751	4,642	0.4655
Kitchen Efficient	345	3,617	500	2,427	0.4630
Kitchen Inefficient	418	6,514	251	2,215	0.5663
Living Room	838	10,131	742	4,642	0.5175
Living Room Efficient	283	3,617	376	2,427	0.5050
Living Room Inefficient	555	6,514	366	2,215	0.5156
Other	2,081	10,131	951	4,642	1.0026
Other Efficient	996	3,617	532	2,427	1.2562
Other Inefficient	1,085	6,514	419	2,215	0.8805
High Rise Bathroom	636	10,131	700	4,642	0.4163
High Rise Bathroom Efficient	153	3,617	333	2,427	0.3083
High Rise Bathroom Inefficient	483	6,514	367	2,215	0.4475
High Rise Bedroom	745	10,131	913	4,642	0.3739
High Rise Bedroom Efficient	219	3,617	436	2,427	0.3370
High Rise Bedroom Inefficient	526	6,514	477	2,215	0.3750
High Rise Dining Room	335	10,131	401	4,642	0.3828
High Rise Dining Room Efficient	67	3,617	174	2,427	0.2584
High Rise Dining Room Inefficient	268	6,514	227	2,215	0.4015
High Rise Exterior	51	10,131	184	4,642	0.1270
High Rise Exterior Efficient	10	3,617	76	2,427	0.0883
High Rise Exterior Inefficient	41	6,514	108	2,215	0.1291
High Rise Kitchen	528	10,131	751	4,642	0.3221
High Rise Kitchen Efficient	206	3,617	500	2,427	0.2765
High Rise Kitchen Inefficient	322	6,514	251	2,215	0.4362
High Rise Living Room	592	10,131	742	4,642	0.3656
High Rise Living Room Efficient	206	3,617	376	2,427	0.3676
High Rise Living Room Inefficient	386	6,514	366	2,215	0.3586
High Rise Other	849	10,131	951	4,642	0.4091
High Rise Other Efficient	235	3,617	532	2,427	0.2964
High Rise Other Inefficient	614	6,514	419	2,215	0.4983

Table D-11: Downstate NY Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Bathroom	341	9,222	700	4,642	0.2452
Bathroom Efficient Bulb	131	5,946	333	2,427	0.1606
Bathroom Inefficient Bulb	210	3,276	367	2,215	0.3869
Bedroom	458	9,222	913	4,642	0.2525
Bedroom Efficient	192	5,946	436	2,427	0.1797
Bedroom Inefficient	266	3,276	477	2,215	0.3770
Dining Room	265	9,222	401	4,642	0.3326
Dining Room Efficient	80	5,946	174	2,427	0.1877
Dining Room Inefficient	185	3,276	227	2,215	0.5510
Exterior	130	9,222	184	4,642	0.3556
Exterior Efficient	35	5,946	76	2,427	0.1880
Exterior Inefficient	95	3,276	108	2,215	0.5947
Kitchen	395	9,222	751	4,642	0.2648
Kitchen Efficient	183	5,946	500	2,427	0.1494
Kitchen Inefficient	212	3,276	251	2,215	0.5711
Living Room	413	9,222	742	4,642	0.2802
Living Room Efficient	127	5,946	376	2,427	0.1379
Living Room Inefficient	286	3,276	366	2,215	0.5283
Other	821	9,222	951	4,642	0.4346
Other Efficient	336	5,946	532	2,427	0.2578
Other Inefficient	485	3,276	419	2,215	0.7826
High Rise Bathroom	636	9,222	700	4,642	0.4573
High Rise Bathroom Efficient	153	5,946	333	2,427	0.1875
High Rise Bathroom Inefficient	483	3,276	367	2,215	0.8898
High Rise Bedroom	745	9,222	913	4,642	0.4107
High Rise Bedroom Efficient	219	5,946	436	2,427	0.2050
High Rise Bedroom Inefficient	526	3,276	477	2,215	0.7456
High Rise Dining Room	335	9,222	401	4,642	0.4205
High Rise Dining Room Efficient	67	5,946	174	2,427	0.1572
High Rise Dining Room Inefficient	268	3,276	227	2,215	0.7982
High Rise Exterior	51	9,222	184	4,642	0.1395
High Rise Exterior	10	5,946	76	2,427	0.0537

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Efficient					
High Rise Exterior Inefficient	41	3,276	108	2,215	0.2567
High Rise Kitchen	528	9,222	751	4,642	0.3539
High Rise Kitchen Efficient	206	5,946	500	2,427	0.1682
High Rise Kitchen Inefficient	322	3,276	251	2,215	0.8674
High Rise Living Room	592	9,222	742	4,642	0.4016
High Rise Living Room Efficient	206	5,946	376	2,427	0.2236
High Rise Living Room Inefficient	386	3,276	366	2,215	0.7131
High Rise Other	849	9,222	951	4,642	0.4494
High Rise Other Efficient	235	5,946	532	2,427	0.1803
High Rise Other Inefficient	614	3,276	419	2,215	0.9908

Table D-12: Upstate NY Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Bathroom	403	3,572	581	4,098	0.7958
Bathroom Efficient Bulb	153	1,437	291	2,166	0.7925
Bathroom Inefficient Bulb	250	2,135	290	1,932	0.7801
Bedroom	524	3,572	805	4,098	0.7468
Bedroom Efficient	184	1,437	388	2,166	0.7148
Bedroom Inefficient	340	2,135	417	1,932	0.7378
Dining Room	297	3,572	350	4,098	0.9735
Dining Room Efficient	76	1,437	153	2,166	0.7487
Dining Room Inefficient	221	2,135	197	1,932	1.0152
Exterior	295	3,572	183	4,098	1.8494
Exterior Efficient	46	1,437	76	2,166	0.9123
Exterior Inefficient	249	2,135	107	1,932	2.1058
Kitchen	368	3,572	647	4,098	0.6525
Kitchen Efficient	162	1,437	429	2,166	0.5692
Kitchen Inefficient	206	2,135	218	1,932	0.8551
Living Room	425	3,572	640	4,098	0.7618
Living Room Efficient	156	1,437	328	2,166	0.7169
Living Room Inefficient	269	2,135	312	1,932	0.7802
Other	1,260	3,572	892	4,098	1.6206
Other Efficient	660	1,437	501	2,166	1.9857
Other Inefficient	600	2,135	391	1,932	1.3886

Table D-13: Manhattan Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
High Rise Bathroom	636	3,766	119	544	0.7720
High Rise Bathroom Efficient	153	1,096	42	261	0.8675
High Rise Bathroom Inefficient	483	2,640	77	283	0.6724
High Rise Bedroom	745	3,766	108	544	0.9964
High Rise Bedroom Efficient	219	1,096	48	261	1.0865
High Rise Bedroom Inefficient	526	2,640	60	283	0.9398
High Rise Dining Room	335	3,766	51	544	0.9488
High Rise Dining Room Efficient	67	1,096	21	261	0.7598
High Rise Dining Room Inefficient	268	2,640	30	283	0.9576
High Rise Exterior	51	3,766	1	544	7.3670
High Rise Exterior Efficient	10	1,096	-	261	1.0000
High Rise Exterior Inefficient	41	2,640	1	283	4.3951
High Rise Kitchen	528	3,766	104	544	0.7334
High Rise Kitchen Efficient	206	1,096	71	261	0.6909
High Rise Kitchen Inefficient	322	2,640	33	283	1.0460
High Rise Living Room	592	3,766	102	544	0.8384
High Rise Living Room Efficient	206	1,096	48	261	1.0220
High Rise Living Room Inefficient	386	2,640	54	283	0.7663
High Rise Other	849	3,766	59	544	2.0786
High Rise Other Efficient	235	1,096	31	261	1.8052
High Rise Other Inefficient	614	2,640	28	283	2.3507

Table D-14: Connecticut Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Bathroom	665	4,098	581	4,098	1.1446
Bathroom Efficient Bulb	274	1,832	291	2,166	1.1132
Bathroom Inefficient Bulb	391	2,266	290	1,932	1.1495
Bedroom	647	4,098	805	4,098	0.8037
Bedroom Efficient	298	1,832	388	2,166	0.9081
Bedroom Inefficient	349	2,266	417	1,932	0.7136
Dining Room	301	4,098	350	4,098	0.8600
Dining Room Efficient	77	1,832	153	2,166	0.5950
Dining Room Inefficient	224	2,266	197	1,932	0.9695
Exterior	335	4,098	183	4,098	1.8306
Exterior Efficient	84	1,832	76	2,166	1.3068
Exterior Inefficient	251	2,266	107	1,932	2.0000
Kitchen	465	4,098	647	4,098	0.7187
Kitchen Efficient	295	1,832	429	2,166	0.8130
Kitchen Inefficient	170	2,266	218	1,932	0.6649
Living Room	530	4,098	640	4,098	0.8281
Living Room Efficient	231	1,832	328	2,166	0.8327
Living Room Inefficient	299	2,266	312	1,932	0.8171
Other	1,155	4,098	892	4,098	1.2948
Other Efficient	573	1,832	501	2,166	1.3522
Other Inefficient	582	2,266	391	1,932	1.2691

Table D-15: Rhode Island Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Bathroom	216	1,749	581	4,098	0.8711
Bathroom Efficient Bulb	75	774	291	2,166	0.7212
Bathroom Inefficient Bulb	141	975	290	1,932	0.9634
Bedroom	287	1,749	805	4,098	0.8353
Bedroom Efficient	110	774	388	2,166	0.7934
Bedroom Inefficient	177	975	417	1,932	0.8411
Dining Room	117	1,749	350	4,098	0.7832
Dining Room Efficient	24	774	153	2,166	0.4390
Dining Room Inefficient	93	975	197	1,932	0.9354
Exterior	114	1,749	183	4,098	1.4596
Exterior Efficient	33	774	76	2,166	1.2151
Exterior Inefficient	81	975	107	1,932	1.5000
Kitchen	201	1,749	647	4,098	0.7279
Kitchen Efficient	97	774	429	2,166	0.6327
Kitchen Inefficient	104	975	218	1,932	0.9453
Living Room	201	1,749	640	4,098	0.7359
Living Room Efficient	80	774	328	2,166	0.6825
Living Room Inefficient	121	975	312	1,932	0.7685
Other	613	1,749	892	4,098	1.6102
Other Efficient	355	774	501	2,166	1.9829
Other Inefficient	258	975	391	1,932	1.3075

Table D-16: Massachusetts Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Bathroom	403	3,572	581	4,098	0.7958
Bathroom Efficient Bulb	153	1,437	291	2,166	0.7925
Bathroom Inefficient Bulb	250	2,135	290	1,932	0.7801
Bedroom	524	3,572	805	4,098	0.7468
Bedroom Efficient	184	1,437	388	2,166	0.7148
Bedroom Inefficient	340	2,135	417	1,932	0.7378
Dining Room	297	3,572	350	4,098	0.9735
Dining Room Efficient	76	1,437	153	2,166	0.7487
Dining Room Inefficient	221	2,135	197	1,932	1.0152
Exterior	295	3,572	183	4,098	1.8494
Exterior Efficient	46	1,437	76	2,166	0.9123
Exterior Inefficient	249	2,135	107	1,932	2.1058
Kitchen	368	3,572	647	4,098	0.6525
Kitchen Efficient	162	1,437	429	2,166	0.5692
Kitchen Inefficient	206	2,135	218	1,932	0.8551
Living Room	425	3,572	640	4,098	0.7618
Living Room Efficient	156	1,437	328	2,166	0.7169
Living Room Inefficient	269	2,135	312	1,932	0.7802
Other	1,260	3,572	892	4,098	1.6206
Other Efficient	660	1,437	501	2,166	1.9857
Other Inefficient	600	2,135	391	1,932	1.3886

Table D-17: Northeast Low Income Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Bathroom	1,530	12,851	340	2,413	0.8450
Bathroom Efficient Bulb	636	5,858	175	1,297	0.8047
Bathroom Inefficient Bulb	894	6,993	165	1,116	0.8647
Bedroom	2,617	12,851	504	2,413	0.9750
Bedroom Efficient	1,068	5,858	251	1,297	0.9421
Bedroom Inefficient	1,549	6,993	253	1,116	0.9771
Dining Room	668	12,851	163	2,413	0.7695
Dining Room Efficient	221	5,858	84	1,297	0.5825
Dining Room Inefficient	447	6,993	79	1,116	0.9030
Exterior	853	12,851	111	2,413	1.4429
Exterior Efficient	249	5,858	49	1,297	1.1251
Exterior Inefficient	604	6,993	62	1,116	1.5547
Kitchen	1,541	12,851	398	2,413	0.7270
Kitchen Efficient	891	5,858	257	1,297	0.7676
Kitchen Inefficient	650	6,993	141	1,116	0.7357
Living Room	1,559	12,851	373	2,413	0.7848
Living Room Efficient	655	5,858	180	1,297	0.8057
Living Room Inefficient	904	6,993	193	1,116	0.7475
Other	3,670	12,851	524	2,413	1.3151
Other Efficient	1,940	5,858	301	1,297	1.4270
Other Inefficient	1,730	6,993	223	1,116	1.2381
High Rise Bathroom	66	12,851	339	2,413	0.0366
High Rise Bathroom Efficient	22	5,858	175	1,297	0.0278
High Rise Bathroom Inefficient	44	6,993	164	1,116	0.0428
High Rise Bedroom	100	12,851	478	2,413	0.0393
High Rise Bedroom Efficient	54	5,858	248	1,297	0.0482
High Rise Bedroom Inefficient	46	6,993	254	1,116	0.0289
High Rise Dining Room	42	12,851	172	2,413	0.0459
High Rise Dining Room Efficient	27	5,858	97	1,297	0.0616
High Rise Dining Room Inefficient	15	6,993	99	1,116	0.0242
High Rise Exterior	1	12,851	132	2,413	0.0014
High Rise Exterior Efficient	0	5,858	72	1,297	1.0000
High Rise Exterior Inefficient	1	6,993	84	1,116	0.0019

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
High Rise Kitchen	48	12,851	379	2,413	0.0238
High Rise Kitchen Efficient	35	5,858	249	1,297	0.0311
High Rise Kitchen Inefficient	13	6,993	154	1,116	0.0135
High Rise Living Room	88	12,851	360	2,413	0.0459
High Rise Living Room Efficient	35	5,858	186	1,297	0.0417
High Rise Living Room Inefficient	53	6,993	198	1,116	0.0427
High Rise Other	68	12,851	507	2,413	0.0252
High Rise Other Efficient	25	5,858	300	1,297	0.0185
High Rise Other Inefficient	43	6,993	231	1,116	0.0297

Table D-18: NYSERDA Low Income Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Bathroom	186	1,961	340	2,413	0.6732
Bathroom Efficient Bulb	98	983	175	1,297	0.7389
Bathroom Inefficient Bulb	88	978	165	1,116	0.6086
Bedroom	267	1,961	504	2,413	0.6519
Bedroom Efficient	134	983	251	1,297	0.7044
Bedroom Inefficient	133	978	253	1,116	0.5999
Dining Room	167	1,961	163	2,413	1.2607
Dining Room Efficient	58	983	84	1,297	0.9110
Dining Room Inefficient	109	978	79	1,116	1.5744
Exterior	85	1,961	111	2,413	0.9423
Exterior Efficient	23	983	49	1,297	0.6193
Exterior Inefficient	62	978	62	1,116	1.1411
Kitchen	191	1,961	398	2,413	0.5905
Kitchen Efficient	143	983	257	1,297	0.7342
Kitchen Inefficient	48	978	141	1,116	0.3885
Living Room	213	1,961	373	2,413	0.7027
Living Room Efficient	75	983	180	1,297	0.5498
Living Room Inefficient	138	978	193	1,116	0.8159
Other	439	1,961	524	2,413	1.0309
Other Efficient	254	983	301	1,297	1.1134
Other Inefficient	185	978	223	1,116	0.9467

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
High Rise Bathroom	66	1,961	340	2,413	0.2389
High Rise Bathroom Efficient	22	983	175	1,297	0.1659
High Rise Bathroom Inefficient	44	978	165	1,116	0.3043
High Rise Bedroom	100	1,961	504	2,413	0.2441
High Rise Bedroom Efficient	54	983	251	1,297	0.2839
High Rise Bedroom Inefficient	46	978	253	1,116	0.2075
High Rise Dining Room	42	1,961	163	2,413	0.3171
High Rise Dining Room Efficient	27	983	84	1,297	0.4241
High Rise Dining Room Inefficient	15	978	79	1,116	0.2167
High Rise Exterior	1	1,961	111	2,413	0.0111
High Rise Exterior Efficient	0	983	49	1,297	1
High Rise Exterior Inefficient	1	978	62	1,116	0.0184
High Rise Kitchen	48	1,961	398	2,413	0.1484
High Rise Kitchen Efficient	35	983	257	1,297	0.1797
High Rise Kitchen Inefficient	13	978	141	1,116	0.1052
High Rise Living Room	88	1,961	373	2,413	0.2903
High Rise Living Room Efficient	35	983	180	1,297	0.2566
High Rise Living Room Inefficient	53	978	193	1,116	0.3134
High Rise Other	68	1,961	524	2,413	0.1597
High Rise Other Efficient	25	983	301	1,297	0.1096
High Rise Other Inefficient	43	978	223	1,116	0.2200

Table D-19: Downstate NY Low Income Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Bathroom	75	968	340	2,413	0.5499
Bathroom Efficient Bulb	49	539	175	1,297	0.6738
Bathroom Inefficient Bulb	26	429	165	1,116	0.4099
Bedroom	116	968	504	2,413	0.5737
Bedroom Efficient	61	539	251	1,297	0.5848
Bedroom Inefficient	55	429	253	1,116	0.5655
Dining Room	53	968	163	2,413	0.8105
Dining Room Efficient	28	539	84	1,297	0.8021
Dining Room Inefficient	25	429	79	1,116	0.8232
Exterior	8	968	111	2,413	0.1797
Exterior Efficient	6	539	49	1,297	0.2946
Exterior Inefficient	2	429	62	1,116	0.0839
Kitchen	97	968	398	2,413	0.6075
Kitchen Efficient	80	539	257	1,297	0.7490
Kitchen Inefficient	17	429	141	1,116	0.3136
Living Room	86	968	373	2,413	0.5747
Living Room Efficient	37	539	180	1,297	0.4946
Living Room Inefficient	49	429	193	1,116	0.6605
Other	120	968	524	2,413	0.5709
Other Efficient	80	539	301	1,297	0.6396
Other Inefficient	40	429	223	1,116	0.4666
High Rise Bathroom	66	968	339	2,413	0.4853
High Rise Bathroom Efficient	22	539	175	1,297	0.3025
High Rise Bathroom Inefficient	44	429	164	1,116	0.6979
High Rise Bedroom	100	968	478	2,413	0.5215
High Rise Bedroom Efficient	54	539	248	1,297	0.5240
High Rise Bedroom Inefficient	46	429	254	1,116	0.4711
High Rise Dining Room	42	968	172	2,413	0.6087
High Rise Dining Room Efficient	27	539	97	1,297	0.6698
High Rise Dining Room Inefficient	15	429	99	1,116	0.3942
High Rise Exterior	1	968	132	2,413	0.0189
High Rise Exterior Efficient	0	539	72	1,297	1.0000
High Rise Exterior Inefficient	1	429	84	1,116	0.0310

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
High Rise Kitchen	48	968	379	2,413	0.3157
High Rise Kitchen Efficient	35	539	249	1,297	0.3382
High Rise Kitchen Inefficient	13	429	154	1,116	0.2196
High Rise Living Room	88	968	360	2,413	0.6093
High Rise Living Room Efficient	35	539	186	1,297	0.4528
High Rise Living Room Inefficient	53	429	198	1,116	0.6963
High Rise Other	68	968	507	2,413	0.3343
High Rise Other Efficient	25	539	300	1,297	0.2005
High Rise Other Inefficient	43	429	231	1,116	0.4842

Table D-20: Upstate NY Low Income Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Bathroom	111	993	26	210	0.9029
Bathroom Efficient Bulb	49	444	25	114	0.5032
Bathroom Inefficient Bulb	62	549	1	96	10.8415
Bedroom	151	993	36	210	0.8870
Bedroom Efficient	73	444	10	114	1.8743
Bedroom Inefficient	78	549	26	96	0.5246
Dining Room	114	993	22	210	1.0959
Dining Room Efficient	30	444	10	114	0.7703
Dining Room Inefficient	84	549	12	96	1.2240
Exterior	77	993	18	210	0.9047
Exterior Efficient	17	444	8	114	0.5456
Exterior Inefficient	60	549	10	96	1.0492
Kitchen	94	993	32	210	0.6212
Kitchen Efficient	63	444	25	114	0.6470
Kitchen Inefficient	31	549	7	96	0.7744
Living Room	127	993	29	210	0.9261
Living Room Efficient	38	444	9	114	1.0841
Living Room Inefficient	89	549	20	96	0.7781
Other	319	993	47	210	1.4354
Other Efficient	174	444	26	114	1.7183
Other Inefficient	145	549	21	96	1.2074

Table D-21: Manhattan Low Income Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
High Rise Bathroom	66	413	24	102	0.6792
High Rise Bathroom Efficient	22	198	9	60	0.7407
High Rise Bathroom Inefficient	44	215	15	42	0.5730
High Rise Bedroom	100	413	18	102	1.3721
High Rise Bedroom Efficient	54	198	12	60	1.3636
High Rise Bedroom Inefficient	46	215	6	42	1.4977
High Rise Dining Room	42	413	7	102	1.4818
High Rise Dining Room Efficient	27	198	7	60	1.1688
High Rise Dining Room Inefficient	15	215	-	42	1.0000
High Rise Exterior	1	413	1	102	0.2470
High Rise Exterior Efficient	0	198	1	60	1.0000
High Rise Exterior Inefficient	1	215	-	42	1.0000
High Rise Kitchen	48	413	20	102	0.5927
High Rise Kitchen Efficient	35	198	14	60	0.7576
High Rise Kitchen Inefficient	13	215	6	42	0.4233
High Rise Living Room	88	413	19	102	1.1439
High Rise Living Room Efficient	35	198	11	60	0.9642
High Rise Living Room Inefficient	53	215	8	42	1.2942
High Rise Other	68	413	13	102	1.2919
High Rise Other Efficient	25	198	7	60	1.0823
High Rise Other Inefficient	43	215	6	42	1.4000

Table D-22: Connecticut Low Income Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Bathroom	145	867	316	2,311	1.2231
Bathroom Efficient Bulb	70	431	166	1,237	1.2103
Bathroom Inefficient Bulb	75	436	150	1,074	1.2317
Bedroom	160	867	486	2,311	0.8775
Bedroom Efficient	81	431	239	1,237	0.9727
Bedroom Inefficient	79	436	247	1,074	0.7879
Dining Room	66	867	156	2,311	1.1277
Dining Room Efficient	24	431	77	1,237	0.8946
Dining Room Inefficient	42	436	79	1,074	1.3096
Exterior	57	867	110	2,311	1.3812
Exterior Efficient	19	431	48	1,237	1.1361
Exterior Inefficient	38	436	62	1,074	1.5098
Kitchen	109	867	378	2,311	0.7686
Kitchen Efficient	63	431	243	1,237	0.7441
Kitchen Inefficient	46	436	135	1,074	0.8393
Living Room	147	867	354	2,311	1.1069
Living Room Efficient	72	431	169	1,237	1.2228
Living Room Inefficient	75	436	185	1,074	0.9986
Other	183	867	511	2,311	0.9546
Other Efficient	102	431	294	1,237	0.9957
Other Inefficient	81	436	217	1,074	0.9195

Table D-23: Rhode Island Low Income Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Bathroom	55	493	316	2,311	0.8159
Bathroom Efficient Bulb	21	203	166	1,237	0.7709
Bathroom Inefficient Bulb	34	290	150	1,074	0.8394
Bedroom	93	493	486	2,311	0.8970
Bedroom Efficient	33	203	239	1,237	0.8414
Bedroom Inefficient	60	290	247	1,074	0.8996
Dining Room	19	493	156	2,311	0.5709
Dining Room Efficient	6	203	77	1,237	0.4748
Dining Room Inefficient	13	290	79	1,074	0.6094
Exterior	33	493	110	2,311	1.4063
Exterior Efficient	4	203	48	1,237	0.5078
Exterior Inefficient	29	290	62	1,074	1.7323
Kitchen	74	493	378	2,311	0.9177
Kitchen Efficient	20	203	243	1,237	0.5015
Kitchen Inefficient	54	290	135	1,074	1.4814
Living Room	74	493	354	2,311	0.9799
Living Room Efficient	32	203	169	1,237	1.1538
Living Room Inefficient	42	290	185	1,074	0.8408
Other	145	493	511	2,311	1.3301
Other Efficient	87	203	294	1,237	1.8032
Other Inefficient	58	290	217	1,074	0.9899

Table D-24: Massachusetts Low Income Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Bathroom	1,144	9,530	316	2,311	0.8779
Bathroom Efficient Bulb	447	4,241	166	1,237	0.7854
Bathroom Inefficient Bulb	697	5,289	150	1,074	0.9436
Bedroom	2,097	9,530	486	2,311	1.0463
Bedroom Efficient	820	4,241	239	1,237	1.0007
Bedroom Inefficient	1,277	5,289	247	1,074	1.0498
Dining Room	416	9,530	156	2,311	0.6467
Dining Room Efficient	133	4,241	77	1,237	0.5038
Dining Room Inefficient	283	5,289	79	1,074	0.7274
Exterior	678	9,530	110	2,311	1.4947
Exterior Efficient	203	4,241	48	1,237	1.2335
Exterior Inefficient	475	5,289	62	1,074	1.5557
Kitchen	1,167	9,530	378	2,311	0.7487
Kitchen Efficient	665	4,241	243	1,237	0.7982
Kitchen Inefficient	502	5,289	135	1,074	0.7551
Living Room	1,125	9,530	354	2,311	0.7706
Living Room Efficient	476	4,241	169	1,237	0.8215
Living Room Inefficient	649	5,289	185	1,074	0.7124
Other	2,903	9,530	511	2,311	1.3776
Other Efficient	1,497	4,241	294	1,237	1.4852
Other Inefficient	1,406	5,289	217	1,074	1.3157

Table D-25: Northeast Non-low Income Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Bathroom	1,916	20,908	360	2,229	0.5674
Bathroom Efficient Bulb	668	7,523	158	1,130	0.6350
Bathroom Inefficient Bulb	1,248	13,385	202	1,099	0.5073
Bedroom	2,312	20,908	409	2,229	0.6026
Bedroom Efficient	912	7,523	185	1,130	0.7405
Bedroom Inefficient	1,400	13,385	224	1,099	0.5132
Dining Room	1,120	20,908	238	2,229	0.5017
Dining Room Efficient	242	7,523	90	1,130	0.4039
Dining Room Inefficient	878	13,385	148	1,099	0.4871
Exterior	985	20,908	73	2,229	1.4385
Exterior Efficient	241	7,523	27	1,130	1.3407
Exterior Inefficient	744	13,385	46	1,099	1.3280
Kitchen	1,772	20,908	353	2,229	0.5352
Kitchen Efficient	912	7,523	243	1,130	0.5637
Kitchen Inefficient	860	13,385	110	1,099	0.6419
Living Room	1,735	20,908	369	2,229	0.5013
Living Room Efficient	674	7,523	196	1,130	0.5165
Living Room Inefficient	1,061	13,385	173	1,099	0.5036
Other	4,422	20,908	427	2,229	1.1040
Other Efficient	2,078	7,523	231	1,130	1.3512
Other Inefficient	2,344	13,385	196	1,099	0.9819
High Rise Bathroom	570	20,908	360	2,229	0.1688
High Rise Bathroom Efficient	131	7,523	158	1,130	0.1245
High Rise Bathroom Inefficient	439	13,385	202	1,099	0.1784
High Rise Bedroom	645	20,908	409	2,229	0.1681
High Rise Bedroom	165		185	1,130	0.1340

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Efficient		7,523			
High Rise Bedroom Inefficient	480	13,385	224	1,099	0.1759
High Rise Dining Room	293	20,908	238	2,229	0.1312
High Rise Dining Room Efficient	40	7,523	90	1,130	0.0668
High Rise Dining Room Inefficient	253	13,385	148	1,099	0.1404
High Rise Exterior	50	20,908	73	2,229	0.0730
High Rise Exterior Efficient	10	7,523	27	1,130	0.0556
High Rise Exterior Inefficient	40	13,385	46	1,099	0.0714
High Rise Kitchen	480	20,908	353	2,229	0.1450
High Rise Kitchen Efficient	171	7,523	243	1,130	0.1057
High Rise Kitchen Inefficient	309	13,385	110	1,099	0.2306
High Rise Living Room	504	20,908	369	2,229	0.1456
High Rise Living Room Efficient	171	7,523	196	1,130	0.1310
High Rise Living Room Inefficient	333	13,385	173	1,099	0.1580
High Rise Other	781	20,908	427	2,229	0.1950
High Rise Other Efficient	210	7,523	231	1,130	0.1366
High Rise Other Inefficient	571	13,385	196	1,099	0.2392

Table D-26: NYSERDA Non-low Income Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Bathroom	558	11,493	360	2,229	0.3006
Bathroom Efficient Bulb	186	3,532	158	1,130	0.3766
Bathroom Inefficient Bulb	372	7,961	202	1,099	0.2542
Bedroom	715	11,493	409	2,229	0.3390
Bedroom Efficient	242	3,532	185	1,130	0.4185
Bedroom Inefficient	473	7,961	224	1,099	0.2915
Dining Room	395	11,493	238	2,229	0.3219
Dining Room Efficient	98	3,532	90	1,130	0.3484
Dining Room Inefficient	297	7,961	148	1,099	0.2770
Exterior	340	11,493	73	2,229	0.9033
Exterior Efficient	58	3,532	27	1,130	0.6873
Exterior Inefficient	282	7,961	46	1,099	0.8463
Kitchen	572	11,493	353	2,229	0.3143
Kitchen Efficient	202	3,532	243	1,130	0.2660
Kitchen Inefficient	370	7,961	110	1,099	0.4643
Living Room	625	11,493	369	2,229	0.3285
Living Room Efficient	208	3,532	196	1,130	0.3395
Living Room Inefficient	417	7,961	173	1,099	0.3328
Other	1,642	11,493	427	2,229	0.7458
Other Efficient	742	3,532	231	1,130	1.0277
Other Inefficient	900	7,961	196	1,099	0.6339
High Rise Bathroom	570	11,493	360	2,229	0.3071
High Rise Bathroom Efficient	131	3,532	158	1,130	0.2653
High Rise Bathroom Inefficient	439	7,961	202	1,099	0.3000
High Rise Bedroom	645	11,493	409	2,229	0.3059
High Rise Bedroom Efficient	165	3,532	185	1,130	0.2853
High Rise Bedroom Inefficient	480	7,961	224	1,099	0.2958
High Rise Dining Room	293	11,493	238	2,229	0.2388
High Rise Dining Room Efficient	40	3,532	90	1,130	0.1422
High Rise Dining Room Inefficient	253	7,961	148	1,099	0.2360
High Rise Exterior	50	11,493	73	2,229	0.1328
High Rise Exterior Efficient	10	3,532	27	1,130	0.1185
High Rise Exterior Inefficient	40	7,961	46	1,099	0.1200

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
High Rise Kitchen	480	11,493	353	2,229	0.2637
High Rise Kitchen Efficient	171	3,532	243	1,130	0.2251
High Rise Kitchen Inefficient	309	7,961	110	1,099	0.3878
High Rise Living Room	504	11,493	369	2,229	0.2649
High Rise Living Room Efficient	171	3,532	196	1,130	0.2791
High Rise Living Room Inefficient	333	7,961	173	1,099	0.2657
High Rise Other	781	11,493	427	2,229	0.3547
High Rise Other Efficient	210	3,532	231	1,130	0.2908
High Rise Other Inefficient	571	7,961	196	1,099	0.4022

Table D-27: Downstate NY Non-low Income Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Bathroom	266	5,591	360	2,229	0.2946
Bathroom Efficient Bulb	82	1,641	158	1,130	0.3574
Bathroom Inefficient Bulb	184	3,950	202	1,099	0.2534
Bedroom	342	5,591	409	2,229	0.3334
Bedroom Efficient	131	1,641	185	1,130	0.4876
Bedroom Inefficient	211	3,950	224	1,099	0.2621
Dining Room	212	5,591	238	2,229	0.3551
Dining Room Efficient	52	1,641	90	1,130	0.3979
Dining Room Inefficient	160	3,950	148	1,099	0.3008
Exterior	122	5,591	73	2,229	0.6663
Exterior Efficient	29	1,641	27	1,130	0.7396
Exterior Inefficient	93	3,950	46	1,099	0.5625
Kitchen	298	5,591	353	2,229	0.3366
Kitchen Efficient	103	1,641	243	1,130	0.2919
Kitchen Inefficient	195	3,950	110	1,099	0.4932
Living Room	327	5,591	369	2,229	0.3533
Living Room Efficient	90	1,641	196	1,130	0.3162
Living Room Inefficient	237	3,950	173	1,099	0.3812
Other	701	5,591	427	2,229	0.6545
Other Efficient	256	1,641	231	1,130	0.7631
Other Inefficient	445	3,950	196	1,099	0.6317

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
High Rise Bathroom	570	5,591	360	2,229	0.6312
High Rise Bathroom Efficient	131	1,641	158	1,130	0.5709
High Rise Bathroom Inefficient	439	3,950	202	1,099	0.6047
High Rise Bedroom	645	5,591	409	2,229	0.6287
High Rise Bedroom Efficient	165	1,641	185	1,130	0.6142
High Rise Bedroom Inefficient	480	3,950	224	1,099	0.5962
High Rise Dining Room	293	5,591	238	2,229	0.4908
High Rise Dining Room Efficient	40	1,641	90	1,130	0.3060
High Rise Dining Room Inefficient	253	3,950	148	1,099	0.4756
High Rise Exterior	50	5,591	73	2,229	0.2731
High Rise Exterior Efficient	10	1,641	27	1,130	0.2550
High Rise Exterior Inefficient	40	3,950	46	1,099	0.2419
High Rise Kitchen	480	5,591	353	2,229	0.5421
High Rise Kitchen Efficient	171	1,641	243	1,130	0.4846
High Rise Kitchen Inefficient	309	3,950	110	1,099	0.7816
High Rise Living Room	504	5,591	369	2,229	0.5445
High Rise Living Room Efficient	171	1,641	196	1,130	0.6008
High Rise Living Room Inefficient	333	3,950	173	1,099	0.5355
High Rise Other	781	5,591	427	2,229	0.7292
High Rise Other Efficient	210	1,641	231	1,130	0.6260
High Rise Other Inefficient	571	3,950	196	1,099	0.8106

Table D-28: Upstate NY Non-low Income Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Bathroom	292	2,579	265	1,787	0.7635
Bathroom Efficient Bulb	104	993	125	929	0.7784
Bathroom Inefficient Bulb	188	1,586	140	858	0.7265
Bedroom	373	2,579	319	1,787	0.8102
Bedroom Efficient	111	993	149	929	0.6970
Bedroom Inefficient	262	1,586	170	858	0.8338
Dining Room	183	2,579	194	1,787	0.6536
Dining Room Efficient	46	993	76	929	0.5663
Dining Room Inefficient	137	1,586	118	858	0.6281
Exterior	218	2,579	73	1,787	2.0692
Exterior Efficient	29	993	27	929	1.0048
Exterior Inefficient	189	1,586	46	858	2.2227
Kitchen	274	2,579	269	1,787	0.7058
Kitchen Efficient	99	993	186	929	0.4980
Kitchen Inefficient	175	1,586	83	858	1.1406
Living Room	298	2,579	286	1,787	0.7220
Living Room Efficient	118	993	159	929	0.6943
Living Room Inefficient	180	1,586	127	858	0.7667
Other	941	2,579	381	1,787	1.7113
Other Efficient	486	993	207	929	2.1965
Other Inefficient	455	1,586	174	858	1.4146

Table D-29: Manhattan Non-low Income Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
High Rise Bathroom	570	3,323	95	442	0.7981
High Rise Bathroom Efficient	131	898	33	201	0.8885
High Rise Bathroom Inefficient	439	2,425	62	241	0.7037
High Rise Bedroom	645	3,323	90	442	0.9533
High Rise Bedroom Efficient	165	898	36	201	1.0259
High Rise Bedroom Inefficient	480	2,425	54	241	0.8834
High Rise Dining Room	293	3,323	44	442	0.8857
High Rise Dining Room Efficient	40	898	14	201	0.6395
High Rise Dining Room Inefficient	253	2,425	30	241	0.8381
High Rise Exterior	50	3,323	0	442	1
High Rise Exterior Efficient	10	898	0	201	1
High Rise Exterior Inefficient	40	2,425	0	241	1
High Rise Kitchen	480	3,323	84	442	0.7601
High Rise Kitchen Efficient	171	898	57	201	0.6715
High Rise Kitchen Inefficient	309	2,425	27	241	1.1374
High Rise Living Room	504	3,323	83	442	0.8077
High Rise Living Room Efficient	171	898	37	201	1.0345
High Rise Living Room Inefficient	333	2,425	46	241	0.7194
High Rise Other	781	3,323	46	442	2.2583
High Rise Other Efficient	210	898	24	201	1.9585
High Rise Other Inefficient	571	2,425	22	241	2.5794

Table D-30: Connecticut Non-low Income Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Bathroom	520	3,231	265	1,787	1.0853
Bathroom Efficient Bulb	204	1,401	125	929	1.0822
Bathroom Inefficient Bulb	316	1,830	140	858	1.0583
Bedroom	487	3,231	319	1,787	0.8444
Bedroom Efficient	217	1,401	149	929	0.9657
Bedroom Inefficient	270	1,830	170	858	0.7446
Dining Room	235	3,231	194	1,787	0.6700
Dining Room Efficient	53	1,401	76	929	0.4624
Dining Room Inefficient	182	1,830	118	858	0.7231
Exterior	278	3,231	73	1,787	2.1062
Exterior Efficient	65	1,401	27	929	1.5963
Exterior Inefficient	213	1,830	46	858	2.1710
Kitchen	356	3,231	269	1,787	0.7320
Kitchen Efficient	232	1,401	186	929	0.8271
Kitchen Inefficient	124	1,830	83	858	0.7005
Living Room	383	3,231	286	1,787	0.7407
Living Room Efficient	159	1,401	159	929	0.6631
Living Room Inefficient	224	1,830	127	858	0.8270
Other	972	3,231	381	1,787	1.4110
Other Efficient	471	1,401	207	929	1.5088
Other Inefficient	501	1,830	174	858	1.3500

Table D-31: Rhode Island Non-low Income Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Bathroom	161	1,256	265	1,787	0.8644
Bathroom Efficient Bulb	54	571	125	929	0.7029
Bathroom Inefficient Bulb	107	685	140	858	0.9573
Bedroom	194	1,256	319	1,787	0.8653
Bedroom Efficient	77	571	149	929	0.8408
Bedroom Inefficient	117	685	170	858	0.8621
Dining Room	98	1,256	194	1,787	0.7187
Dining Room Efficient	18	571	76	929	0.3853
Dining Room Inefficient	80	685	118	858	0.8492
Exterior	81	1,256	73	1,787	1.5787
Exterior Efficient	29	571	27	929	1.7475
Exterior Inefficient	52	685	46	858	1.4159
Kitchen	127	1,256	269	1,787	0.6717
Kitchen Efficient	77	571	186	929	0.6735
Kitchen Inefficient	50	685	83	858	0.7546
Living Room	127	1,256	286	1,787	0.6318
Living Room Efficient	48	571	159	929	0.4912
Living Room Inefficient	79	685	127	858	0.7791
Other	468	1,256	381	1,787	1.7477
Other Efficient	268	571	207	929	2.1064
Other Inefficient	200	685	174	858	1.4397

Table D-32: Massachusetts Non-low Income Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Bathroom	677	4,928	265	1,787	0.9264
Bathroom Efficient Bulb	224	2,019	125	929	0.8246
Bathroom Inefficient Bulb	453	2,909	140	858	0.9544
Bedroom	916	4,928	319	1,787	1.0413
Bedroom Efficient	376	2,019	149	929	1.1611
Bedroom Inefficient	540	2,909	170	858	0.9369
Dining Room	392	4,928	194	1,787	0.7327
Dining Room Efficient	73	2,019	76	929	0.4420
Dining Room Inefficient	319	2,909	118	858	0.7974
Exterior	286	4,928	73	1,787	1.4207
Exterior Efficient	89	2,019	27	929	1.5167
Exterior Inefficient	197	2,909	46	858	1.2631
Kitchen	717	4,928	269	1,787	0.9665
Kitchen Efficient	401	2,019	186	929	0.9920
Kitchen Inefficient	316	2,909	83	858	1.1229
Living Room	600	4,928	286	1,787	0.7607
Living Room Efficient	259	2,019	159	929	0.7495
Living Room Inefficient	341	2,909	127	858	0.7919
Other	1,340	4,928	381	1,787	1.2754
Other Efficient	597	2,019	207	929	1.3270
Other Inefficient	743	2,909	174	858	1.2595

Table D-33: Northeast Multifamily Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Bathroom	685	7,751	328	1,790	0.4823
Bathroom Efficient Bulb	260	2,772	173	965	0.5232
Bathroom Inefficient Bulb	425	4,979	155	825	0.4543
Bedroom	835	7,751	377	1,790	0.5115
Bedroom Efficient	310	2,772	166	965	0.6501
Bedroom Inefficient	525	4,979	211	825	0.4123
Kitchen	613	7,751	333	1,790	0.4251
Kitchen Efficient	367	2,772	240	965	0.5323
Kitchen Inefficient	246	4,979	93	825	0.4383
Living Room	649	7,751	318	1,790	0.4713
Living Room Efficient	253	2,772	155	965	0.5682
Living Room Inefficient	396	4,979	163	825	0.4025
Other	1,233	7,751	434	1,790	0.6561
Other Efficient	486	2,772	231	965	0.7324
Other Inefficient	747	4,979	203	825	0.6097
High Rise Bathroom	636	7,751	328	1,790	0.4478
High Rise Bathroom Efficient	153	2,772	173	965	0.3079
High Rise Bathroom Inefficient	483	4,979	155	825	0.5163
High Rise Bedroom	745	7,751	377	1,790	0.4564
High Rise Bedroom Efficient	219	2,772	166	965	0.4593
High Rise Bedroom Inefficient	526	4,979	211	825	0.4131
High Rise Kitchen	528	7,751	333	1,790	0.3662
High Rise Kitchen Efficient	206	2,772	240	965	0.2988
High Rise Kitchen Inefficient	322	4,979	93	825	0.5737
High Rise Living Room	592	7,751	318	1,790	0.4299
High Rise Living Room Efficient	206	2,772	155	965	0.4627
High Rise Living Room Inefficient	386	4,979	163	825	0.3924
High Rise Other	1,235	7,751	434	1,790	0.6572
High Rise Other Efficient	312	2,772	231	965	0.4702
High Rise Other Inefficient	923	4,979	203	825	0.7534

Table D-34: NYSERDA Multifamily Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Bathroom	133	4,565	328	1,790	0.1590
Bathroom Efficient Bulb	57	1,398	173	965	0.2274
Bathroom Inefficient Bulb	76	3,167	155	825	0.1277
Bedroom	172	4,565	377	1,790	0.1789
Bedroom Efficient	59	1,398	166	965	0.2453
Bedroom Inefficient	113	3,167	211	825	0.1395
Kitchen	122	4,565	333	1,790	0.1437
Kitchen Efficient	62	1,398	240	965	0.1783
Kitchen Inefficient	60	3,167	93	825	0.1681
Living Room	154	4,565	318	1,790	0.1899
Living Room Efficient	36	1,398	155	965	0.1603
Living Room Inefficient	118	3,167	163	825	0.1886
Other	248	4,565	434	1,790	0.2241
Other Efficient	88	1,398	231	965	0.2630
Other Inefficient	160	3,167	203	825	0.2053
High Rise Bathroom	636	4,565	328	1,790	0.7603
High Rise Bathroom Efficient	153	1,398	173	965	0.6105
High Rise Bathroom Inefficient	483	3,167	155	825	0.8117
High Rise Bedroom	745	4,565	377	1,790	0.7749
High Rise Bedroom Efficient	219	1,398	166	965	0.9107
High Rise Bedroom Inefficient	526	3,167	211	825	0.6494
High Rise Kitchen	528	4,565	333	1,790	0.6217
High Rise Kitchen Efficient	206	1,398	240	965	0.5925
High Rise Kitchen Inefficient	322	3,167	93	825	0.9019
High Rise Living Room	592	4,565	318	1,790	0.7300
High Rise Living Room Efficient	206	1,398	155	965	0.9174
High Rise Living Room Inefficient	386	3,167	163	825	0.6169
High Rise Other	1,235	4,565	434	1,790	1.1158
High Rise Other Efficient	312	1,398	231	965	0.9323
High Rise Other Inefficient	923	3,167	203	825	1.1844

Table D-35: Downstate NY Multifamily Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Bathroom	113	4,439	328	1,790	0.1389
Bathroom Efficient Bulb	42	1,337	173	965	0.1752
Bathroom Inefficient Bulb	71	3,102	155	825	0.1218
Bedroom	151	4,439	377	1,790	0.1615
Bedroom Efficient	50	1,337	166	965	0.2174
Bedroom Inefficient	101	3,102	211	825	0.1273
Kitchen	107	4,439	333	1,790	0.1296
Kitchen Efficient	53	1,337	240	965	0.1594
Kitchen Inefficient	54	3,102	93	825	0.1544
Living Room	142	4,439	318	1,790	0.1801
Living Room Efficient	32	1,337	155	965	0.1490
Living Room Inefficient	110	3,102	163	825	0.1795
Other	190	4,439	434	1,790	0.1765
Other Efficient	64	1,337	231	965	0.2000
Other Inefficient	126	3,102	203	825	0.1651
High Rise Bathroom	636	4,439	328	1,790	0.7819
High Rise Bathroom Efficient	153	1,337	173	965	0.6383
High Rise Bathroom Inefficient	483	3,102	155	825	0.8288
High Rise Bedroom	745	4,439	377	1,790	0.7969
High Rise Bedroom Efficient	219	1,337	166	965	0.9522
High Rise Bedroom Inefficient	526	3,102	211	825	0.6630
High Rise Kitchen	528	4,439	333	1,790	0.6394
High Rise Kitchen Efficient	206	1,337	240	965	0.6195
High Rise Kitchen Inefficient	322	3,102	93	825	0.9208
High Rise Living Room	592	4,439	318	1,790	0.7507
High Rise Living Room Efficient	206	1,337	155	965	0.9592
High Rise Living Room Inefficient	386	3,102	163	825	0.6298
High Rise Other	1,235	4,439	434	1,790	1.1475
High Rise Other Efficient	312	1,337	231	965	0.9749
High Rise Other Inefficient	923	3,102	203	825	1.2093

Table D-36: Upstate NY Multifamily Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Bathroom	20	126	209	1,246	0.9463
Bathroom Efficient Bulb	15	61	131	704	1.3215
Bathroom Inefficient Bulb	5	65	78	542	0.5345
Bedroom	21	126	269	1,246	0.7720
Bedroom Efficient	9	61	118	704	0.8802
Bedroom Inefficient	12	65	151	542	0.6627
Kitchen	15	126	229	1,246	0.6477
Kitchen Efficient	9	61	169	704	0.6146
Kitchen Inefficient	6	65	60	542	0.8338
Living Room	12	126	216	1,246	0.5494
Living Room Efficient	4	61	107	704	0.4314
Living Room Inefficient	8	65	109	542	0.6120
Other	58	126	323	1,246	1.7757
Other Efficient	24	61	179	704	1.5474
Other Inefficient	34	65	144	542	1.9688

Table D-37: Manhattan Multifamily Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
High Rise Bathroom	636	3,736	119	544	0.7782
High Rise Bathroom Efficient	153	1,096	42	261	0.8675
High Rise Bathroom Inefficient	483	2,640	77	283	0.6724
High Rise Bedroom	745	3,736	108	544	1.0044
High Rise Bedroom Efficient	219	1,096	48	261	1.0865
High Rise Bedroom Inefficient	526	2,640	60	283	0.9398
High Rise Kitchen	528	3,736	104	544	0.7393
High Rise Kitchen Efficient	206	1,096	71	261	0.6909
High Rise Kitchen Inefficient	322	2,640	33	283	1.0460
High Rise Living Room	592	3,736	102	544	0.8451
High Rise Living Room Efficient	206	1,096	48	261	1.0220
High Rise Living Room Inefficient	386	2,640	54	283	0.7663
High Rise Other	1,235	3,736	111	544	1.6201
High Rise Other Efficient	312	1,096	52	261	1.4288
High Rise Other Inefficient	923	2,640	59	283	1.6770

Table D-38: Connecticut Multifamily Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Bathroom	223	1,089	209	1,246	1.2208
Bathroom Efficient Bulb	81	445	131	704	0.9782
Bathroom Inefficient Bulb	142	644	78	542	1.5322
Bedroom	209	1,089	269	1,246	0.8890
Bedroom Efficient	75	445	118	704	1.0055
Bedroom Inefficient	134	644	151	542	0.7469
Kitchen	143	1,089	229	1,246	0.7145
Kitchen Efficient	98	445	169	704	0.9174
Kitchen Inefficient	45	644	60	542	0.6312
Living Room	140	1,089	216	1,246	0.7416
Living Room Efficient	67	445	107	704	0.9906
Living Room Inefficient	73	644	109	542	0.5637
Other	374	1,089	323	1,246	1.3248
Other Efficient	124	445	179	704	1.0959
Other Inefficient	250	644	144	542	1.4611

Table D-39: Rhode Island Multifamily Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Bathroom	39	229	209	1,246	1.0153
Bathroom Efficient Bulb	22	108	131	704	1.0947
Bathroom Inefficient Bulb	17	121	78	542	0.9763
Bedroom	48	229	269	1,246	0.9709
Bedroom Efficient	14	108	118	704	0.7734
Bedroom Inefficient	34	121	151	542	1.0086
Kitchen	38	229	229	1,246	0.9029
Kitchen Efficient	26	108	169	704	1.0028
Kitchen Inefficient	12	121	60	542	0.8959
Living Room	36	229	216	1,246	0.9068
Living Room Efficient	15	108	107	704	0.9138
Living Room Inefficient	21	121	109	542	0.8630
Other	68	229	323	1,246	1.1455
Other Efficient	31	108	179	704	1.1289
Other Inefficient	37	121	144	542	1.1509

Table D-40: Massachusetts Multifamily Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Bathroom	290	1,868	209	1,246	0.9255
Bathroom Efficient Bulb	100	821	131	704	0.6546
Bathroom Inefficient Bulb	190	1,047	78	542	1.2610
Bedroom	406	1,868	269	1,246	1.0067
Bedroom Efficient	162	821	118	704	1.1772
Bedroom Inefficient	244	1,047	151	542	0.8365
Kitchen	310	1,868	229	1,246	0.9030
Kitchen Efficient	181	821	169	704	0.9184
Kitchen Inefficient	129	1,047	60	542	1.1130
Living Room	319	1,868	216	1,246	0.9851
Living Room Efficient	135	821	107	704	1.0819
Living Room Inefficient	184	1,047	109	542	0.8739
Other	543	1,868	323	1,246	1.1213
Other Efficient	243	821	179	704	1.1641
Other Inefficient	300	1,047	144	542	1.0785

Table D-41: Northeast Single Family Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Bathroom	2,344	19,081	372	2,852	0.9418
Bathroom Efficient Bulb	901	8,363	160	1,462	0.9844
Bathroom Inefficient Bulb	1,443	10,718	212	1,390	0.8827
Bedroom	3,329	19,081	536	2,852	0.9283
Bedroom Efficient	1,429	8,363	270	1,462	0.9252
Bedroom Inefficient	1,900	10,718	266	1,390	0.9263
Dining Room	1,283	19,081	246	2,852	0.7795
Dining Room Efficient	344	8,363	99	1,462	0.6074
Dining Room Inefficient	939	10,718	147	1,390	0.8284
Exterior	1,488	19,081	178	2,852	1.2495
Exterior Efficient	397	8,363	73	1,462	0.9507
Exterior Inefficient	1,091	10,718	105	1,390	1.3475
Kitchen	2,322	19,081	418	2,852	0.8303
Kitchen Efficient	1,247	8,363	260	1,462	0.8385
Kitchen Inefficient	1,075	10,718	158	1,390	0.8824
Living Room	2,263	19,081	424	2,852	0.7978
Living Room Efficient	938	8,363	221	1,462	0.7420
Living Room Inefficient	1,325	10,718	203	1,390	0.8465
Other	6,052	19,081	678	2,852	1.3342
Other Efficient	3,107	8,363	379	1,462	1.4331
Other Inefficient	2,945	10,718	299	1,390	1.2774

Table D-42: NYSERDA Single Family Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Bathroom	611	5,566	372	2,852	0.8416
Bathroom Efficient Bulb	227	2,219	160	1,462	0.9348
Bathroom Inefficient Bulb	384	3,347	212	1,390	0.7522
Bedroom	810	5,566	536	2,852	0.7743
Bedroom Efficient	317	2,219	270	1,462	0.7735
Bedroom Inefficient	493	3,347	266	1,390	0.7697
Dining Room	479	5,566	246	2,852	0.9977
Dining Room Efficient	135	2,219	99	1,462	0.8984
Dining Room Inefficient	344	3,347	147	1,390	0.9719
Exterior	421	5,566	178	2,852	1.2119
Exterior Efficient	80	2,219	73	1,462	0.7220
Exterior Inefficient	341	3,347	105	1,390	1.3487
Kitchen	641	5,566	418	2,852	0.7858
Kitchen Efficient	283	2,219	260	1,462	0.7171
Kitchen Inefficient	358	3,347	158	1,390	0.9410
Living Room	684	5,566	424	2,852	0.8266
Living Room Efficient	247	2,219	221	1,462	0.7364
Living Room Inefficient	437	3,347	203	1,390	0.8940
Other	1,920	5,566	678	2,852	1.4510
Other Efficient	930	2,219	379	1,462	1.6167
Other Inefficient	990	3,347	299	1,390	1.3751

Table D-43: Downstate NY Single Family Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Bathroom	228	2,120	372	2,852	0.8245
Bathroom Efficient Bulb	89	843	160	1,462	0.9647
Bathroom Inefficient Bulb	139	1,277	212	1,390	0.7137
Bedroom	307	2,120	536	2,852	0.7705
Bedroom Efficient	142	843	270	1,462	0.9121
Bedroom Inefficient	165	1,277	266	1,390	0.6752
Dining Room	207	2,120	246	2,852	1.1320
Dining Room Efficient	66	843	99	1,462	1.1562
Dining Room Inefficient	141	1,277	147	1,390	1.0441
Exterior	129	2,120	178	2,852	0.9750
Exterior Efficient	35	843	73	1,462	0.8315
Exterior Inefficient	94	1,277	105	1,390	0.9745
Kitchen	288	2,120	418	2,852	0.9269
Kitchen Efficient	130	843	260	1,462	0.8671
Kitchen Inefficient	158	1,277	158	1,390	1.0885
Living Room	271	2,120	424	2,852	0.8598
Living Room Efficient	95	843	221	1,462	0.7455
Living Room Inefficient	176	1,277	203	1,390	0.9437
Other	690	2,120	678	2,852	1.3691
Other Efficient	286	843	379	1,462	1.3087
Other Inefficient	404	1,277	299	1,390	1.4707

Table D-44: Upstate NY Single Family Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Bathroom	383	3,446	372	2,852	0.8521
Bathroom Efficient Bulb	138	1,376	160	1,462	0.9164
Bathroom Inefficient Bulb	245	2,070	212	1,390	0.7760
Bedroom	503	3,446	536	2,852	0.7767
Bedroom Efficient	175	1,376	270	1,462	0.6887
Bedroom Inefficient	328	2,070	266	1,390	0.8280
Dining Room	272	3,446	246	2,852	0.9151
Dining Room Efficient	69	1,376	99	1,462	0.7405
Dining Room Inefficient	203	2,070	147	1,390	0.9273
Exterior	292	3,446	178	2,852	1.3577
Exterior Efficient	45	1,376	73	1,462	0.6550
Exterior Inefficient	247	2,070	105	1,390	1.5796
Kitchen	353	3,446	418	2,852	0.6989
Kitchen Efficient	153	1,376	260	1,462	0.6252
Kitchen Inefficient	200	2,070	158	1,390	0.8500
Living Room	413	3,446	424	2,852	0.8062
Living Room Efficient	152	1,376	221	1,462	0.7308
Living Room Inefficient	261	2,070	203	1,390	0.8634
Other	1,230	3,446	678	2,852	1.5014
Other Efficient	644	1,376	379	1,462	1.8054
Other Inefficient	586	2,070	299	1,390	1.3160

Table D-45: Connecticut Single Family Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Bathroom	442	3,009	372	2,852	1.1262
Bathroom Efficient Bulb	193	1,387	160	1,462	1.2715
Bathroom Inefficient Bulb	249	1,622	212	1,390	1.0065
Bedroom	438	3,009	536	2,852	0.7745
Bedroom Efficient	223	1,387	270	1,462	0.8706
Bedroom Inefficient	215	1,622	266	1,390	0.6927
Dining Room	212	3,009	246	2,852	0.8168
Dining Room Efficient	52	1,387	99	1,462	0.5537
Dining Room Inefficient	160	1,622	147	1,390	0.9328
Exterior	310	3,009	178	2,852	1.6507
Exterior Efficient	82	1,387	73	1,462	1.1840
Exterior Inefficient	228	1,622	105	1,390	1.8608
Kitchen	322	3,009	418	2,852	0.7301
Kitchen Efficient	197	1,387	260	1,462	0.7987
Kitchen Inefficient	125	1,622	158	1,390	0.6780
Living Room	390	3,009	424	2,852	0.8718
Living Room Efficient	164	1,387	221	1,462	0.7822
Living Room Inefficient	226	1,622	203	1,390	0.9541
Other	895	3,009	678	2,852	1.2512
Other Efficient	476	1,387	379	1,462	1.3238
Other Inefficient	419	1,622	299	1,390	1.2009

Table D-46: Rhode Island Single Family Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Bathroom	160	1,311	372	2,852	0.9357
Bathroom Efficient Bulb	53	666	160	1,462	0.7272
Bathroom Inefficient Bulb	107	645	212	1,390	1.0877
Bedroom	206	1,311	536	2,852	0.8361
Bedroom Efficient	96	666	270	1,462	0.7805
Bedroom Inefficient	110	645	266	1,390	0.8912
Dining Room	76	1,311	246	2,852	0.6721
Dining Room Efficient	22	666	99	1,462	0.4878
Dining Room Inefficient	54	645	147	1,390	0.7916
Exterior	102	1,311	178	2,852	1.2466
Exterior Efficient	29	666	73	1,462	0.8721
Exterior Inefficient	73	645	105	1,390	1.4983
Kitchen	140	1,311	418	2,852	0.7286
Kitchen Efficient	71	666	260	1,462	0.5995
Kitchen Inefficient	69	645	158	1,390	0.9411
Living Room	128	1,311	424	2,852	0.6567
Living Room Efficient	65	666	221	1,462	0.6456
Living Room Inefficient	63	645	203	1,390	0.6688
Other	499	1,311	678	2,852	1.6011
Other Efficient	330	666	379	1,462	1.9114
Other Inefficient	169	645	299	1,390	1.2181

Table D-47: Massachusetts Single Family Room Weights

Room/Bulb Type	Bulbs in a Specific Room	Bulbs in All Rooms	Metered Bulbs in Specific Room	Metered Bulbs in All Rooms	Weight
Bathroom	1,131	9,195	372	2,852	0.9430
Bathroom Efficient Bulb	428	4,091	160	1,462	0.9560
Bathroom Inefficient Bulb	703	5,104	212	1,390	0.9031
Bedroom	1,875	9,195	536	2,852	1.0850
Bedroom Efficient	793	4,091	270	1,462	1.0496
Bedroom Inefficient	1,082	5,104	266	1,390	1.1078
Dining Room	516	9,195	246	2,852	0.6506
Dining Room Efficient	135	4,091	99	1,462	0.4873
Dining Room Inefficient	381	5,104	147	1,390	0.7058
Exterior	655	9,195	178	2,852	1.1414
Exterior Efficient	206	4,091	73	1,462	1.0085
Exterior Inefficient	449	5,104	105	1,390	1.1646
Kitchen	1,219	9,195	418	2,852	0.9045
Kitchen Efficient	696	4,091	260	1,462	0.9567
Kitchen Inefficient	523	5,104	158	1,390	0.9015
Living Room	1,061	9,195	424	2,852	0.7762
Living Room Efficient	462	4,091	221	1,462	0.7471
Living Room Inefficient	599	5,104	203	1,390	0.8036
Other	2,738	9,195	678	2,852	1.2526
Other Efficient	1,371	4,091	379	1,462	1.2928
Other Inefficient	1,367	5,104	299	1,390	1.2451

Appendix E Onsite Handbooks

E.1 Onsite and Logger Retrieval Handbooks – Connecticut

E.2 Onsite Retrieval Handbook – Massachusetts

E.3 Onsite and Logger Retrieval Handbooks – New York City

E.4 Onsite and Logger Retrieval Handbooks – New York State

E.5 Onsite and Logger Retrieval Handbooks – Rhode Island

Regional Hours of Use Study: Onsite Handbook

Connecticut

1/14/2013

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Contents

Tables

Figures

Overview of Handbook

The purpose of this document is to provide all the information required to conduct site visits for the Regional HOU Study. This document will be provided to all field technicians and will be used as the main reference material for in-person field technician training conducted for this study. This document contains the following sections:

- Training Plan
  - → Independent Training Steps
  - → In-person Training Session Outline
- Background / Purpose of the Study
- Onsite Protocol
- Onsite Form Instructions (included as separate Appendix)
  - → Example Completed Saturation Forms (included as separate Appendix)
- Logger Installation Instructions
- Quality Assurance and Control Procedures
- Frequently Asked Questions
  - → The Energy Independence and Security Act (EISA) of 2007
- Mileage Tracking Form
- Reimbursement Form
- EPA Cleanup and Disposal Guidelines for Compact Fluorescent Light Bulbs (CFLs)

All field technicians should review this document in its entirety prior to the in-person training session. This document contains independent training exercises that all technicians will be expected to complete prior to in-person training.

1 Training Plan

Training for this project consists of both independent and in-person training. A brief outline of training activities is included below. Additional detail about each step of training is covered in later sections. The first training step is to thoroughly review this document in its entirety.

1.1 Independent Training *(approximately three hours – total)*

- Review of Materials – field technician will spend one hour reviewing materials contained in this document.
- Store Visit – field technician will go to a hardware, lighting, or big box retailer to familiarize themselves with various bulb types. This activity will require about one hour.
- Mock Site Visit – after reviewing materials and completing the store visit, field technician will spend 30 minutes to an hour conducting a mock lighting audit for his/her home. As he/she is conducting the audit, he/she should reference the protocol to address any questions that arise. Once complete, he/she will send the completed site visit forms to the project manager for review.
- Logger Installation Practice – NMR will send the technician a logger and a light pipe to practice using and installing them on different fixtures. The technician will take pictures of the installed loggers and email them to the project manager to review.

1.2 In-person Training *(approximately four hours – total)*

- Questions and Answers – field technicians will be provided with the opportunity to ask questions about materials or the study that came up during independent training. Field technicians are also encouraged to ask questions during the remainder of the training session. *(20 minutes)*
- Review of Materials – the trainer will walk field technicians through the protocols, onsite forms, and equipment required for this project. *(45 minutes)*
- Administrative Matters – the trainer will review administrative procedures with field technicians. *(20 minutes)*
- Mock Site Visit – the trainer will act as a customer participating in the study and the field technician will go through the steps of conducting a site visit. *(30 minutes)*
- Walk-Along Visit – the trainer will walk-along with the field technician on their first site visit to observe them in the field. *(2 hours)*

2 Background / Purpose of the Study

The parties responsible for evaluation of energy-efficiency programs in Massachusetts, Connecticut, Rhode Island, and New York have committed to conducting a study to estimate hours of use (HOU) of light bulbs in homes. The main objective of this study, therefore, is to estimate HOU, and we will do so by room type, not lighting type (technology) as many studies have done in the past. Our focus on room types assumes that people are likely to use their lights in a given room the same way regardless of the type of bulbs in the room.

To accomplish this objective, field technicians will perform two interrelated tasks: 1) conduct an inventory of lighting to determine the number and type of bulbs currently installed in customers' homes, and 2) install a series of lighting loggers to capture information on how customers use lights in their homes. These two tasks are interrelated because in order to install loggers in a random selection of light fixtures, we must first identify all of the light fixtures in a customer's home.

NMR is recruiting and scheduling participants for this study via telephone. During the recruiting and scheduling, customers are provided with the following project details:

> *The Connecticut Energy Efficiency Board is offering you the opportunity to take part in an important study. We are offering eligible households $50 to allow a trained technician to visit their homes to gather more information about the lighting products they use. The visit should take about an hour. The visit would involve a trained technician walking through your home and recording the types of lighting products that you are using. The technician will also attach some very small devices to several light sockets in your home to record lighting usage. Most lamp or fixture shades will block the devices from view, so they won't affect your decor. They also won't affect how your lights work. When the technician returns to remove these devices in six months, you'll receive an additional $100, for a total of $150. Participation in the study will require two visits, the first about an hour in length and the second a shorter visit of about 30 minutes, six months later. During the visits, there will be no attempt to sell you anything. The information gathered will be used to evaluate and improve the energy efficiency programs offered by your electric utility.*

As a field technician you will not recruit customers. Instead, you will be provided with a list of customers to visit each week. This list will include the customer's name, telephone number, address, and an appointment time. You should also receive a check for each participant prior to visiting their home, participants will receive two separate checks: one for the first visit (installation) and one for the second visit six months later (removal).

3 Onsite Protocol

This section outlines the procedures field technicians will follow when performing the lighting inventories and installing the loggers. These protocols cover both the lighting inventory and the selection of fixtures for loggers. The protocols for installing lighting loggers differ between single-family and multi-family as noted throughout this section.

3.1 Prior to Visit

Before visiting a home, you should make sure that, at a minimum, you have the following:

Onsite Handbook
Onsite data form
Appointment sheet
Company Polo Shirt
ID Badge
GPS

Data Collection Kit
Camera
Flashlight
Pen
Sharpie
Flat & Philips head screwdrivers
Insulated gloves
Shoe coverings
Latex gloves
Step ladder
6, 10, and 20-sided Dice

Materials for Customer
FAQs and Info Sheet
NMR contact's business card
Check ($50)

Logger Installation Kit
Zip ties
Adhesive 3M pads/control strips
Light loggers
8 *loggers for single-family*
6 *loggers for multi-family*
Light pipes
Sealable sandwich bags

CFL Clean up Kit
Sealable plastic bags
Disposable wipes
Vacuum
Duct tape
Flat brush

3.2 Arrival at Onsite

After the door is opened, immediately ascertain that the person at the door is the scheduled interviewee. Introduce yourself and hand him/her the business card.

- **Sample Introduction** *(not to be read verbatim)***:**
  Hello, my name is _____, and I am working with NMR Group, Inc. NMR is working under contract with ***the Connecticut Energy Efficiency Board****. I'm here to meet with _____. As mentioned on the phone, I'm here to walk through your home and record the types of lighting fixtures and bulbs installed in each socket.* ***[Customer should be expecting you]****. During my visit I'll also be installing a few lighting loggers to capture hours of use* ***[show customer a logger]****. In six months another technician will return to collect the loggers that I install. The loggers can only tell when a light is turned on and off, they do not record anything else. In appreciation for your time, on behalf of* ***the Connecticut Energy Efficiency Board****, we are offering you a payment of $50 today and $100 when we return in six months to remove the loggers. Do you have any questions regarding my visit?*

Prior to Data Collection

- Give the customer a step by step description of what you'll be doing (show the data collection form and a logger as you explain)
  - → First I need to walk around the outside of your home and record the types of lights.
  - → Then I will cover the bulbs inside your home – room by room – including bulbs in storage.
  - → After counting all of the lights I need determine which fixtures to install the loggers on.
- The customer should not be surprised by any of this information as they have already been told what the study will consist of. However, if the customer is uncomfortable with the visit and refuses to allow you to conduct the inventory or install the loggers, courteously explain that you will be unable to provide the incentive check if they do not participate. If they still refuse, ask if it would be ok to have your supervisor call them to discuss the project with them. Immediately inform your supervisor of the situation and whether or not the customer is expecting a call from your him/her.
  - → Customers must participate in both aspects of the study in order to receive the incentive—the lighting inventory and the lighting logger study.

General sequence of data collection

1. Installed bulbs - Exterior:
   → Walk around the outside of the home in a clockwise direction.
   → Record information on all exterior lighting sockets.

2. Installed bulb - Interior:
   → Next, proceed through the inside of the home in a clockwise direction.
   → Begin with foyer (entry way).
   → Go through each room and part of the home systematically, in a clockwise direction (or as clockwise as is possible).

3. Stored Bulbs**:**
   → **Ask:** *"Now, I would like to see all light bulbs and fixtures that are not currently installed. This would include those you have bought and not yet installed as well as those that were installed and then removed."*
   → Record information on all bulbs in storage.

4. Logger Installation:
   → Consult logger installation instructions.
   → Install loggers on selected fixtures (with customer's approval of placement).

5. After Data Collection:
   → Thank the customer for his/her time
   → Give him/her the $50 check.
   → Remind the customer that when we return in six months to retrieve the loggers we will provide them with a check for $100.
   → Have the customer sign off on your data collection form to indicate that you visited their home and provided him/her with a $50 check.
   → Leave with the customer the "Logger Participant Frequently Asked Questions" one-page sheet.

Data Collection Guidelines

- **<u>All recorded information must be legible</u>.**
- **What information to collect:**
  - → **All lights that use electricity** (meaning they are plugged in or hard wired) must be captured, including night lights.
    - Ex. ***Do*** *capture* solar landscaping lights that also use electricity from electric lines; ***do not*** *capture* solar landscaping lights that don't use any electricity lines at all.
  - → **DO NOT** capture lights that run **only** on batteries like flashlights or battery-operated closet or under-cabinet lights (even if the batteries are rechargeable).
  - → **DO NOT** capture information for temporary seasonal lights or lighting displays. This could include strings of lights such as holiday lights as well as novelty lights like plug in candles, yard decorations, holiday village displays, etc. Ask the customer if it is permanent or a seasonal holiday light; if permanent, capture this information.
- **Removing Bulbs or Fixture covers:**
  - → **<u>Never remove a cover or bulb without permission from the customer.</u>**
  - → If any fixture is covered and/or the bulb is not immediately visible, ask the customer if the bulb is easily accessible. If yes, ask if you can turn off the fixture and take it apart to see the light bulb.
  - → If the customer offers to turn off the fixture and take it apart him/herself, **ALWAYS** let the customer do it.
  - → If the customer refuses to let you do it and does not offer to do it him/herself; the fixture is damaged or delicate; or the fixture is inaccessible given your equipment, ask the customer for his/her best guess of the information needed on the form.
  - → **DO NOT TOUCH** if fixtures have cracked or damaged covers, or look delicate or easily breakable.
- **Burned Out Bulbs:**
  - → If a bulb is burned out, ask the customer if he/she intends to replace the bulb.
    - If the answer is yes, treat the burned out bulb as if it's currently working and record all.
    - If customer does not intend to replace them OR purposely unscrews some bulbs so that they don't turn on, treat them as if they were an empty socket.

- **Broken Bulbs:**
  - → If you break any type of light bulb and/or if a broken CFL came into direct contact with clothing or bedding which subsequently needed to be thrown out, give the customer the "Reimbursement Form."
  - → Note what type of bulb was broken and contact the project manager as soon as possible to report the incident.
  - → Take a picture of the broken bulb and any other damage.
  - → **If a CFL or a fluorescent bulb should be broken**, refer to the "Cleanup and Disposal Guidelines for Compact Fluorescent Light Bulbs" of the Environmental Protection Agency (EPA) included in this packet.
- **Unplugged Fixtures:**
  - → If the interviewee has unplugged light fixtures in storage areas, ask the customer if he/she uses the fixture.
    - o If the answer is no, then treat the light bulbs in the fixture as if they are in storage (record it in the CFL in Storage Form if the bulb is a CFL and do not record it if it is not a CFL).
    - o If the answer is yes, then record the fixture in the "installed lighting" form and denote when it is used in the "notes" column.

4 Onsite Form Instructions

This section provides specific details about how the onsite form should be completed by field technicians.

4.1 Home Schematic

→ Draw a **CLEAR** diagram of the house on the sheets provided as you go through the home, labeling each room on the diagram (in order to locate loggers on the follow up visit).

→ If the home has multiple levels create a separate diagram for each level, including the basement and/or attic.

→ If the attic or any other room in the home is not accessible, still include it in the diagram but record it as "inaccessible".

→ **Indicate the location within a room of any fixtures that have loggers installed by marking the diagram with an X.**

4.2 Onsite Saturation Form

Program Participation

Before filling out the onsite form, ask the homeowner: **Have you participated in any programs that replaced bulbs in your house with energy efficient bulbs?**

- Yes
- No

→ If "Yes", ask which programs they participated in and record their responses.

Room Descriptions

→ Choose from the codes below.

→ You may use a downward arrow to indicate the same room for more than one line.

→ If a home has a great room or a single room with several purposes, look at the particular usage of the light and record the lamps accordingly.

→ When in doubt of a room's purpose ask the customer how they would describe the room.

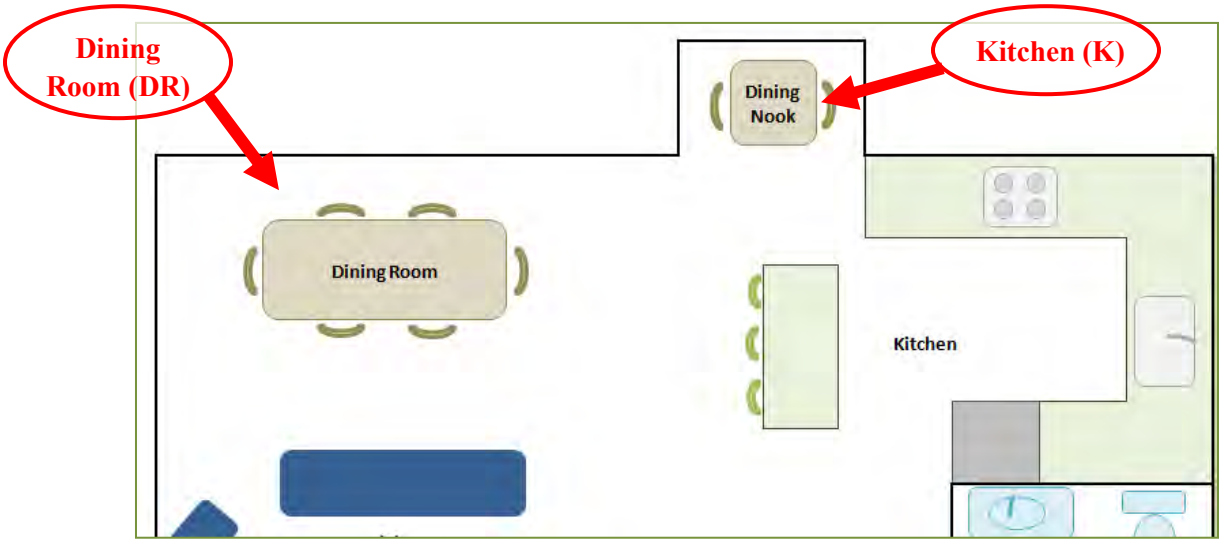
→ If there are multiple rooms of the same type add a number after the code (ex. BR1, BR2).

Table 1: Room Type List

Room	Code	Room	Code	Room	Code
Dining Room	DR	Living Space	L	Garage	G
Exterior	E	Hallway	H	Office	OFF
Kitchen	K	Foyer	F	Den	DEN
Bedroom	BR	Utility	U	Closet	[Room code] -C
Bathroom	BT	Basement	BA	Other [Specify]	O

Dining Room (DR)

A dining room is any room where the primary purpose is eating. Substantial dining areas that are not separated from other rooms in the home directly by walls and doors are still considered a dining room if they are set apart from other rooms. Observations of a dining area attached to the kitchen, such as a dining nook, will be labeled as a kitchen.



Exterior (E)

Technicians will audit lamps that are attached to the home and those that are owned by the customer. These include lampposts not attached to the home and light lamps that are part of driveway entrances. Exterior includes sheds, greenhouses, and other storage facilities and exterior buildings owned by the customer **except garages** which have their own category discussed below.

While all homes have exteriors not all lights on all homes are directly controlled by the person who lives there. Only capture exterior lights if they are directly controlled by the person who lives in the home we are visiting. Lighting in common areas of apartment buildings (interior/exterior) and lights not controlled on the exterior of townhomes are examples of exterior lights that we do not need to capture.

Kitchen (K)

Technicians will include the lights that are primarily used in a kitchen area or inside the kitchen, such as a counter with bar stools or a small kitchen table. However, technicians will not include the light under the range hood or in the refrigerator.

Every home will have at least one kitchen. If the home is an efficiency or a studio apartment, designate the lights directly present in the kitchen area (area containing stove, refrigerator and sink) as the kitchen.

Bedroom (BR)

All bedrooms will be noted with a unique identifier (i.e. BR 1).

Every home will have at least one bedroom. If the home is an efficiency or a studio apartment, designate the lights directly present in the sleeping area (area containing bed) as the bedroom.

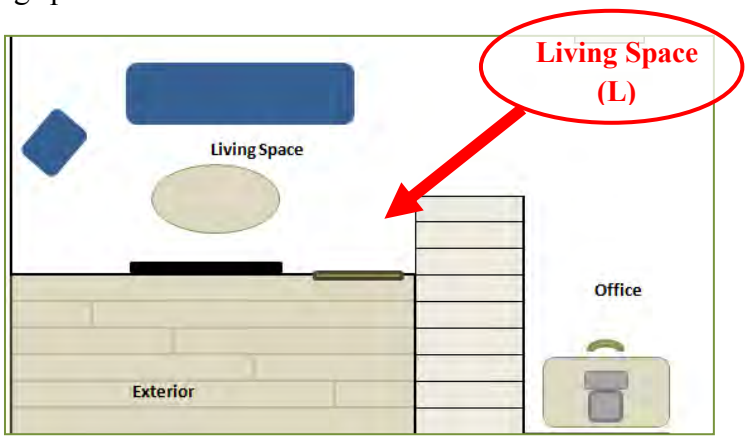
Bathroom (BT)

The bathrooms included can be full baths, half baths, or three-quarter baths. If a particular bathroom has two rooms (such as a separate shower and sink area), the lighting will be coded in both rooms as the same bathroom.

Every home will have at least one bathroom. Efficiency and studio apartments should have a separate bathroom. In the event that the bathroom is not separated from the rest of the home by walls and a door, designate the lights directly present in the bathroom area (area containing the shower, toilet and sink) as the bathroom.

Living Space (Living Room/Family Room) (L)

This room is the most commonly used area for family activities, such as watching television or entertaining. The form does not differentiate between living room and family room since this distinction can often be subjective. If the apartment is a studio or efficiency where the bedroom and living space are the same and have only one light, prioritize living space over bedroom.



Hallway (H)

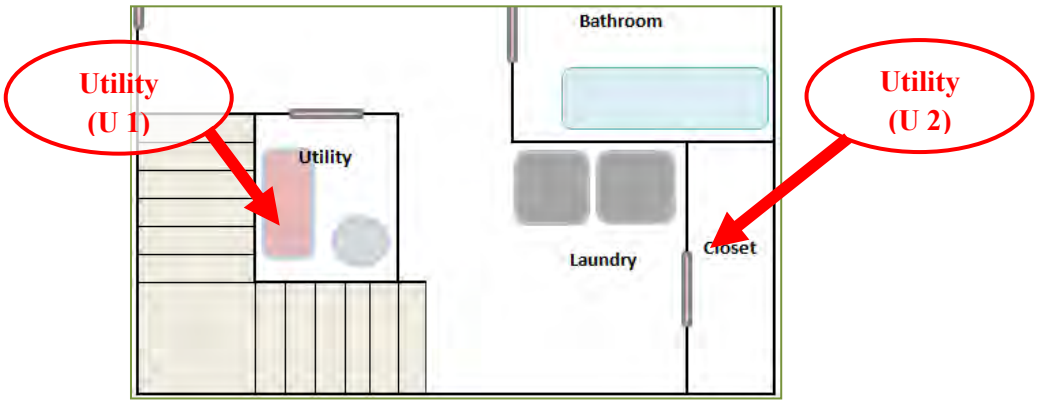
Hallways include all stairways with lights.

Foyer (F)

This category includes all entry ways, even those called mudrooms.

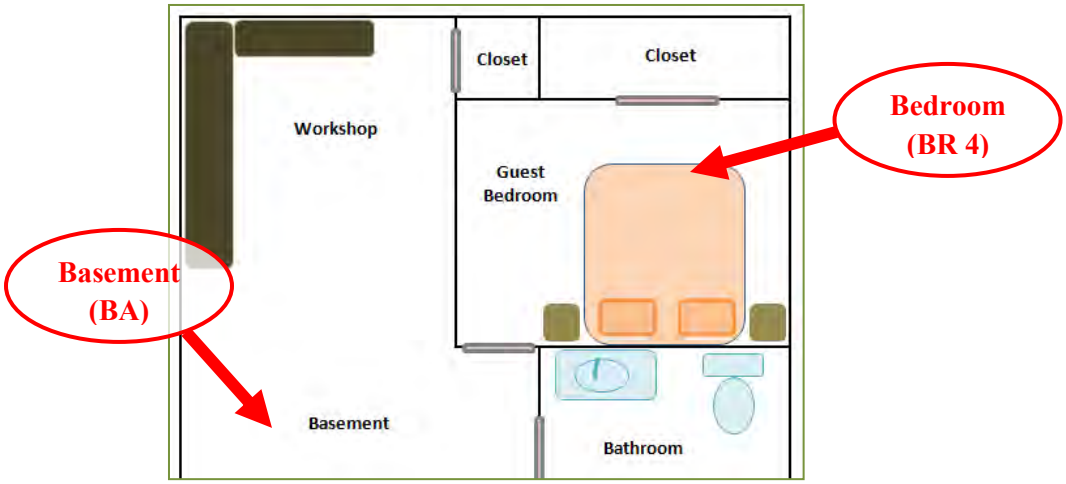
Utility (U)

The main purpose of this room is washing clothes. Technicians will also include furnace/HVAC areas as a utility room unless the furnace/HVAC is part of an unfinished one room basement.



Basement (BA)

The basement is the main room under the first floor. If there are bedrooms, bathrooms, closets, utility rooms, etc. in the basement, they will be coded and recorded as such.

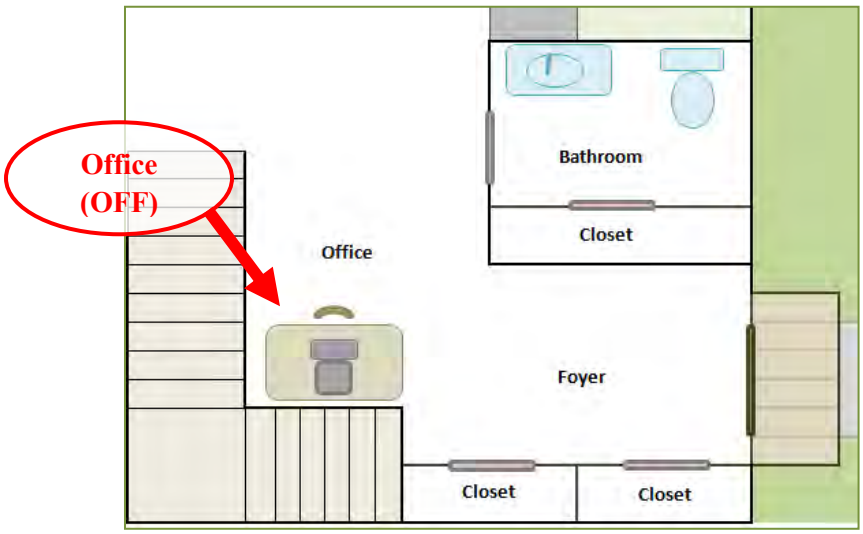


Garage (G)

In addition to a typical garage, a carport fits into this category. Bulbs found in garage door opening mechanisms will be included.

Office (OFF)

Technicians will collect lighting data in computer rooms, home offices, and parts of a great room that have office functions. In the notes column indicate whether the office is a separate room or part of a larger room. The primary function of this room appears to be doing something at a desk or computer.

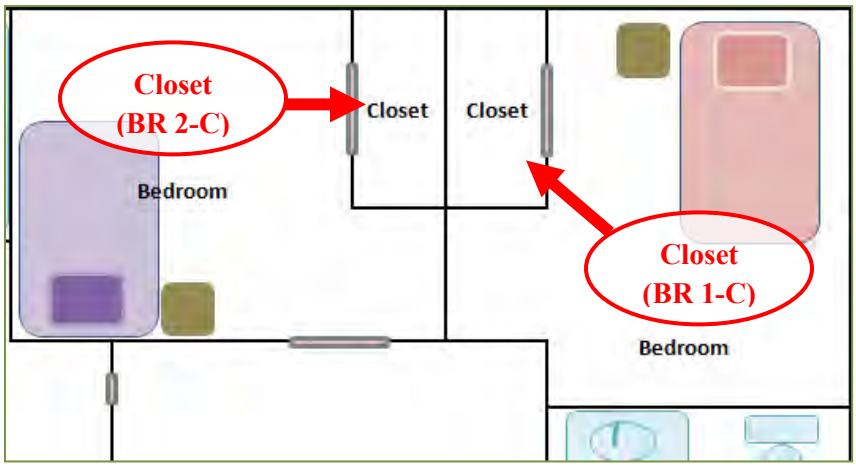


Den (DEN)

This category refers only to dens, libraries and other small, secluded rooms. If the room contains a full size couch, this would be considered a living space. Technicians should defer to the "Living Space" category if they cannot decide how a room should be categorized.

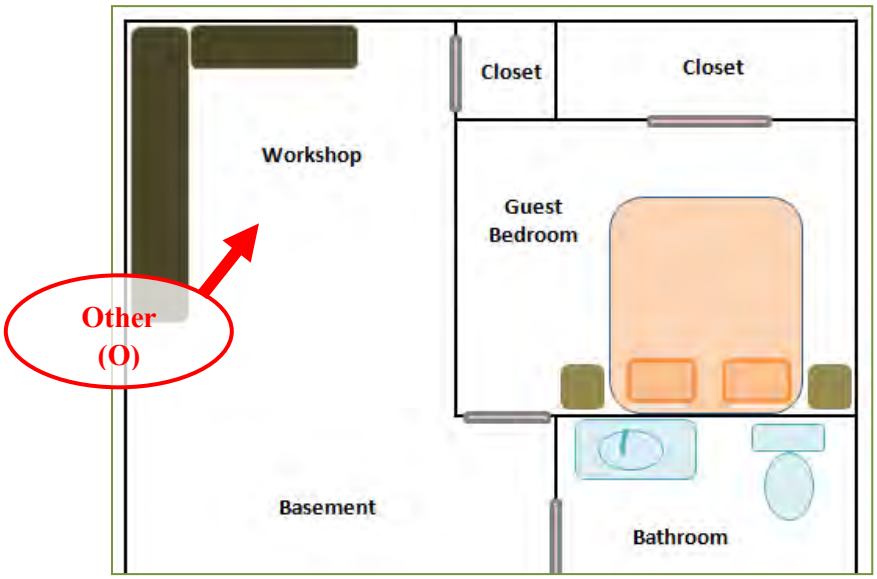
Closets ([Room Code]-C)

Technicians will collect lighting data for lamps in closets. Closets should be recorded separately from the spaces that contain them but with the name of the room included. For example, a closet in the master bedroom would be recorded as BR1-C.



Other (O)

Technicians will collect lighting data for lamps in other room types. In the notes column, describe the room type in more detail.



Primary Room

→ When multiple rooms of one type exist (ex. Bedrooms, bathrooms), record a "Y" in the "Primary" column to indicate the room used most frequently

→ If it is not clear which room is used most frequently, ask the homeowner.

→ For bedrooms, the "Primary room" is the master bedroom.

→ The column can be left blank if only one room exists of that type.

Fixture Group

→ A fixture group includes <u>all fixtures that are controlled by the same switch</u>.

→ Number fixture groups in *each room type targeted for loggers* from 1, 2, 3, 4, etc. up to the number of fixture groups in each room of the same type

- Single family homes targeted room types: Dining rooms, exteriors, living spaces, other room #1, other room #2, bedrooms, bathrooms and kitchens.
- Multifamily homes targeted room types: Living spaces, dining rooms (or other room #1), other room #2, bedrooms, bathrooms, and kitchens.
- For "other" rooms #1 and #2 - group all remaining rooms together to number fixture groups for other room type.
- Ex. If a house has three bedrooms, start with fixture group #1 in BR1 and count through fixture group #8 (the last fixture group) which is in BR3.

→ Repeat fixture group number until all bulbs associated with it are recorded.

Control Type

→ Include control-type information for each light fixture using the codes below.

→ For dimmable and 3-way control types

- Test the fixture to make sure these specialty features are functional.
- If the control also has on/off capability, still label the control by its specialty feature

Table 2: Control Type List

Control Types	Code	Details
On-Off	OF	Control can only turn a lamp on or off.
Dimmable	Dim	Control increases/decreases bulb brightness as it is turned or is moved up/down.
3-way	3W	Controls a fixture that uses a three-way bulb to produce three levels of light, switching the level with each turn (ex. 50-100-150 watts).
Wireless	W	Fixture is turned on by a remote control or a wall-mounted control that is not connected to the house's wiring.
Motion or Photo Sensor	MS	Fixture turns on when a moving object is detected.
None	None	Fixture has no control switch; the bulb is always on.
Breaker/Disconnect Plug	B	Fixture has no control switch; only turns on when plugged in.
Other	O	

Wall-Mounted Control

→ Record whether or not the control is wall mounted (Y/N)

→ Wall-Mounted controls are those that are permanently connected to the house's wiring (as opposed to controls that are mounted on the socket, base, or in-line with the cord or wireless remote control)

→ If a fixture can be turned on/off by two different control types, ask the homeowner which control is used the most.

- Ex. A table lamp that has its own switch but can also be turned on/off by a wall mounted control.

Fixture Number

→ Number fixtures in each room from 1, 2, 3, 4, etc. up to the number of fixtures in the room.

→ **Do not** restart numbering of fixtures from 1 for each room. Fixtures should be numbered sequentially throughout the entire home such that when you number the final fixture in the home the total number of fixtures in the home should match the fixture number.

→ Repeat the fixture number until all bulbs associated with it are recorded.

Multi-Switch

→ If a fixture is controlled by two separate wall-mounted switches (for example, a hallway light with switches at both ends of the hall), record this in the column

Fixture Type

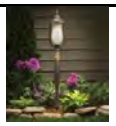
→ Include fixture type information for each installed bulb using the codes below.

→ **You do not need to capture fixtures inside appliances** like ovens, range hoods, refrigerators, or microwaves.

Table 3: Fixture Type List

Fixture	Code	Fixture	Code	Fixture	Code
Recessed	R	Wall Mount	WM	Walkway	W
Pendant	P	Night Light	NL	Exterior Flood	EF
Flush Mount	FM	Table Lamp	TL	Garage Door	G
Track	T	Floor Lamp	FL	Under Cabinet	U
Ceiling	CF	Post Mount	PM	Other	O

Table 4: Fixture Type Exhibit

Fixture	Image	Fixture	Image
Recessed *(light bulb does not stick out of the plane of the ceiling)*		**Table Lamp** *(lamps that are put on tables)*	
Pendant *(fixture and bulb hangs from ceiling, i.e. chandelier)*		**Floor Lamp** *(lamps that are put on the floor)*	
Flush Mount *(fixture is flush with the ceiling)*		**Post Mount** *(exterior lights on a lamppost)*	
Track *(light bulbs on a strip/track)*		**Walkway** *(lights on a path outside the home)*	
Ceiling Fan *(lights attached to a ceiling fan)*		**Exterior Flood** *(fixtures that flood a large area with light, found on the side of home, above garage, or under peak of roof)*	
Wall Mount *(fixture attached to wall)*		**Garage Door**	
Night Light		**Under cabinet** *(lights under kitchen cabinets for lighting counter)*	

Bulb Type

→ Record bulb type information for each installed bulb using the codes below.
→ If socket is empty, record as "E."

Table 5: Bulb Types Code List

Bulb Type	Code	Bulb Type	Code
Incandescent	I	Halogen	H
CFL	CFL	Other	O
Fluorescent	F	Empty Socket	E
LED	LED		

Table 6: Bulb Types Exhibit

Bulb Types	Image	Description
Incandescent (I)		Bulbs have a filament that's heated to the point of glowing
Compact Fluorescent (CFL)		Bulbs are energy-efficient; use 67% less energy than incandescent bulbs and last longer. Covered CFLs have a plastic cover that conceals the traditional spiral shape. If you look closely at the bulb you will be able to see the spirals through the covering—especially when the bulb is turned on.
Fluorescent (F)		Bulbs are filled with mercury vapor that emits ultraviolet light when electricity is applied, then coating inside bulbs turns the UV rays into visible light
Light-Emitting Diode (LED)		Bulbs have a semiconductor chip so current flows through; light is released when an electron falls into a lower energy level. Some LEDs have a yellow filter.
Halogen (H)		More efficient type of incandescent bulb with filament sealed into a compact transparent envelope filled a small amount of halogen, allowing the filament to be at a higher temperature. Some halogens are virtually indistinguishable from regular incandescent bulbs. They may be smaller (ex. A-17 size instead of A-19) or can be distinguished by the presence of a glass tube around the filament (halogen) instead of the filament by itself (incandescent).

Bulb Shape

→ Include bulb shape information for each installed bulb using the codes below.

Table 7: Bulb Shape List

Bulb Shape	Code	Bulb Shape	Code
Twist/Spiral	T	Spot/Reflector/Flood	S
Globe	G	Circline	C
A-lamp	A	Tube	Tub
Bullet/Torpedo	B	Candle	Can
Bug light	Bug	Other [Specify]	O

Table 8: Bulb Shape Exhibit

Bulb Shape	Image	Bulb Shape	Image
Twist/Spiral (T)		**Spotlight/ Reflector/Flood (S)**	
Globe (G) *(e.g., for bathroom vanity fixtures)*		**Circline (C)**	
A-lamp (A) *(shaped like standard incandescent)*		**Tube Style (Tub)**	
Bullet/Torpedo (B) *(pointed top, standard screw base)*		**Candle (Can)** *(pointed top with a candelabra screw base)*	
Bug light (Bug) *(yellow color; do not confuse with LEDs with yellow filters)*			

Socket Type

→ Record socket type for each installed bulb using the codes below.

→ Socket type refers to the bulb base (circled in red in Table 10) and how the base attaches to the fixture.

Table 9: Socket Type List

Socket Type	Code
Medium Screw Base (Standard)	S
Small Screw Base (Candelabra)	Can
Pin Base	P
GU Pin Base	GU
Other	O

Table 10: Socket Type Exhibit

Socket	Image	Description
Medium Screw Base (S)		Light bulb screwed into socket
Small Screw Base [Candelabra] (Can)		Smaller screw base
Pin Base (P)		Pin on base of bulb sticks into socket
GU Base (GU)		Pin with larger head on base of bulb sticks into socket

Notes

→ Use this column to describe any feature labeled as "other."
→ Use this column to record any additional information that may be useful in the data analysis phase.
→ Ex1. The resident refused access to certain rooms or fixtures; or lamp types cannot be determined unless a lighting fixture cover is removed (and the customer does not wish for this to be done).

4.3 Onsite Stored Bulbs Form

Package Group

→ A package group includes all stored bulbs that are in the same package.
→ Number package 1, 2, 3, 4, etc..
→ In the onsite form, repeat the package group number until all bulbs in the package are recorded. (The onsite form is one row per bulb, so a package group number is repeated in all rows until all bulbs are recorded)
→ If a bulb is not in a package, write "NA" in this column.

Bulb Type

→ Record bulb-type information for each stored bulb using the codes from Table 5.

Bulb Shape

→ Record bulb-shape information for each stored bulb using the codes from Table 7.

Base Type

→ Record the base type for each stored bulb using the socket type codes from Table 9.

Removed?

A. Had this bulb been installed in a fixture and later removed?
- Yes (Y)
- No (N)

Room

B. **[If A=Y]** ***What room was this bulb removed from?***

- Record appropriate room code from Table 1.

Reason for Removal

C. ***Why did you remove this bulb?*** **(Allow for multiple responses)**

1. Did not fit/work with fixture
2. Bulb burned out/broke
3. Did not like appearance/light/brightness
4. Other [Specify – record verbatim]
5. Refused
6. Don't know

Reason for Storage

D. ***Why are you storing this bulb?*** **(Allow for multiple responses)**

1. For future use
2. Do not plan to use
3. Plan to throw out/recycle
4. Other [Specify – record verbatim]
5. Refused
6. Don't know

Type of bulb it will replace

E. ***What type of bulb will this bulb likely replace?***

1. CFL bulb
2. Incandescent bulb
3. Whichever needs replacing first
4. The same type of bulb as the stored bulb
5. Other [Specify – record verbatim]
6. Refused
7. Don't know

4.4 Logger Information and Location Form

→ Record room information for installed loggers:

- **Single Family Homes (8 loggers)**
  1. Dining room
  2. Exterior
  3. Living space
  4. Other room #1
  5. Other room #2
  6. Bedroom
  7. Bathroom
  8. Kitchen
- **Multifamily Homes (6 loggers)**
  1. Living space
  2. Other room #1
  3. Other room #2
  4. Bedroom
  5. Bathroom
  6. Kitchen

→ For "Other room #1" and "Other room #2", record the room code on the line provided.

→ Record room code for room types that have multiple rooms. Ex. If the main bedroom is "BR 3", record this code in the form below "Bedroom."

→ Record fixture and bulb characteristics for those lights on which you installed loggers.

4.5 Homeowner Verification of Receipt of Incentive Payment

Have the homeowner sign the onsite form upon receiving their incentive check in the space provided on the cover page.

5 Logger Installation Instructions

5.1 Installation

- Install up to **eight** loggers on selected fixture groups in **single-family homes**
- Install up to **six** loggers on selected fixture groups in **multi-family homes**
- Use the data collection form to determine the total number of fixture groups. A fixture group refers to all fixtures controlled by the same switch.
- Take a picture(s) of the fixture with the logger on it (in order for easy recognition when retrieving).
- If installation of the desired number of loggers is not possible, note the reason on the onsite form.
- If the resident objects to installing loggers on any fixture group, note the reason on the intake sheet.

5.2 Room Prioritization

- **Single-family homes (8 loggers)**
  - → Install **one** logger in each of the following room types:
    1. Dining room
    2. Exterior
    3. Living space
    4. Bedroom
    5. Bathroom
    6. Kitchen
  - → Install **two** loggers in *other room types*. This includes any room that is **not** specified above (may include hallways, utility closets, offices, garages, etc.) If you have captured an area of room as part of another room (i.e. an office that is part of a great room) treat that area as a separate room.

- **Multi-family homes (6 loggers)**:
  - → Install **one** logger in each of the following room types:
    1. Living Space
    2. Bedroom
    3. Bathroom
    4. Kitchen
  - → Install **two** loggers in *other room types*. This includes any room that is **not** specified above (may include hallways, utility closets, offices, garages, etc.)

- **If any home does not include a specified room**, the logger allocated for that room will instead be assigned to a random fixture in a random room even if a logger is already installed in that room. **Install a maximum of two loggers in any one room.** If the randomly selected room already has two loggers installed assign the logger to the next room in order. (Ex1. If you roll a two but there are already two loggers in the dining room install the logger on the exterior. Ex2. If you roll a seven but there are already two loggers installed in other rooms, install the logger in a bedroom.)

- **Note**: Loggers must be installed on fixtures controlled by separate control devices. If a room only has one fixture or if all fixtures in a room are connected to the same control, **do not install multiple loggers**. Instead, install only one logger and allocate the second logger to another randomly selected room. **Install a maximum of two loggers in any one room.** If the random room selected already has two loggers installed assign the logger to the next room sequentially. (Ex1. If you roll a two but there are already two loggers in the dining room install the logger on the exterior. Ex2. If you roll a seven but there are already two loggers installed in other rooms, install the logger in a bedroom.)

Table 11: Random Selection of Room

Single-Family (10-sided die)			Multi-Family (6-sided die)		
Room	**# Rolled**	**Probability**	**Room**	**# Rolled**	**Probability**
Dining Room	1 or 2	20%	Living Space	1 or 2	33%
Exterior	3 or 4	20%	Other	3	17%
Living Space	5 or 6	20%	Bedroom	4	17%
Other	7	10%	Bathroom	5	17%
Bedroom	8	10%	Kitchen	6	17%
Bathroom	9	10%			
Kitchen	10	10%			

5.3 Random Fixture Group Selection

- For **single-family** homes:
  - → If eight or fewer fixture groups are identified in the lighting audit, install a logger on one fixture in each fixture group.
  - → If more than eight fixture groups are identified, field technicians will use the following random selection method to determine which fixtures to meter.
  - → **If any home does not include a specified room**, the logger allocated for that room will instead be assigned to a random fixture in a random room even if a logger is already installed in that room.

- For **multi-family** homes:
  - → If six or fewer fixture groups are identified in the lighting audit, install a logger on one fixture in each fixture group.
  - → If more than six fixture groups are identified, field technicians will use the following random selection method to determine which fixtures to meter.
  - → **If any home does not include a specified room**, the logger allocated for that room will instead be assigned to a random fixture in a random room even if a logger is already installed in that room.

Random Selection Method

- Determine the number of fixture groups in a room from the audit.
  - → If there are multiple rooms of a given type (e.g., bedrooms or bathrooms), count all fixture groups in all of the rooms of that type.
- Based on the fixture group count, select the most appropriate die provided and roll it once to determine which fixture group that should have a logger installed.[1] For example, if the room type has five fixture groups, use the six-sided die. If the room has 18 fixture groups, use the 20-sided die and so forth.
- If the number of fixture groups in a room is less than the random start number, continue counting from fixture group 1. (Ex. If a room has 11 fixture groups you would roll the 20-sided die. If the die shows the number 12, fixture group 1 would be selected.)
- If the number of fixture groups in a room exceeds 20 than you will need to roll the die multiple times. The first roll will determine a starting point and the second number will determine how many fixture groups to count to before installing the logger. (Ex. If a room has 21 fixture groups you would roll the 20-sided die once and get a 15, you would then roll the die again and get an 8. In this example you would install the logger on the 2nd fixture group.)
- If a second logger needs to be installed in the same room, roll the die again, if you get the same number move to the next fixture group in the room.
- Choose a fixture and bulb to install the logger on in this fixture group
  - → While fixture groups are selected at random, you can install the logger on any light bulb in the selected fixture group.
  - → Try to pick a bulb that will not interfere with normal use of the light and will be easy to install a logger on.

Examples

- If a bedroom has 10 fixture groups, the technician rolls the ten-sided die and rolls a four. The technician then identifies the fourth fixture group in the bedroom, and installs a logger.

[1] Field technicians will be provided with the three dice—20 sided, ten sided, and six sided.

- If a home has two exterior fixture groups, the technician rolls the six-sided die and rolls a five. Because there are only two fixtures on the exterior of this house, this means that the logger actually goes on the first fixture group (because if there are fewer fixture groups in the room than the random number, upon reaching the last fixture group in the room, one continues counting from the first group). Fixture group one contains three fixtures, one exposed on the eve of the home, one on the covered porch, and one on a 20' tall post in the yard. Since all three fixtures are controlled by the same control device (a wall switch), logging any one will give the same results. In this situation, the technician should install the logger on the covered porch as it is the easiest to reach and is protected from the elements.
- If an elegant bathroom has 16 fixture groups, the technician rolls the 20-sided die and rolls an 11. Fixture group 11 includes the ceiling fan and the vanity lights. In this situation, the technician should install the logger near a vanity bulb as they are easier to reach than the ceiling fan.

5.4 Other Metering Guidelines

- Resident agrees to allow installation of light loggers.
- Lights must be operating properly during site visit.
- Light loggers will be installed on fixtures in a way that is the least obtrusive to customers (based on resident preference/discretion).
  - → If logger cannot be installed on a fixture due to customer preference – try another fixture in the same fixture group – if no other fixtures in that fixture group exist choose the next fixture group in order.
- Light loggers will be installed where fixtures are easily accessible (e.g., not requiring more than a stepladder to access) and that are not fragile (e.g., crystal chandelier).
  - → If logger cannot be installed on a fixture due to inaccessibility – try another fixture in the same fixture group – if no other fixtures in that fixture group exist choose the next fixture group in order.
- When installing light loggers on fixtures, field technicians will take great care to minimize disturbances that could potentially invalidated the data.
  - → As needed, loggers will be positioned so only light from the fixture is recorded.
  - → When it is difficult to eliminate exposure to ambient light, field technicians will attach a fiber optic eye to the logger, which prevents the logger from "seeing" ambient light.
  - → Additionally, field technicians will secure loggers to fixtures using hard plastic cable ties, adhesive strips, and magnets.

5.5 Installing a Light Logger

This study will utilize Hobo UX 90s and DENT TOU-L loggers to record on/off instances. The instructions provided below are specific to the Hobo UX 90s loggers. Installations of DENT TOU-L loggers follow the same deployment principles. To successfully install a light logger, the technician will perform the following steps:

1. **Identify the light to be metered.**

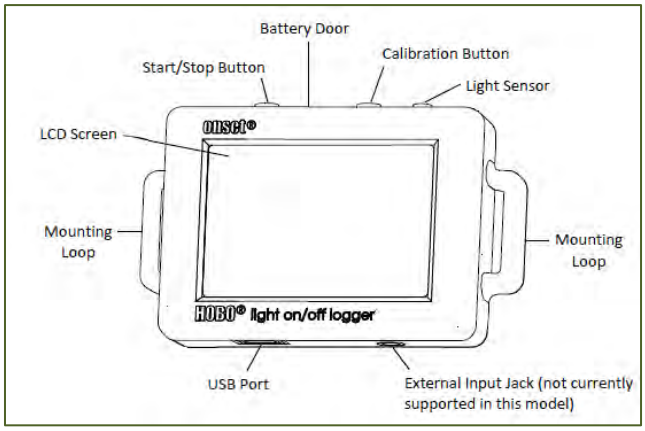
2. **Minimize impacts on the logger from other light sources.** If light from another bulb or from the sun can reach the light logger's sensor, it may record a false reading. To prevent this:
   - → Consider the path of the sun throughout the day.
   - → Consider reflection and refraction from nearby materials.
   - → Consider other fixtures nearby.

3. Before the logger is deployed, the screen should look like Figure 1. If the screen is different or blank, then there is a problem with the logger. Set it aside and choose another.

Figure 1: Logger Screen before Deployment

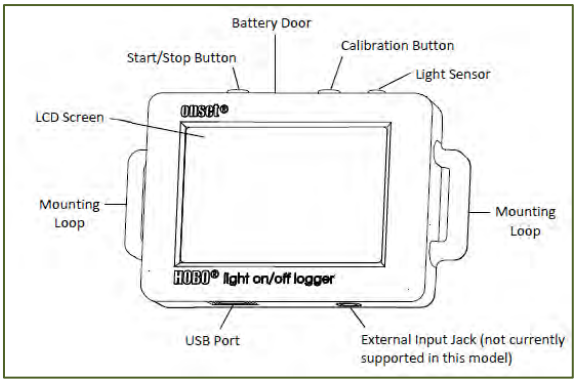
4. **Set the light logger.** To do this, press and hold the start/stop button for 3 seconds to start or stop logging data. (Figure 2).

Figure 2: Setting Light Logger



5. **Auto-calibrate the Light Logger** (Figure 3).

Figure 3: Auto-calibrating the Light Logger



- → After launching, deploy the logger near the light source to be monitored and turn the light source on.
- → Press the Calibrate button for 1 second. The LCD screen will display the signal strength of the light. The signal strength should ideally be at least 3 bars. Orient the logger as necessary to increase the signal strength.
- → Press the Calibrate button for 3 seconds while "HOLD" appears on the LCD screen. Move your hand away from the logger to prevent shadowing. The logger will count down to the auto-calibration and then display either "PASS" or "FAIL" after calibration is complete.
- → If the auto-calibration fails, point the sensor directly at the light source and then repeat these steps.
- → If you cannot get the logger to respond correctly in a given fixture, move on to the next fixture.
- → **Note:** The sensor is sensitive to lights that emit high amounts of infrared radiation like incandescent and halogen bulbs. It is best to use auto-calibration when possible when monitoring on/off conditions for lights with high infrared radiation.
- → **Note:** Auto calibration does not apply to DENT TOU-L loggers. DENT TOU-L loggers have sensitivity dials on them and a "sun" appears on the display when the logger is able to sense the light. Starting from the off position auditors increase the sensitivity while the light is on until the "sun" shows in the display.

6. When the logger is correctly responding to the light, assess the best mechanism to attach the logger to the light. The light logger can be attached with one or more of the following items:
   - → 3M Command Strips
   - → Zip ties
   - → Magnets on back of logger

   Avoid placing the light logger so it directly contacts the light. Place the sensor in an area with minimal potential to damage the fixture or light.

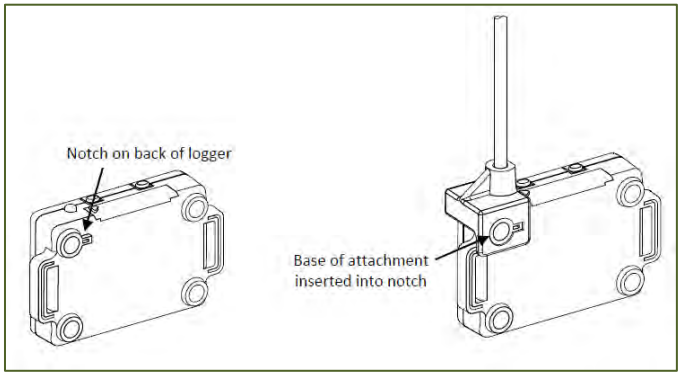
7. To ensure that the light logger is still responding, turn the light on and off, and verify the bulb icon appears and disappears.

Figure 4: Light On - Bulb On

8. If the light logger is in a location with significant sun exposure or other light sources, and you cannot get the logger to respond to the light, and then install the logger with the fiber optic attachment (light pipe). The light pipe connects to the back of the logger. Locate the notch in the upper left corner next to the mounting magnet. Insert the black base of the attachment into the notch so that the base clips onto the corner of the logger as shown in Figure 5.

9. **Light Pipe Deployment Guidelines** - follow these instructions when you need to use a light pipe:
   - → Make sure the end of the light pipe is as close to the light source as possible.
   - → Maximize the signal strength on the logger LCD screen by adjusting the light pipe while looking at the signal bars.
   - → Be sure to secure the light pipe after the signal has been optimized.
   - → Do not support the logger by the light pipe.
   - → Be sure that the pipe is seated all the way into the bracket before deployment.

Figure 5: Attached Light Pipe



   - → Set the logger, as described above.
   - → Attach the logger in a discrete area using the 3M Command Strip, Zip ties, or the magnets.

→ Direct the tip of the pipe as close as possible to brightest part of the light (see Figure 6).

Figure 6: Fiber Optic Eye Aimed at Brightest Part of Light

→ Do not bend the light pipe at sharp angles—this will damage it.

→ Turn the light off. If the bulb icon remains on, auto-calibrate the lighting logger again. The light may need to be turned on and off multiple times before the light logger is properly adjusted.

10. The loggers are configured to operate with the LCD screen off.

→ Once the logger is deployed, the screen will turn off after 10 minutes. You can reactivate the display for 10 minutes by pressing the start/stop button.

Installation Tips

- Install logger on the fixture in a way that is the least obtrusive to the homeowner.
- To minimize disturbances that could invalidate the data:
  - Position the light sensor so only light from the fixture is recorded;
  - Consider the path of the sun, reflection and refraction from nearby materials, and other fixtures;
  - Use a light pipe to focus in on the light source if the fixture is near a window or in a place where it is difficult to eliminate exposure to ambient light
- Be creative! While the magnets may be the easiest way to attach the logger to the fixture, it might not be the best placement to capture light – use the Velcro strip, zip ties, adhesive strips and magnets (or any combination of these) to install the logger in the optimum position.

Logger Numbers

3 possible versions of ID#s

Installation Examples: Good and Bad

Ceiling Fans

NO

Unable to focus on one bulb; captures too much ambient light

Unable to detect any light from bulbs

YES

If unable to place the logger closer, use light pipe to focus in on light source

Attached by magnets with light sensor pointed down toward the bulb

Wall Mounted Fixtures

NO

Logger is placed so the fixture blocks it from detecting light.

YES

Logger is placed next to the fixture with a light pipe curving around fixture to focus directly on the light source

Under Cabinet Fixtures

NO

Logger is installed away from the light source and the light sensor is up against the cabinet.

YES

Logger is placed with the light sensor facing the light source.

Table Lamps

NO

Logger is too far from light source, subject to external light, and obstructs use of the lamp.

YES

Logger is inside lamp and out of the homeowner's way.

Flush Mounts:

NO

Logger is too visible to homeowner.

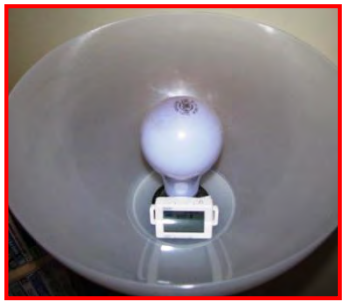
YES

Logger is installed on the base of the fixture;
NOTE: Loggers can melt if placed too close to bulbs in an enclosed fixture!

Logger is installed inside the lip of the light cover without being too visible to the homeowner.

Floor Lamps

NO



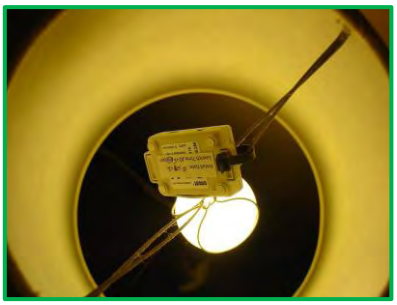
Logger is not attached to anything; it's also placed too close to the bulb and may melt.

Installed with light sensor facing away from the bulb.

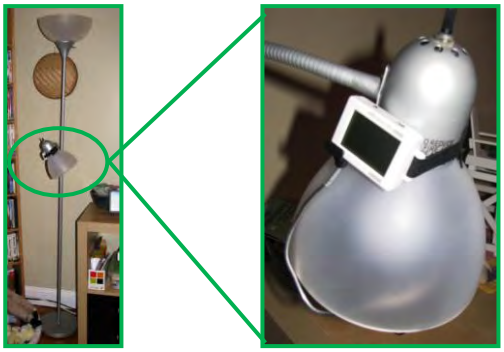
Logger is not focused in on any light source.

Floor Lamps (cont)

YES



Logger is attached to lamp shade with zip ties with the light sensor facing the bulb.



Logger is attached with the Velcro strip and uses a light pipe to focus in on the source.

Recessed

NO

Logger will not be able to accurately measure light from this fixture.

YES

This is a curved recessed fixture – logger is installed using a 3M strip on the Velcro strap to stick to the curved surface

---

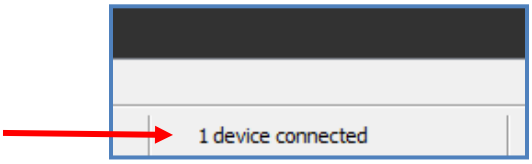
Melted Loggers

Logger was ~ 1in away from incandescent bulb and was too hot.

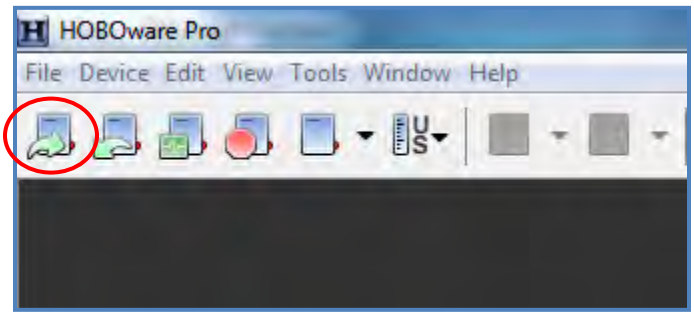
Moved to inside glass cover to distance it from the heat but still close enough to detect the light.

5.6 Resetting a Logger

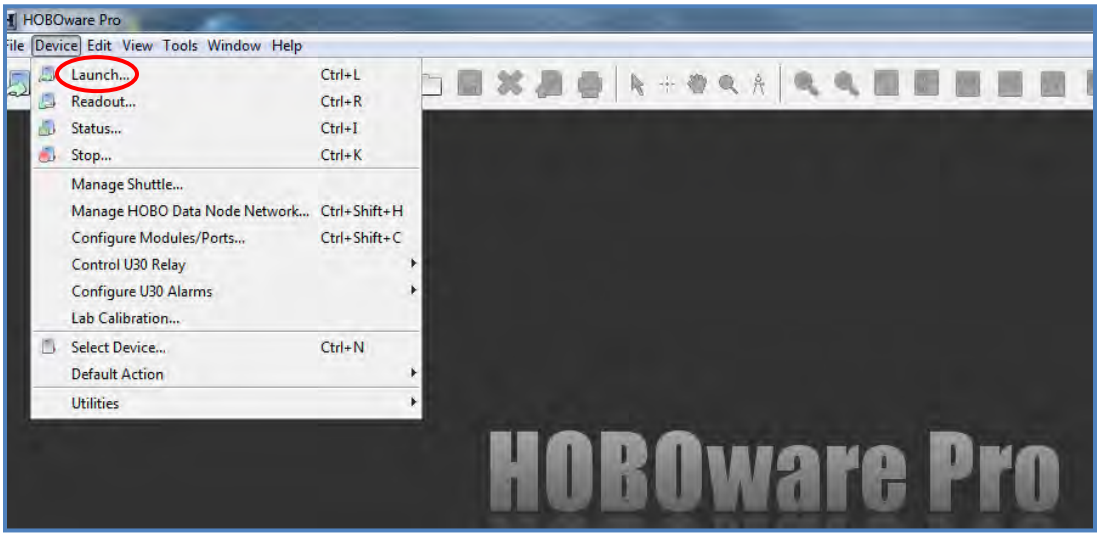
1. Open HOBOware Pro
2. Attach logger to computer with USB cord provided.
3. Once the logger is connected, you'll see this on the bottom right corner of your screen:



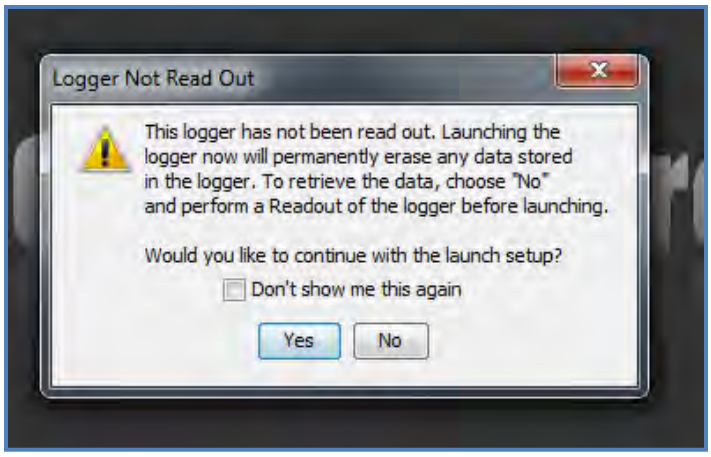
4. Click the **Launch Device** button



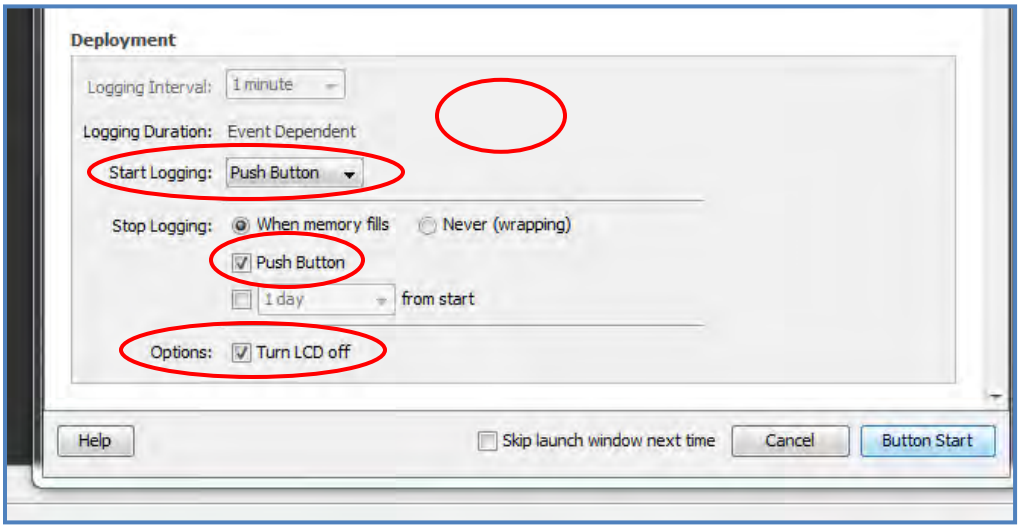
OR choose **Launch** from the **Device** dropdown menu:



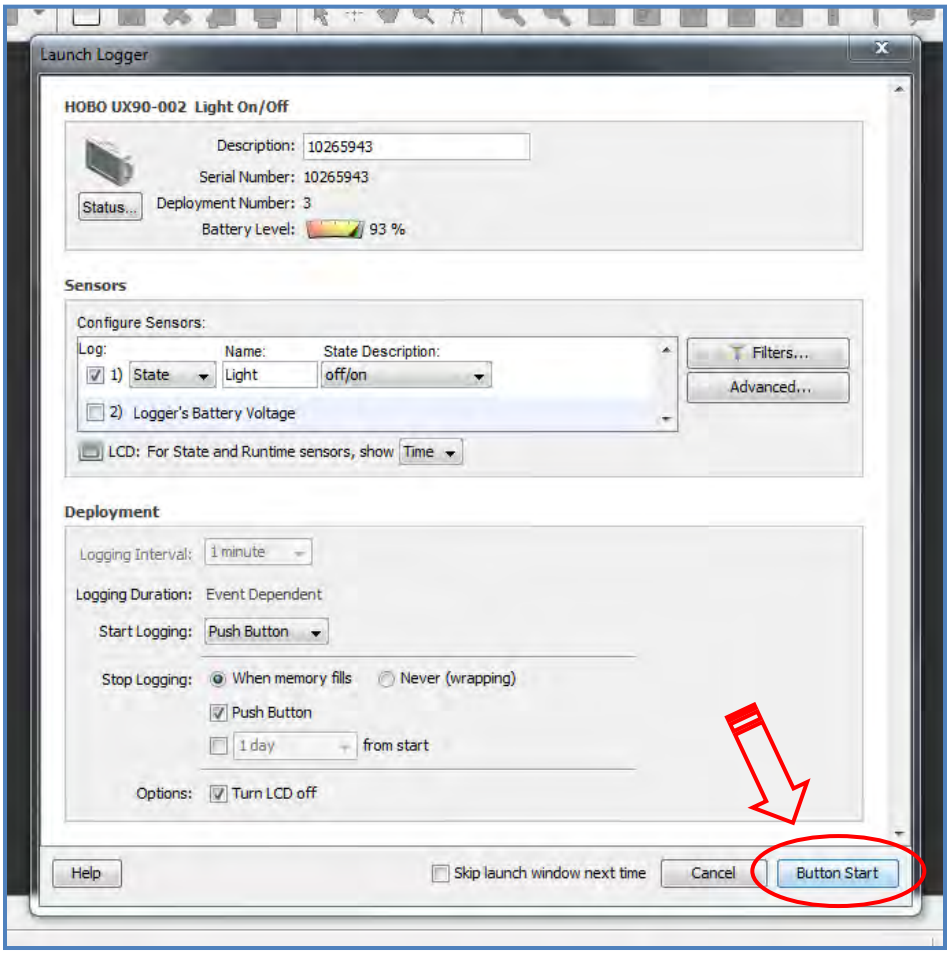
5. When you see the Logger Not Read Out screen, click YES. *(This is only to reset the logger so it is not necessary to read out the data)*



6. On the Launch Logger screen, make sure that:
   - → Start Logging is set to Push Button
   - → Stop Logging has the Push Button box checked
   - → Options has the Turn LCD Off box checked



7. Once the Launch Logger screen is set, click BUTTON START.



8. Logger is now reset now and can be calibrated again.

5.7 Logger Removal Protocols

Prior to removing light loggers, removal technicians will receive the logger installation data, which indicates the rooms and fixtures where loggers were installed in winter 2012. Field technicians will visit participants' homes in the summer of 2013 (six months later) to conduct logger removals and obtain additional data for the HOU analysis. Field technicians will also record *in situ* observations and photograph each logger prior to removal. The logger removal and data collection process includes the following:

- Photograph the logger prior to removal.
- Indicate the orientation of the sensor or light pipe (e.g., Is the sensor directed towards the light source?)
- Perform a state test to determine whether or not the logger accurately records event data; turn the light on and off to ensure that the bulb icon changes appropriately.
- Remove logger and review the total time on from logger screen.
- If the time on indicates extreme low use or extreme high use, ask the participant to verify, based on their own usage of the light fixture in question.
- Ask participant whether logger has fallen off the fixture or has otherwise been uninstalled prior to the technician's removal site visit; if so, ask participants to provide a date and time. **[Note: During the installation visit, participants will be asked to call and inform us if something does happen to the logger.]**
- Note the presence of windows and televisions/computers in rooms where loggers are installed.
- Note the condition of loggers upon removal and assess the battery status.
- Ask the participant to estimate typical usage for each metered fixture (e.g., 4 hours per day in the afternoon only).
- Record the presence of children under the age of 18 living in the home.
- If a logger is installed in a basement, record whether the basement is finished or unfinished.

After removing loggers, carefully pack and store loggers. Return the loggers to the project manager. Data from the loggers will be downloaded using appropriate software, raw data will be exported into CSV (comma separated values) format, and uploaded to the project's SharePoint site where analysts will access the data for review and analysis.

6 Quality Assurance and Control Procedures

As with all of our work, NMR endeavors to maintain a high quality work product. The sensitive nature of onsite work means that we take special precautions to ensure the quality of data collected and to avoid jeopardizing the relationship our clients have with their customers. To that end, we employ a number of steps to ensure that onsite technicians perform quality work that reflects well on NMR and its clients.

Our quality control and standard operating procedures begin well before a field technician ever steps foot in a customer's home. All of our field technicians receive rigorous project specific training. Training topics include project background, project specific data collection protocols, and customer service and interaction training. We also provide our scheduling staff with an overview of this training so that they know what customers will expect when they agree to participate and are able to answer any questions customers may have. We make every effort to ensure that customers are fully informed and avoid unnecessary surprises.

Below, we outline some of the specific quality control and training measures we will utilize for the Regional HOU study.

Quality Control and Training Measures:

- All field staff will receive training directly from NMR staff using training materials successfully implemented in similar onsite lighting saturation studies but tailored to the unique needs of the Regional Logger Study. Training for this project will include instruction on how to perform the following:
    - Identify various types and shapes of sockets, light bulbs, and controls
    - Examine light bulbs in a safe manner, including instructions on what equipment to bring to a home, working with covered fixtures, and clean-up of (especially CFLs and fluorescents) and compensation for bulbs and fixtures accidentally damaged during the visit
    - Ensure that they have located and inventoried all light bulbs (including stored bulbs) in the home through such procedures as creating a home schematic, mapping their route through the home, and documenting difficult-to-characterize lighting with pictures,
    - Correctly setup and install lighting loggers
- Training will also include some background on EISA and its requirements so that the field technician can answer questions he or she may receive on this topic while performing the inventory.
- NMR staff will accompany each part-time field technician on their first day of site visits.
- NMR staff will recruit participants and schedule appointments, assigning them to field staff based on location and work load.
- Each field staff member will be required to report his or her progress at the end of each day and forward hard copies of completed onsite forms to NMR staff for review each week.

In addition to reviewing the onsite forms, NMR staff will call 20% of participants to ensure that their experience with the field technician was satisfactory, and we will also revisit approximately 5% of the homes and repeat the data collection and observe logger installation to make sure the technician performed all tasks in a satisfactory manner.

7 Frequently Asked Questions

- **What is this device and how do I know what it does?**

  The device is called a "lighting logger." It is about the size of a business card but is ½ inch thick. **[SHOW CUSTOMER A LOGGER]** The type of lighting logger we use can tell when you turn you the light it is attached to on and off, but it does not collect any other information. If you want to know what the loggers look like, they can be found easily through a web search of the term "lighting logger." We will mainly be using the "HOBO" and "DENT" brands. It does not send any information wirelessly or emit any signals; it just records when the light is on or off.

- **What's in it for me and how long will this take?**
  We are offering $50 for your time when we install the loggers and $100 when we pick up the logger six months later. This is a total of $150. The visit should take around one hour, depending on the size of your house

- **What does the visit involve?**
  Technicians will walk around your home and count the various types of lighting products you have installed. They will also install some lighting loggers to record how often you use certain lights.

- **Where will the loggers be installed?**
  Technicians will install the loggers in a way so they do not interfere with normal use of lights. The loggers are very small and will not interfere in any way with the normal use of your lights.

- **When do you remove the loggers?**
  The loggers need to remain in place for six months. At the end of six months we will return to remove the loggers. We will schedule the visits at a time that is convenient for you.

- **Why six months?**
  We need to record their lighting usage over time to account for differences in usage based on varying daylight conditions. Households use their lights differently during the winter months and summer months.

- **Who we are?**
  I am _____ and I work for the NMR Group, Inc., a consulting firm. We have been hired by ***the Connecticut Energy Efficiency Board*** to perform this study.

- **Purpose of Study?**
  - → Establish customer awareness of lighting options and changes in the lighting market
  - → Understand how people use the light bulbs in their home, as this has a large impact on how much energy households use.
  - → Determine current rates of use and storage for various light bulbs.
  - → The results of the study will be used in planning for future energy needs in Rhode Island.
- **How do I know you are legit?**
  The Connecticut Energy Efficiency Board is sponsoring this program and study. The contact person is Tim Cole. His phone number is 860-874-5813 and his email address is CT_EEB@ATT.NET.

7.1 The Energy Independent and Security Act (EISA of 2007)

This section is meant to provide field technicians a brief overview of EISA and potential impacts on lighting. While knowledge of EISA is not crucial to field technicians performing their duties, EISA in-part prompted this study and it is possible that customers may ask questions about EISA during onsite visits.

Summary

The Energy Independence and Security Act (EISA) of 2007 sets maximum wattage levels by lumen output (that is, how bright the bulb is) for medium, screw-base bulbs that have a range from 310 to 2,600 lumens (Table 12). Bulbs not meeting these standards will be phased out over the next few years. This lumen range generally corresponds to the brightness of 40 Watt to 100 Watt incandescent bulbs, and it is primarily incandescent bulbs that will be phase out.

The standards started to go into effect under a phased approach that began in 2012, when general service bulbs (that is, typical bulbs) began to be required to use from 20 percent to 30 percent less energy than current incandescent bulbs. The law first applied to bulbs in the 1,490 to 2,600 lumen range, effectively banning the manufacture and import of general service 100 Watt incandescent bulbs in the United States after January 1, 2012. Over the next few years, the law will limit the manufacture and import of all general service incandescent bulbs between 40 and 100 Watts.

Table 12: EISA Phase-out Schedule – Stage 1

Rated Lumen Ranges	Typical Current Lamp Wattage	Maximum Rate Wattage	Minimum Rate Lifetime	Effective Date
1490-2600	100	72	1,000 hours	January 1, 2012
1050-1489	75	53	1,000 hours	January 1, 2013
750-1049	60	43	1,000 hours	January 1, 2014
310-749	40	29	1,000 hours	January 1, 2014

EISA prohibits the manufacture and import of incandescent bulbs, but not the sale of incandescent bulbs. Therefore, standard incandescent bulbs will remain available to consumers on retailers' shelves until all stock acquired before the relevant effective date, is sold. Additionally, as remaining stocks sell out, consumers will have the option of replacing higher-wattage incandescent bulbs with lower-wattage ones during the transition period. Some stores, however, have voluntarily chosen not to carry certain wattages of incandescent bulbs in anticipation of the law's implementation.

Important Details

- On December 19, 2007, President George W. Bush signed H.R. 6, the Energy Independence and Security Act of 2007, into law (Public Law 110-140).
- Sets maximum wattage levels by lumen output for medium, screw-base bulbs:
  - → 310 to 2,600 lumens, which roughly correspond to the brightness emitted by 40 Watt to 100 Watt incandescent bulbs
  - → Began to be implemented on January 1, 2012; during this study its main impact will be on 1,050 to 2,600 lumen bulbs (100 Watt and 75 Watt incandescent bulbs)

Manufacture vs. Sale

EISA prohibits the **manufacture** and **import** of incandescent bulbs but does **not** prohibit the **sale** of incandescent bulbs. So people can still buy incandescent bulbs until the current stock runs out, and they may also use lower wattage bulbs not yet covered by EISA to replace higher wattage ones when they are no longer available in stores.

Consumer Lighting Options

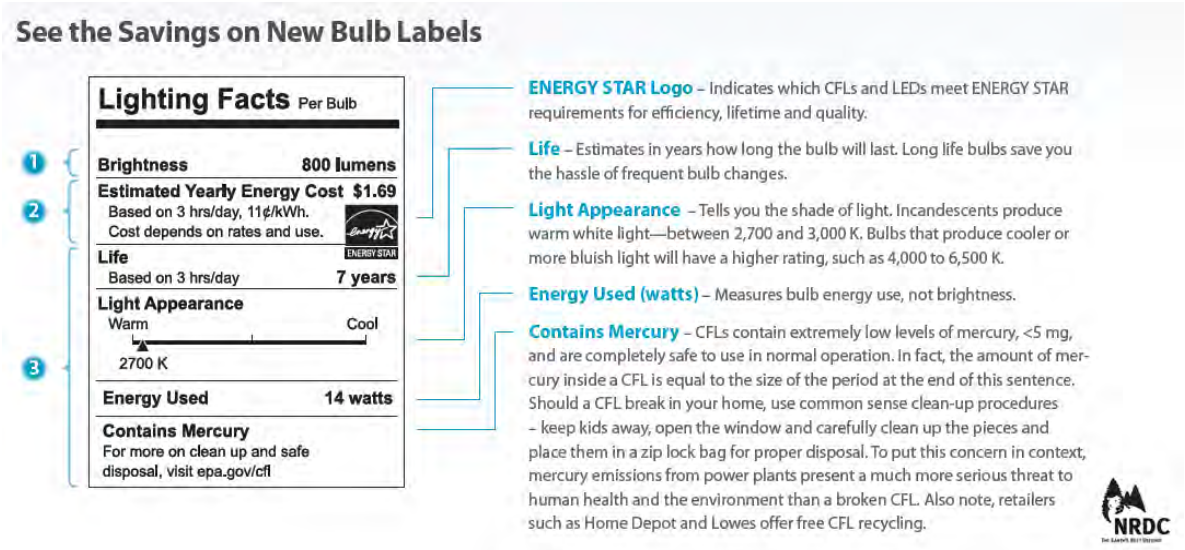
Consumers have a variety of options for replacement bulbs for those being phased out:

- Lower wattage incandescent bulbs (Cost is less than $1)
  - → Most similar to what many costumers are familiar with
- EISA-compliant halogen bulbs (Cost between $1.50 and $3.00)
  - → About 30% more efficient that standard incandescent bulbs
  - → Similar to standard incandescent bulbs in terms of appearance and light quality
- CFL bulbs (Cost between $1.00 and $3.00)
  - → More efficient than standard incandescent bulbs
  - → Some consumers concerned by mercury in CFL bulbs
- Non-directional LED bulbs (as opposed to spot and flood LEDs) (Cost between $10 and $20)
  - → Only a few on the market currently – still a developing technology
  - → While the price has been declining, still an expensive option and most consumers will not view LEDs as a viable replacement option until the price decreases.

Consumer Response

Consumer awareness of the EISA-mandated phase-out of incandescent bulbs and on how to choose light bulbs based on factors other than "wattage" (which most consumers equate with brightness) is relatively low. The Federal Trade Commission (FTC) has developed a new lighting facts label to help consumers make informed purchase decisions based on lumens instead of wattages and lifecycle costs.

Figure 7: FTC Lighting Facts Label



8 Mileage Tracking Form

NMR Group, Inc.

Regional Hours of Use Study
Time and Mileage

Time Sheet								
Task	Hours							Total Hours
	Mon	Tues	Wed	Thurs	Fri	Sat	Sun	
Training								
Onsite								
Travel								
Paper Work								
TOTAL:								

Mileage Log			
Date	Origination	Destination	Distance
		TOTAL:	

Name: _____ Week of: _____

Signature: _____ Date: _____

50-2 Howard Street, Somerville, MA 02144
Phone: (617) 284-6230 Fax: (617) 284-6239
www.nmrgroupinc.com

9 Reimbursement Form

NMR Group, Inc.

Regional Hours of Use Study

Reimbursement Form

Homeowner Name: _____

Address: _____

_____

Phone: _____

Technician: _____

Date of Visit: _____ Time: _____

Description: _____

_____

- Please attach a receipt for the replacement light bulb to this form and mail this form and the receipt to:

  Attn: Kiersten von Trapp
  NMR Group Inc
  50-2 Howard St.
  Somerville, MA 02144

50-2 Howard Street, Somerville, MA 02144
Phone: (617) 284-6230 Fax: (617) 284-6239
www.nmrgroupinc.com

10 EPA Cleanup and Disposal Guidelines for CFLs

Cleanup and Disposal Guidelines
For Compact Fluorescent Light Bulbs (CFLs)
June 2008

What precautions should I take when using CFLs in my home?

CFLs are made of glass and can break if dropped or roughly handled. Be careful when removing the bulb from its packaging, installing it, or replacing it. Always screw and unscrew the light bulb by its base (not the glass), and never forcefully twist the CFL into a light socket. If a CFL breaks in your home, follow the clean-up recommendations below. Used CFLs should be disposed of properly (see below).

What should I do with a CFL when it burns out?

EPA recommends that consumers take advantage of available local recycling options for compact fluorescent light bulbs. EPA is working with CFL manufacturers and major U.S. retailers to expand recycling and disposal options. Consumers can contact their local municipal solid waste agency directly, or go to www.epa.gov/bulbrecycling or www.earth911.org to identify local recycling options.

If your state or local environmental regulatory agency permits you to put used or broken CFLs in the garbage, seal the bulb in two plastic bags and put it into the outside trash, or other protected outside location, for the next normal trash collection. Never send a fluorescent light bulb or any other mercury-containing product to an incinerator.

If your ENERGY STAR qualified CFL product burns out before it should, look at the CFL base to find the manufacturer's name. Visit the manufacturer's web site to find the customer service contact information to inquire about a refund or replacement. Manufacturers producing ENERGY STAR qualified CFLs are required to offer at least a two-year limited warranty (covering manufacturer defects) for CFLs used at home. In the future, save your receipts to document the date of purchase.

How should I clean up a broken fluorescent bulb?

Because CFLs contain a small amount of mercury, EPA recommends the following clean-up and disposal guidelines:

1. Before Clean-up: Air Out the Room

- Have people and pets leave the room, and don't let anyone walk through the breakage area on their way out.
- Open a window and leave the room for 15 minutes or more.
- Shut off the central forced-air heating/air conditioning system, if you have one.

2. Clean-Up Steps for Hard Surfaces

- Carefully scoop up glass fragments and powder using stiff paper or cardboard and place them in a glass jar with metal lid (such as a canning jar) or in a sealed plastic bag.
- Use sticky tape, such as duct tape, to pick up any remaining small glass pieces and powder.
- Wipe the area clean with damp paper towels or disposable wet wipes. Place towels in the glass jar or plastic bag.
- Do not use a vacuum or broom to clean up the broken bulb on hard surfaces.

3. Clean-up Steps for Carpeting or Rug:

- Carefully pick up glass fragments and place them in a glass jar with metal lid (such as a canning jar) or in a sealed plastic bag.
- Use sticky tape, such as duct tape, to pick up any remaining small glass fragments and powder.
- If vacuuming is needed after all visible materials are removed, vacuum the area where the bulb was broken.
- Remove the vacuum bag (or empty and wipe the canister), and put the bag or vacuum debris in a sealed plastic bag.

4. Clean-up Steps for Clothing, Bedding, etc.:

- If clothing or bedding materials come in direct contact with broken glass or mercury-containing powder from inside the bulb that may stick to the fabric, the clothing or bedding should be thrown away. Do not wash such clothing or bedding because mercury fragments in the clothing may contaminate the machine and/or pollute sewage.
- You can, however, wash clothing or other materials that have been exposed to the mercury vapor from a broken CFL, such as the clothing you are wearing when you cleaned up the broken CFL, as long as that clothing has not come into direct contact with the materials from the broken bulb.
- If shoes come into direct contact with broken glass or mercury-containing powder from the bulb, wipe them off with damp paper towels or disposable wet wipes. Place the towels or wipes in a glass jar or plastic bag for disposal.

5. Disposal of Clean-up Materials

- Immediately place all clean-up materials outdoors in a trash container or protected area for the next normal trash pickup.
- Wash your hands after disposing of the jars or plastic bags containing clean-up materials.
- Check with your local or state government about disposal requirements in your specific area. Some states do not allow such trash disposal. Instead, they require that broken and unbroken mercury-containing bulbs be taken to a local recycling center.

6. Future Cleaning of Carpeting or Rug: Air Out the Room During and After Vacuuming

- The next several times you vacuum, shut off the central forced-air heating/air conditioning system and open a window before vacuuming.
- Keep the central heating/air conditioning system shut off and the window open for at least 15 minutes after vacuuming is completed.
- For more information about compact fluorescent bulbs, visit http://www.energystar.gov/cfls

For more information about compact fluorescent bulbs and mercury, visit http://www.energystar.gov/mercury EPA is continually reviewing its clean-up and disposal recommendations for CFLs to ensure that the Agency presents the most up-to-date information for consumers and businesses.

Regional Hours of Use Study: Onsite Handbook

Connecticut

6/24/2013

Prepared for:

The Massachusetts Energy Efficiency Program Administrators

The Connecticut Energy Efficiency Board Evaluation Consultant

National Grid Rhode Island

The New York State Energy Research and Development Authority

50-2 Howard Street, Somerville, MA 02144
Phone: (617) 284-6230 Fax: (617) 284-6239
www.nmrgroupinc.com

Contents

Tables

1 Training Plan

- Independent Review of Materials – The purpose of this document is to provide all the information required to conduct site visits to collect the loggers installed for the Regional HOU Study. All field technicians should **review this document in its entirety prior to the over-the-phone training session.** *(1 hour)*
- Store Visit **[for new technicians only]** – All field technicians will go to a hardware, lighting, or big box retailer to familiarize themselves with various bulb types. *(1 hour)*
- Over-the-Phone Training Session – All field technicians will have an over-the-phone training session with the NMR program manager to review the protocols, onsite forms, and equipment required for this project. *(30 minutes)*

2 Background / Purpose of the Study

The parties responsible for evaluation of energy-efficiency programs in Massachusetts, Connecticut, Rhode Island, and New York have committed to conducting a study to estimate hours of use (HOU) of light bulbs in homes. The main objective of this study, therefore, is to estimate HOU, and we will do so by room type, not lighting type (technology) as many studies have done in the past. Our focus on room types assumes that people are likely to use their lights in a given room the same way regardless of the type of bulbs in the room.

To accomplish this objective, in the winter of 2012-2013 field technicians conducted an inventory of lighting to determine the number and type of bulbs installed in customers' homes, and installed a series of lighting loggers to capture information on how customers use lights in their homes. Technicians are now returning to the sites to collect the lighting loggers in order to retrieve the data for analysis.

NMR is scheduling the follow up visits for this study via telephone. As a field technician you will be provided with a list of customers to visit each week. This list will include the customer's name, telephone number, address, and an appointment time. You will also receive a check for each participant prior to visiting their home.

3 Onsite Protocol

Prior to removing light loggers, technicians will receive the logger installation data, which indicates the rooms, fixtures and bulb characteristics where loggers were installed in six months earlier; when available, the technicians will also receive the home schematic showing the exact location of the installed loggers.

Prior to Visit

Before visiting a home, you should make sure that, at a minimum, you have the following:

- → Onsite handbook
- → Data Form & Home Schematic
- → Appointment sheet
- → Company Polo Shirt
- → ID Badge
- → GPS

Materials for Customer

- → FAQs and Info Sheet
- → NMR contact's business card
- → Check ($100)

CFL Clean up Kit

- → Sealable plastic bags
- → Disposable wipes
- → Vacuum
- → Duct tape
- → Flat brush

Logger Removal Kit

- → Camera
- → Flashlight
- → Pen/Pencils
- → Flat & Philips head screwdrivers
- → Insulated gloves
- → Shoe coverings
- → Latex gloves
- → Step ladder
- → Wire Cutters
- → Scissors
- → Cleaning rags
- → Adhesive Remover Solution with Scraper
- → Sealable sandwich bags
- → Trash bag

Arrival at Onsite

After the door is opened, immediately ascertain that the person at the door is the scheduled interviewee. Introduce yourself and hand him/her the business card.

- **Sample Introduction** *(not to be read verbatim)***:**
  "Hello, my name is _____, and I am working with NMR. NMR is working under contract with ***the Connecticut Energy Efficiency Board****. I'm here to meet with _____. As mentioned on the phone, I'm here to walk through your home and collect the loggers that were installed on selected fixtures six months ago.* ***[Customer should be expecting inspector]****. During my visit I have a few wrap-up questions for you about the status of the loggers during the duration of the study, as well as some limited demographic questions. Today, in appreciation for your time, on behalf of* ***the Connecticut Energy Efficiency Board****, you'll also receive the second payment of $100. Do you have any questions regarding my visit?"*

Prior to Data Collection

- Give the customer a step by step description of what you'll be doing (show the data collection form as you explain)
  - → First I will remove the loggers installed in your home.
  - → Then I will ask you a few questions about the loggers as well as some demographic questions.
- The customer should not be surprised by any of this information as they have already been told what the study will consist of.

General sequence of data collection

- Logger Removal:
  - → Consult logger removal instructions.
  - → Check that the information provided for each logger is correct; record any discrepancies.
  - → For each logger, ask the homeowner, *"Were there any changes to this logger, light bulb, or fixture during the duration of its installation?"* and record response.
- Customer Survey:
  - → Ask the homeowner the demographic questions in the customer survey.
- After Data Collection:
  - → Thank the customer for his/her time
  - → Give him/her the $100 check.
  - → Have the customer sign off on your data collection form to indicate that you visited their home and provided him/her with a $100 check.
  - → Leave with the customer the "Logger Participant Frequently Asked Questions" one-page sheet.

4 Onsite Form Instructions

NMR will provide you with onsite forms specific to each site. These forms will be pre-filled with the logger ID number, room, fixture type, bulb type, bulb shape and socket type for each logger expected to be installed in each site.

Customer Information

→ Customer Name, Customer Address, and Customer ID will be provided on the sheet.

→ Fill in your name and the date and time of the appointment.

Site Specific Notes

→ NMR will include any known issue associated with a logger or household in this column (ex. The resident phoned NMR to report a logger had melted.)

→ If applicable, follow up on this comment with the homeowner.

Logger Retrieval Form

→ Using the information and home schematic (if applicable) provided by NMR, locate each logger installed in the home.

→ **Before removing the logger**, ask: ***Were there any changes to this bulb, logger, or fixture during the time the logger was installed?***

- If yes, take a photo of the logger and the replacement bulb
- Record any changes in the box provided (detailed instructions provided below)

→ **For each logger**, check that the pre-filled information is correct.

→ If there are any discrepancies between the expected and installed logger number, fixture, or bulb information provided, **fill in the actual information on the corresponding line below**.

→ **Record all information in clear, easy to read handwriting**

Logger ID

→ If a logger number has an asterisk (*), this number has been identified as one that **needs to be double checked** – record the correct logger number for each of these on the line below (even if it is the same).

→ **Always include a note for these loggers** (even if it is just "everything correct") so that we can confirm it was double-checked.

Room, Fixture Type, Bulb Type, Bulb Shape, Socket Type

→ Record any discrepancies in the row below the pre-filled information.

→ If a bulb has been changed, record the new bulb info in the box on the second page.

Light Pipe

→ For each logger, indicate if the logger has a light pipe attached (Y/N) in the space provided.

State Test

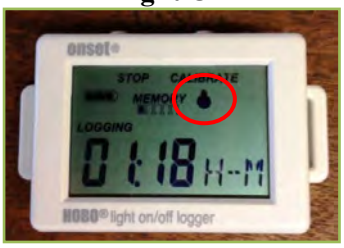
→ **<u>Before removing the logger</u>, perform a state test** to determine whether or not the logger accurately records event data.

- The logger screen will be blank – click one of the top buttons to make the screen appear (do not hold the button as that will stop the logger)
- Turn the fixture on and off; record whether the light bulb icon appears "on" and "off" appropriately (Pass/Fail).

→ If the battery is dead, or you are unable to complete the state test for a different reason, record this information in the box provided.

Light On

Light Off



Total Time

→ Record the total time either immediately before or immediately after removing the logger;

→ The time display shows the total amount of time the light has been on since logging began, ranging from seconds to days.

Hours & Minutes

1 hour, 18 minutes

Days & Hours

4 days, 17 hours (or 113 hours)

Usage Estimate

→ **<u>For each logger</u>**, ask the homeowner:

What was the typical usage for this fixture?

→ Record response in the column provided (Ex. 4 hours per day in the afternoon only).

→ **<u>Extreme Usage</u>:**

- Usage should be in the range of 70 to 800 hours - if the time on indicates extreme low use or extreme high use (anything above or below this range) **take photos of the fixture and the room.**
- Ex. If there is a window nearby, the logger may have been recording ambient light in addition to lamp usage.
- Do a quick calculation to see how the estimate compares to the total time:
  - The loggers have been in place approximately 150 days.
  - Ex. If the customer estimates 4 hours use per day, the total time should be in the range of 25 days (4 hours a day * 150 days = 600 hours. 600 hours/24 hours a day = 25 days).
- If the estimate and logger time are far apart, look for an explanation and ask the customer if they have any ideas that could explain the difference.

Record Changes

→ **<u>For each logger</u>**, ask the homeowner:

Were there any changes to this bulb, logger, or fixture during the time the logger was installed?

→ If "Yes", record the associated logger ID number and the date (or approximate date) the change occurred.

→ **If the bulb was replaced**, record the new bulb information in the space provided.

- For all bulb types record: Bulb type, shape, and wattage
- Ask: ***Was the new bulb a new purchase or was it a stored bulb?***
  1. Stored
  2. New Purchase
  3. Don't Know

Changes made since logger installation?		New Bulb				
Logger ID #	Date of Change	Bulb Type	Bulb Shape	Watts	Stored/ New	Other Change
12345678	4/13/13	CFL	T	13	New	

→ **If another change occurred**, record this information in the space provided for details.

Changes made since logger installation?		New Bulb				
Logger ID #	Date of Change	Bulb Type	Bulb Shape	Watts	Stored/ New	Other Change
87654321	2/4/13					Logger blew off fixture; home owner put it back up.

Customer Survey

→ Ask the homeowner the following questions:

- ***How many children under the age of 18 live in this household on a full time basis?*** → *Record the number on the line provided.*
- ***What is the highest level of education completed so far by the head of the household?*** *(If more than one head of household, ask for the education level of the household head with the highest degree)*

1. Less than 9th grade
2. 9th to 12th Grade, no diploma
3. High School Graduate/GED
4. Some College, No Degree
5. Associates Degree
6. Bachelors Degree
7. Graduate or professional degree
8. Don't Know
9. (Refused)

Additional Notes

→ Record any additional comments the homeowner may have or any other relevant observations in this column.

Customer Signature

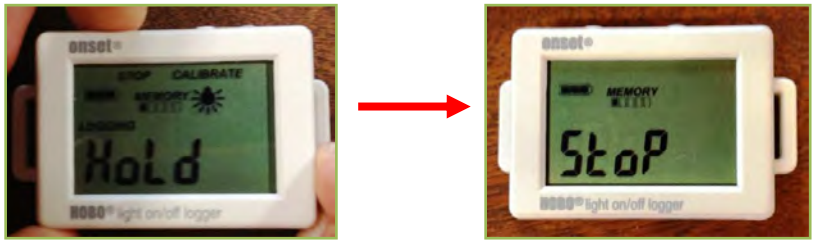
→ Have the homeowner sign the onsite form upon receiving their incentive check in the space provided on the cover page.

5 Logger Removal Protocols

5.1 Removing a Logger

To successfully remove a light logger, the technician will perform the following steps:

- Identify the fixture on which the logger is installed and locate the logger.
  - → If the customer offers to turn off the fixture and take it apart him/herself, **ALWAYS** let the customer do it.
  - → If there have been any changes to the bulb or fixture, take a photo of the bulb and fixture before removal.
- The logger screen should be blank when you find it; you can reactivate the display by quickly pressing the start/stop button. (Note: Do not hold the button for a few seconds, as that may turn the logger off)
- Remove the logger from the fixture **as carefully as possible**.
  - → If the customer offers to remove the logger from the fixture, let him/her do it.
  - → NMR will provide you with wire cutters and scissors to remove loggers installed with zip ties, as well as adhesive remover to remove any adhesive left from loggers installed with duct tape or 3M strips.
  - → Clean up all trash associated with logger removal; NMR will provide a small trash bag if there is not one easily accessible near the fixture.
- **Stopping a Logger**:
  - → Once you've removed the logger and recorded all the necessary data, stop the logger.
  - → Logging will end once you press the Start/Stop logging button for 3 seconds.



- **Light Pipes:**
  - → Some loggers will have light pipes attached to them. When you see one, inspect it to make sure it is still properly attached and pointing at the light bulb. If it is not, take a picture and make a note before removing the light pipe.
  - → To remove a light pipe: while holding the logger with the screen facing you, carefully push the base of the light pipe away from you:

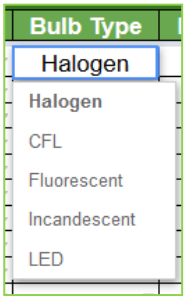
- **Packing Loggers:**
  - → **Put all loggers and the completed onsite form** from the site in one Ziploc bag and close the seal.
  - → The light pipes do not have to go in the site-specific Ziploc bag; all collected light pipes should be carefully packed together.

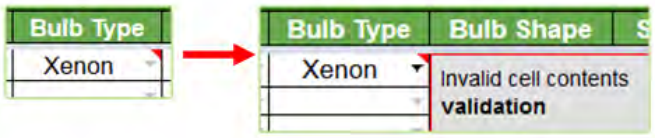
5.2 Removal Guidelines

- **Damage:**
  - → If you break or damage any fixtures, furniture, etc, give the customer the "Reimbursement Form."
  - → Note what was broken and contact the project manager as soon as possible to report the incident.
  - → Take a picture of the damage.
- **Broken Bulbs:**
  - → If you break any type of light bulb and/or if a broken CFL came into direct contact with clothing or bedding which subsequently needed to be thrown out, give the customer the "Reimbursement Form."
  - → Note what type of bulb was broken and contact the project manager as soon as possible to report the incident.
  - → Take a picture of the broken bulb and any other damage.
  - → **If a CFL or a fluorescent bulb should be broken**, refer to the "Cleanup and Disposal Guidelines for Compact Fluorescent Light Bulbs" of the Environmental Protection Agency (EPA) included in this packet.
- **Removing Bulbs or Fixture covers:**
  - → If the customer offers to turn off the fixture and take it apart him/herself, **ALWAYS** let the customer do it.
  - → **DO NOT TOUCH** if fixtures have cracked or damaged covers, or look delicate or easily breakable; if a logger is attached to such a fixture, proceed with caution with the homeowner present.
- **Burned Out Bulbs:**
  - → If a bulb is burned out, ask the customer the date (or approximate date) that the bulb burned out and record this in the appropriate spot on the onsite form.

5.3 Reporting Data

- At the end of each day, review the completed onsite forms to ensure that all necessary information is recorded and is clear and easy to read.
- **Entering Data into Google Docs:**
  - → A Gmail account will be necessary for this phase of the project; you'll need to open a new account if you don't already have one.
  - → Enter the completed onsite information into your Google doc for this project; all of your onsite data will be entered here.
  - → The Google doc has two tabs: **Logger Info** and **Customer Survey**. Enter the following information in each tab:
    - Logger Info:
      - Customer ID (repeat for all loggers associated with this ID)
      - Each Logger ID # and the correct information associated with each one
      - Any changes made since the loggers were installed – if no changes were made, enter an "N" under the "Change?" column.
    - Customer Survey:
      - Customer ID
      - Number of children under 18
      - Education
      - Additional Notes
  - → If provided, choose the correct information from the drop-down menu; if there is no drop-down menu, type in the recorded data.
    - Any onsite data that is not included in the drop-down menu can be typed in.
    - Ignore the red triangle that will appear in the upper right corner (and the comment box that appears when you scroll over the red triangle); this notifies you that the data entered is not in the list provided, but will not delete the cell contents.





- Upload, email, or text any photos to the NMR project manager at the end of each day with the associated Customer ID and Logger ID #.
- The NMR project manager will collect the loggers from you at the end of the project. Data from the loggers will be downloaded for review and analysis.

6 Quality Assurance and Control Procedures

As with all of our work, NMR endeavors to maintain a high quality work product. The sensitive nature of onsite work means that we take special precautions to ensure the quality of data collected and to avoid jeopardizing the relationship our clients have with their customers. To that end, to ensure that onsite technicians perform quality work that reflects well on NMR and our clients, the NMR project manager will:

- Review the onsite data entered on the Google doc at the end of each day.
- Call 20% of participants to ensure that their experience with the field technician was satisfactory.

7 Frequently Asked Questions

- **Who we are?**
  I am _____ and I work for NMR Group Inc, a consulting firm. We have been hired by the Connecticut Energy Efficiency Board to perform this study.
- **Purpose of Study?**
  The parties responsible for evaluation of energy-efficiency programs in Massachusetts, Connecticut, Rhode Island, and New York have committed to conducting a study to estimate hours of use (HOU) of light bulbs in homes. The main objectives of this study are as follows:
  - → Establish customer awareness of lighting options and changes in the lighting market
  - → Understand how people use the light bulbs in their home, as this has a large impact on how much energy households use.
  - → Determine current rates of use and storage for various light bulbs.
  - → The results of the study will be used in planning for future energy needs in Massachusetts, Connecticut, Rhode Island, and New York.
- **What happens with our data?**
  The lighting logger recorded when your light was turned on and off over the past six months. It did not collect any other information. When we download the data from the logger we will assign the information to a number (not a name) and no one will know that the data is for your home.
- **How can I find out the results?**
  The study results will be the property of by the Connecticut Energy Efficiency Board and will become accessible to the public in the spring of 2014.
- **How do I know you are legit?**
  The Connecticut Energy Efficiency Board is sponsoring this program and study. The contact person is Tim Cole. His phone number is 860-874-5813 and his email address is CT_EEB@ATT.NET.

8 EPA Cleanup and Disposal Guidelines for CFLs

Cleanup and Disposal Guidelines
For Compact Fluorescent Light Bulbs (CFLs)
June 2008

What precautions should I take when using CFLs in my home?
CFLs are made of glass and can break if dropped or roughly handled. Be careful when removing the bulb from its packaging, installing it, or replacing it. Always screw and unscrew the light bulb by its base (not the glass), and never forcefully twist the CFL into a light socket. If a CFL breaks in your home, follow the clean-up recommendations below. Used CFLs should be disposed of properly (see below).

What should I do with a CFL when it burns out?
EPA recommends that consumers take advantage of available local recycling options for compact fluorescent light bulbs. EPA is working with CFL manufacturers and major U.S. retailers to expand recycling and disposal options. Consumers can contact their local municipal solid waste agency directly, or go to www.epa.gov/bulbrecycling or www.earth911.org to identify local recycling options.

If your state or local environmental regulatory agency permits you to put used or broken CFLs in the garbage, seal the bulb in two plastic bags and put it into the outside trash, or other protected outside location, for the next normal trash collection. Never send a fluorescent light bulb or any other mercury-containing product to an incinerator.

If your ENERGY STAR qualified CFL product burns out before it should, look at the CFL base to find the manufacturer's name. Visit the manufacturer's web site to find the customer service contact information to inquire about a refund or replacement. Manufacturers producing ENERGY STAR qualified CFLs are required to offer at least a two-year limited warranty (covering manufacturer defects) for CFLs used at home. In the future, save your receipts to document the date of purchase.

How should I clean up a broken fluorescent bulb?
Because CFLs contain a small amount of mercury, EPA recommends the following clean-up and disposal guidelines:

1. Before Clean-up: Air Out the Room

- Have people and pets leave the room, and don't let anyone walk through the breakage area on their way out.
- Open a window and leave the room for 15 minutes or more.
- Shut off the central forced-air heating/air conditioning system, if you have one.

2. Clean-Up Steps for Hard Surfaces

- Carefully scoop up glass fragments and powder using stiff paper or cardboard and place them in a glass jar with metal lid (such as a canning jar) or in a sealed plastic bag.
- Use sticky tape, such as duct tape, to pick up any remaining small glass pieces and powder.
- Wipe the area clean with damp paper towels or disposable wet wipes. Place towels in the glass jar or plastic bag.
- Do not use a vacuum or broom to clean up the broken bulb on hard surfaces.

3. Clean-up Steps for Carpeting or Rug:

- Carefully pick up glass fragments and place them in a glass jar with metal lid (such as a canning jar) or in a sealed plastic bag.
- Use sticky tape, such as duct tape, to pick up any remaining small glass fragments and powder.
- If vacuuming is needed after all visible materials are removed, vacuum the area where the bulb was broken.
- Remove the vacuum bag (or empty and wipe the canister), and put the bag or vacuum debris in a sealed plastic bag.

4. Clean-up Steps for Clothing, Bedding, etc.:

- If clothing or bedding materials come in direct contact with broken glass or mercury-containing powder from inside the bulb that may stick to the fabric, the clothing or bedding should be thrown away. Do not wash such clothing or bedding because mercury fragments in the clothing may contaminate the machine and/or pollute sewage.
- You can, however, wash clothing or other materials that have been exposed to the mercury vapor from a broken CFL, such as the clothing you are wearing when you cleaned up the broken CFL, as long as that clothing has not come into direct contact with the materials from the broken bulb.
- If shoes come into direct contact with broken glass or mercury-containing powder from the bulb, wipe them off with damp paper towels or disposable wet wipes. Place the towels or wipes in a glass jar or plastic bag for disposal.

5. Disposal of Clean-up Materials

- Immediately place all clean-up materials outdoors in a trash container or protected area for the next normal trash pickup.
- Wash your hands after disposing of the jars or plastic bags containing clean-up materials.
- Check with your local or state government about disposal requirements in your specific area. Some states do not allow such trash disposal. Instead, they require that broken and unbroken mercury-containing bulbs be taken to a local recycling center.

6. Future Cleaning of Carpeting or Rug: Air Out the Room During and After Vacuuming

- The next several times you vacuum, shut off the central forced-air heating/air conditioning system and open a window before vacuuming.
- Keep the central heating/air conditioning system shut off and the window open for at least 15 minutes after vacuuming is completed.
- For more information about compact fluorescent bulbs, visit http://www.energystar.gov/cfls

For more information about compact fluorescent bulbs and mercury, visit http://www.energystar.gov/mercury EPA is continually reviewing its clean-up and disposal recommendations for CFLs to ensure that the Agency presents the most up-to-date information for consumers and businesses.

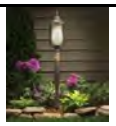
9 Onsite Reference Exhibits

Fixture Type

Table 1: Fixture Type List

Fixture	Code	Fixture	Code	Fixture	Code
Recessed	R	Wall Mount	WM	Walkway	W
Pendent	P	Night Light	NL	Exterior Flood	EF
Flush Mount	FM	Table Lamp	TL	Garage Door	G
Track	T	Floor Lamp	FL	Under Cabinet	U
Ceiling Fan	CF	Post Mount	PM	Other	O

Table 2: Fixture Type Exhibit

Fixture	Image	Fixture	Image
Recessed *(light bulb does not stick out of the plane of the ceiling)*		**Table Lamp** *(lamps that are put on tables)*	
Pendant *(fixture and bulb hangs from ceiling, i.e. chandelier)*		**Floor Lamp** *(lamps that are put on the floor)*	
Flush Mount *(fixture is flush with the ceiling)*		**Post Mount** *(exterior lights on a lamppost)*	
Track *(light bulbs on a strip/track)*		**Walkway** *(lights on a path outside the home)*	
Ceiling Fan *(lights attached to a ceiling fan)*		**Exterior Flood** *(fixtures that flood a large area with light, found on the side of home, above garage, or under peak of roof)*	
Wall Mount *(fixture attached to wall)*		**Garage Door**	
Night Light		**Under cabinet** *(lights under kitchen cabinets for lighting counter)*	

Bulb Type

Table 3: Bulb Types Code List

Bulb Type	Code	Bulb Type	Code
Incandescent	I	Halogen	H
CFL	CFL	Other	O
Fluorescent	F	Empty Socket	E
LED	LED		

Table 4: Bulb Types Exhibit

Bulb Types	Image	Description
Incandescent (I)		Bulbs have a filament that's heated to the point of glowing
Compact Fluorescent (CFL)		Bulbs are energy-efficient; use 67% less energy than incandescent bulbs and last longer. Covered CFLs have a plastic cover that conceals the traditional spiral shape. If you look closely at the bulb you will be able to see the spirals through the covering—especially when the bulb is turned on.
Fluorescent (F)		Bulbs are filled with mercury vapor that emits ultraviolet light when electricity is applied, then coating inside bulbs turns the UV rays into visible light
Light-Emitting Diode (LED)		Bulbs have a semiconductor chip so current flows through; light is released when an electron falls into a lower energy level. Some LEDs have a yellow filter.
Halogen (H)		More efficient type of incandescent bulb with filament sealed into a compact transparent envelope filled a small amount of halogen, allowing the filament to be at a higher temperature. Some halogens are virtually indistinguishable from regular incandescent bulbs. They may be smaller (ex. A-17 size instead of A-19) or can be distinguished by the presence of a glass tube around the filament (halogen) instead of the filament by itself (incandescent).

Bulb Shape

Table 5: Bulb Shape List

Bulb Shape	Code	Bulb Shape	Code
Twist/Spiral	T	Spot/Reflector/Flood	S
Globe	G	Circline	C
A-Line	A	Tube	Tub
Bullet/Torpedo	B	Candle	Can
Bug light	Bug	Other [Specify]	O

Table 6: Bulb Shape Exhibit

Bulb Shape	Image	Bulb Shape	Image
Twist/Spiral (T)		**Spotlight/ Reflector/Flood (S)**	
Globe (G) *(e.g., for bathroom vanity fixtures)*		**Circline (C)**	
A-Line (A) *(shaped like standard incandescent)*		**Tube Style (Tub)**	
Bullet/Torpedo (B) *(pointed top, standard screw base)*		**Candle (Can)** *(pointed top with a candelabra screw base)*	
Bug light (Bug) *(yellow color; do not confuse with LEDs with yellow filters)*			

Socket Type

Table 7: Socket Type List

Socket Type	Code
Medium Screw Base (Standard)	S
Small Screw Base (Candelabra)	Can
Pin Base	P
GU Pin Base	GU
Other	O

Table 8: Socket Type Exhibit

Socket	Image	Description
Medium Screw Base (S)		Light bulb screwed into socket
Small Screw Base [Candelabra] (Can)		Smaller screw base
Pin Base (P)		Pin on base of bulb sticks into socket
GU Base (GU)		Pin with larger head on base of bulb sticks into socket

Logger Numbers

Table 9: Types of Logger ID Numbers

Regional Hours of Use Study: Onsite Handbook

12/5/2012

Prepared for:

The Massachusetts Energy Efficiency Program Administrators

The Connecticut Energy Efficiency Board Evaluation Consultant

National Grid Rhode Island

The New York State Energy Research and Development Authority

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Contents

Tables

Figures

Overview of Handbook

The purpose of this document is to provide all the information required to conduct site visits for the Regional HOU Study. This document will be provided to all field technicians and will be used as the main reference material for in-person field technician training conducted for this study. This document contains the following sections:

- Training Plan
  - → Independent Training Steps
  - → In-person Training Session Outline
- Background / Purpose of the Study
- Onsite Protocol
- Onsite Form Instructions (included as separate Appendix)
  - → Example Completed Saturation Forms (included as separate Appendix)
- Logger Installation Instructions
- Quality Assurance and Control Procedures
- Frequently Asked Questions
  - → The Energy Independence and Security Act (EISA) of 2007
- Reimbursement Form
- EPA Cleanup and Disposal Guidelines for Compact Fluorescent Light Bulbs (CFLs)

All field technicians should review this document in its entirety prior to the in-person training session. This document contains independent training exercises that all technicians will be expected to complete prior to in-person training.

1 Training Plan

Training for this project consists of both independent and in-person training. A brief outline of training activities is included below. Additional detail about each step of training is covered in later sections. The first training step is to thoroughly review this document in its entirety.

1.1 Independent Training *(approximately three hours – total)*

- Review of Materials – field technician will spend one hour reviewing materials contained in this document.
- Store Visit – field technician will go to a hardware, lighting, or big box retailer to familiarize themselves with various bulb types. This activity will require about one hour.
- Mock Site Visit – after reviewing materials and completing the store visit, field technician will spend 30 minutes to an hour conducting a mock lighting audit for his/her home. As he/she is conducting the audit, he/she should reference the protocol to address any questions that arise. Once complete, he/she will send the completed site visit forms to the project manager for review.

1.2 In-person Training *(approximately four hours – total)*

- Questions and Answers – field technicians will be provided with the opportunity to ask questions about materials or the study that came up during independent training. Field technicians are also encouraged to ask questions during the remainder of the training session. *(20 minutes)*
- Review of Materials – the trainer will walk field technicians through the protocols, onsite forms, and equipment required for this project. *(45 minutes)*
- Administrative Matters – the trainer will review administrative procedures with field technicians. *(20 minutes)*
- Mock Site Visit – the trainer will act as a customer participating in the study and the field technician will go through the steps of conducting a site visit. *(30 minutes)*
- Walk-Along Visit – the trainer will walk-along with the field technician on their first site visit to observe them in the field. *(2 hours)*

2 Background / Purpose of the Study

The parties responsible for evaluation of energy-efficiency programs in Massachusetts, Connecticut, Rhode Island, and New York have committed to conducting a study to estimate hours of use (HOU) of light bulbs in homes. The main objective of this study, therefore, is to estimate HOU, and we will do so by room type, not lighting type (technology) as many studies have done in the past. Our focus on room types assumes that people are likely to use their lights in a given room the same way regardless of the type of bulbs in the room.

To accomplish this objective, field technicians will perform two interrelated tasks: 1) conduct an inventory of lighting to determine the number and type of bulbs currently installed in customers' homes, and 2) install a series of lighting loggers to capture information on how customers use lights in their homes. These two tasks are interrelated because in order to install loggers in a random selection of light fixtures, we must first identify all of the light fixtures in a customer's home.

Tetra Tech is recruiting and KEMA is scheduling participants for this study via telephone. During the recruiting and scheduling, customers are provided with the following project details (note that the amount being offered is higher in Massachusetts and New York, as the lighting inventory in those states involves more detailed data collection than in Connecticut and Rhode Island):

> *Energy Efficiency Program Administrators are offering you the opportunity to take part in an important study. We are offering eligible households a $150 gift card to allow a trained technician to visit their homes to gather more information about the lighting products they use. The visit should take about an hour. The visit would involve a trained technician walking through your home and recording the types of lighting products that you are using. The technician will also attach some very small devices to several light sockets in your home to record lighting usage. Most lamp or fixture shades will block the devices from view, so they won't affect your decor. They also won't affect how your lights work. When the technician returns to remove these devices in six months, you'll receive $100 gift card to participate in the study. Participation in the study will require two visits, the first about an hour in length and the second a shorter visit of about 30 minutes, six months later. During the visits, there will be no attempt to sell you anything. The information gathered will be used to evaluate and improve the energy efficiency programs offered by your electric utility.*

As a field technician you will not recruit customers. Instead, you will be provided with a list of customers to visit each week. This list will include the customer's name, telephone number, address, and an appointment time. You should also receive a gift card for each participant prior to visiting their home, participants will receive two separate gift cards one for the first visit (installation) and one for the second visit six months later (removal).

3 Onsite Protocol

This section outlines the procedures field technicians will follow when performing the lighting inventories and installing the loggers. These protocols cover both the lighting inventory and the selection of fixtures for loggers. The protocols for installing lighting loggers differ between single-family and multi-family as noted throughout this section.

3.1 Prior to Visit

Before visiting a home, you should make sure that, at a minimum, you have the following:

Onsite Handbook
Onsite data form
Appointment sheet
Company Polo Shirt
ID Badge
Cell Phone

Data Collection Kit
Camera
Flashlight
Pen
Sharpie
Flat & Philips head screwdrivers
Insulated gloves
Shoe coverings
Latex gloves
Step ladder
Example CFL bulb
6, 10, 20-, and 30-sided Dice

Materials for Customer
FAQs and Info Sheet
Business card
Gift card

Logger Installation Kit
Logger installation instructions
Zip ties
Light loggers
8 *loggers for single-family*
6 *loggers for multi-family*
Light pipes
Logger labels
Sealable sandwich bags

CFL Clean up Kit
Sealable plastic bags
Disposable wipes
Vacuum
Duct tape
Flat brush

3.2 Arrival at Onsite

After the door is opened, immediately ascertain that the person at the door is the scheduled interviewee. Introduce yourself and hand him/her the business card.

- **Sample Introduction** *(not to be read verbatim)***:**
  Hello, my name is _____, and I am working with KEMA. KEMA is working under contract with ***the Massachusetts Energy Efficiency Program Administrators****. I'm here to meet with _____. As mentioned on the phone, I'm here to walk through your home and record the types of lighting fixtures and bulbs installed in each socket.* ***[Customer should be expecting you]****. During my visit I'll also be installing a few lighting loggers to capture hours of use* ***[show customer a logger]****. In six months another technician will return to collect the loggers that I install. The loggers can only tell when a light is turned on and off, they do not record anything else. In appreciation for your time, on behalf of* ***the Massachusetts Energy Efficiency Program Administrators****, we are offering you a $150 gift card today and $100 gift card when we return in six months to remove the loggers. Do you have any questions regarding my visit?*

Prior to Data Collection

- Give the customer a step by step description of what you'll be doing (show the data collection form and a logger as you explain)
  - → First I need to walk around the outside of your home and record the types of lights.
  - → Then I will cover the bulbs inside your home – room by room – including bulbs in storage.
  - → After counting all of the lights I need determine which fixtures to install the loggers on.
- The customer should not be surprised by any of this information as they have already been told what the study will consist of. However, if the customer is uncomfortable with the visit and refuses to allow you to conduct the inventory or install the loggers, courteously explain that you will be unable to provide the incentive gift card if they do not participate. If they still refuse, ask if it would be ok to have your supervisor call them to discuss the project with them. Immediately inform your supervisor of the situation and whether or not the customer is expecting a call from your supervisor.
  - → **For Massachusetts:** Customers may participate in all aspects of the study or just the lighting inventory by itself. However, the vast majority 137 of the 150 saturation visits will need to participate in both aspects.

General sequence of data collection

1. Installed bulbs - Exterior:
   → Walk around the outside of the home in a clockwise direction.
   → Record information on all exterior lighting sockets.

2. Installed bulb - Interior:
   → Next, proceed through the inside of the home in a clockwise direction.
   → Begin with foyer (entry way).
   → Go through each room and part of the home systematically, in a clockwise direction (or as clockwise as is possible).

3. Stored Bulbs**:**
   → **Ask:** *"Now, I would like to see all light bulbs and fixtures that are not currently installed. This would include those you have bought and not yet installed as well as those that were installed and then removed."*
   → Record information on all bulbs in storage.

4. Logger Installation:
   → Consult logger installation instructions.
   → Install loggers on selected fixtures (with customer's approval of placement).

5. After Data Collection:
   → Thank the customer for his/her time
   → Give him/her the $150 gift card.
   → Remind the customer that when we return in six months to retrieve the loggers we will provide them with a gift card for $100.
   → Have the customer sign off on your data collection form to indicate that you visited their home and provided him/her with a $150 gift card.
   → Leave with the customer the "Logger Participant Frequently Asked Questions" one-page sheet.

Data Collection Guidelines

- **<u>All recorded information must be legible</u>.**
- **What information to collect:**
  - → **All lights that use electricity** (meaning they are plugged in or hard wired) must be captured, including night lights.
    - Ex. Solar landscaping lights that also use electricity from electric lines, ***capture*** *the information*; solar landscaping lights that don't use any electricity lines at all, ***do not*** *capture*.
  - → **DO NOT** capture lights that run **only** on batteries like flashlights (even if the batteries are rechargeable).
  - → **DO NOT** capture information for temporary seasonal lights or lighting displays. This could include strings of lights such as holiday lights as well as novelty lights like plug in candles, yard decorations, holiday village displays, etc. Ask the customer if it is permanent or a seasonal holiday light.
- **Removing Bulbs or Fixture covers:**
  - → **<u>Never remove a cover or bulb without permission from the customer.</u>**
  - → If any fixture is covered and/or the bulb is not immediately visible, ask the customer if the bulb is easily accessible. If yes, ask if you can turn off the fixture and take it apart to see the light bulb.
  - → If the customer offers to turn off the fixture and take it apart him/herself, **ALWAYS** let the customer do it.
  - → If the customer refuses to let you do it and does not offer to do it him/herself; the fixture is damaged or delicate; or the fixture is inaccessible given your equipment, ask the customer for his/her best guess of the information needed on the form.
  - → **DO NOT TOUCH** if fixtures have cracked or damaged covers, or look delicate or easily breakable.
- **Burned Out Bulbs:**
  - → If a bulb is burned out, ask the customer if he/she intends to replace the bulb.
    - If the answer is yes, treat the burned out bulb as if it's currently working and record all.
    - If customer does not intend to replace them OR purposely unscrews some bulbs so that they don't turn on, treat them as if they were an empty socket.
    - **Note: Do not install loggers on burned out bulbs**

- **Broken Bulbs:**
  - → If you break any type of light bulb and/or if a broken CFL came into direct contact with clothing or bedding which subsequently needed to be thrown out, give the customer the "Reimbursement Form."
  - → Note what type of bulb was broken and contact the project manager as soon as possible to report the incident.
  - → Take a picture of the broken bulb and any other damage.
  - → **If a CFL or a fluorescent bulb should be broken**, refer to the "Cleanup and Disposal Guidelines for Compact Fluorescent Light Bulbs" of the Environmental Protection Agency (EPA) included in this packet.
- **Unplugged Fixtures:**
  - → If the interviewee has unplugged light fixtures in storage areas, ask the customer if he/she uses the fixture.
    - o If the answer is no, then treat the light bulbs in the fixture as if they are in storage (record it in the CFL in Storage Form if the bulb is a CFL and do not record it if it is not a CFL).
    - o If the answer is yes, then record the fixture in the "installed lighting" form and denote when it is used in the "season" column.

4 Onsite Form Instructions

This section provides specific details about how the onsite form should be completed by field technicians.

4.1 Home Schematic

→ Draw a **CLEAR** diagram of the house on the sheets provided as you go through the home, labeling each room on the diagram (in order to locate loggers on the follow up visit).
→ If the home has multiple levels create a separate diagram for each level, including the basement and/or attic.
→ If the attic or any other room in the home is not accessible, still include it in the diagram but record it as "inaccessible".
→ **Indicate the location within a room of any fixtures that have loggers installed by marking the diagram with an X.**

4.2 Onsite Saturation Form

Program Participation

→ Before filling out the onsite form, ask the homeowner: **Have you participated in any programs that replaced bulbs in your house with energy efficient bulbs?**
  - Yes
  - No
→ If "Yes", ask which programs they participated in and record their responses.

Room Descriptions

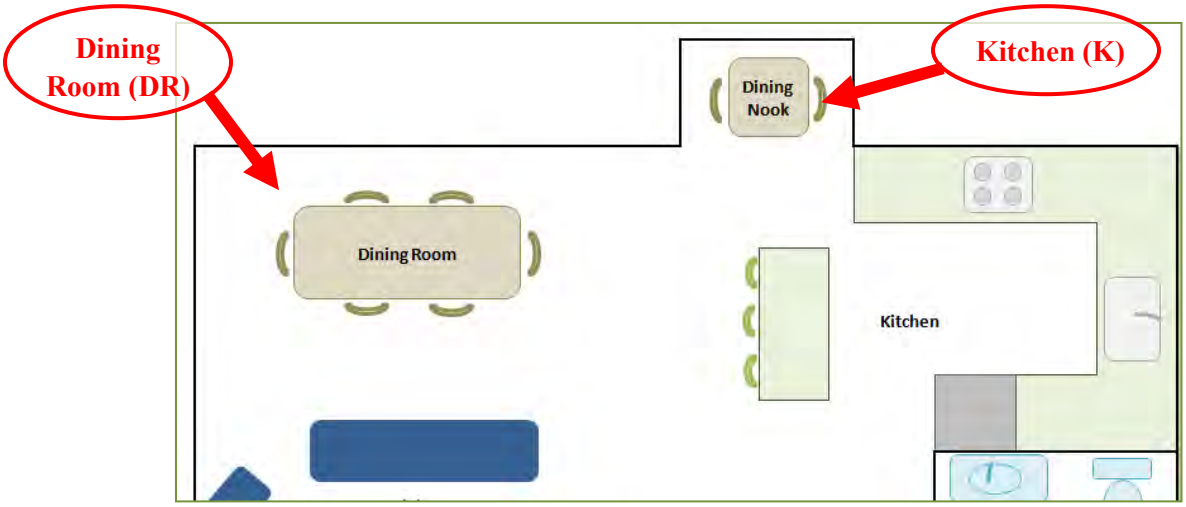
→ Choose from the codes below.
→ You may use a downward arrow to indicate the same room for more than one line.
→ If a home has a great room or a single room with several purposes, look at the particular usage of the light and record the lamps accordingly.
→ When in doubt of a room's purpose, ask the customer how they would describe the room.
→ If there are multiple rooms of the same type add a number after the code (ex. BR1, BR2).

Table 1: Room Type List

Room	Code	Room	Code	Room	Code
Dining Room	DR	Living Space	L	Garage	G
Exterior	E	Hallway	H	Office	OFF
Kitchen	K	Foyer	F	Den	DEN
Bedroom	BR	Utility	U	Closet	[Room code] -C
Bathroom	BT	Basement	BA	Other [Specify]	O

Dining Room (DR)

A dining room is any room where the primary purpose is eating. Substantial dining areas that are not separated from other rooms in the home directly by walls and doors are still considered a dining room if they are set apart from other rooms. Observations of a dining area attached to the kitchen, such as a dining nook, will be labeled as a kitchen.



Exterior (E)

Technicians will audit lamps that are attached to the home and those that are owned by the customer. These include lampposts not attached to the home and light lamps that are part of driveway entrances. Exterior includes sheds, greenhouses, and other storage facilities and exterior buildings owned by the customer **except garages** which have their own category discussed below.

While all homes have exteriors not all lights on all homes are directly controlled by the person who lives there. Only capture exterior lights if they are directly controlled by the person who lives in the home we are visiting. Lighting in common areas of apartment buildings (interior/exterior) and lights not controlled on the exterior of townhomes are examples of exterior lights that we do not need to capture.

Kitchen (K)

Technicians will include the lights that are primarily used in a kitchen area or inside the kitchen, such as a counter with bar stools or a small kitchen table. However, technicians will not include the light under the range hood or in the refrigerator.

Every home will have at least one kitchen. If the home is an efficiency or a studio apartment, designate the lights directly present in the kitchen area (area containing stove, refrigerator and sink) as the kitchen.

Bedroom (BR)

All bedrooms will be noted with a unique identifier (i.e. BR 1).

Every home will have at least one bedroom. If the home is an efficiency or a studio apartment, designate the lights directly present in the sleeping area (area containing bed) as the bedroom.

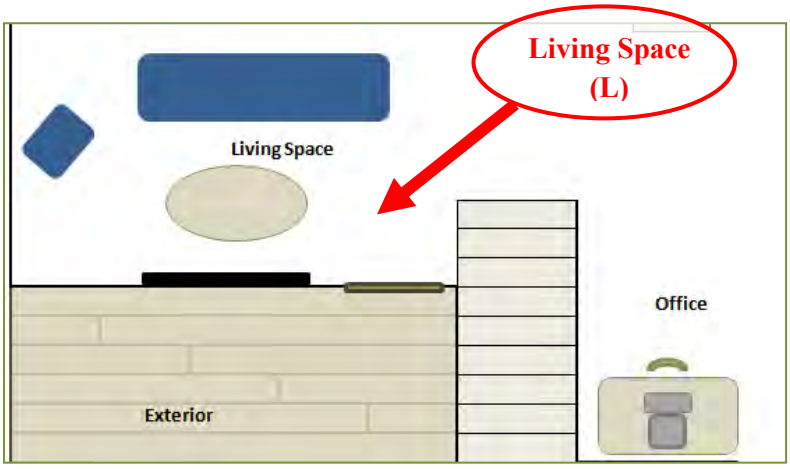
Bathroom (BT)

The bathrooms included can be full baths, half baths, or three-quarter baths. If a particular bathroom has two rooms (such as a separate shower and sink area), the lighting will be coded in both rooms as the same bathroom.

Every home will have at least one bathroom. Efficiency and studio apartments should have a separate bathroom. In the event that the bathroom is not separated from the rest of the home by walls and a door, designate the lights directly present in the bathroom area (area containing the shower, toilet and sink) as the bathroom.

Living Space (Living Room/Family Room) (L)

This room is the most commonly used area for family activities, such as watching television or entertaining. The form does not differentiate between living room and family room since this distinction can often be subjective.



Hallway (H)

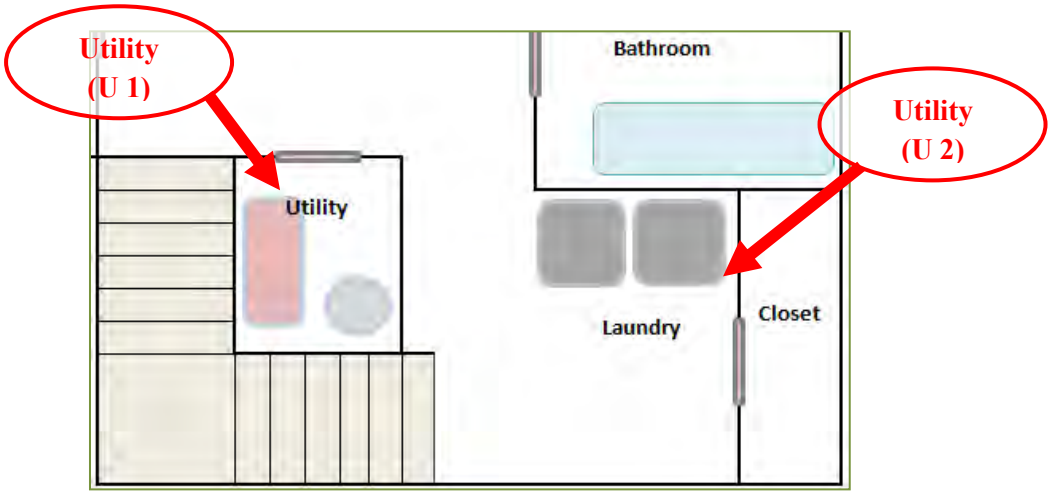
Hallways include all stairways with lights.

Foyer (F)

This category includes all entry ways, even those called mudrooms.

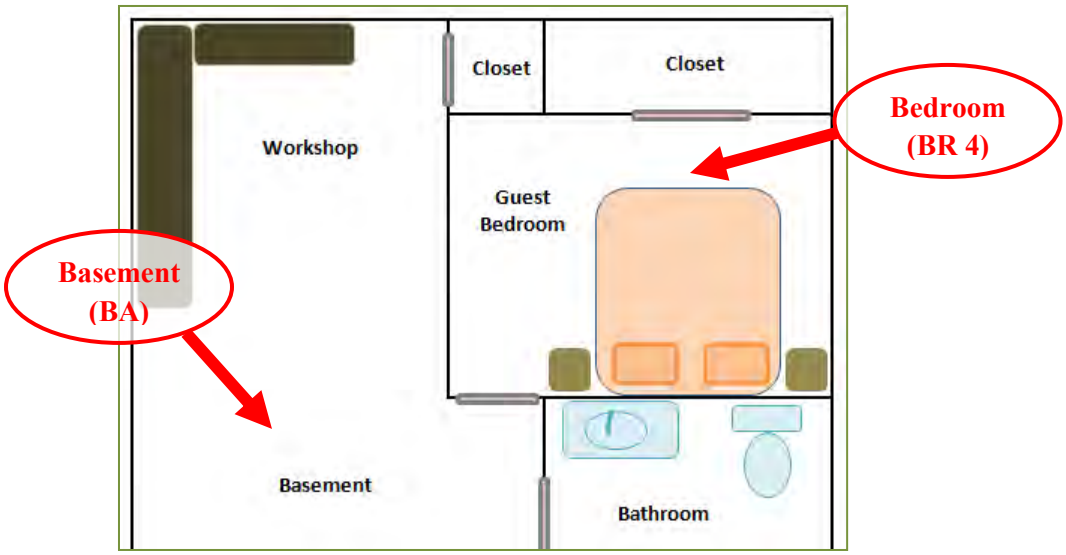
Utility (U)

The main purpose of this room is washing clothes. Technicians will also include furnace/HVAC areas as a utility room unless the furnace/HVAC is part of an unfinished one room basement.



Basement (BA)

The basement is the main room under the first floor. If there are bedrooms, bathrooms, closets, utility rooms, etc. in the basement, they will be coded and recorded as such.

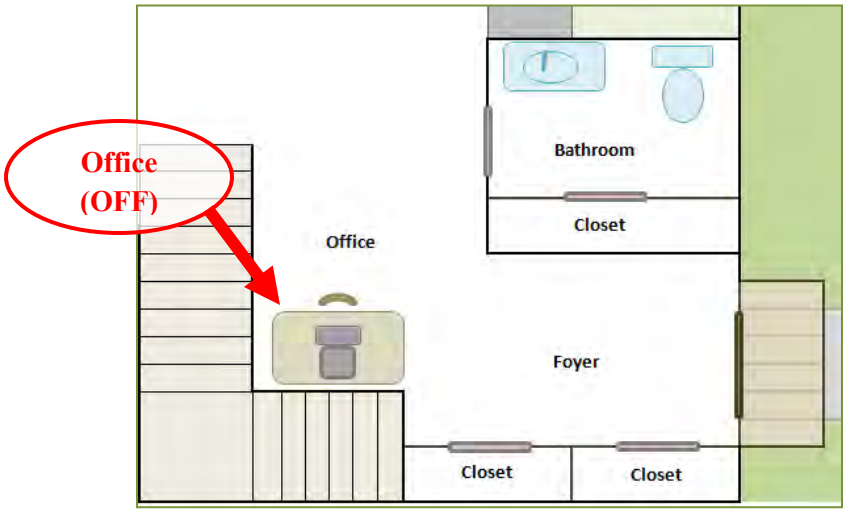


Garage (G)

In addition to a typical garage, a carport fits into this category. Bulbs found in garage door opening mechanisms will be included.

Office (OFF)

Technicians will collect lighting data in computer rooms, home offices, and parts of a great room that have office functions. In the notes column indicate whether the office is a separate room or part of a larger room. The primary function of this room appears to be doing something at a desk or computer.

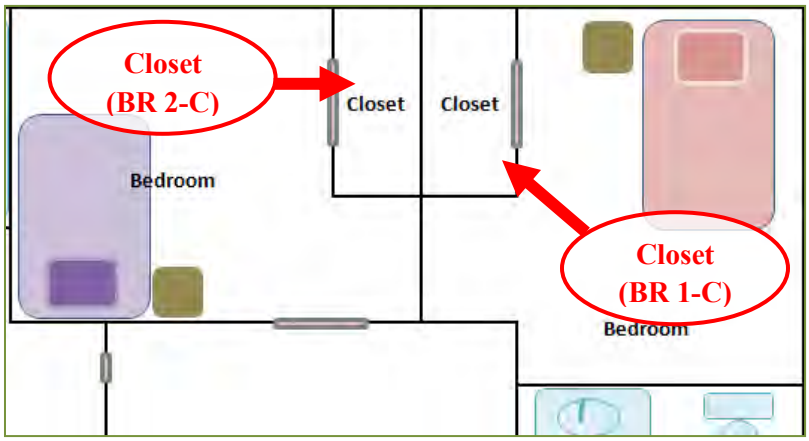


Den (DEN)

This category includes dens, libraries and other small, secluded rooms.

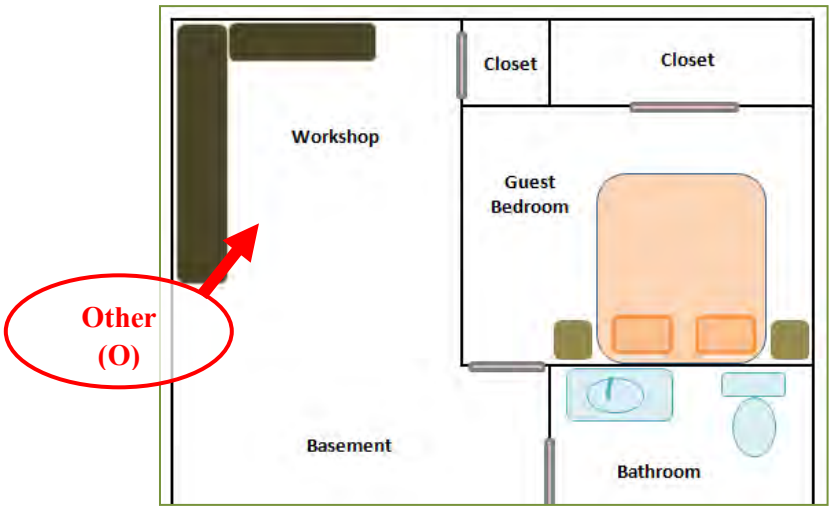
Closets ([Room Code]-C)

Technicians will collect lighting data for lamps in closets. Closets should be recorded separately from the spaces that contain them but with the name of the room included. For example, a closet in the master bedroom would be recorded as BR1-C.



Other (O)

Technicians will collect lighting data for lamps in other room types. In the notes column, describe the room type in more detail.



Primary Room

→ When multiple rooms of one type exist (ex. Bedrooms, bathrooms), record a "Y" in the "Primary" column to indicate the room used most frequently

Fixture Group

→ A fixture group includes all fixtures that are controlled by the same switch.

→ Number fixture groups in each room from 1, 2, 3, 4, etc. up to the number of fixture groups in the room.

→ If a fixture has two controls associated with it, these should be considered one fixture group, with the fixture group attributed to the room that the fixture is located in.

→ **FOR TARGETED ROOMS:** Restart numbering of fixture groups from 1 for each specific room type we are looking to place a logger in – this includes dining rooms, exteriors, living space, bedrooms, bathrooms, or kitchens. For example, all of the fixture groups in all bedrooms should be sequential.

→ **FOR "OTHER" ROOMS:** Fixture groups in *other rooms* should be numbered sequentially – this includes all rooms that are not dining rooms, exteriors, living space, bedrooms, bathrooms, or kitchens.

→ In the onsite form, repeat the fixture group number until all bulbs associated with it are recorded. (The onsite form is one row per bulb, so a fixture group number is repeated all rows until all bulbs are recorded)

Control Type

→ Include control-type information for each light fixture using the codes below.

Table 2: Control Type List

Control Types	Code
On-Off	OF
Dimmable	Dim
3-way	3W
Motion or Photo Sensor	MS
None (always on)	None
Breaker/Disconnect Plug (no switch)	B
Other	O

Wall-Mounted Control

→ Record whether or not the control is wall mounted (Y/N)

Fixture Number

→ Number fixtures in each room from 1, 2, 3, 4, etc. up to the number of fixtures in the room.

→ **Do not** restart numbering of fixtures from 1 for each room. Fixtures should be numbered sequentially throughout the entire home such that when you number the final fixture in the home the total number of fixtures in the home should match the fixture number.

→ Repeat the fixture number until all bulbs associated with it are recorded.

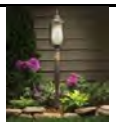
Fixture Type

→ Include fixture type information for each installed bulb using the codes below.

Table 3: Fixture Type List

Fixture	Code	Fixture	Code	Fixture	Code
Recessed	R	Wall Mount	WM	Walkway	W
Pendent	P	Night Light	NL	Exterior Flood	EF
Flush Mount	FM	Table Lamp	TL	Garage Door	G
Track	T	Floor Lamp	FL	Under Cabinet	U
Ceiling	CF	Post Mount	PM	Other	O

Table 4: Fixture Type Exhibit

Fixture	Image	Fixture	Image
Recessed *(light bulb does not stick out of the plane of the ceiling)*		**Table Lamp** *(lamps that are put on tables)*	
Pendant *(fixture and bulb hangs from ceiling, i.e. chandelier)*		**Floor Lamp** *(lamps that are put on the floor)*	
Flush Mount *(fixture is flush with the ceiling)*		**Post Mount** *(exterior lights on a lamppost)*	
Track *(light bulbs on a strip/track)*		**Walkway** *(lights on a path outside the home)*	
Ceiling Fan *(lights attached to a ceiling fan)*		**Exterior Flood** *(fixtures that flood a large area with light, found on the side of home, above garage, or under peak of roof)*	
Wall Mount *(fixture attached to wall)*		**Garage Door**	
Night Light		**Under cabinet** *(lights under kitchen cabinets for lighting counter)*	

Bulb Type

→ Record bulb type information for each installed bulb using the codes below.
→ If socket is empty, record as "E."

Table 5: Bulb Types Code List

Bulb Type	Code	Bulb Type	Code
Incandescent	I	Halogen	H
CFL	CFL	Other	O
Fluorescent	F	Empty Socket	E
LED	LED		

Table 6: Bulb Types Exhibit

Bulb Types	Image	Description
Incandescent (I)		Bulbs have a filament that's heated to the point of glowing
Compact Fluorescent (CFL)		Bulbs are energy-efficient; use 67% less energy than incandescent bulbs and last longer. Covered CFLs have a plastic cover that conceals the traditional spiral shape. If you look closely at the bulb you will be able to see the spirals through the covering—especially when the bulb is turned on.
Fluorescent (F)		Bulbs are filled with mercury vapor that emits ultraviolet light when electricity is applied, then coating inside bulbs turns the UV rays into visible light
Light-Emitting Diode (LED)		Bulbs have a semiconductor chip so current flows through; light is released when an electron falls into a lower energy level. Some LEDs have a yellow filter.
Halogen (H)		More efficient type of incandescent bulb with filament sealed into a compact transparent envelope filled a small amount of halogen, allowing the filament to be at a higher temperature. Some halogens are virtually indistinguishable from regular incandescent bulbs. They may be smaller (ex. A-17 size instead of A-19) or can be distinguished by the presence of a glass tube around the filament (halogen) instead of the filament by itself (incandescent).

Bulb Shape

→ Include bulb shape information for each installed bulb using the codes below.

Table 7: Bulb Shape List

Bulb Shape	Code	Bulb Shape	Code
Twist/Spiral	T	Spot/Reflector/Flood	S
Globe	G	Circline	C
A-lamp	A	Tube	Tub
Bullet/Torpedo	B	Candle	Can
Bug light	Bug	Other [Specify]	O

Table 8: Bulb Shape Exhibit

Bulb Shape	Image	Bulb Shape	Image
Twist/Spiral (T)		**Spotlight/ Reflector/Flood (S)**	
Globe (G) *(e.g., for bathroom vanity fixtures)*		**Circline (C)**	
A-lamp (A) *(shaped like standard incandescent)*		**Tube Style (Tub)**	
Bullet/Torpedo (B) *(pointed top, standard screw base)*		**Candle (Can)** *(pointed top, curved like a flame)*	
Bug light (Bug) *(yellow color; do not confuse with LEDs with yellow filters)*			

Socket Type

→ Record socket type for each installed bulb using the codes below.

→ Socket type refers to the bulb base (circled in red in Table 10) and how the base attaches to the fixture.

Table 9: Socket Type List

Socket Type	Code
Medium Screw Base (Standard)	S
Small Screw Base (Candelabra)	Can
Pin Base	P
GU Pin Base	GU
Other	O

Table 10: Socket Type Exhibit

Socket	Image	Description
Medium Screw Base (S)		Light bulb screwed into socket
Small Screw Base [Candelabra] (Can)		Smaller screw base
Pin Base (P)		Pin on base of bulb sticks into socket
GU Base (GU)		Pin with larger head on base of bulb sticks into socket

Wattage

→ Record the wattage for each installed bulb.
→ **For Massachusetts and New York ONLY.**

Manufacturer

→ **CFL and LED bulbs ONLY:**
→ Record the manufacturer for each installed bulb.
→ If the manufacturer is not clear, ask the homeowner if they recall the manufacturer.

Model Number

→ **CFL and LED bulbs ONLY:**
→ Record the model number of installed CFL and LED bulbs.
→ Model numbers can include both numbers and letters.
→ Model numbers can usually be found on the base or near the base of the bulb.

When Purchased

→ **CFL and LED bulbs ONLY,** ask the homeowner:
<u>When</u> did you purchase this bulb?

1. January to February 2013
2. July to December 2012
3. January to June 2012
4. Before 2012

What Replaced

→ **CFL and LED bulbs ONLY if purchased in past year,** ask the homeowner:
<u>What</u> type of bulb was installed here before you installed this CFL or LED?

1. Incandescent
2. Halogen
3. CFL
4. LED
5. Something else (specify in notes)

Where Purchased

→ **CFL and LED bulbs ONLY,** ask the homeowner:

<u>Where</u> did you purchase this bulb?

- Record the store name.
- If the homeowner doesn't recall, ask what type of store they purchased the bulb from using Table 11 below.

Table 11: Store Types

Code	Store Type
A	Grocery store or supermarket, such as Shaw's, Stop n Shop, or Whole Foods
B	Warehouse store, such as Sam's Club, BJ's, or Costco
C	Home improvement store, such as Home Depot or Lowe's
D	Hardware store, such as True Value or ACE Hardware
E	Mass merchandise/discount department store, such as Wal-Mart, Kohl's, K-Mart, or Target
F	Drugstore, such as Walgreen's or CVS
G	Convenience store, such as 7-Eleven, White Hen Pantry, or Cumberland Farms
H	Specialty lighting or electrical store
I	Home furnishing store, such as a Bed, Bath, and Beyond, or Pottery Barn
J	Mail order catalogs
K	Through the Internet
L	Bargain store, such as the Building 19, Dollar Store, or Family Dollar
M	Office supply store, such as Office Depot or Staples
O	Other

Notes

→ Use this column to describe any feature labeled as "other."

→ Use this column to record any additional information that may be useful in the data analysis phase.

→ Ex1. The resident refused access to certain rooms or fixtures; or lamp types cannot be determined unless a lighting fixture cover is removed (and the customer does not wish for this to be done).

4.3 Onsite Stored Bulbs Form

Package Group

→ A package group includes all stored bulbs that are in the same package.
→ Number package 1, 2, 3, 4, etc.
→ In the onsite form, repeat the package group number until all bulbs in the package are recorded. (The onsite form is one row per bulb, so a package group number is repeated in all rows until all bulbs are recorded)
→ If a bulb is not in a package, write "NA" in this column.

Bulb Type

→ Record bulb-type information for each stored bulb using the codes from Table 5.

Bulb Shape

→ Record bulb-shape information for each stored bulb using the codes from Table 7.

Base Type

→ Record the base type for each stored bulb using the socket type codes from Table 9.

Wattage

→ Record the wattage for each stored bulb.
→ **For Massachusetts and New York ONLY.**

Manufacturer

→ **CFL and LED bulbs ONLY:**
→ Record the manufacturer for each stored bulb.
→ If the manufacturer is not clear, ask the homeowner if they recall the manufacturer.

Model Number

→ **CFL and LED bulbs ONLY:**
→ Record the model number of stored CFL and LED bulbs.
→ Model numbers can include both numbers and letters.
→ Model numbers can usually be found on the base or near the base of the bulb.

When Purchased

→ **CFL and LED bulbs ONLY,** ask the homeowner:

<u>When</u> did you purchase this bulb?

1. 2013
2. July to December 2012
3. January to June 2012
4. Before 2012

Where Purchased

→ **CFL and LED bulbs ONLY,** ask the homeowner:

<u>Where</u> did you purchase this bulb?

- Record the store name.
- If the homeowner doesn't recall, ask what type of store they purchased the bulb from using Table 11.

Why Purchased and Stored

→ **100 Watt and 75 Watt Incandescent Bulbs ONLY,** ask the homeowner:

Did you purchase and store this particular wattage and type of bulb for any particular reason?

1. As a back-up/to replace 100w bulbs
2. As a back-up/to replace 75w bulbs
3. To have extras
4. Don't know/No reason
5. Other

Type of bulb it will replace

→ **For each stored bulb,** ask the homeowner:

What type of bulb will this bulb likely replace?

1. CFL bulb
2. Incandescent bulb
3. Whichever needs replacing first
4. The same type of bulb as the stored bulb
5. Other [Specify – record verbatim]
6. Refused
7. Don't know

4.4 Logger Information and Location Form

→ Record room information for installed loggers:

- **Single Family Homes (8 loggers)**
  1. Dining room
  2. Exterior
  3. Living space
  4. Other room #1
  5. Other room #2
  6. Bedroom
  7. Bathroom
  8. Kitchen
- **Multifamily Homes (6 loggers)**
  1. Living space
  2. Other room #1
  3. Other room #2
  4. Bedroom
  5. Bathroom
  6. Kitchen

→ Record serial number for each logger on the line provided.

→ For "Other room #1" and "Other room #2", record the room code on the line provided.

→ Record room code and number for room types that have multiple rooms. Ex. If the bedroom with the logger is "BR 3", record this code in the form below "Bedroom."

→ Record fixture and bulb characteristics for those lights on which you installed loggers.

4.5 Homeowner Verification of Receipt of Incentive Gift Card

Have the homeowner sign the onsite form upon receiving their incentive gift card in the space provided on the cover page.

5 Logger Installation Instructions

5.1 Installation

- Install up to **eight** loggers on selected fixture groups in **single-family homes**
- Install up to **six** loggers on selected fixture groups in **multi-family homes**
- Use the data collection form to determine the total number of fixture groups. A fixture group refers to all fixtures controlled by the same switch.
- Take a picture of the fixture with the logger on it (in order for easy recognition when retrieving).
- If installation of the desired number of loggers is not possible, note the reason on the onsite form.
- If the resident objects to installing meters on any fixture group, note the reason on the intake sheet.

5.2 Room Prioritization

- **Single-family homes (8 loggers)**
  - → Install **one** logger in each of the following room types:
    1. Dining room
    2. Exterior
    3. Living space
    4. Bedroom
    5. Bathroom
    6. Kitchen
  - → Install **two** loggers in *other room types*.
    - This includes any room that is **not** specified above (may include hallways, utility closets, offices, garages, etc.)
    - If you have captured an area of room as part of another room (i.e. an office that is part of a great room) treat that area as a separate room.

- **Multi-family homes (6 loggers)**:
  - → Install **one** logger in each of the following room types:
    1. Living Space
    2. Bedroom
    3. Bathroom
    4. Kitchen
  - → Install **two** loggers in *other room types*.
    - This includes any room that is **not** specified above (may include hallways, utility closets, offices, garages, etc.)
    - **If the multi-family home has a dining room/area, install ONE of the 'other room' loggers in the dining room or area.**

- **<u>If any home does not include a specified room</u>**, the logger allocated for that room will instead be assigned to a random fixture in a random room even if a logger is already installed in that room.
  - → **Install a maximum of two loggers in any one room.** If the randomly selected room already has two loggers installed assign the logger to the next room in order.
    - Ex1. If you roll a two but there are already two loggers in the dining room install the logger on the exterior.
    - Ex2. If you roll a seven but there are already two loggers installed in other rooms, install the logger in a bedroom.

- **<u>Note</u>**: Loggers must be installed on fixtures controlled by separate control devices.
  - → If a room only has one fixture device or if all fixtures in a room are connected to the same control, **do not install multiple loggers**. Instead, install only one logger and allocate the second logger to another randomly selected room.
  - → **Install a maximum of two loggers in any one room.** If the random room selected already has two loggers installed assign the logger to the next room sequentially.
    - Ex1. If you roll a two but there are already two loggers in the dining room install the logger on the exterior.
    - Ex2. If you roll a seven but there are already two loggers installed in other rooms, install the logger in a bedroom.

Table 12: Random Selection of Room

Single-Family (10-sided die)			Multi-Family (6-sided die)		
Room	**# Rolled**	**Probability**	**Room**	**# Rolled**	**Probability**
Dining Room	1 or 2	20%	Living Space	1 or 2	33%
Exterior	3 or 4	20%	Other	3	17%
Living Space	5 or 6	20%	Bedroom	4	17%
Other	7	10%	Bathroom	5	17%
Bedroom	8	10%	Kitchen	6	17%
Bathroom	9	10%			
Kitchen	10	10%			

5.3 Random Fixture Group Selection

- For **single-family** homes:
  - → If eight or fewer fixture groups are identified in the lighting audit, install a logger on one fixture in each fixture group.
  - → If more than eight fixture groups are identified, field technicians will use the following random selection method to determine which fixtures to meter.
  - → **If any home does not include a specified room**, the logger allocated for that room will instead be assigned to a random fixture in a random room even if a logger is already installed in that room.

- For **multi-family** homes:
  - → If six or fewer fixture groups are identified in the lighting audit, install a logger on one fixture in each fixture group.
  - → If more than six fixture groups are identified, field technicians will use the following random selection method to determine which fixtures to meter.
  - → **If any home does not include a specified room**, the logger allocated for that room will instead be assigned to a random fixture in a random room even if a logger is already installed in that room.

5.3.1 Random Selection Method:

1. Determine the number of fixture groups in a room from the audit.
   - → If there are multiple rooms of a given type (e.g., bedrooms or bathrooms), count all fixture groups in all of the rooms of that type.
   - → For *other rooms*, include the total number of fixture groups from all *other rooms*. For example, if a home has an office with three fixture groups, a den with two fixture groups, and a green house with eight fixture groups, the total number of fixture groups in other rooms would be 13.
2. Based on the fixture group count, select the most appropriate die provided and roll it once to determine which fixture group that should have a logger installed.[1] For example, if the room type has five fixture groups, use the six-sided die. If the room has 18 fixture groups, use the 20-sided die and so forth.
3. If the number of fixture groups in a room is less than the number rolled on the die, continue counting from fixture group 1. (Ex. If a room has 11 fixture groups you would roll the 20-sided die. If the die shows the number 12, fixture group 1 would be selected.)

[1] Field technicians will be provided with the four dice—30 sided, 20 sided, ten sided, and six sided.

4. If the number of fixture groups in a room exceeds 30 than you will need to roll the die multiple times. The first roll will determine a starting point and the second number will determine how many fixture groups to count to before installing the logger. (Ex. If a room has 31 fixture groups you would roll the 30-sided die once and get a 15, you would then roll the die again and get an 8. In this example you would install the logger on the 23rd fixture group.)

5. If a second logger needs to be installed in the same room, roll the die again, if you get the same number move to the next fixture group in the room.

6. Choose a fixture and bulb to install the logger on in this fixture group
   - → While fixture groups are selected at random, you can install the logger on any light bulb in the selected fixture group.
   - → Try to pick a bulb that will not interfere with normal use of the light and will be easy to install a logger on.

Examples:

- If a bedroom has 10 fixture groups, the technician rolls the ten-sided die and rolls a four. The technician then identifies the fourth fixture group in the bedroom, and installs a logger.

- If a home has two exterior fixture groups, the technician rolls the six-sided die and rolls a five. Because there are only two fixtures on the exterior of this house, this means that the logger actually goes on the first fixture group (because if there are fewer fixture groups in the room than the random number, upon reaching the last fixture group in the room, one continues counting from the first group). Fixture group one contains three fixtures, one exposed on the eve of the home, one on the covered porch, and one on a 20' tall post in the yard. Since all three fixtures are controlled by the same control device (a wall switch), logging any one will give the same results. In this situation, the technician should install the logger on the covered porch as it is the easiest to reach and is protected from the elements.

- If an elegant bathroom has 16 fixture groups, the technician rolls the 20-sided die and rolls an 11. Fixture group 11 includes the ceiling fan and the vanity lights. In this situation, the technician should install the logger near a vanity bulb as they are easier to reach than the ceiling fan.

5.4 Other Metering Guidelines

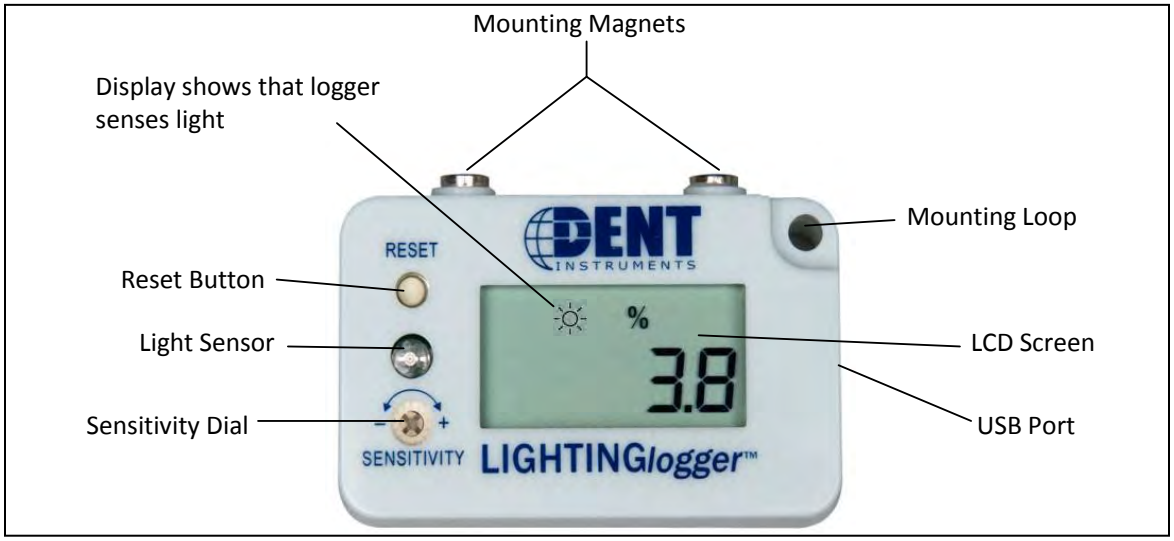
- Resident agrees to allow installation of light loggers.
- Lights must be operating properly during site visit.
- Light loggers will be installed on fixtures in a way that is the least obtrusive to customers (based on resident preference/discretion).
  - → If logger cannot be installed on a fixture due to customer preference – try another fixture in the same fixture group – if no other fixtures in that fixture group exist choose the next fixture group in order.
- Light loggers will be installed where fixtures are easily accessible (e.g., not requiring more than a stepladder to access) and that are not fragile (e.g., crystal chandelier).
  - → If logger cannot be installed on a fixture due to inaccessibility – try another fixture in the same fixture group – if no other fixtures in that fixture group exist choose the next fixture group in order.
- When installing light loggers on fixtures, field technicians will take great care to minimize disturbances that could potentially invalidated the data.
  - → As needed, loggers will be positioned so only light from the fixture is recorded.
  - → When it is difficult to eliminate exposure to ambient light, field technicians will attach a fiber optic eye to the logger, which prevents the logger from "seeing" ambient light.
  - → Additionally, field technicians will secure loggers to fixtures using hard plastic cable ties, adhesive strips, and magnets.

5.5 Installing a Light Logger

This study will utilize Hobo UX 90s and DENT TOU-L loggers to record on/off instances. The instructions provided below are specific to the DENT TOU-L loggers. Installations of Hobo UX 90s loggers follow the same deployment principles. To successfully install a light logger, the technician will perform the following steps:

1. Identify the light to be metered.
2. Minimize impacts on the logger from other light sources:
   → Consider the path of the sun throughout the day.
   → Consider reflection and refraction from nearby materials.
   → Consider other fixtures nearby.
3. Set and calibrate the light logger. To do this, turn light on, point light sensor on logger toward light, and adjust sensitivity dial until the "sun" appears on the display designating that the logger senses the light. Turn the light off to make sure the "sun" disappears on the logger display. Install the logger with mounting magnets or zip ties and press and hold the reset button for 3 seconds to clear the data gathered during installation. (Figure 1).

Figure 1: Setting Light Logger



4. Record the date and time the unit was set on the provided labels.
   → This is ***very important***; without knowing the exact time and date the logger was installed, the data will be unusable.

5. If the light logger is in a location with significant sun exposure or other light sources, and you cannot get the logger to respond to the light, and then install the logger with the fiber optic wand. The wand connects to the left side of the logger and is directed toward the light source so that the logger does not sense any ambient light.
6. Deployment Guidelines - follow these tips for successful deployment:
   - → Make sure the end of the wand is as close to the light source as possible.
   - → Maximize the signal strength on the logger LCD screen by adjusting the wand and sensitivity dial while looking for the "sun" on the display screen.
   - → Do not support the logger by the wand.
   - → Be sure that the wand is seated all the way into the bracket before deployment.
   - → Set and calibrate the logger, as described above.
   - → Attach the logger in a discrete area using the Zip ties or mounting magnet.
   - → Direct the tip of the eye as close as possible to brightest part of the light (see Figure 2).

Figure 2: Fiber Optic Eye Aimed at Brightest Part of Light

   - → Do not bend the fiber optic eye on sharp angles—this will damage the eye.
   - → With the light is turned on, adjust the logger sensitivity to the maximum setting, so that the "sun" symbol displays.
   - → Turn the light off. If the bulb icon remains on, auto-calibrate the lighting logger again. The light may need to be turned on and off multiple times before the light logger is properly adjusted.

5.6 Logger Removal Protocols

Prior to removing light loggers, removal technicians will receive the logger installation data, which indicates the rooms and fixtures where loggers were installed in winter 2012. Field technicians will visit participants' homes in the summer of 2013 (six months later) to conduct logger removals and obtain additional data for the HOU analysis. Field technicians will also record *in situ* observations and photograph each logger prior to removal. The logger removal and data collection process includes the following:

- Photograph the logger prior to removal.
- Indicate the orientation of the sensor or fiber optic eye (e.g. Is the sensor directed towards the light source?)
- Perform a state test to determine whether or not the logger accurately records event data; turn the light on and off to ensure that the sun icon appears and disappears appropriately.
- Remove logger and review the total time on from logger screen.
- If the time on indicates extreme low use or extreme high use, ask the participant to verify, based on their own usage of the light fixture in question.
- Ask participant whether logger has fallen off the fixture or has otherwise been uninstalled prior to the technician's removal site visit; if so, ask participants to provide a date and time. **[Note: During the installation visit, participants will be asked to call and inform us if something does happen to the logger.]**
- Note the presence of windows and televisions/computers in rooms where loggers are installed.
- Note the condition of loggers upon removal and assess the battery status.
- Ask the participant to estimate typical usage for each metered fixture (e.g., 4 hours per day in the afternoon only).
- Record the presence of children under the age of 18 living in the home.
- If a logger is installed in a basement, record whether the basement is finished or unfinished.

After removing loggers, carefully pack and store loggers. Return the loggers to the project manager. Data from the loggers will be downloaded using appropriate software, raw data will be exported into CSV (comma separated values), and uploaded to the project's SharePoint site where analysts will access the data for review and analysis.

6 Quality Assurance and Control Procedures

As with all of our work, NMR and KEMA endeavor to maintain a high quality work product. The sensitive nature of onsite work means that we take special precautions to ensure the quality of data collected and to avoid jeopardizing the relationship our clients have with their customers. To that end, we employ a number of steps to ensure that onsite technicians perform quality work that reflects well on NMR, KEMA and our clients.

Our quality control and standard operating procedures begin well before a field technician ever steps foot in a customer's home. All of our field technicians receive rigorous project specific training. Training topics include project background, project specific data collection protocols, and customer service and interaction training. We also provide our scheduling staff with an overview of this training so that they know what customers will expect when they agree to participate and are able to answer any questions customers may have. We make every effort to ensure that customers are fully informed and avoid unnecessary surprises.

Below, we outline some of the specific quality control and training measures we will utilize for the Regional HOU study.

Quality Control and Training Measures:

- All field staff will receive training directly from KEMA staff using training materials successfully implemented in similar onsite lighting saturation studies but tailored to the unique needs of the Regional Logger Study. Training for this project will include instruction on how to perform the following:
  - Identify various types and shapes of sockets, light bulbs, and controls
  - Examine light bulbs in a safe manner, including instructions on what equipment to bring to a home, working with covered fixtures, and clean-up of (especially CFLs and fluorescents) and compensation for bulbs and fixtures accidentally damaged during the visit
  - Ensure that they have located and inventoried all light bulbs (including stored bulbs) in the home through such procedures as creating a home schematic, mapping their route through the home, and documenting difficult-to-characterize lighting with pictures,
  - Correctly setup and install lighting loggers
- Training will also include some background on EISA and its requirements so that the field technician can answer questions he or she may receive on this topic while performing the inventory.
- The KEMA project manager or a designated staff member will accompany each part-time field technician on their first day of site visits.

- The KEMA project manager or a designated staff member will recruit participants and schedule appointments, assigning them to field staff based on location and work load.
- Each field staff member will be required to report his or her progress at the end of each day and forward hard copies of completed onsite forms to the KEMA project manager for review each week.

In addition to reviewing the onsite forms, KEMA staff will call 20% of participants to ensure that their experience with the field technician was satisfactory, and we will also revisit approximately 5% of the homes and repeat the data collection and observe logger installation to make sure the technician performed all tasks in a satisfactory manner.

7 Frequently Asked Questions

- **What is this device and how do I know what it does?**

  The device is called a "lighting logger." It is about the size of a business card but is ½ inch thick. **[SHOW CUSTOMER A LOGGER]** The type of lighting logger we use can tell when you turn you the light it is attached to on and off, but it does not collect any other information. If you want to know what the loggers look like, they can be found easily through a web search of the term "lighting logger." We will mainly be using the "HOBO" and "DENT" brands.

- **What's in it for me and how long will this take?**
  We are offering $150 for your time when we install the loggers and $100 when we pick up the logger six months later. This is a total of $250. The visit should take around one hour, depending on the size of your house

- **What does the visit involve?**
  Technicians will walk around your home and count the various types of lighting products you have installed. They will also install some lighting loggers to record how often you use certain lights.

- **Where will the loggers be installed?**
  Technicians will install the loggers in a way so they do not interfere with normal use of lights. The loggers are very small and will not interfere in any way with the normal use of your lights.

- **When do you remove the loggers?**
  The loggers need to remain in place for six months. At the end of six months we will return to remove the loggers. We will schedule the visits at a time that is convenient for you.

- **What do I do if something happens to my light in the next six months?**

  → **A bulb with a logger burns out?**

  → **Something breaks?**

  → **The logger is removed?**

  If your light bulb burns out, replace the bulb as you normally would and continue to use the light as normal. The logger will not be affected.

  If, the logger is removed for any reason (falls off the fixture, uninstalled, something else) please call us and let us know. Please contact Jeff Zynda at 860-346-5001 ext. 72203. You can set the logger aside and we will collect it with the others when we return.

- **Why six months?**
  We need to record their lighting usage over time to account for differences in usage based on varying daylight conditions. Households use their lights differently during the winter months and summer months.
- **Who we are?**
  I am _____ and I work for the KEMA, a consulting firm. We have been hired by [SPONSOR] to perform this study.
- **Purpose of Study?**
  - → Establish customer awareness of lighting options and changes in the lighting market
  - → Understand how people use the light bulbs in their home, as this has a large impact on how much energy households use.
  - → Determine current rates of use and storage for various light bulbs
  - → The results of the study will be used in planning for future energy needs in Massachusetts
- **How do I know you are legit?**
  The Massachusetts Energy Efficiency Program Administrators are sponsoring this program and study. The contact person is Matt Nelson 781-441-3456.

7.1 The Energy Independent and Security Act (EISA of 2007)

This section is meant to provide field technicians a brief overview of EISA and potential impacts on lighting. While knowledge of EISA is not crucial to field technicians performing their duties, EISA in-part prompted this study and it is possible that customers may ask questions about EISA during onsite visits.

Summary

The Energy Independence and Security Act (EISA) of 2007 sets maximum wattage levels by lumen output (that is, how bright the bulb is) for medium, screw-base bulbs that have a range from 310 to 2,600 lumens (Table 13). Bulbs not meeting these standards will be phased out over the next few years. This lumen range generally corresponds to the brightness of 40 Watt to 100 Watt incandescent bulbs, and it is primarily incandescent bulbs that will be phase out.

The standards started to go into effect under a phased approach that began in 2012, when general service bulbs (that is, typical bulbs) began to be required to use from 20 percent to 30 percent less energy than current incandescent bulbs. The law first applied to bulbs in the 1,490 to 2,600 lumen range, effectively banning the manufacture and import of general service 100 Watt incandescent bulbs in the United States after January 1, 2012. Over the next few years, the law will limit the manufacture and import of all general service incandescent bulbs between 40 and 100 Watts.

Table 13: EISA Phase-out Schedule – Stage 1

Rated Lumen Ranges	Typical Current Lamp Wattage	Maximum Rate Wattage	Minimum Rate Lifetime	Effective Date
1490-2600	100	72	1,000 hours	January 1, 2012
1050-1489	75	53	1,000 hours	January 1, 2013
750-1049	60	43	1,000 hours	January 1, 2014
310-749	40	29	1,000 hours	January 1, 2014

EISA prohibits the manufacture and import of incandescent bulbs, but not the sale of incandescent bulbs. Therefore, standard incandescent bulbs will remain available to consumers on retailers' shelves until all stock acquired before the relevant effective date, is sold. Additionally, as remaining stocks sell out, consumers will have the option of replacing higher-wattage incandescent bulbs with lower-wattage ones during the transition period. Some stores, however, have voluntarily chosen not to carry certain wattages of incandescent bulbs in anticipation of the law's implementation.

Important Details

- On December 19, 2007, President George W. Bush signed H.R. 6, the Energy Independence and Security Act of 2007, into law (Public Law 110-140).
- Sets maximum wattage levels by lumen output for medium, screw-base bulbs:
  - → 310 to 2,600 lumens, which roughly correspond to the brightness emitted by 40 Watt to 100 Watt incandescent bulbs
  - → Began to be implemented on January 1, 2012; during this study its main impact will be on 1,050 to 2,600 lumen bulbs (100 Watt and 75 Watt incandescent bulbs)

Manufacture vs. Sale

EISA prohibits the **manufacture** and **import** of incandescent bulbs but does **not** prohibit the **sale** of incandescent bulbs. So people can still buy incandescent bulbs until the current stock runs out, and they may also use lower wattage bulbs not yet covered by EISA to replace higher wattage ones when they are no longer available in stores.

Consumer Lighting Options

Consumers have a variety of options for replacement bulbs for those being phased out:

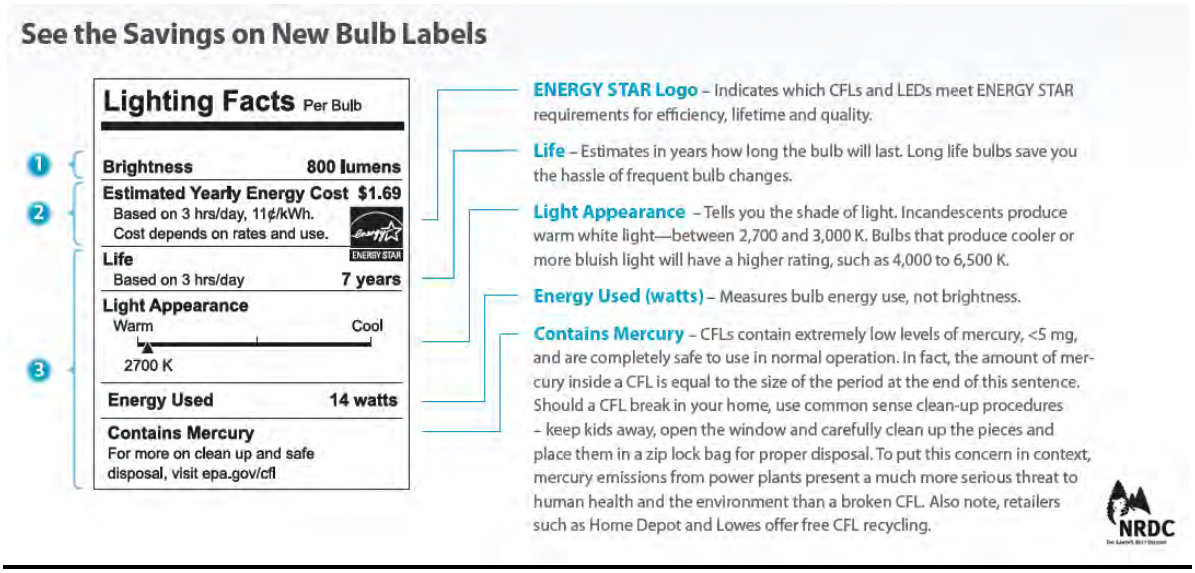
- Lower wattage incandescent bulbs (Cost is less than $1)
  - → Most similar to what many costumers are familiar with
- EISA-compliant halogen bulbs (Cost between $1.50 and $3.00)
  - → About 30% more efficient that standard incandescent bulbs
  - → Similar to standard incandescent bulbs in terms of appearance and light quality
- CFL bulbs (Cost between $1.00 and $3.00)
  - → More efficient than standard incandescent bulbs
  - → Some consumers concerned by mercury in CFL bulbs

- Non-directional LED bulbs (as opposed to spot and flood LEDs) (Cost between $10 and $20)
  - → Only a few on the market currently – still a developing technology
  - → While the price has been declining, still an expensive option and most consumers will not view LEDs as a viable replacement option until the price decreases.

Consumer Response

Consumer awareness of the EISA-mandated phase-out of incandescent bulbs and on how to choose light bulbs based on factors other than "wattage" (which most consumers equate with brightness) is relatively low. The Federal Trade Commission (FTC) has developed a new lighting facts label to help consumers make informed purchase decisions based on lumens instead of wattages and lifecycle costs.

Figure 3: FTC Lighting Facts Label



8 Reimbursement Form

Regional Hours of Use Study

Reimbursement Form

Customer Name: _____

Address: _____

_____

Phone: _____

Technician: _____

Date of Visit: _____ Time: _____

Description: _____

_____

- Please attach a receipt for the replacement light bulb to this form and mail this form and the receipt to:

DNV KEMA, Inc.
Attn: Jeffrey Zynda
200 Court St, 1st Floor
Middletown, CT 06457

200 Court Street, 1st Floor, Middletown, CT 06457
Phone: (860) 346-5001 Fax: (860) 346-5533
www.dnvkema.com

9 EPA Cleanup and Disposal Guidelines for CFLs

Cleanup and Disposal Guidelines
For Compact Fluorescent Light Bulbs (CFLs)
June 2008

What precautions should I take when using CFLs in my home?
CFLs are made of glass and can break if dropped or roughly handled. Be careful when removing the bulb from its packaging, installing it, or replacing it. Always screw and unscrew the light bulb by its base (not the glass), and never forcefully twist the CFL into a light socket. If a CFL breaks in your home, follow the clean-up recommendations below. Used CFLs should be disposed of properly (see below).

What should I do with a CFL when it burns out?
EPA recommends that consumers take advantage of available local recycling options for compact fluorescent light bulbs. EPA is working with CFL manufacturers and major U.S. retailers to expand recycling and disposal options. Consumers can contact their local municipal solid waste agency directly, or go to www.epa.gov/bulbrecycling or www.earth911.org to identify local recycling options.

If your state or local environmental regulatory agency permits you to put used or broken CFLs in the garbage, seal the bulb in two plastic bags and put it into the outside trash, or other protected outside location, for the next normal trash collection. Never send a fluorescent light bulb or any other mercury-containing product to an incinerator.

If your ENERGY STAR qualified CFL product burns out before it should, look at the CFL base to find the manufacturer's name. Visit the manufacturer's web site to find the customer service contact information to inquire about a refund or replacement. Manufacturers producing ENERGY STAR qualified CFLs are required to offer at least a two-year limited warranty (covering manufacturer defects) for CFLs used at home. In the future, save your receipts to document the date of purchase.

How should I clean up a broken fluorescent bulb?
Because CFLs contain a small amount of mercury, EPA recommends the following clean-up and disposal guidelines:

1. Before Clean-up: Air Out the Room

- Have people and pets leave the room, and don't let anyone walk through the breakage area on their way out.
- Open a window and leave the room for 15 minutes or more.
- Shut off the central forced-air heating/air conditioning system, if you have one.

2. Clean-Up Steps for Hard Surfaces

- Carefully scoop up glass fragments and powder using stiff paper or cardboard and place them in a glass jar with metal lid (such as a canning jar) or in a sealed plastic bag.
- Use sticky tape, such as duct tape, to pick up any remaining small glass pieces and powder.
- Wipe the area clean with damp paper towels or disposable wet wipes. Place towels in the glass jar or plastic bag.
- Do not use a vacuum or broom to clean up the broken bulb on hard surfaces.

3. Clean-up Steps for Carpeting or Rug:

- Carefully pick up glass fragments and place them in a glass jar with metal lid (such as a canning jar) or in a sealed plastic bag.
- Use sticky tape, such as duct tape, to pick up any remaining small glass fragments and powder.
- If vacuuming is needed after all visible materials are removed, vacuum the area where the bulb was broken.
- Remove the vacuum bag (or empty and wipe the canister), and put the bag or vacuum debris in a sealed plastic bag.

4. Clean-up Steps for Clothing, Bedding, etc.:

- If clothing or bedding materials come in direct contact with broken glass or mercury-containing powder from inside the bulb that may stick to the fabric, the clothing or bedding should be thrown away. Do not wash such clothing or bedding because mercury fragments in the clothing may contaminate the machine and/or pollute sewage.
- You can, however, wash clothing or other materials that have been exposed to the mercury vapor from a broken CFL, such as the clothing you are wearing when you cleaned up the broken CFL, as long as that clothing has not come into direct contact with the materials from the broken bulb.
- If shoes come into direct contact with broken glass or mercury-containing powder from the bulb, wipe them off with damp paper towels or disposable wet wipes. Place the towels or wipes in a glass jar or plastic bag for disposal.

5. Disposal of Clean-up Materials

- Immediately place all clean-up materials outdoors in a trash container or protected area for the next normal trash pickup.
- Wash your hands after disposing of the jars or plastic bags containing clean-up materials.
- Check with your local or state government about disposal requirements in your specific area. Some states do not allow such trash disposal. Instead, they require that broken and unbroken mercury-containing bulbs be taken to a local recycling center.

6. Future Cleaning of Carpeting or Rug: Air Out the Room During and After Vacuuming

- The next several times you vacuum, shut off the central forced-air heating/air conditioning system and open a window before vacuuming.
- Keep the central heating/air conditioning system shut off and the window open for at least 15 minutes after vacuuming is completed.
- For more information about compact fluorescent bulbs, visit http://www.energystar.gov/cfls

For more information about compact fluorescent bulbs and mercury, visit http://www.energystar.gov/mercury EPA is continually reviewing its clean-up and disposal recommendations for CFLs to ensure that the Agency presents the most up-to-date information for consumers and businesses.

High-Rise Hours of Use Study: Onsite Handbook

New York City: High-Rise Oversample

1/2/2013

Prepared for:

The New York State Energy Research and Development Authority

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Contents

Tables

Figures

Overview of Handbook

The purpose of this document is to provide all the information required to conduct site visits for the High-Rise Oversample portion of the Regional HOU Study. This document will be provided to all field technicians and will be used as the main reference material for in-person field technician training conducted for this study. This document contains the following sections:

- Training Plan
  - → Independent Training Steps
  - → In-person Training Session Outline
- Background / Purpose of the Study
- Onsite Protocol
- Onsite Form Instructions (included as separate Appendix)
  - → Example Completed Saturation Forms (included as separate Appendix)
- Logger Installation Instructions
- Solar Shading Measurement Instructions
- Quality Assurance and Control Procedures
- Frequently Asked Questions
  - → The Energy Independence and Security Act (EISA) of 2007
- Mileage Tracking Form
- Reimbursement Form
- EPA Cleanup and Disposal Guidelines for Compact Fluorescent Light Bulbs (CFLs)

All field technicians should review this document in its entirety prior to the in-person training session. This document contains independent training exercises that all technicians will be expected to complete prior to in-person training.

1 Training Plan

Training for this project consists of both independent and in-person training. A brief outline of training activities is included below. Additional detail about each step of training is covered in later sections. The first training step is to thoroughly review this document in its entirety.

1.1 Independent Training *(approximately three hours – total)*

- Review of Materials – field technician will spend one hour reviewing materials contained in this document.
- Store Visit – field technician will go to a hardware, lighting, or big box retailer to familiarize themselves with various bulb types. This activity will require about one hour.
- Mock Site Visit – after reviewing materials and completing the store visit, field technician will spend 30 minutes to an hour conducting a mock lighting audit for his/her home. As he/she is conducting the audit, he/she should reference the protocol to address any questions that arise. Once complete, he/she will send the completed site visit forms to the project manager for review.
- Logger Installation Practice – NMR will send the technician a logger and a light pipe to practice using and installing them on different fixtures. The technician will take pictures of the installed loggers and email them to the project manager to review.

1.2 In-person Training *(approximately five hours – total)*

- Questions and Answers – field technicians will be provided with the opportunity to ask questions about materials or the study that came up during independent training. Field technicians are also encouraged to ask questions during the remainder of the training session. *(20 minutes)*
- Review of Materials – the trainer will walk field technicians through the protocols, onsite forms, and equipment required for this project. *(45 minutes)*
- Solar Shading Training – field technicians will be provided with training required to operate the Solar Pathfinder™ device. *(60 minutes)*
- Administrative Matters – the trainer will review administrative procedures with field technicians. *(20 minutes)*
- Mock Site Visit – the trainer will act as a customer participating in the study and the field technician will go through the steps of conducting a site visit. *(30 minutes)*
- Walk-Along Visit – the trainer will walk-along with the field technician on their first site visit to observe them in the field. *(2 hours)*

2 Background / Purpose of the Study

The parties responsible for evaluation of energy-efficiency programs in Massachusetts, Connecticut, Rhode Island, and New York have committed to conducting a study to estimate hours of use (HOU) of light bulbs in homes. The main objective of this study, therefore, is to estimate HOU, and we will do so by room type, not lighting type (technology) as many studies have done in the past. Our focus on room types assumes that people are likely to use their lights in a given room the same way regardless of the type of bulbs in the room. To account for the differences in lighting among high-rise apartment buildings in New York City, NYSERDA has chosen to field an oversample among high-rise apartments. High-rise apartment buildings are the focus of this document.

To accomplish this objective, field technicians will perform three tasks: 1) conduct an inventory of lighting to determine the number and type of bulbs currently installed in customers' homes, 2) install a series of lighting loggers to capture information on how customers use lights in their homes, and 3) measure the percent of solar availability for apartments selected for the study. These first two tasks are interrelated because in order to install loggers in a random selection of light fixtures, we must first identify all of the light fixtures in a customer's home.

NMR is recruiting and scheduling participants for this study via telephone. During the recruiting and scheduling, customers are provided with the following project details:

> *NYSERDA is offering you the opportunity to take part in an important study. We are offering eligible households $100 to allow a trained technician to visit their homes to gather more information about the lighting products they use. The visit should take about an hour. The visit would involve a trained technician walking through your home and recording the types of lighting products that you are using. The technician will also attach some very small devices to several light sockets in your home to record lighting usage. Most lamp or fixture shades will block the devices from view, so they won't affect your decor. They also won't affect how your lights work. When the technician returns to remove these devices in six months, you'll receive $100 to participate in the study – for a total of $200. Participation in the study will require two visits, the first about an hour in length and the second a shorter visit of about 30 minutes, six months later. During the visits, there will be no attempt to sell you anything. The information gathered will be used to evaluate and improve the energy efficiency programs offered by NYSERDA.*

As a field technician you will not recruit customers. Instead, you will be provided with a list of customers to visit each week. This list will include the customer's name, telephone number, address, and an appointment time. You should also receive a check for each participant prior to visiting their home, participants will receive two separate checks one for the first visit (installation) and one for the second visit six months later (removal).

3 Onsite Protocol

This section outlines the procedures field technicians will follow when performing the lighting inventories and installing the loggers. These protocols cover both the lighting inventory and the selection of fixtures for loggers. The protocols for installing lighting loggers differ between single-family and multi-family as noted throughout this section.

3.1 Prior to Visit

Before visiting a home, you should make sure that, at a minimum, you have the following:

- Onsite Handbook
- Onsite data form
- Appointment sheet
- Company Polo Shirt
- ID Badge
- Cell Phone

Data Collection Kit

- Camera
- Flashlight
- Pen
- Sharpie
- Flat & Philips head screwdrivers
- Insulated gloves
- Shoe coverings
- Latex gloves
- Step ladder
- Example CFL bulb
- 6, 10, and 20-sided Dice
- Measuring tape
- Range finder
- Solar Pathfinder™
- Compass
- Backpack

Logger Installation Kit

- Logger installation instructions
- Zip ties
- Adhesive 3M pads
- Light loggers *(5 for high-rise apartments)*
- Light pipes
- Logger labels
- Sealable sandwich bags

CFL Clean up Kit

- Sealable plastic bags
- Disposable wipes
- Vacuum
- Duct tape
- Flat brush

Materials for Customer

- FAQs and Info Sheet
- Business card
- Check ($100)

3.2 Arrival at Onsite

After the door is opened, immediately ascertain that the person at the door is the scheduled interviewee. Introduce yourself and hand him/her the business card.

- **Sample Introduction** *(not to be read verbatim)***:**
  Hello, my name is _____, and I am working with NMR. NMR is working under contract with ***NYSERDA (the New York State Energy Research and Development Authority)****. I'm here to meet with _____. As mentioned on the phone, I'm here to walk through your home and record the types of lighting fixtures and bulbs installed in each socket.* ***[Customer should be expecting you]****. During my visit I'll also be installing a few lighting loggers to capture hours of use* ***[show customer a logger]****. In six months another technician will return to collect the loggers that I install. The loggers can only tell when a light is turned on and off, they do not record anything else. In appreciation for your time, on behalf of* ***NYSERDA****, we are offering you a payment of $100 today and $100 when we return in six months to remove the loggers. Do you have any questions regarding my visit?*

Prior to Data Collection

- Give the customer a step by step description of what you'll be doing (show the data collection form and a logger as you explain)
  - → First I need to walk around the inside your home – room by room – to record the type of bulbs present including any bulbs in storage. While I am working through your home I will also be recording the dimensions of your windows and any walls with windows on them.
  - → After counting all of the lights, I need determine which fixtures to install the loggers on.
  - → *(If LEDs present)* While I am installing the loggers, you can fill out this short survey on LEDs
  - → After we're finished inside your home, I will be taking a few measurements of solar shading outside your home at street level. [The customer does not need to come with you for this part of the data collection]
- The customer should not be surprised by any of this information as they have already been told what the study will consist of. However, if the customer is uncomfortable with the visit and refuses to allow you to conduct the inventory or install the loggers, courteously explain that you will be unable to provide the incentive check if they do not participate. If they still refuse, ask if it would be ok to have your supervisor call them to discuss the project with them. Immediately inform your supervisor of the situation and whether or not the customer is expecting a call from your supervisor.
  - → Customers must participate in all aspects of the study—the lighting inventory and the logger installation.

General sequence of data collection

- Installed bulb - Interior:
  - → Next, proceed through the inside of the home in a clockwise direction.
  - → Begin with foyer (entry way).
  - → Go through each room and part of the home systematically, in a clockwise direction (or as clockwise as is possible).
- Window and room dimensions - Interior:
  - → As you proceed through the home, measure and record the dimensions of any windows and all exterior walls. Note the dimensions on the data collection form.
- Stored Bulbs**:**
  - → **Ask:** *"Now, I would like to see all light bulbs and fixtures that are not currently installed. This would include those you have bought and not yet installed as well as those that were installed and then removed."*
  - → Record information on all bulbs in storage.
- Logger Installation:
  - → Consult logger installation instructions.
  - → Install loggers on selected fixtures (with customer's approval of placement).
- After Data Collection:
  - → Thank the customer for his/her time
  - → Give him/her the $100 check.
  - → Remind the customer that when we return in six months to retrieve the loggers we will provide them with a check for $100.
  - → Have the customer sign off on your data collection form to indicate that you visited their home and provided him/her with a $100 check.
  - → Leave with the customer the "Logger Participant Frequently Asked Questions" one-page sheet.
- Solar Shading Analysis (at street level – outside customers home):
  - → Proceed to street-level
  - → Consult your home schematic to determine the approximate location of the unit and any windows.
  - → Setup the pathfinder and take measurements for any side of the building where a window (in the unit) is present. Measurements should be taken on the east, south, and west sides of the building (if windows are present) but not on the north side of the building.

Data Collection Guidelines

- **<u>All recorded information must be legible</u>.**
- **What information to collect:**
  - → **All lights that use electricity** (meaning they are plugged in or hard wired) must be captured, including night lights.
    - Ex. Solar landscaping lights that also use electricity from electric lines, ***capture*** *the information*; solar landscaping lights that don't use any electricity lines at all, ***do not*** *capture*.
  - → **DO NOT** capture lights that run **only** on batteries like flashlights or battery-operated closet or under-cabinet lights (even if the batteries are rechargeable).
  - → **DO NOT** capture information for temporary seasonal lights or lighting displays. This could include strings of lights such as holiday lights as well as novelty lights like plug in candles, yard decorations, holiday village displays, etc. Ask the customer if it is permanent or a seasonal holiday light; if permanent, capture this information.
- **Removing Bulbs or Fixture covers:**
  - → **<u>Never remove a cover or bulb without permission from the customer.</u>**
  - → If any fixture is covered and/or the bulb is not immediately visible, ask the customer if the bulb is easily accessible. If yes, ask if you can turn off the fixture and take it apart to see the light bulb.
  - → If the customer offers to turn off the fixture and take it apart him/herself, **ALWAYS** let the customer do it.
  - → If the customer refuses to let you do it and does not offer to do it him/herself; the fixture is damaged or delicate; or the fixture is inaccessible given your equipment, ask the customer for his/her best guess of the information needed on the form.
  - → **DO NOT TOUCH** if fixtures have cracked or damaged covers, or look delicate or easily breakable.
- **Burned Out Bulbs:**
  - → If a bulb is burned out, ask the customer if he/she intends to replace the bulb.
    - If the answer is yes, treat the burned out bulb as if it's currently working and record all.
    - If customer does not intend to replace them OR purposely unscrews some bulbs so that they don't turn on, treat them as if they were an empty socket.
    - **Note: Do not install loggers on burned out bulbs**

- **Broken Bulbs:**
  - → If you break any type of light bulb and/or if a broken CFL came into direct contact with clothing or bedding which subsequently needed to be thrown out, give the customer the "Reimbursement Form."
  - → Note what type of bulb was broken and contact the project manager as soon as possible to report the incident.
  - → Take a picture of the broken bulb and any other damage.
  - → **If a CFL or a fluorescent bulb should be broken**, refer to the "Cleanup and Disposal Guidelines for Compact Fluorescent Light Bulbs" of the Environmental Protection Agency (EPA) included in this packet.
- **Unplugged Fixtures:**
  - → If the interviewee has unplugged light fixtures in storage areas, ask the customer if he/she uses the fixture.
    - o If the answer is no, then treat the light bulbs in the fixture as if they are in storage (record it in the CFL in Storage Form if the bulb is a CFL and do not record it if it is not a CFL).
    - o If the answer is yes, then record the fixture in the "installed lighting" form and denote when it is used in the "notes" column.

4 Onsite Form Instructions

This section provides specific details about how the onsite form should be completed by field technicians.

4.1 Home Schematic

→ Draw a **CLEAR** diagram of the house on the sheets provided as you go through the home, labeling each room on the diagram (in order to locate loggers on the follow up visit).
→ Use your compass to note the cardinal directions (N, S, E, and W)
→ Note any windows (including windows in doors and sliding glass doors) on the schematic with the letters **W-I-N**
→ If the home has multiple levels create a separate diagram for each level, including the basement and/or attic.
→ If the attic or any other room in the home is not accessible, still include it in the diagram but record it as "inaccessible".
→ **Indicate the location within a room of any fixtures that have loggers installed by marking the diagram with an X.**

4.2 Onsite Saturation Form

Program Participation

→ Before filling out the onsite form, ask the homeowner: **Have you participated in any programs that replaced bulbs in your house with energy efficient bulbs?**
  - Yes
  - No
→ If "Yes", ask which programs they participated in and record their responses.

Room Descriptions

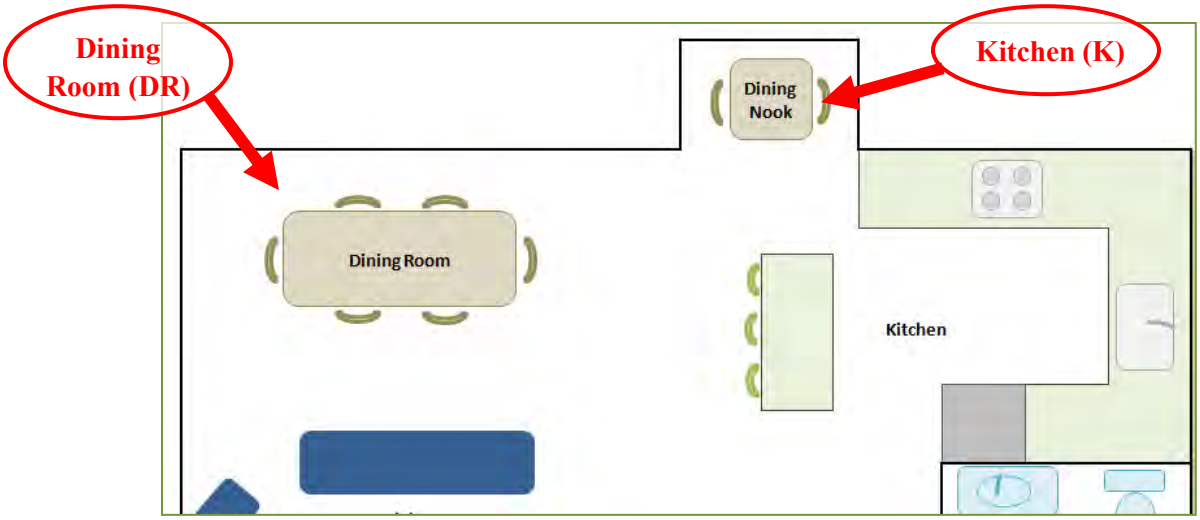
→ Choose from the codes below.
→ You may use a downward arrow to indicate the same room for more than one line.
→ If a home has a great room or a single room with several purposes, look at the particular usage of the light and record the lamps accordingly.
→ When in doubt of a room's purpose ask the customer how they would describe the room.
→ If there are multiple rooms of the same type add a number after the code (ex. BR1, BR2).

Table 1: Room Type List

Room	Code	Room	Code	Room	Code
Dining Room	DR	Living Space	L	Garage	G
Exterior	E	Hallway	H	Office	OFF
Kitchen	K	Foyer	F	Den	DEN
Bedroom	BR	Utility	U	Closet	[Room code] -C
Bathroom	BT	Basement	BA	Other [Specify]	O

Dining Room (DR)

A dining room is any room where the primary purpose is eating. Substantial dining areas that are not separated from other rooms in the home directly by walls and doors are still considered a dining room if they are set apart from other rooms. Observations of a dining area attached to the kitchen, such as a dining nook, will be labeled as a kitchen.



Exterior (E)

Technicians will audit lamps that are attached to the home and those that are owned by the customer. These include lampposts not attached to the home and light lamps that are part of driveway entrances. Exterior includes sheds, greenhouses, and other storage facilities and exterior buildings owned by the customer **except garages** which have their own category discussed below.

While all homes have exteriors not all lights on all homes are directly controlled by the person who lives there. Only capture exterior lights if they are directly controlled by the person who lives in the home we are visiting. Lighting in common areas of apartment buildings (interior/exterior) and lights not controlled on the exterior of townhomes are examples of exterior lights that we do not need to capture.

Kitchen (K)

Technicians will include the lights that are primarily used in a kitchen area or inside the kitchen, such as a counter with bar stools or a small kitchen table. However, technicians will not include the light under the range hood or in the refrigerator.

Every home will have at least one kitchen. If the home is an efficiency or a studio apartment, designate the lights directly present in the kitchen area (area containing stove, refrigerator and sink) as the kitchen.

Bedroom (BR)

All bedrooms will be noted with a unique identifier (i.e. BR 1).

Every home will have at least one bedroom. If the home is an efficiency or a studio apartment, designate the lights directly present in the sleeping area (area containing bed) as the bedroom.

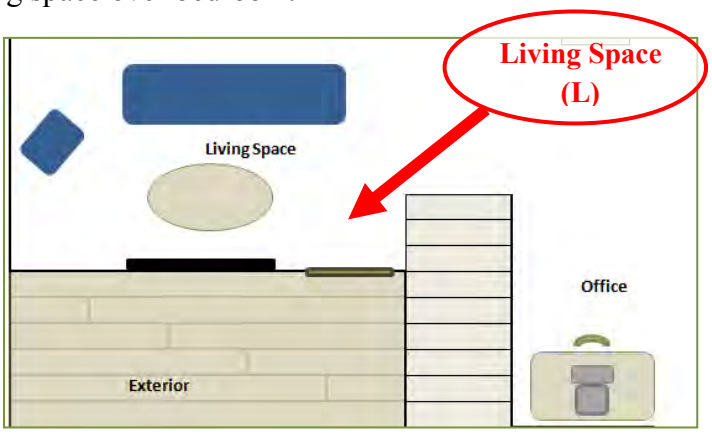
Bathroom (BT)

The bathrooms included can be full baths, half baths, or three-quarter baths. If a particular bathroom has two rooms (such as a separate shower and sink area), the lighting will be coded in both rooms as the same bathroom.

Every home will have at least one bathroom. Efficiency and studio apartments should have a separate bathroom. In the event that the bathroom is not separated from the rest of the home by walls and a door, designate the lights directly present in the bathroom area (area containing the shower, toilet and sink) as the bathroom.

Living Space (Living Room/Family Room) (L)

This room is the most commonly used area for family activities, such as watching television or entertaining. The form does not differentiate between living room and family room since this distinction can often be subjective. If the apartment is a studio or efficiency where the bedroom and living space are the same and have only one light, prioritize living space over bedroom.



Hallway (H)

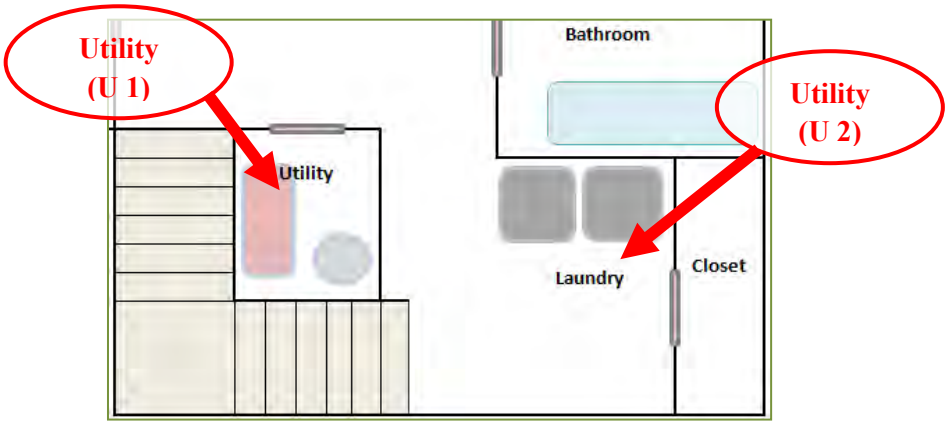
Hallways include all stairways with lights.

Foyer (F)

This category includes all entry ways, even those called mudrooms.

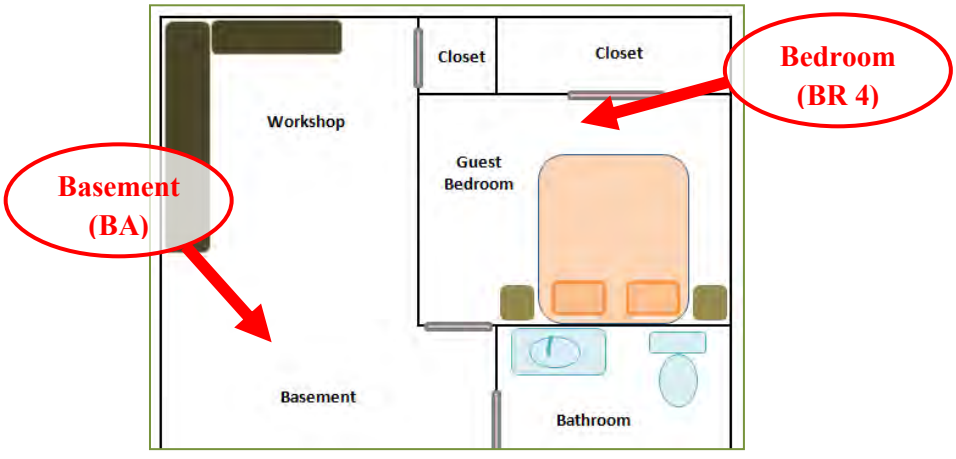
Utility (U)

The main purpose of this room is washing clothes. Technicians will also include furnace/HVAC areas as a utility room unless the furnace/HVAC is part of an unfinished one room basement. Do not include apartment building laundry rooms used by all tenants; only include those that are inside the homeowner's apartment.



Basement (BA)

The basement is the main room under the first floor. If there are bedrooms, bathrooms, closets, utility rooms, etc. in the basement, they will be coded and recorded as such.

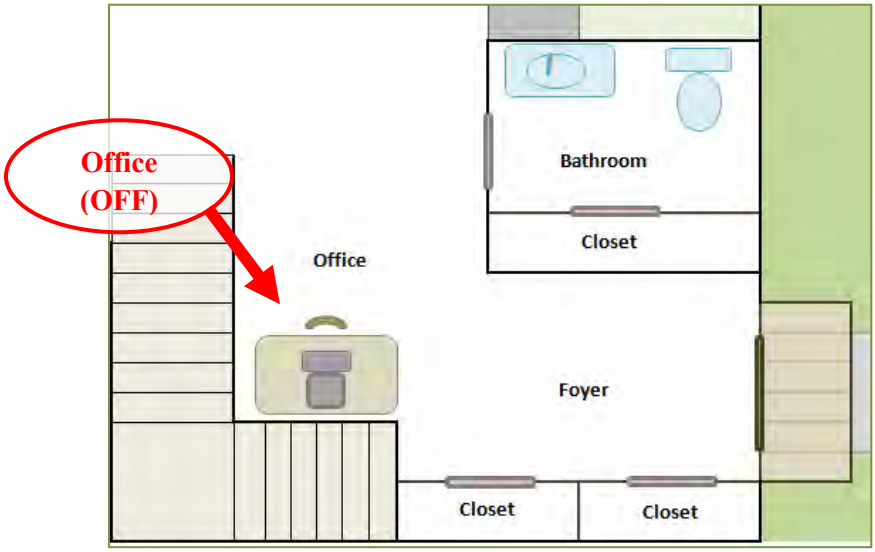


Garage (G)

In addition to a typical garage, a carport fits into this category. Bulbs found in garage door opening mechanisms will be included.

Office (OFF)

Technicians will collect lighting data in computer rooms, home offices, and parts of a great room that have office functions. In the notes column indicate whether the office is a separate room or part of a larger room. The primary function of this room appears to be doing something at a desk or computer.

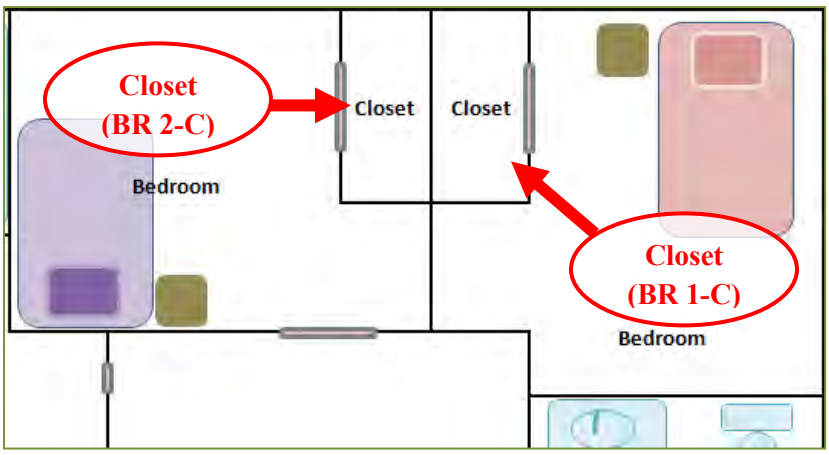


Den (DEN)

This category refers only to dens, libraries and other small, secluded rooms. If the room contains a full size couch, this would be considered a living space. Technicians should defer to the "Living Space" category if they cannot decide how a room should be categorized.

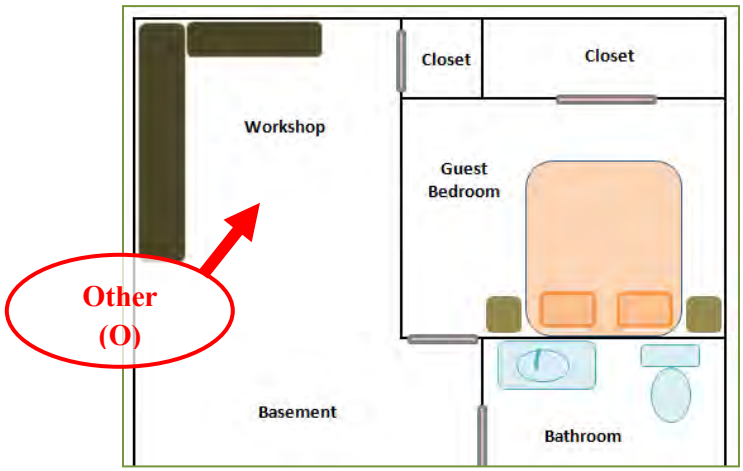
Closets ([Room Code]-C)

Technicians will collect lighting data for lamps in closets. Closets should be recorded separately from the spaces that contain them but with the name of the room included. For example, a closet in the master bedroom would be recorded as BR1-C.



Other (O)

Technicians will collect lighting data for lamps in other room types. In the notes column, describe the room type in more detail.



Primary Room

→ When multiple rooms of one type exist (ex. Bedrooms, bathrooms), record a "Y" in the "Primary" column to indicate the room used most frequently.

→ If it is not clear which room is used most frequently, ask the homeowner.

→ For bedrooms, the "Primary room" is the master bedroom.

→ The column can be left blank if only one room exists of that type.

Fixture Group

→ A fixture group includes <u>all fixtures that are controlled by the same switch</u>.

→ Number fixture groups in *each room type targeted for loggers* from 1, 2, 3, 4, etc. up to the number of fixture groups in each room of the same type

- Single family homes targeted room types: Dining rooms, exteriors, living spaces, other room #1, other room #2, bedrooms, bathrooms and kitchens.
- Multifamily homes targeted room types: Living spaces, dining rooms (or other room #1), other room #2, bedrooms, bathrooms, and kitchens.
- For "other" rooms #1 and #2 - group all remaining rooms together to number fixture groups for other room type.
- Ex. If a house has three bedrooms, start with fixture group #1 in BR1 and count through fixture group #8 (the last fixture group) which is in BR3.

→ Repeat fixture group number until all bulbs associated with it are recorded.

Control Type

→ Include control-type information for each light fixture using the codes below.
→ For dimmable and 3-way control types
  - Test the fixture to make sure these specialty features are functional.
  - If the control also has on/off capability, still label the control by its specialty feature

Table 2: Control Type List

Control Types	Code	Details
On-Off	OF	Control can only turn a lamp on or off.
Dimmable	Dim	Control increases/decreases bulb brightness as it is turned or is moved up/down.
3-way	3W	Controls a fixture that uses a three-way bulb to produce three levels of light, switching the level with each turn (ex. 50-100-150 watts).
Wireless	W	Fixture is turned on by a remote control or a wall-mounted control that is not connected to the house's wiring.
Motion or Photo Sensor	MS	Fixture turns on when a moving object is detected.
None	None	Fixture has no control switch; the bulb is always on.
Breaker/Disconnect Plug	B	Fixture has no control switch; only turns on when plugged in.
Other	O	

Wall-Mounted Control

→ Record whether or not the control is wall mounted (Y/N)
→ Wall-Mounted controls are those that are permanently connected to the house's wiring (as opposed to controls that are mounted on the socket, base, or in-line with the cord or those that are controlled remotely)

Fixture Number

→ Number fixtures in each room from 1, 2, 3, 4, etc. up to the number of fixtures in the room.
→ **Do not** restart numbering of fixtures from 1 for each room. Fixtures should be numbered sequentially throughout the entire home such that when you number the final fixture in the home the total number of fixtures in the home should match the fixture number.
→ Repeat the fixture number until all bulbs associated with it are recorded.
→ **You do not need to capture fixtures inside appliances** like ovens, range hoods, refrigerators, or microwaves.

Multi-Switch

→ If a fixture is controlled by two separate switches, record this in the column provided (Y/N)

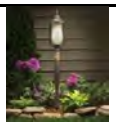
Fixture Type

→ Include fixture type information for each installed bulb using the codes below.

Table 3: Fixture Type List

Fixture	Code	Fixture	Code	Fixture	Code
Recessed	R	Wall Mount	WM	Walkway	W
Pendent	P	Night Light	NL	Exterior Flood	EF
Flush Mount	FM	Table Lamp	TL	Garage Door	G
Track	T	Floor Lamp	FL	Under Cabinet	U
Ceiling Fan	CF	Post Mount	PM	Other	O

Table 4: Fixture Type Exhibit

Fixture	Image	Fixture	Image
Recessed *(light bulb does not stick out of the plane of the ceiling)*		**Table Lamp** *(lamps that are put on tables)*	
Pendant *(fixture and bulb hangs from ceiling, i.e. chandelier)*		**Floor Lamp** *(lamps that are put on the floor)*	
Flush Mount *(fixture is flush with the ceiling)*		**Post Mount** *(exterior lights on a lamppost)*	
Track *(light bulbs on a strip/track)*		**Walkway** *(lights on a path outside the home)*	
Ceiling Fan *(lights attached to a ceiling fan)*		**Exterior Flood** *(fixtures that flood a large area with light, found on the side of home, above garage, or under peak of roof)*	
Wall Mount *(fixture attached to wall)*		**Garage Door**	
Night Light		**Under cabinet** *(lights under kitchen cabinets for lighting counter)*	

Bulb Type

→ Record bulb type information for each installed bulb using the codes below.
→ If socket is empty, record as "E."

Table 5: Bulb Types Code List

Bulb Type	Code	Bulb Type	Code
Incandescent	I	Halogen	H
CFL	CFL	Other	O
Fluorescent	F	Empty Socket	E
LED	LED		

Table 6: Bulb Types Exhibit

Bulb Types	Image	Description
Incandescent (I)		Bulbs have a filament that's heated to the point of glowing
Compact Fluorescent (CFL)		Bulbs are energy-efficient; use 67% less energy than incandescent bulbs and last longer. Covered CFLs have a plastic cover that conceals the traditional spiral shape. If you look closely at the bulb you will be able to see the spirals through the covering—especially when the bulb is turned on.
Fluorescent (F)		Bulbs are filled with mercury vapor that emits ultraviolet light when electricity is applied, then coating inside bulbs turns the UV rays into visible light
Light-Emitting Diode (LED)		Bulbs have a semiconductor chip so current flows through; light is released when an electron falls into a lower energy level. Some LEDs have a yellow filter.
Halogen (H)		More efficient type of incandescent bulb with filament sealed into a compact transparent envelope filled a small amount of halogen, allowing the filament to be at a higher temperature. Some halogens are virtually indistinguishable from regular incandescent bulbs. They may be smaller (ex. A-17 size instead of A-19) or can be distinguished by the presence of a glass tube around the filament (halogen) instead of the filament by itself (incandescent).

Bulb Shape

→ Include bulb shape information for each installed bulb using the codes below.

Table 7: Bulb Shape List

Bulb Shape	Code	Bulb Shape	Code
Twist/Spiral	T	Spot/Reflector/Flood	S
Globe	G	Circline	C
A-lamp	A	Tube	Tub
Bullet/Torpedo	B	Candle	Can
Bug light	Bug	Other [Specify]	O

Table 8: Bulb Shape Exhibit

Bulb Shape	Image	Bulb Shape	Image
Twist/Spiral (T)		**Spotlight/ Reflector/Flood (S)**	
Globe (G) *(e.g., for bathroom vanity fixtures)*		**Circline (C)**	
A-lamp (A) *(shaped like standard incandescent)*		**Tube Style (Tub)**	
Bullet/Torpedo (B) *(pointed top, standard screw base)*		**Candle (Can)** *(pointed top with a candelabra screw base)*	
Bug light (Bug) *(yellow color; do not confuse with LEDs with yellow filters)*			

Socket Type

→ Record socket type for each installed bulb using the codes below.

→ Socket type refers to the bulb base (circled in red in Table 10) and how the base attaches to the fixture.

Table 9: Socket Type List

Socket Type	Code
Medium Screw Base (Standard)	S
Small Screw Base (Candelabra)	Can
Pin Base	P
GU Pin Base	GU
Other	O

Table 10: Socket Type Exhibit

Socket	Image	Description
Medium Screw Base (S)		Light bulb screwed into socket
Small Screw Base [Candelabra] (Can)		Smaller screw base
Pin Base (P)		Pin on base of bulb sticks into socket
GU Base (GU)		Pin with larger head on base of bulb sticks into socket

Wattage

→ Record the wattage for each installed bulb.

Manufacturer

→ **CFL and LED bulbs ONLY:**
→ Record the manufacturer for each installed bulb.
→ If the manufacturer is not clear, ask the homeowner if they recall the manufacturer.

Model Number

→ **CFL and LED bulbs ONLY:**
→ Record the model number of installed CFL and LED bulbs.
→ Model numbers can include both numbers and letters.
→ Model numbers can usually be found on the base or near the base of the bulb.

When Purchased

→ **CFL and LED bulbs ONLY:**
→ Ask the homeowner:

<u>When</u> did you purchase this bulb?

1. January to February 2013
2. July to December 2012
3. January to June 2012
4. Before 2012

What Replaced

→ **CFL and LED bulbs ONLY if purchased in past year:**
→ Ask the homeowner:

<u>What</u> <u>type</u> of bulb was installed here before you installed this CFL or LED?

1. Incandescent
2. Halogen
3. CFL
4. LED
5. Something else (specify in notes)

Where Purchased

→ **CFL and LED bulbs ONLY:**

→ Ask the homeowner:

Where did you purchase this bulb?

- Record the store name.
- If the homeowner doesn't recall, ask what type of store they purchased the bulb from using Table 11 below.

Table 11: Store Types

Code	Store Type
A	Grocery store or supermarket, such as Shaw's, Stop n Shop, or Whole Foods
B	Warehouse store, such as Sam's Club, BJ's, or Costco
C	Home improvement store, such as Home Depot or Lowe's
D	Hardware store, such as True Value or ACE Hardware
E	Mass merchandise/discount department store, such as Wal-Mart, Kohl's, K-Mart, or Target
F	Drugstore, such as Walgreen's or CVS
G	Convenience store, such as 7-Eleven, White Hen Pantry, or Cumberland Farms
H	Specialty lighting or electrical store
I	Home furnishing store, such as a Bed, Bath, and Beyond, or Pottery Barn
J	Mail order catalogs
K	Through the Internet
L	Bargain store, such as the Building 19, Dollar Store, or Family Dollar
M	Office supply store, such as Office Depot or Staples
O	Other

Notes

→ Use this column to describe any feature labeled as "other."

→ Use this column to record any additional information that may be useful in the data analysis phase.

→ Ex. The resident refused access to certain rooms or fixtures; or lamp types cannot be determined unless a lighting fixture cover is removed (and the customer does not wish for this to be done).

4.3 Onsite Stored Bulbs Form

- **Ask:** *"Now, I would like to see all light bulbs and fixtures that are not currently installed. This would include those you have bought and not yet installed as well as those that were installed and then removed."*
- Stored bulbs may include those currently stored in the apartment itself or in a storage area in the building separate from the apartment itself. The technician can go with the homeowner to the separate storage unit to count the stored bulbs or ask the homeowner to estimate what is stored in the separate unit.
- Record information on all bulbs in storage.

Package Group

→ A package group includes all stored bulbs that are in the same package.
→ Number package 1, 2, 3, 4, etc.
→ In the onsite form, repeat the package group number until all bulbs in the package are recorded. (The onsite form is one row per bulb, so a package group number is repeated in all rows until all bulbs are recorded)
→ If a bulb is not in a package, write "NA" in this column.

Bulb Type

→ Record bulb-type information for each stored bulb using the codes from Table 5.

Bulb Shape

→ Record bulb-shape information for each stored bulb using the codes from Table 7.

Base Type

→ Record the base type for each stored bulb using the socket type codes from Table 9.

Wattage

→ Record the wattage for each stored bulb.
→ **For Massachusetts and New York ONLY.**

Specialty Feature

→ **CFL and LED bulbs ONLY:**
→ In the column provided, record if the stored bulb is dimmable (Dim) or 3-way (3W).
→ If the bulb is not dimmable or 3-way, leave the column blank.

Manufacturer

→ **CFL and LED bulbs ONLY:**
→ Record the manufacturer for each stored bulb.
→ If the manufacturer is not clear, ask the homeowner if they recall the manufacturer.

Model Number

→ **CFL and LED bulbs ONLY:**
→ Record the model number of stored CFL and LED bulbs.
→ Model numbers can include both numbers and letters.
→ Model numbers can usually be found on the base or near the base of the bulb.

ENERGY STAR Label

→ **CFL and LED bulbs ONLY:**
→ In the column provided, record if the stored bulb has an ENERGY STAR label.

When Purchased

→ **CFL and LED bulbs ONLY:**
→ Ask the homeowner:

<u>When</u> did you purchase this bulb?

1. July to December 2012
2. January to June 2012
3. Before 2012

Where Purchased

→ **CFL and LED bulbs ONLY:**
→ Ask the homeowner:

<u>Where</u> did you purchase this bulb?

- Record the store name.
- If the homeowner doesn't recall, ask what type of store they purchased the bulb from using Table 11.

Online Purchase

→ **CFL and LED bulbs ONLY:**

→ If the bulb was purchased at the aforementioned store online, indicate this in the column provided.

Why Purchased and Stored

→ **100 Watt and 75 Watt Incandescent Bulbs ONLY:**

→ Ask the homeowner:

Did you purchase and store this particular wattage and type of bulb for any particular reason?

1. As a back-up/to replace 100w bulbs
2. As a back-up/to replace 75w bulbs
3. To have extras
4. Don't know/No reason
5. Other

Reason for Storage

D. Why are you storing this bulb? **(Allow for multiple responses)**

1. For future use
2. Do not plan to use
3. Plan to throw out/recycle
4. Other [Specify – record verbatim]
5. Refused
6. Don't know

Type of Bulb it will Replace

E. What type of bulb will this bulb likely replace?

1. CFL bulb
2. Incandescent bulb
3. Whichever needs replacing first
4. The same type of bulb as the stored bulb (if not CFL or Incandescent)
5. Other [Specify – record verbatim]
6. Refused
7. Don't know

4.4 Logger Information and Location Form

→ Record room information for installed loggers **(5 Loggers)**

1. Living space
2. Other room
3. Bedroom
4. Bathroom
5. Kitchen

→ Record serial number for each logger on the line provided.

→ For "Other room #1" and "Other room #2", record the room code on the line provided.

→ Record room code for room types that have multiple rooms. Ex. If the main bedroom is "BR 3", record this code in the form below "Bedroom."

→ Record fixture and bulb characteristics for those lights on which you installed loggers.

4.5 LED Onsite Survey

This survey is to be filled out by the homeowner only in homes in which you find LED bulbs. Before installing light loggers, give the homeowner the LED onsite survey to fill out while you are installing.

- Before giving the homeowner the survey:
  - → On page 1, circle the rooms in which you found screw in LED bulbs installed.
  - → On page 2, circle the rooms in which you found CFL bulbs installed. **If you did not find any installed CFLs, cross out question E.**
- If possible, the person in the home who most recently bought LED bulbs should fill out this survey.
- Instruct the homeowner to complete the survey as thoroughly as possible while you are installing the loggers.
- Collect the completed survey before providing homeowner with their incentive payment.

4.6 Homeowner Verification of Receipt of Incentive Payment

Have the homeowner sign the onsite form upon receiving their incentive check in the space provided on the cover page.

5 Logger Installation Instructions

5.1 Installation

- Install up to **five** loggers on selected fixture groups in **high rise homes**
- Use the data collection form to determine the total number of fixture groups. A fixture group refers to all fixtures controlled by the same switch.
- Take a picture of the fixture with the logger on it (in order for easy recognition when retrieving).
- If installation of the desired number of loggers is not possible, note the reason on the onsite form.
- If the resident objects to installing meters on any fixture group, note the reason on the intake sheet.

5.2 Room Prioritization

- **High-rise homes (5 loggers)**:
  - → Install **one** logger in each of the following room types:
    1. Living Space
    2. Bedroom
    3. Bathroom
    4. Kitchen
  - → Install **one** logger in one *other room* type. This includes any room that is **not** specified above (may include hallways, utility closets, offices, garages, etc.) **If the high-rise home has a dining room/area install ONE of the 'other room' loggers in the dining room or area.**

- **If any home does not include a specified room**, the logger allocated for that room will instead be assigned to a random fixture in a random room even if a logger is already installed in that room. **Install a maximum of two loggers in any one room.** If the randomly selected room already has two loggers installed assign the logger to the next room in order. (Ex1. If you roll a two but there are already two loggers in the dining room install the logger on the exterior. Ex2. If you roll a seven but there are already two loggers installed in other rooms, install the logger in a bedroom.)

- **Note**: Loggers must be installed on fixtures controlled by separate control devices. If a room only has one fixture device or if all fixtures in a room are connected to the same control, **do not install multiple loggers**. Instead, install only one logger and allocate the second logger to another randomly selected room. **Install a maximum of two loggers in any one room.** If the random room selected already has two loggers installed assign the logger to the next room sequentially. (Ex1. If you roll a two but there are already two loggers in the dining room install the logger on the exterior. Ex2. If you roll a seven but there are already two loggers installed in other rooms, install the logger in a bedroom.)

Table 12: Random Selection of Room

High-Rise (6-sided die)		
Room	**# Rolled**	**Probability**
Living Space	1 or 2	33%
Other	3	17%
Bedroom	4	17%
Bathroom	5	17%
Kitchen	6	17%

5.3 Random Fixture Group Selection

- For **high-rise** homes:
  - → If five or fewer fixture groups are identified in the lighting audit, install a logger on one fixture in each fixture group.
  - → If more than five fixture groups are identified, field technicians will use the following random selection method to determine which fixtures to meter.
  - → **If any home does not include a specified room**, the logger allocated for that room will instead be assigned to a random fixture in a random room even if a logger is already installed in that room.

Random Selection Method

- Determine the number of fixture groups in a room from the audit.
  - → If there are multiple rooms of a given type (e.g., bedrooms or bathrooms), count all fixture groups in all of the rooms of that type.

- Based on the fixture group count, select the most appropriate die provided and roll it once to determine which fixture group that should have a logger installed.[1] For example, if the room type has five fixture groups, use the six-sided die. If the room has 18 fixture groups, use the 20-sided die and so forth.

- If the number of fixture groups in a room is less than the number rolled on the die, continue counting from fixture group 1. (Ex. If a room has 11 fixture groups you would roll the 20-sided die. If the die shows the number 12, fixture group 1 would be selected.)

- If the number of fixture groups in a room exceeds 20 than you will need to roll the die multiple times. The first roll will determine a starting point and the second number will determine how many fixture groups to count to before installing the logger. (Ex. If a room has 21 fixture groups you would roll the 20-sided die once and get a 15, you would then roll the die again and get an 8. In this example you would install the logger on the 2nd fixture group.)

[1] Field technicians will be provided with the three dice— 20 sided, ten sided, and six sided.

- If a second logger needs to be installed in the same room, roll the die again, if you get the same number move to the next fixture group in the room.
- Choose a fixture and bulb to install the logger on in this fixture group
  - → While fixture groups are selected at random, you can install the logger on any light bulb in the selected fixture group.
  - → Try to pick a bulb that will not interfere with normal use of the light and will be easy to install a logger on.

Examples:

- If a bedroom has 10 fixture groups, the technician rolls the ten-sided die and rolls a four. The technician then identifies the fourth fixture group in the bedroom, and installs a logger.
- If an elegant bathroom has 16 fixture groups, the technician rolls the 20-sided die and rolls an 11. Fixture group 11 includes the ceiling fan and the vanity lights. In this situation, the technician should install the logger near a vanity bulb as they are easier to reach than the ceiling fan.

5.4 Other Metering Guidelines

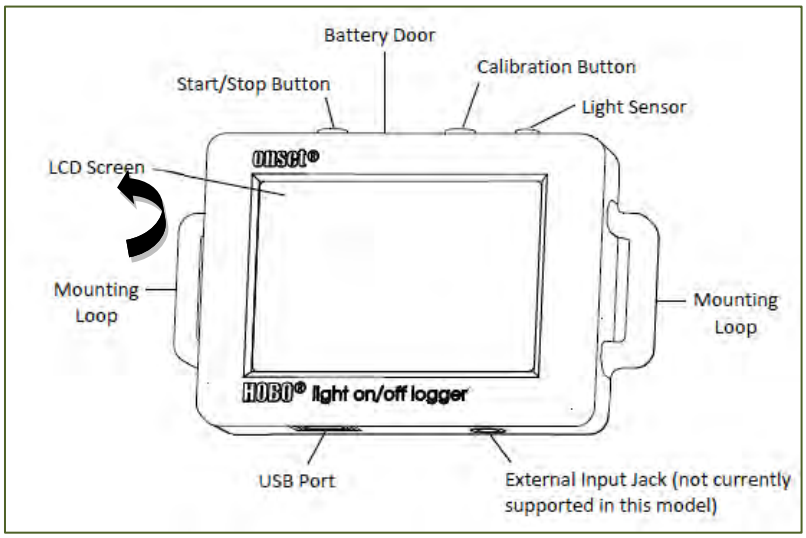
- Resident agrees to allow installation of light loggers.
- Lights must be operating properly during site visit.
- Light loggers will be installed on fixtures in a way that is the least obtrusive to customers (based on resident preference/discretion).
  - → If logger cannot be installed on a fixture due to customer preference – try another fixture in the same fixture group – if no other fixtures in that fixture group exist choose the next fixture group in order.
- Light loggers will be installed where fixtures are easily accessible (e.g., not requiring more than a stepladder to access) and that are not fragile (e.g., crystal chandelier).
  - → If logger cannot be installed on a fixture due to inaccessibility – try another fixture in the same fixture group – if no other fixtures in that fixture group exist choose the next fixture group in order.
- When installing light loggers on fixtures, field technicians will take great care to minimize disturbances that could potentially invalidated the data.
  - → As needed, loggers will be positioned so only light from the fixture is recorded.
  - → When it is difficult to eliminate exposure to ambient light, field technicians will attach a fiber optic eye to the logger, which prevents the logger from "seeing" ambient light.
  - → Additionally, field technicians will secure loggers to fixtures using hard plastic cable ties, adhesive strips, and magnets.

5.5 Installing a Light Logger

This study will utilize Hobo UX 90s and DENT TOU-L loggers to record on/off instances. The instructions provided below are specific to the Hobo UX 90s loggers. Installations of DENT TOU-L loggers follow the same deployment principles. To successfully install a light logger, the technician will perform the following steps:

1. Identify the light to be metered.
2. Minimize impacts on the logger from other light sources:
   → Consider the path of the sun throughout the day.
   → Consider reflection and refraction from nearby materials.
   → Consider other fixtures nearby.
3. Set the light logger. To do this, press and hold the start/stop button for 3 seconds to start or stop logging data. (Figure 1).

Figure 1: Setting Light Logger

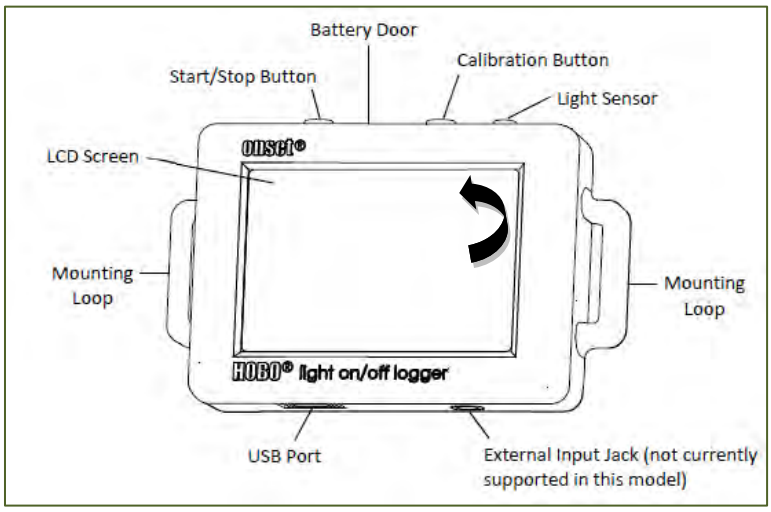


4. Record the date and time the unit was set on the provided labels (Figure 2).
   → This is ***very important***; without knowing the exact time and date the logger was installed, the data will be unusable.
   → Attach a label on the back or bottom of the logger. DO NOT place the label over light sensor or on the LCD screen.

Figure 2: Labeling Date and Time on Light Logger

5. Auto-calibrate the Light Logger Figure 3.

Figure 3: Auto-calibrating the Light Logger



→ After launching, deploy the logger near the light source to be monitored and turn the light source on.

→ Press the Calibrate button for 1 second. The LCD screen will display the signal strength of the light. The signal strength should ideally be at least 3 bars. Orient the logger as necessary to increase the signal strength.

→ Press the Calibrate button for 3 seconds while "HOLD" appears on the LCD screen. Move your hand away from the logger to prevent shadowing. The logger will count down to the auto-calibration and then display either "PASS" or "FAIL" after calibration is complete.

→ If the auto-calibration fails, point the sensor directly at the light source and then repeat these steps.

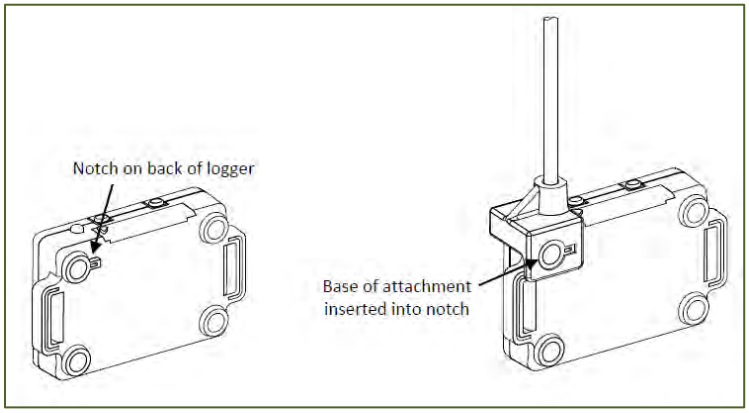
→ If you cannot get the logger to respond correctly in a given fixture, move on to the next fixture.

- → **Note:** The sensor is sensitive to lights that emit high amounts of infrared radiation like incandescent and halogen bulbs. It is best to use auto-calibration when possible when monitoring on/off conditions for lights with high infrared radiation.
- → **Note:** Auto calibration does not apply to DENT TOU-L loggers. DENT TOU-L loggers have sensitivity dials on them and a "sun" appears on the display when the logger is able to sense the light. Starting from the off position auditors increase the sensitivity while the light is on until the "sun" shows in the display.

6. When the logger is correctly responding to the light, assess the best mechanism to attach the logger to the light. The light logger can be attached with one or more of the following items:
   - → 3M Command Strips
   - → Zip ties
   - → Magnets on top of logger

   Avoid placing the light logger so it directly contacts the light. Place the sensor in an area with minimal potential to damage the fixture or light.
7. To ensure that the light logger is still responding, turn the light on and off, and verify the bulb icon appears and disappears.
8. If the light logger is in a location with significant sun exposure or other light sources, and you cannot get the logger to respond to the light, and then install the logger with the fiber optic attachment (light pipe). The light pipe connects to the back of the logger. Locate the notch in the upper left corner next to the mounting magnet. Insert the black base of the attachment into the notch so that the base clips onto the corner of the logger as shown in Figure 4.
9. Deployment Guidelines - follow these tips for successful deployment:
   - → Make sure the end of the light pipe is as close to the light source as possible.
   - → Maximize the signal strength on the logger LCD screen by adjusting the light pipe while looking at the signal bars.
   - → Be sure to secure the light pipe after the signal has been optimized.
   - → Do not support the logger by the light pipe.
   - → Be sure that the pipe is seated all the way into the bracket before deployment.

Figure 4: Attached Fiber Optic Eye



→ Set the logger, as described above.

→ Attach the logger in a discrete area using the 3M Command Strip, Zip ties, or a magnet.

→ Direct the tip of the eye as close as possible to brightest part of the light (see Figure 5).

Figure 5: Fiber Optic Eye Aimed at Brightest Part of Light

→ Do not bend the fiber optic eye on sharp angles—this will damage the eye.

→ With the light is turned on, adjust the logger sensitivity to the maximum setting, so that the bulb symbol displays (see Figure 6).

Figure 6: Light On - Bulb On

→ Turn the light off. If the bulb icon remains on, auto-calibrate the lighting logger again. The light may need to be turned on and off multiple times before the light logger is properly adjusted.

10. The loggers are configured to operate with the LCD screen off. Before the logger is deployed, the screen should look like this:

Figure 7: Logger Screen before Deployment

→ Once the logger is deployed, the screen will turn off after 10 minutes. You can reactivate the display for 10 minutes by pressing the start/stop button.

Additional Placement Examples

Figure 8 illustrates the preferred placement of a lighting logger for permanent flush mount fixtures, which Figure 9 shows an inappropriate placement as this would be very visible to the customer. Figure 10, Figure 11, and Figure 12 show additional preferred logger placement examples.

Figure 8: Flush Mount Style Fixture – Remove Dome

Figure 9: DO NOT Place Logger in Bottom of Dome

Figure 10: Logger Secured in Lamp with Zip Ties

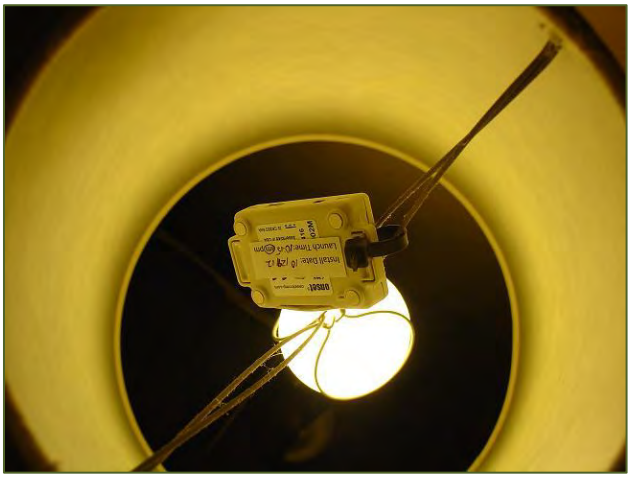


Figure 11: Logger Secured in Lamp with Magnets

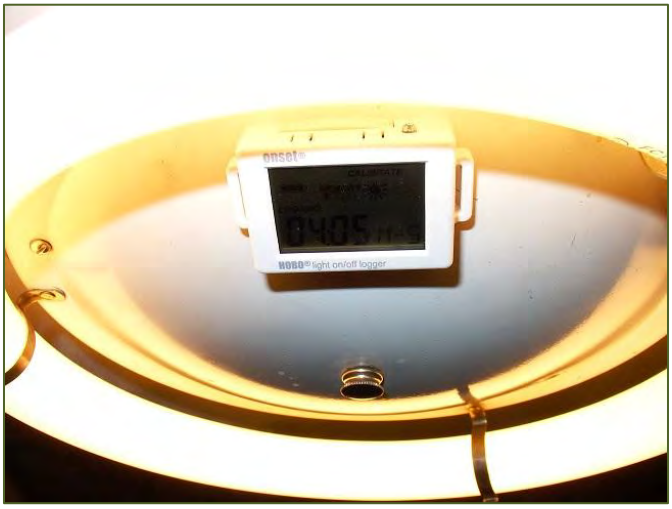


Figure 12: Logger Secured in Lamp with Command Strips

5.6 Logger Removal Protocols

Prior to removing light loggers, removal technicians will receive the logger installation data, which indicates the rooms and fixtures where loggers were installed in winter 2012. Field technicians will visit participants' homes in the summer of 2013 (six months later) to conduct logger removals and obtain additional data for the HOU analysis. Field technicians will also record *in situ* observations and photograph each logger prior to removal. The logger removal and data collection process includes the following:

- Photograph the logger prior to removal.
- Indicate the orientation of the sensor or fiber optic eye (e.g., Is the sensor directed towards the light source?)
- Perform a state test to determine whether or not the logger accurately records event data; turn the light on and off to ensure that the sun icon appears and disappears appropriately.
- Remove logger and review the total time on from logger screen.
- If the time on indicates extreme low use or extreme high use, ask the participant to verify, based on their own usage of the light fixture in question.
- Ask participant whether logger has fallen off the fixture or has otherwise been uninstalled prior to the technician's removal site visit; if so, ask participants to provide a date and time. **[Note: During the installation visit, participants will be asked to call and inform us if something does happen to the logger.]**
- Note the presence of windows and televisions/computers in rooms where loggers are installed.
- Note the condition of loggers upon removal and assess the battery status.
- Ask the participant to estimate typical usage for each metered fixture (e.g., 4 hours per day in the afternoon only).
- Record the presence of children under the age of 18 living in the home.
- If a logger is installed in a basement, record whether the basement is finished or unfinished.

After removing loggers, carefully pack and store loggers. Return the loggers to the project manager. Data from the loggers will be downloaded using appropriate software, raw data will be exported into CSV (comma separated values), and uploaded to the project's SharePoint site where analysts will access the data for review and analysis.

6 Solar Shading Measurements

To capture solar shading field technicians will be provided with a device called a Solar Pathfinder™ (Pathfinder) to estimate the percent of solar exposure available for a site. The Pathfinder is a simple mechanical device used for shade analysis primarily in the solar energy industry. It provides a method for measuring a full year of solar data based on a reflected image overlaid on a sun path diagram. Instead of relying on shadows, the Pathfinder uses a highly reflective convex dome that provides a panoramic view of the entire site. This makes it possible to use the Pathfinder at any time of the day or year. Details on the operation of the Pathfinder device and the principles behind it can be found here.

For each unit included in the study, field technicians will record the presence of windows and which direction those windows face. Any windows which are completely obstructed by a wall directly outside the window, a room air-conditioning unit, or another object, will be listed as obstructed and we will assume a solar shading value of 100%.[2] Window data will be recorded on the window onsite form. The following fields must be completed:

Window Direction

→ The direction which the window faces

→ "Windows" includes windows in doors and sliding glass doors.

Table 13: Window Direction Codes

Direction	Code	Direction	Code	Direction	Code
North	N	South	S	East	E
Northeast	NE	Southeast	SE	West	W
Northwest	NW	Southwest	SW		

Window Size

→ Record length and height in inches

→ For windows, measure from edge to edge of the frame (not the glass).

→ When estimating dimensions of inaccessible windows, XXX

[2] Windows that are partially obstructed will be included but only the unobstructed portion (in the case of window AC units) will be measured.

Exterior Walls

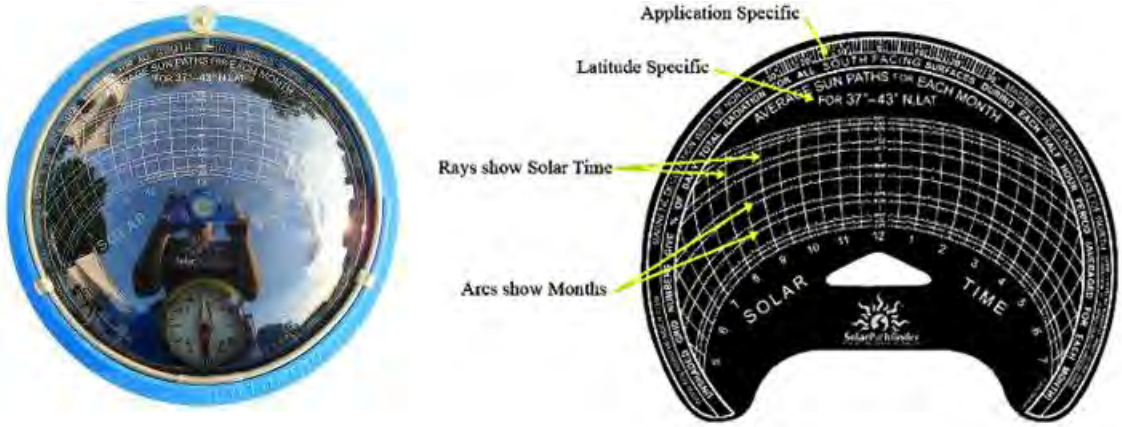
→ Record length and height in inches for all exterior walls, record one entry for each direction that exterior walls face.

→ Exterior walls are those walls that define the outside of the apartment – this could include walls that separate units for other units, interior common spaces or the outside.

After field technicians have completed the portion of the site visit that takes place in the respondent's home, the field technicians will return to street level to measure solar shading using the Pathfinder. This will be done by taking one reading on each side of the building where the unit has an unobstructed window. For example, if a unit has a window facing south and one facing west, the field technician will take two measurements, one on the south side of the building and one on the west side of the building. The measurements will be taken relative to the unit's position in the building, so if a unit is located centrally, the measurements will be taken as near as possible to the center of the building; if the unit is located on the south-east corner of a building, the field technician will setup the Pathfinder device on the south-east corner, and so on.

To take a measurement, field technicians will setup the Pathfinder so that the diagram faces true south. They will then take a picture of the Pathfinder. The picture will be downloaded and analyzed using Thermal Assistant Software. The output of the analysis will be the percent of solar radiation available at the site by month (the inverse of which is the amount of shading).

Additional details about the setup and operation of the Pathfinder can be found, here. All field technicians will thoroughly review the Pathfinder manual independently and with the trainer during the in-person training session.



Source: Solar Pathfinder™: http://www.solarpathfinder.com/PF

Accounting for unit height

As described above, using the Pathfinder requires taking measurements at street level. By measuring angle to shade object and distance to shade object—we will be able to adjust for unit height using the following formula:

$$a_2 = \tan^{-1}(a_1) - \frac{P}{D}$$

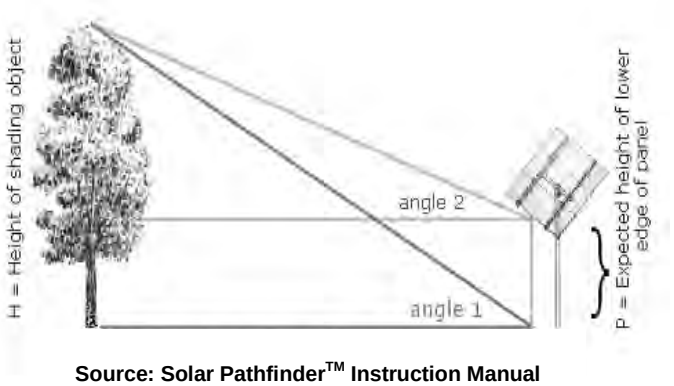
Where:

a1 = Ground-level angle measurement

a2 = Calculated angle at height "P"

P = Estimated height of unit

D = Distance to the shading object (building)



Source: Solar Pathfinder™ Instruction Manual

Pathfinder Picture

→ Record the file name of the Pathfinder picture that corresponds to the direction the window is facing

Ground-level Angel Measurement

→ Record the ground-level angle measurement to the top of the nearest obstruction (shade object)

Distance to Obstruction

→ Record the distance to the nearest obstruction (shade object)

7 Quality Assurance and Control Procedures

As with all of our work, NMR endeavors to maintain a high quality work product. The sensitive nature of onsite work means that we take special precautions to ensure the quality of data collected and to avoid jeopardizing the relationship our clients have with their customers. To that end, we employ a number of steps to ensure that onsite technicians perform quality work that reflects well on NMR and our clients.

Our quality control and standard operating procedures begin well before a field technician ever steps foot in a customer's home. All of our field technicians receive rigorous project specific training. Training topics include project background, project specific data collection protocols, and customer service and interaction training. We also provide our scheduling staff with an overview of this training so that they know what customers will expect when they agree to participate and are able to answer any questions customers may have. We make every effort to ensure that customers are fully informed and avoid unnecessary surprises.

Below, we outline some of the specific quality control and training measures we will utilize for the Regional HOU study.

Quality Control and Training Measures:

- All field staff will receive training directly from NMR staff using training materials successfully implemented in similar onsite lighting saturation studies but tailored to the unique needs of the Regional Logger Study. Training for this project will include instruction on how to perform the following:
  - Identify various types and shapes of sockets, light bulbs, and controls
  - Examine light bulbs in a safe manner, including instructions on what equipment to bring to a home, working with covered fixtures, and clean-up of (especially CFLs and fluorescents) and compensation for bulbs and fixtures accidentally damaged during the visit
  - Ensure that they have located and inventoried all light bulbs (including stored bulbs) in the home through such procedures as creating a home schematic, mapping their route through the home, and documenting difficult-to-characterize lighting with pictures.
  - Correctly setup and install lighting loggers
- Training will also include some background on EISA and its requirements so that the field technician can answer questions he or she may receive on this topic while performing the inventory.
- The NMR project manager or a designated staff member will accompany each part-time field technician on their first day of site visits.
- The NMR project manager or a designated staff member will recruit participants and schedule appointments, assigning them to field staff based on location and work load.

- Each field staff member will be required to report his or her progress at the end of each day and forward hard copies of completed onsite forms to the NMR project manager for review each week.

In addition to reviewing the onsite forms, NMR staff will call 20% of participants to ensure that their experience with the field technician was satisfactory, and we will also revisit approximately 5% of the homes and repeat the data collection and observe logger installation to make sure the technician performed all tasks in a satisfactory manner.

8 Frequently Asked Questions

- **What is this device and how do I know what it does?**
  The device is called a "lighting logger." It is about the size of a business card but is ½ inch thick. **[SHOW CUSTOMER A LOGGER]** The type of lighting logger we use can tell when you turn you the light it is attached to on and off, but it does not collect any other information. If you want to know what the loggers look like, they can be found easily through a web search of the term "lighting logger." We will mainly be using the "HOBO" and "DENT" brands. It does not send any information wirelessly or emit any signals; it just records when the light is on or off.

- **What's in it for me and how long will this take?**
  We are offering $100 for your time when we install the loggers and $100 when we pick up the logger six months later. This is a total of $200. The visit should take around one hour, depending on the size of your house

- **What does the visit involve?**
  Technicians will walk around your home and count the various types of lighting products you have installed. They will also install some lighting loggers to record how often you use certain lights.

- **Where will the loggers be installed?**
  Technicians will install the loggers in a way so they do not interfere with normal use of lights. The loggers are very small and will not interfere in any way with the normal use of your lights.

- **When do you remove the loggers?**
  The loggers need to remain in place for six months. At the end of six months we will return to remove the loggers. We will schedule the visits at a time that is convenient for you.

- **What do I do if something happens to my light in the next six months?**

  → **A bulb with a logger burns out?**

  → **Something breaks?**

  → **The logger is removed?**

  If your light bulb burns out, replace the bulb as you normally would and continue to use the light as normal. The logger will not be affected.

  If, the logger is removed for any reason (falls off the fixture, uninstalled, something else) please call us and let us know. Please contact Erin Coates at 617-284-6230 x19. You can set the logger aside and we will collect it with the others when we return.

- **Why six months?**
  We need to record their lighting usage over time to account for differences in usage based on varying daylight conditions. Households use their lights differently during the winter months and summer months.
- **Who we are?**
  I am _____ and I work for the NMR, a consulting firm. We have been hired by NYSERDA to perform this study.
- **Purpose of Study?**
  - → Establish customer awareness of lighting options and changes in the lighting market
  - → Understand how people use the light bulbs in their home, as this has a large impact on how much energy households use.
  - → Determine current rates of use and storage for various light bulbs
  - → The results of the study will be used in planning for future energy needs in NYSERDA
- **How do I know you are legit?**
  NYSERDA is sponsoring this program and study. The contact person is Victoria Engel-Fowles. Her phone number is 518-862-1090 x3207 and her email address is vse@nyserda.org.

8.1 The Energy Independent and Security Act (EISA of 2007)

This section is meant to provide field technicians a brief overview of EISA and potential impacts on lighting. While knowledge of EISA is not crucial to field technicians performing their duties, EISA in-part prompted this study and it is possible that customers may ask questions about EISA during onsite visits.

Summary

The Energy Independence and Security Act (EISA) of 2007 sets maximum wattage levels by lumen output (that is, how bright the bulb is) for medium, screw-base bulbs that have a range from 310 to 2,600 lumens (Table 14). Bulbs not meeting these standards will be phased out over the next few years. This lumen range generally corresponds to the brightness of 40 Watt to 100 Watt incandescent bulbs, and it is primarily incandescent bulbs that will be phase out.

The standards started to go into effect under a phased approach that began in 2012, when general service bulbs (that is, typical bulbs) began to be required to use from 20 percent to 30 percent less energy than current incandescent bulbs. The law first applied to bulbs in the 1,490 to 2,600 lumen range, effectively banning the manufacture and import of general service 100 Watt incandescent bulbs in the United States after January 1, 2012. Over the next few years, the law will limit the manufacture and import of all general service incandescent bulbs between 40 and 100 Watts.

Table 14: EISA Phase-out Schedule – Stage 1

Rated Lumen Ranges	Typical Current Lamp Wattage	Maximum Rate Wattage	Minimum Rate Lifetime	Effective Date
1490-2600	100	72	1,000 hours	January 1, 2012
1050-1489	75	53	1,000 hours	January 1, 2013
750-1049	60	43	1,000 hours	January 1, 2014
310-749	40	29	1,000 hours	January 1, 2014

EISA prohibits the manufacture and import of incandescent bulbs, but not the sale of incandescent bulbs. Therefore, standard incandescent bulbs will remain available to consumers on retailers' shelves until all stock acquired before the relevant effective date, is sold. Additionally, as remaining stocks sell out, consumers will have the option of replacing higher-wattage incandescent bulbs with lower-wattage ones during the transition period. Some stores, however, have voluntarily chosen not to carry certain wattages of incandescent bulbs in anticipation of the law's implementation.

Important Details

- On December 19, 2007, President George W. Bush signed H.R. 6, the Energy Independence and Security Act of 2007, into law (Public Law 110-140).
- Sets maximum wattage levels by lumen output for medium, screw-base bulbs:
  - → 310 to 2,600 lumens, which roughly correspond to the brightness emitted by 40 Watt to 100 Watt incandescent bulbs
  - → Began to be implemented on January 1, 2012; during this study its main impact will be on 1,050 to 2,600 lumen bulbs (100 Watt and 75 Watt incandescent bulbs)

Manufacture vs. Sale

EISA prohibits the **manufacture** and **import** of incandescent bulbs but does **not** prohibit the **sale** of incandescent bulbs. So people can still buy incandescent bulbs until the current stock runs out, and they may also use lower wattage bulbs not yet covered by EISA to replace higher wattage ones when they are no longer available in stores.

Consumer Lighting Options

Consumers have a variety of options for replacement bulbs for those being phased out:

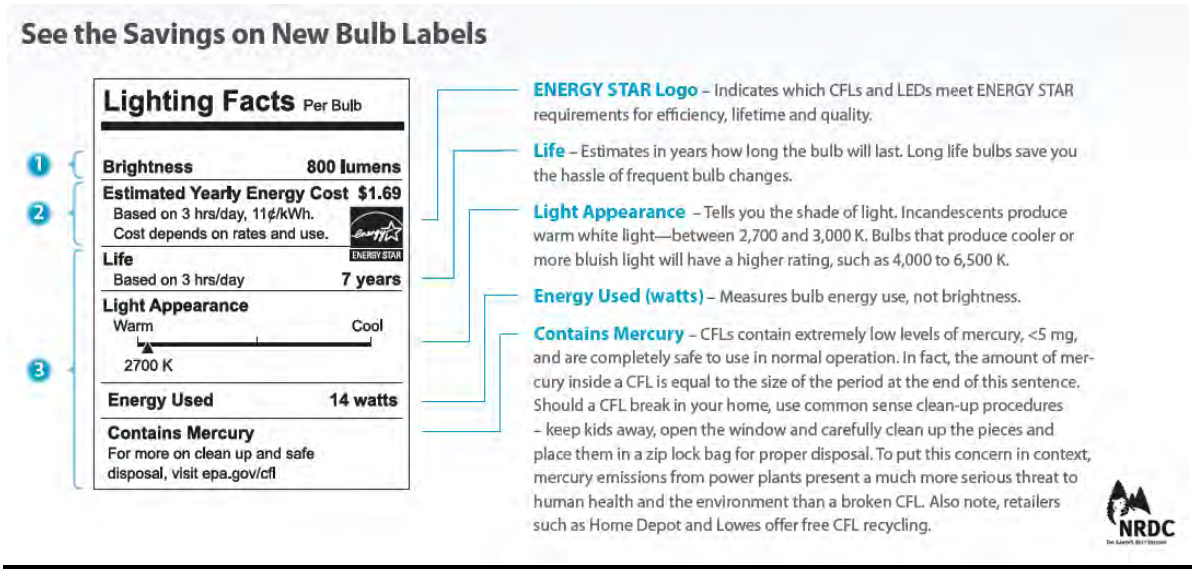
- Lower wattage incandescent bulbs (Cost is less than $1)
  - → Most similar to what many costumers are familiar with
- EISA-compliant halogen bulbs (Cost between $1.50 and $3.00)
  - → About 30% more efficient that standard incandescent bulbs
  - → Similar to standard incandescent bulbs in terms of appearance and light quality
- CFL bulbs (Cost between $1.00 and $3.00)
  - → More efficient than standard incandescent bulbs
  - → Some consumers concerned by mercury in CFL bulbs

- Non-directional LED bulbs (as opposed to spot and flood LEDs) (Cost between $10 and $20)
  - → Only a few on the market currently – still a developing technology
  - → While the price has been declining, still an expensive option and most consumers will not view LEDs as a viable replacement option until the price decreases.

Consumer Response

Consumer awareness of the EISA-mandated phase-out of incandescent bulbs and on how to choose light bulbs based on factors other than "wattage" (which most consumers equate with brightness) is relatively low. The Federal Trade Commission (FTC) has developed a new lighting facts label to help consumers make informed purchase decisions based on lumens instead of wattages and lifecycle costs.

Figure 13: FTC Lighting Facts Label



9 Mileage Tracking Form

NMR Group, Inc.

Regional Hours of Use Study
Time and Mileage

Time Sheet								
Task	Hours							Total Hours
	Mon	Tues	Wed	Thurs	Fri	Sat	Sun	
Training								
Onsite								
Travel								
Paper Work								
TOTAL:								

Mileage Log			
Date	Origination	Destination	Distance
		TOTAL:	

Name: _____ **Week of:** _____

Signature: _____ **Date:** _____

50-2 Howard Street, Somerville, MA 02144
Phone: (617) 284-6230 Fax: (617) 284-6239
www.nmrgroupinc.com

10 Reimbursement Form

NMR Group, Inc.

Regional Hours of Use Study

Reimbursement Form

Participant Name: _____

Participant Address: _____

_____

Participant Phone: _____

Technician Name: _____

Time and Date of Onsite Visit: _____

Description: _____

_____

**Please attach a receipt for the replacement light bulb to this form and mail this form and the receipt to:

Attn: Erin Cotes
NMR Group Inc
50-2 Howard St.
Somerville, MA 02144

50-2 Howard Street, Somerville, MA 02144
Phone: (617) 284-6230 Fax: (617) 284-6239
www.nmrgroupinc.com

11 EPA Cleanup and Disposal Guidelines for CFLs

Cleanup and Disposal Guidelines
For Compact Fluorescent Light Bulbs (CFLs)
June 2008

What precautions should I take when using CFLs in my home?
CFLs are made of glass and can break if dropped or roughly handled. Be careful when removing the bulb from its packaging, installing it, or replacing it. Always screw and unscrew the light bulb by its base (not the glass), and never forcefully twist the CFL into a light socket. If a CFL breaks in your home, follow the clean-up recommendations below. Used CFLs should be disposed of properly (see below).

What should I do with a CFL when it burns out?
EPA recommends that consumers take advantage of available local recycling options for compact fluorescent light bulbs. EPA is working with CFL manufacturers and major U.S. retailers to expand recycling and disposal options. Consumers can contact their local municipal solid waste agency directly, or go to www.epa.gov/bulbrecycling or www.earth911.org to identify local recycling options.

If your state or local environmental regulatory agency permits you to put used or broken CFLs in the garbage, seal the bulb in two plastic bags and put it into the outside trash, or other protected outside location, for the next normal trash collection. Never send a fluorescent light bulb or any other mercury-containing product to an incinerator.

If your ENERGY STAR qualified CFL product burns out before it should, look at the CFL base to find the manufacturer's name. Visit the manufacturer's web site to find the customer service contact information to inquire about a refund or replacement. Manufacturers producing ENERGY STAR qualified CFLs are required to offer at least a two-year limited warranty (covering manufacturer defects) for CFLs used at home. In the future, save your receipts to document the date of purchase.

How should I clean up a broken fluorescent bulb?
Because CFLs contain a small amount of mercury, EPA recommends the following clean-up and disposal guidelines:

1. Before Clean-up: Air Out the Room

- Have people and pets leave the room, and don't let anyone walk through the breakage area on their way out.
- Open a window and leave the room for 15 minutes or more.
- Shut off the central forced-air heating/air conditioning system, if you have one.

2. Clean-Up Steps for Hard Surfaces

- Carefully scoop up glass fragments and powder using stiff paper or cardboard and place them in a glass jar with metal lid (such as a canning jar) or in a sealed plastic bag.
- Use sticky tape, such as duct tape, to pick up any remaining small glass pieces and powder.
- Wipe the area clean with damp paper towels or disposable wet wipes. Place towels in the glass jar or plastic bag.
- Do not use a vacuum or broom to clean up the broken bulb on hard surfaces.

3. Clean-up Steps for Carpeting or Rug:

- Carefully pick up glass fragments and place them in a glass jar with metal lid (such as a canning jar) or in a sealed plastic bag.
- Use sticky tape, such as duct tape, to pick up any remaining small glass fragments and powder.
- If vacuuming is needed after all visible materials are removed, vacuum the area where the bulb was broken.
- Remove the vacuum bag (or empty and wipe the canister), and put the bag or vacuum debris in a sealed plastic bag.

4. Clean-up Steps for Clothing, Bedding, etc.:

- If clothing or bedding materials come in direct contact with broken glass or mercury-containing powder from inside the bulb that may stick to the fabric, the clothing or bedding should be thrown away. Do not wash such clothing or bedding because mercury fragments in the clothing may contaminate the machine and/or pollute sewage.
- You can, however, wash clothing or other materials that have been exposed to the mercury vapor from a broken CFL, such as the clothing you are wearing when you cleaned up the broken CFL, as long as that clothing has not come into direct contact with the materials from the broken bulb.
- If shoes come into direct contact with broken glass or mercury-containing powder from the bulb, wipe them off with damp paper towels or disposable wet wipes. Place the towels or wipes in a glass jar or plastic bag for disposal.

5. Disposal of Clean-up Materials

- Immediately place all clean-up materials outdoors in a trash container or protected area for the next normal trash pickup.
- Wash your hands after disposing of the jars or plastic bags containing clean-up materials.
- Check with your local or state government about disposal requirements in your specific area. Some states do not allow such trash disposal. Instead, they require that broken and unbroken mercury-containing bulbs be taken to a local recycling center.

6. Future Cleaning of Carpeting or Rug: Air Out the Room During and After Vacuuming

- The next several times you vacuum, shut off the central forced-air heating/air conditioning system and open a window before vacuuming.
- Keep the central heating/air conditioning system shut off and the window open for at least 15 minutes after vacuuming is completed.
- For more information about compact fluorescent bulbs, visit http://www.energystar.gov/cfls

For more information about compact fluorescent bulbs and mercury, visit http://www.energystar.gov/mercury EPA is continually reviewing its clean-up and disposal recommendations for CFLs to ensure that the Agency presents the most up-to-date information for consumers and businesses.

Regional Hours of Use Study: Onsite Handbook

New York City

6/12/2013

Prepared for:

The Massachusetts Energy Efficiency Program Administrators

The Connecticut Energy Efficiency Board Evaluation Consultant

National Grid Rhode Island

The New York State Energy Research and Development Authority

50-2 Howard Street, Somerville, MA 02144
Phone: (617) 284-6230 Fax: (617) 284-6239
www.nmrgroupinc.com

Contents

Tables

1 Training Plan

- Independent Review of Materials – The purpose of this document is to provide all the information required to conduct site visits to collect the loggers installed for the Regional HOU Study. All field technicians should **review this document in its entirety prior to the over-the-phone training session.** *(1 hour)*
- Store Visit **[for new technicians only]** – All field technicians will go to a hardware, lighting, or big box retailer to familiarize themselves with various bulb types. *(1 hour)*
- Over-the-Phone Training Session – All field technicians will have an over-the-phone training session with the NMR program manager to review the protocols, onsite forms, and equipment required for this project. *(30 minutes)*

2 Background / Purpose of the Study

The parties responsible for evaluation of energy-efficiency programs in Massachusetts, Connecticut, Rhode Island, and New York have committed to conducting a study to estimate hours of use (HOU) of light bulbs in homes. The main objective of this study, therefore, is to estimate HOU, and we will do so by room type, not lighting type (technology) as many studies have done in the past. Our focus on room types assumes that people are likely to use their lights in a given room the same way regardless of the type of bulbs in the room.

To accomplish this objective, in the winter of 2012-2013 field technicians conducted an inventory of lighting to determine the number and type of bulbs installed in customers' homes, and installed a series of lighting loggers to capture information on how customers use lights in their homes. Technicians are now returning to the sites to collect the lighting loggers in order to retrieve the data for analysis.

NMR is scheduling the follow up visits for this study via telephone. As a field technician you will be provided with a list of customers to visit each week. This list will include the customer's name, telephone number, address, and an appointment time. You will also receive a check for each participant prior to visiting their home.

3 Onsite Protocol

Prior to removing light loggers, technicians will receive the logger installation data, which indicates the rooms, fixtures and bulb characteristics where loggers were installed in six months earlier; when available, the technicians will also receive the home schematic showing the exact location of the installed loggers.

Prior to Visit

Before visiting a home, you should make sure that, at a minimum, you have the following:

- → Onsite handbook
- → Data Form & Home Schematic
- → Appointment sheet
- → Company Polo Shirt
- → ID Badge

Materials for Customer

- → FAQs and Info Sheet
- → NMR contact's business card
- → Check ($100)

CFL Clean up Kit

- → Sealable plastic bags
- → Disposable wipes
- → Vacuum
- → Duct tape
- → Flat brush

Logger Removal Kit

- → Camera
- → Flashlight
- → Pen/Pencils
- → Flat & Philips head screwdrivers
- → Insulated gloves
- → Shoe coverings
- → Latex gloves
- → Step ladder
- → Wire Cutters
- → Scissors
- → Cleaning rags
- → Adhesive Remover Solution with Scraper
- → Sealable sandwich bags
- → Trash bag

Arrival at Onsite

After the door is opened, immediately ascertain that the person at the door is the scheduled interviewee. Introduce yourself and hand him/her the business card.

- **Sample Introduction** *(not to be read verbatim)***:**
  "Hello, my name is _____, and I am working with NMR. NMR is working under contract with ***NYSERDA (the New York State Energy Research and Development Authority)****. I'm here to meet with _____. As mentioned on the phone, I'm here to walk through your home and collect the loggers that were installed on selected fixtures six months ago.* ***[Customer should be expecting inspector]****. During my visit I have a few wrap-up questions for you about the status of the loggers during the duration of the study, as well as some limited demographic questions. Today, in appreciation for your time, on behalf of* ***NYSERDA****, you'll also receive the second payment of $100. Do you have any questions regarding my visit?"*

Prior to Data Collection

- Give the customer a step by step description of what you'll be doing (show the data collection form as you explain)
  - → First I will remove the loggers installed in your home.
  - → Then I will ask you a few questions about the loggers as well as some demographic questions.
- The customer should not be surprised by any of this information as they have already been told what the study will consist of.

General sequence of data collection

- Logger Removal:
  - → Consult logger removal instructions.
  - → Check that the information provided for each logger is correct; record any discrepancies.
  - → For each logger, ask the homeowner, *"Were there any changes to this logger, light bulb, or fixture during the duration of its installation?"* and record response.
- Customer Survey:
  - → Ask the homeowner the demographic questions in the customer survey.
- After Data Collection:
  - → Thank the customer for his/her time
  - → Give him/her the $100 check.
  - → Have the customer sign off on your data collection form to indicate that you visited their home and provided him/her with a $100 check.
  - → Leave with the customer the "Logger Participant Frequently Asked Questions" one-page sheet.

4 Onsite Form Instructions

NMR will provide you with onsite forms specific to each site. These forms will be pre-filled with the logger ID number, room, fixture type, bulb type, bulb shape and socket type for each logger expected to be installed in each site.

Customer Information

→ Customer Name, Customer Address, and Customer ID will be provided on the sheet.

→ Fill in your name and the date and time of the appointment.

Site Specific Notes

→ NMR will include any known issue associated with a logger or household in this column (ex. The resident phoned NMR to report a logger had melted.)

→ If applicable, follow up on this comment with the homeowner.

Logger Retrieval Form

→ Using the information and home schematic (if applicable) provided by NMR, locate each logger installed in the home.

→ **Before removing the logger**, ask: ***Were there any changes to this bulb, logger, or fixture during the time the logger was installed?***

- If yes, take a photo of the logger and the replacement bulb
- Record any changes in the box provided (detailed instructions provided below)

→ **For each logger**, check that the pre-filled information is correct.

→ If there are any discrepancies between the expected and installed logger number, fixture, or bulb information provided, **fill in the actual information on the corresponding line below**.

→ **Record all information in clear, easy to read handwriting**

Logger ID

→ If a logger number has an asterisk (*), this number has been identified as one that **needs to be double checked** – record the correct logger number for each of these on the line below (even if it is the same).

→ **Always include a note for these loggers** (even if it is just "everything correct") so that we can confirm it was double-checked.

Room, Fixture Type, Bulb Type, Bulb Shape, Socket Type

→ Record any discrepancies in the row below the pre-filled information.

→ If a bulb has been changed, record the new bulb info in the box on the second page.

Light Pipe

→ For each logger, indicate if the logger has a light pipe attached (Y/N) in the space provided.

State Test

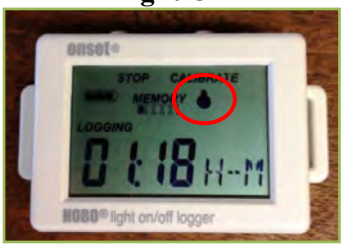
→ **<u>Before removing the logger</u>, perform a state test** to determine whether or not the logger accurately records event data.

- The logger screen will be blank – click one of the top buttons to make the screen appear (do not hold the button as that will stop the logger)
- Turn the fixture on and off; record whether the light bulb icon appears "on" and "off" appropriately (Pass/Fail).

→ If the battery is dead, or you are unable to complete the state test for a different reason, record this information in the box provided.

Light On

Light Off



Total Time

→ Record the total time either immediately before or immediately after removing the logger;

→ The time display shows the total amount of time the light has been on since logging began, ranging from seconds to days.

Hours & Minutes

1 hour, 18 minutes

Days & Hours

4 days, 17 hours (or 113 hours)

Usage Estimate

→ **<u>For each logger</u>**, ask the homeowner:

What was the typical usage for this fixture?

→ Record response in the column provided (Ex. 4 hours per day in the afternoon only).

→ **<u>Extreme Usage</u>:**

- Usage should be in the range of 70 to 800 hours - if the time on indicates extreme low use or extreme high use (anything above or below this range) **take photos of the fixture and the room.**
- Ex. If there is a window nearby, the logger may have been recording ambient light in addition to lamp usage.
- Do a quick calculation to see how the estimate compares to the total time:
  - The loggers have been in place approximately 150 days.
  - Ex. If the customer estimates 4 hours use per day, the total time should be in the range of 25 days (4 hours a day * 150 days = 600 hours. 600 hours/24 hours a day = 25 days).
- If the estimate and logger time are far apart, look for an explanation and ask the customer if they have any ideas that could explain the difference.

Record Changes

→ **<u>For each logger</u>**, ask the homeowner:

Were there any changes to this bulb, logger, or fixture during the time the logger was installed?

→ If "Yes", record the associated logger ID number and the date (or approximate date) the change occurred.

→ **If the bulb was replaced**, record the new bulb information in the space provided.

- For all bulb types record: Bulb type, shape, and wattage
- Ask: ***Was the new bulb a new purchase or was it a stored bulb?***
  1. Stored
  2. New Purchase
  3. Don't Know

Changes made since logger installation?		New Bulb				
Logger ID #	Date of Change	Bulb Type	Bulb Shape	Watts	Stored/ New	Other Change
12345678	4/13/13	CFL	T	13	New	

→ **If another change occurred**, record this information in the space provided for details.

Changes made since logger installation?		New Bulb				
Logger ID #	Date of Change	Bulb Type	Bulb Shape	Watts	Stored/ New	Other Change
87654321	2/4/13					Logger blew off fixture; home owner put it back up.

Customer Survey

→ Ask the homeowner the following questions:

- ***How many children under the age of 18 live in this household on a full time basis?*** → *Record the number on the line provided.*
- ***What is the highest level of education completed so far by the head of the household?*** *(If more than one head of household, ask for the education level of the household head with the highest degree)*

1. Less than 9th grade
2. 9th to 12th Grade, no diploma
3. High School Graduate/GED
4. Some College, No Degree
5. Associates Degree
6. Bachelors Degree
7. Graduate or professional degree
8. Don't Know
9. (Refused)

Additional Notes

→ Record any additional comments the homeowner may have or any other relevant observations in this column.

Customer Signature

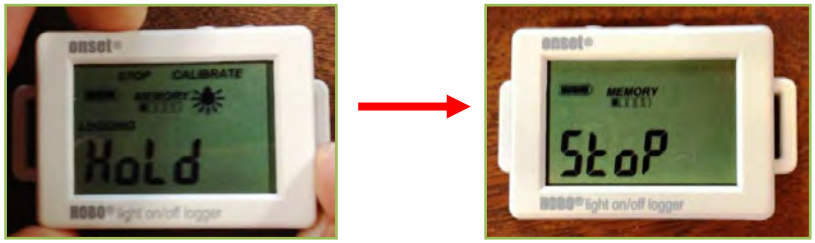
→ Have the homeowner sign the onsite form upon receiving their incentive check in the space provided on the cover page.

5 Logger Removal Protocols

5.1 Removing a Logger

To successfully remove a light logger, the technician will perform the following steps:

- Identify the fixture on which the logger is installed and locate the logger.
  - → If the customer offers to turn off the fixture and take it apart him/herself, **ALWAYS** let the customer do it.
  - → If there have been any changes to the bulb or fixture, take a photo of the bulb and fixture before removal.
- The logger screen should be blank when you find it; you can reactivate the display by quickly pressing the start/stop button. (Note: Do not hold the button for a few seconds, as that may turn the logger off)
- Remove the logger from the fixture **as carefully as possible**.
  - → If the customer offers to remove the logger from the fixture, let him/her do it.
  - → NMR will provide you with wire cutters and scissors to remove loggers installed with zip ties, as well as adhesive remover to remove any adhesive left from loggers installed with duct tape or 3M strips.
  - → Clean up all trash associated with logger removal; NMR will provide a small trash bag if there is not one easily accessible near the fixture.
- **Stopping a Logger**:
  - → Once you've removed the logger and recorded all the necessary data, stop the logger.
  - → Logging will end once you press the Start/Stop logging button for 3 seconds.



- **Light Pipes:**
  - → Some loggers will have light pipes attached to them. When you see one, inspect it to make sure it is still properly attached and pointing at the light bulb. If it is not, take a picture and make a note before removing the light pipe.
  - → To remove a light pipe: while holding the logger with the screen facing you, carefully push the base of the light pipe away from you:

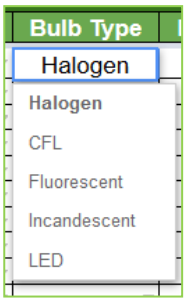
- **Packing Loggers:**
  - → **Put all loggers and the completed onsite form** from the site in one Ziploc bag and close the seal.
  - → The light pipes do not have to go in the site-specific Ziploc bag; all collected light pipes should be carefully packed together.

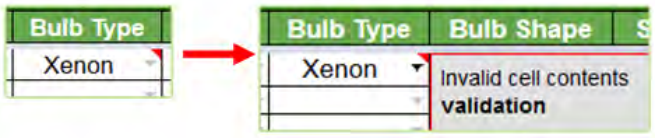
5.2 Removal Guidelines

- **Damage:**
  - → If you break or damage any fixtures, furniture, etc, give the customer the "Reimbursement Form."
  - → Note what was broken and contact the project manager as soon as possible to report the incident.
  - → Take a picture of the damage.
- **Broken Bulbs:**
  - → If you break any type of light bulb and/or if a broken CFL came into direct contact with clothing or bedding which subsequently needed to be thrown out, give the customer the "Reimbursement Form."
  - → Note what type of bulb was broken and contact the project manager as soon as possible to report the incident.
  - → Take a picture of the broken bulb and any other damage.
  - → **If a CFL or a fluorescent bulb should be broken**, refer to the "Cleanup and Disposal Guidelines for Compact Fluorescent Light Bulbs" of the Environmental Protection Agency (EPA) included in this packet.
- **Removing Bulbs or Fixture covers:**
  - → If the customer offers to turn off the fixture and take it apart him/herself, **ALWAYS** let the customer do it.
  - → **DO NOT TOUCH** if fixtures have cracked or damaged covers, or look delicate or easily breakable; if a logger is attached to such a fixture, proceed with caution with the homeowner present.
- **Burned Out Bulbs:**
  - → If a bulb is burned out, ask the customer the date (or approximate date) that the bulb burned out and record this in the appropriate spot on the onsite form.

5.3 Reporting Data

- At the end of each day, review the completed onsite forms to ensure that all necessary information is recorded and is clear and easy to read.
- **Entering Data into Google Docs:**
  - → Enter the completed onsite information into your Google doc for this project; all of your onsite data will be entered here.
  - → The Google doc has two tabs: **Logger Info** and **Customer Survey**. Enter the following information in each tab:
    - Logger Info:
      - Customer ID (repeat for all loggers associated with this ID)
      - Each Logger ID # and the correct information associated with each one
      - Any changes made since the loggers were installed – if no changes were made, enter an "N" under the "Change?" column.
    - Customer Survey:
      - Customer ID
      - Number of children under 18
      - Education
      - Additional Notes
  - → If provided, choose the correct information from the drop-down menu; if there is no drop-down menu, type in the recorded data.
    - Any onsite data that is not included in the drop-down menu can be typed in.
    - Ignore the red triangle that will appear in the upper right corner (and the comment box that appears when you scroll over the red triangle); this notifies you that the data entered is not in the list provided, but will not delete the cell contents.





- Upload, email, or text any photos to the NMR project manager at the end of each day with the associated Customer ID and Logger ID #.
- The NMR project manager will collect the loggers from you at the end of the project. Data from the loggers will be downloaded for review and analysis.

6 Quality Assurance and Control Procedures

As with all of our work, NMR endeavors to maintain a high quality work product. The sensitive nature of onsite work means that we take special precautions to ensure the quality of data collected and to avoid jeopardizing the relationship our clients have with their customers. To that end, to ensure that onsite technicians perform quality work that reflects well on NMR and our clients, the NMR project manager will:

- Review the onsite data entered on the Google doc at the end of each day.
- Call 20% of participants to ensure that their experience with the field technician was satisfactory.

7 Frequently Asked Questions

- **Who we are?**
  I am _____ and I work for NMR Group Inc, a consulting firm. We have been hired by NYSERDA to perform this study.
- **Purpose of Study?**
  The parties responsible for evaluation of energy-efficiency programs in Massachusetts, Connecticut, Rhode Island, and New York have committed to conducting a study to estimate hours of use (HOU) of light bulbs in homes. The main objectives of this study are as follows:
  - → Establish customer awareness of lighting options and changes in the lighting market
  - → Understand how people use the light bulbs in their home, as this has a large impact on how much energy households use.
  - → Determine current rates of use and storage for various light bulbs.
  - → The results of the study will be used in planning for future energy needs in Massachusetts, Connecticut, Rhode Island, and New York.
- **What happens with our data?**
  The lighting logger recorded when your light was turned on and off over the past six months. It did not collect any other information. When we download the data from the logger we will assign the information to a number (not a name) and no one will know that the data is for your home.
- **How can I find out the results?**

  The study results will be the property of NYSERDA and will become accessible to the public in the spring of 2014.
- **How do I know you are legit?**
  NYSERDA is sponsoring this program and study. The contact person is Victoria Engel-Fowles. Her phone number is 518-862-1090 x3207 and her email address is vse@nyserda.org.

8 EPA Cleanup and Disposal Guidelines for CFLs

Cleanup and Disposal Guidelines
For Compact Fluorescent Light Bulbs (CFLs)
June 2008

What precautions should I take when using CFLs in my home?
CFLs are made of glass and can break if dropped or roughly handled. Be careful when removing the bulb from its packaging, installing it, or replacing it. Always screw and unscrew the light bulb by its base (not the glass), and never forcefully twist the CFL into a light socket. If a CFL breaks in your home, follow the clean-up recommendations below. Used CFLs should be disposed of properly (see below).

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If your state or local environmental regulatory agency permits you to put used or broken CFLs in the garbage, seal the bulb in two plastic bags and put it into the outside trash, or other protected outside location, for the next normal trash collection. Never send a fluorescent light bulb or any other mercury-containing product to an incinerator.

If your ENERGY STAR qualified CFL product burns out before it should, look at the CFL base to find the manufacturer's name. Visit the manufacturer's web site to find the customer service contact information to inquire about a refund or replacement. Manufacturers producing ENERGY STAR qualified CFLs are required to offer at least a two-year limited warranty (covering manufacturer defects) for CFLs used at home. In the future, save your receipts to document the date of purchase.

How should I clean up a broken fluorescent bulb?
Because CFLs contain a small amount of mercury, EPA recommends the following clean-up and disposal guidelines:

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- Have people and pets leave the room, and don't let anyone walk through the breakage area on their way out.
- Open a window and leave the room for 15 minutes or more.
- Shut off the central forced-air heating/air conditioning system, if you have one.

2. Clean-Up Steps for Hard Surfaces

- Carefully scoop up glass fragments and powder using stiff paper or cardboard and place them in a glass jar with metal lid (such as a canning jar) or in a sealed plastic bag.
- Use sticky tape, such as duct tape, to pick up any remaining small glass pieces and powder.
- Wipe the area clean with damp paper towels or disposable wet wipes. Place towels in the glass jar or plastic bag.
- Do not use a vacuum or broom to clean up the broken bulb on hard surfaces.

3. Clean-up Steps for Carpeting or Rug:

- Carefully pick up glass fragments and place them in a glass jar with metal lid (such as a canning jar) or in a sealed plastic bag.
- Use sticky tape, such as duct tape, to pick up any remaining small glass fragments and powder.
- If vacuuming is needed after all visible materials are removed, vacuum the area where the bulb was broken.
- Remove the vacuum bag (or empty and wipe the canister), and put the bag or vacuum debris in a sealed plastic bag.

4. Clean-up Steps for Clothing, Bedding, etc.:

- If clothing or bedding materials come in direct contact with broken glass or mercury-containing powder from inside the bulb that may stick to the fabric, the clothing or bedding should be thrown away. Do not wash such clothing or bedding because mercury fragments in the clothing may contaminate the machine and/or pollute sewage.
- You can, however, wash clothing or other materials that have been exposed to the mercury vapor from a broken CFL, such as the clothing you are wearing when you cleaned up the broken CFL, as long as that clothing has not come into direct contact with the materials from the broken bulb.
- If shoes come into direct contact with broken glass or mercury-containing powder from the bulb, wipe them off with damp paper towels or disposable wet wipes. Place the towels or wipes in a glass jar or plastic bag for disposal.

5. Disposal of Clean-up Materials

- Immediately place all clean-up materials outdoors in a trash container or protected area for the next normal trash pickup.
- Wash your hands after disposing of the jars or plastic bags containing clean-up materials.
- Check with your local or state government about disposal requirements in your specific area. Some states do not allow such trash disposal. Instead, they require that broken and unbroken mercury-containing bulbs be taken to a local recycling center.

6. Future Cleaning of Carpeting or Rug: Air Out the Room During and After Vacuuming

- The next several times you vacuum, shut off the central forced-air heating/air conditioning system and open a window before vacuuming.
- Keep the central heating/air conditioning system shut off and the window open for at least 15 minutes after vacuuming is completed.
- For more information about compact fluorescent bulbs, visit http://www.energystar.gov/cfls

For more information about compact fluorescent bulbs and mercury, visit http://www.energystar.gov/mercury EPA is continually reviewing its clean-up and disposal recommendations for CFLs to ensure that the Agency presents the most up-to-date information for consumers and businesses.

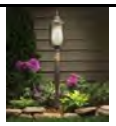
9 Onsite Reference Exhibits

Fixture Type

Table 1: Fixture Type List

Fixture	Code	Fixture	Code	Fixture	Code
Recessed	R	Wall Mount	WM	Walkway	W
Pendent	P	Night Light	NL	Exterior Flood	EF
Flush Mount	FM	Table Lamp	TL	Garage Door	G
Track	T	Floor Lamp	FL	Under Cabinet	U
Ceiling Fan	CF	Post Mount	PM	Other	O

Table 2: Fixture Type Exhibit

Fixture	Image	Fixture	Image
Recessed *(light bulb does not stick out of the plane of the ceiling)*		**Table Lamp** *(lamps that are put on tables)*	
Pendant *(fixture and bulb hangs from ceiling, i.e. chandelier)*		**Floor Lamp** *(lamps that are put on the floor)*	
Flush Mount *(fixture is flush with the ceiling)*		**Post Mount** *(exterior lights on a lamppost)*	
Track *(light bulbs on a strip/track)*		**Walkway** *(lights on a path outside the home)*	
Ceiling Fan *(lights attached to a ceiling fan)*		**Exterior Flood** *(fixtures that flood a large area with light, found on the side of home, above garage, or under peak of roof)*	
Wall Mount *(fixture attached to wall)*		**Garage Door**	
Night Light		**Under cabinet** *(lights under kitchen cabinets for lighting counter)*	

Bulb Type

Table 3: Bulb Types Code List

Bulb Type	Code	Bulb Type	Code
Incandescent	I	Halogen	H
CFL	CFL	Other	O
Fluorescent	F	Empty Socket	E
LED	LED		

Table 4: Bulb Types Exhibit

Bulb Types	Image	Description
Incandescent (I)		Bulbs have a filament that's heated to the point of glowing
Compact Fluorescent (CFL)		Bulbs are energy-efficient; use 67% less energy than incandescent bulbs and last longer. Covered CFLs have a plastic cover that conceals the traditional spiral shape. If you look closely at the bulb you will be able to see the spirals through the covering—especially when the bulb is turned on.
Fluorescent (F)		Bulbs are filled with mercury vapor that emits ultraviolet light when electricity is applied, then coating inside bulbs turns the UV rays into visible light
Light-Emitting Diode (LED)		Bulbs have a semiconductor chip so current flows through; light is released when an electron falls into a lower energy level. Some LEDs have a yellow filter.
Halogen (H)		More efficient type of incandescent bulb with filament sealed into a compact transparent envelope filled a small amount of halogen, allowing the filament to be at a higher temperature. Some halogens are virtually indistinguishable from regular incandescent bulbs. They may be smaller (ex. A-17 size instead of A-19) or can be distinguished by the presence of a glass tube around the filament (halogen) instead of the filament by itself (incandescent).

Bulb Shape

Table 5: Bulb Shape List

Bulb Shape	Code	Bulb Shape	Code
Twist/Spiral	T	Spot/Reflector/Flood	S
Globe	G	Circline	C
A-lamp	A	Tube	Tub
Bullet/Torpedo	B	Candle	Can
Bug light	Bug	Other [Specify]	O

Table 6: Bulb Shape Exhibit

Bulb Shape	Image	Bulb Shape	Image
Twist/Spiral (T)		**Spotlight/ Reflector/Flood (S)**	
Globe (G) *(e.g., for bathroom vanity fixtures)*		**Circline (C)**	
A-lamp (A) *(shaped like standard incandescent)*		**Tube Style (Tub)**	
Bullet/Torpedo (B) *(pointed top, standard screw base)*		**Candle (Can)** *(pointed top with a candelabra screw base)*	
Bug light (Bug) *(yellow color; do not confuse with LEDs with yellow filters)*			

Socket Type

Table 7: Socket Type List

Socket Type	Code
Medium Screw Base (Standard)	S
Small Screw Base (Candelabra)	Can
Pin Base	P
GU Pin Base	GU
Other	O

Table 8: Socket Type Exhibit

Socket	Image	Description
Medium Screw Base (S)		Light bulb screwed into socket
Small Screw Base [Candelabra] (Can)		Smaller screw base
Pin Base (P)		Pin on base of bulb sticks into socket
GU Base (GU)		Pin with larger head on base of bulb sticks into socket

Logger Numbers

Table 9: Types of Logger ID Numbers

Regional Hours of Use Study: Onsite Handbook

New York State

1/22/2013

Prepared for:

The Massachusetts Energy Efficiency Program Administrators

The Connecticut Energy Efficiency Board Evaluation Consultant

National Grid Rhode Island

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Contents

Tables

Figures

Overview of Handbook

The purpose of this document is to provide all the information required to conduct site visits for the Regional HOU Study. This document will be provided to all field technicians and will be used as the main reference material for in-person field technician training conducted for this study. This document contains the following sections:

- Training Plan
  - → Independent Training Steps
  - → In-person Training Session Outline
- Background / Purpose of the Study
- Onsite Protocol
- Onsite Form Instructions (included as separate Appendix)
  - → Example Completed Saturation Forms (included as separate Appendix)
- Logger Installation Instructions
- Quality Assurance and Control Procedures
- Frequently Asked Questions
  - → The Energy Independence and Security Act (EISA) of 2007
- Mileage Tracking Form
- Reimbursement Form
- EPA Cleanup and Disposal Guidelines for Compact Fluorescent Light Bulbs (CFLs)

All field technicians should review this document in its entirety prior to the in-person training session. This document contains independent training exercises that all technicians will be expected to complete prior to in-person training.

1 Training Plan

Training for this project consists of both independent and in-person training. A brief outline of training activities is included below. Additional detail about each step of training is covered in later sections. The first training step is to thoroughly review this document in its entirety.

1.1 Independent Training *(approximately three hours – total)*

- Review of Materials – field technician will spend one hour reviewing materials contained in this document.
- Store Visit – field technician will go to a hardware, lighting, or big box retailer to familiarize themselves with various bulb types. This activity will require about one hour.
- Mock Site Visit – after reviewing materials and completing the store visit, field technician will spend 30 minutes to an hour conducting a mock lighting audit for his/her home. As he/she is conducting the audit, he/she should reference the protocol to address any questions that arise. Once complete, he/she will send the completed site visit forms to the project manager for review.
- Logger Installation Practice – NMR will send the technician a logger and a light pipe to practice using and installing them on different fixtures. The technician will take pictures of the installed loggers and email them to the project manager to review.

1.2 In-person Training *(approximately four hours – total)*

- Questions and Answers – field technicians will be provided with the opportunity to ask questions about materials or the study that came up during independent training. Field technicians are also encouraged to ask questions during the remainder of the training session. *(20 minutes)*
- Review of Materials – the trainer will walk field technicians through the protocols, onsite forms, and equipment required for this project. *(45 minutes)*
- Administrative Matters – the trainer will review administrative procedures with field technicians. *(20 minutes)*
- Mock Site Visit – the trainer will act as a customer participating in the study and the field technician will go through the steps of conducting a site visit. *(30 minutes)*
- Walk-Along Visit – the trainer will walk-along with the field technician on their first site visit to observe them in the field. *(2 hours)*

2 Background / Purpose of the Study

The parties responsible for evaluation of energy-efficiency programs in Massachusetts, Connecticut, Rhode Island, and New York have committed to conducting a study to estimate hours of use (HOU) of light bulbs in homes. The main objective of this study, therefore, is to estimate HOU, and we will do so by room type, not lighting type (technology) as many studies have done in the past. Our focus on room types assumes that people are likely to use their lights in a given room the same way regardless of the type of bulbs in the room.

To accomplish this objective, field technicians will perform two interrelated tasks: 1) conduct an inventory of lighting to determine the number and type of bulbs currently installed in customers' homes, and 2) install a series of lighting loggers to capture information on how customers use lights in their homes. These two tasks are interrelated because in order to install loggers in a random selection of light fixtures, we must first identify all of the light fixtures in a customer's home.

NMR is recruiting and scheduling participants for this study via telephone. During the recruiting and scheduling, customers are provided with the following project details (note that the amount being offered is higher in Massachusetts and New York, as the lighting inventory in those states involves more detailed data collection than in Connecticut and Rhode Island):

> *NYSERDA is offering you the opportunity to take part in an important study. We are offering eligible households $150 to allow a trained technician to visit their homes to gather more information about the lighting products they use. The visit should take about an hour. The visit would involve a trained technician walking through your home and recording the types of lighting products that you are using. The technician will also attach some very small devices to several light sockets in your home to record lighting usage. Most lamp or fixture shades will block the devices from view, so they won't affect your decor. They also won't affect how your lights work. When the technician returns to remove these devices in six months, you'll receive $100 to participate in the study – for a total of $250. Participation in the study will require two visits, the first about an hour in length and the second a shorter visit of about 30 minutes, six months later. During the visits, there will be no attempt to sell you anything. The information gathered will be used to evaluate and improve the energy efficiency programs offered by NYSERDA.*

As a field technician you will not recruit customers. Instead, you will be provided with a list of customers to visit each week. This list will include the customer's name, telephone number, address, and an appointment time. You should also receive a check for each participant prior to visiting their home, participants will receive two separate checks one for the first visit (installation) and one for the second visit six months later (removal).

3 Onsite Protocol

This section outlines the procedures field technicians will follow when performing the lighting inventories and installing the loggers. These protocols cover both the lighting inventory and the selection of fixtures for loggers. The protocols for installing lighting loggers differ between single-family and multi-family as noted throughout this section.

3.1 Prior to Visit

Before visiting a home, you should make sure that, at a minimum, you have the following:

Onsite handbook
Onsite data form
Appointment sheet
Company Polo Shirt
ID Badge
GPS

Data Collection Kit
Camera
Flashlight
Pen/Pencils
Sharpie
Flat & Philips head screwdrivers
Insulated gloves
Shoe coverings
Latex gloves
Step ladder
6, 10, and 20-sided Dice

Materials for Customer
FAQs and Info Sheet
NMR contact's business card
Check ($150)

Logger Installation Kit
Zip ties
Adhesive 3M pads/control strips
Light loggers
- ***8*** *loggers for single-family*
- ***6*** *loggers for multi-family*

Light pipes
Sealable sandwich bags

CFL Clean up Kit
Sealable plastic bags
Disposable wipes
Vacuum
Duct tape
Flat brush

3.2 Arrival at Onsite

After the door is opened, immediately ascertain that the person at the door is the scheduled interviewee. Introduce yourself and hand him/her the business card.

- **Sample Introduction** *(not to be read verbatim)***:**
  Hello, my name is _____, and I am working with NMR. NMR is working under contract with ***NYSERDA (the New York State Energy Research and Development Authority)****. I'm here to meet with _____. As mentioned on the phone, I'm here to walk through your home and record the types of lighting fixtures and bulbs installed in each socket.* ***[Customer should be expecting you]****. During my visit I'll also be installing a few lighting loggers to capture hours of use* ***[show customer a logger]****. In six months another technician will return to collect the loggers that I install. The loggers can only tell when a light is turned on and off, they do not record anything else. In appreciation for your time, on behalf of* ***NYSERDA****, we are offering you a payment of $150 today and $100 when we return in six months to remove the loggers. Do you have any questions regarding my visit?*

Prior to Data Collection

- Give the customer a step by step description of what you'll be doing (show the data collection form and a logger as you explain)
  - → First I need to walk around the outside of your home and record the types of lights.
  - → Then I will cover the bulbs inside your home – room by room – including bulbs in storage.
  - → After counting all of the lights I need determine which fixtures to install the loggers on.
- The customer should not be surprised by any of this information as they have already been told what the study will consist of. However, if the customer is uncomfortable with the visit and refuses to allow you to conduct the inventory or install the loggers, courteously explain that you will be unable to provide the incentive check if they do not participate. If they still refuse, ask if it would be ok to have your supervisor call them to discuss the project with them. Immediately inform your supervisor of the situation and whether or not the customer is expecting a call from your supervisor.
  - → Customers must participate in all aspects of the study—the lighting inventory and the logger installation.

General sequence of data collection

- → Installed bulbs - Exterior:
  - → Walk around the outside of the home in a clockwise direction.
  - → Record information on all exterior lighting sockets.
- → Installed bulb - Interior:
  - → Next, proceed through the inside of the home in a clockwise direction.
  - → Begin with foyer (entry way).
  - → Go through each room and part of the home systematically, in a clockwise direction (or as clockwise as is possible).
- → Stored Bulbs**:**
  - → **Ask:** *"Now, I would like to see all light bulbs and fixtures that are not currently installed. This would include those you have bought and not yet installed as well as those that were installed and then removed."*
  - → Record information on all bulbs in storage.
- → Logger Installation:
  - → Consult logger installation instructions.
  - → Install loggers on selected fixtures (with customer's approval of placement).
- → After Data Collection:
  - → Thank the customer for his/her time
  - → Give him/her the $150 check.
  - → Remind the customer that when we return in six months to retrieve the loggers we will provide them with a check for $100.
  - → Have the customer sign off on your data collection form to indicate that you visited their home and provided him/her with a $150 check.
  - → Leave with the customer the "Logger Participant Frequently Asked Questions" one-page sheet.

Data Collection Guidelines

- **<u>All recorded information must be legible</u>.**
- **What information to collect:**
  - → **All lights that use electricity** (meaning they are plugged in or hard wired) must be captured, including night lights.
    - Ex. Solar landscaping lights that also use electricity from electric lines, ***capture*** *the information*; solar landscaping lights that don't use any electricity lines at all, ***do not*** *capture*.
  - → **DO NOT** capture lights that run **only** on batteries like flashlights or battery-operated closet or under-cabinet lights (even if the batteries are rechargeable).
  - → **DO NOT** capture information for temporary seasonal lights or lighting displays. This could include strings of lights such as holiday lights as well as novelty lights like plug in candles, yard decorations, holiday village displays, etc. Ask the customer if it is permanent or a seasonal holiday light; if permanent, capture this information.
- **Removing Bulbs or Fixture covers:**
  - → **<u>Never remove a cover or bulb without permission from the customer.</u>**
  - → If any fixture is covered and/or the bulb is not immediately visible, ask the customer if the bulb is easily accessible. If yes, ask if you can turn off the fixture and take it apart to see the light bulb.
  - → If the customer offers to turn off the fixture and take it apart him/herself, **ALWAYS** let the customer do it.
  - → If the customer refuses to let you do it and does not offer to do it him/herself; the fixture is damaged or delicate; or the fixture is inaccessible given your equipment, ask the customer for his/her best guess of the information needed on the form.
  - → **DO NOT TOUCH** if fixtures have cracked or damaged covers, or look delicate or easily breakable.
- **Burned Out Bulbs:**
  - → If a bulb is burned out, ask the customer if he/she intends to replace the bulb.
    - If the answer is yes, treat the burned out bulb as if it's currently working and record all.
    - If customer does not intend to replace them OR purposely unscrews some bulbs so that they don't turn on, treat them as if they were an empty socket.
    - **Note: Do not install loggers on burned out bulbs**

- **Broken Bulbs:**
  - → If you break any type of light bulb and/or if a broken CFL came into direct contact with clothing or bedding which subsequently needed to be thrown out, give the customer the "Reimbursement Form."
  - → Note what type of bulb was broken and contact the project manager as soon as possible to report the incident.
  - → Take a picture of the broken bulb and any other damage.
  - → **If a CFL or a fluorescent bulb should be broken**, refer to the "Cleanup and Disposal Guidelines for Compact Fluorescent Light Bulbs" of the Environmental Protection Agency (EPA) included in this packet.
- **Unplugged Fixtures:**
  - → If the interviewee has unplugged light fixtures in storage areas, ask the customer if he/she uses the fixture.
    - o If the answer is no, then treat the light bulbs in the fixture as if they are in storage (record it in the CFL in Storage Form if the bulb is a CFL and do not record it if it is not a CFL).
    - o If the answer is yes, then record the fixture in the "installed lighting" form and denote when it is used in the "notes" column.

4 Onsite Form Instructions

This section provides specific details about how the onsite form should be completed by field technicians.

4.1 Home Schematic

→ Draw a **CLEAR** diagram of the house on the sheets provided as you go through the home, labeling each room on the diagram (in order to locate loggers on the follow up visit).

→ If the home has multiple levels create a separate diagram for each level, including the basement and/or attic.

→ If the attic or any other room in the home is not accessible, still include it in the diagram but record it as "inaccessible".

→ **Indicate the location within a room of any fixtures that have loggers installed by marking the diagram with an X.**

4.2 Onsite Saturation Form

Program Participation

→ Before filling out the onsite form, ask the homeowner: **Have you participated in any programs that replaced bulbs in your house with energy efficient bulbs?**

- Yes
- No

→ If "Yes", ask which programs they participated in and record their responses.

Room Descriptions

→ Choose from the codes below.

→ You may use a downward arrow to indicate the same room for more than one line.

→ If a home has a great room or a single room with several purposes, look at the particular usage of the light and record the lamps accordingly.

→ When in doubt of a room's purpose ask the customer how they would describe the room.

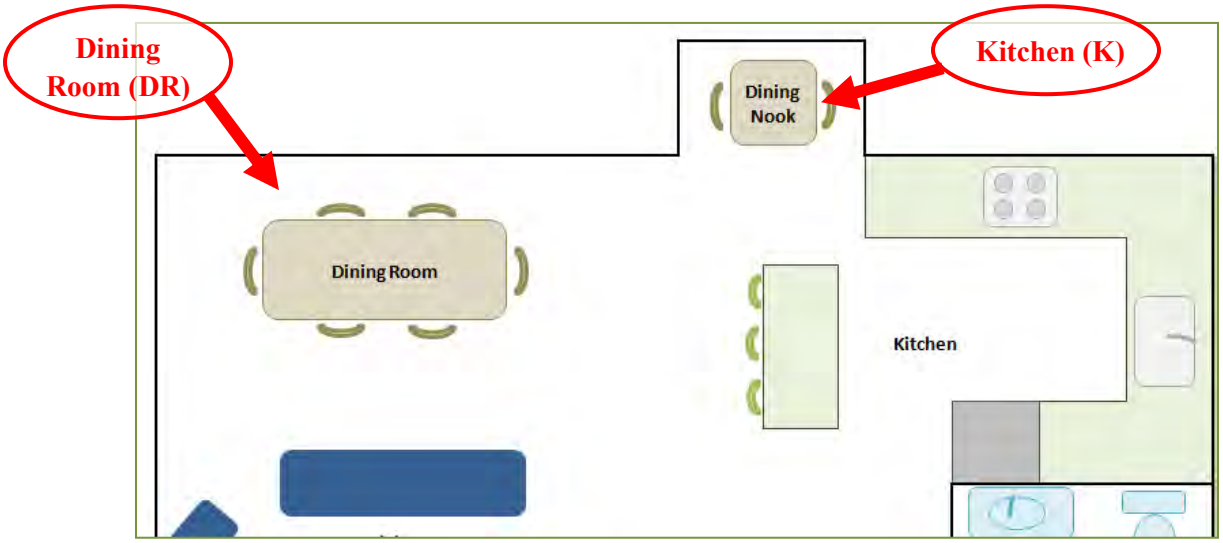
→ If there are multiple rooms of the same type add a number after the code (ex. BR1, BR2).

Table 1: Room Type List

Room	Code	Room	Code	Room	Code
Dining Room	DR	Living Space	L	Garage	G
Exterior	E	Hallway	H	Office	OFF
Kitchen	K	Foyer	F	Den	DEN
Bedroom	BR	Utility	U	Closet	[Room code] -C
Bathroom	BT	Basement	BA	Other [Specify]	O

Dining Room (DR)

A dining room is any room where the primary purpose is eating. Substantial dining areas that are not separated from other rooms in the home directly by walls and doors are still considered a dining room if they are set apart from other rooms. Observations of a dining area attached to the kitchen, such as a dining nook, will be labeled as a kitchen.



Exterior (E)

Technicians will audit lamps that are attached to the home and those that are owned by the customer. These include lampposts not attached to the home and light lamps that are part of driveway entrances. Exterior includes sheds, greenhouses, and other storage facilities and exterior buildings owned by the customer **except garages** which have their own category discussed below.

While all homes have exteriors not all lights on all homes are directly controlled by the person who lives there. Only capture exterior lights if they are directly controlled by the person who lives in the home we are visiting. Lighting in common areas of apartment buildings (interior/exterior) and lights not controlled on the exterior of townhomes are examples of exterior lights that we do not need to capture.

Kitchen (K)

Technicians will include the lights that are primarily used in a kitchen area or inside the kitchen, such as a counter with bar stools or a small kitchen table. However, technicians will not include the light under the range hood or in the refrigerator.

Every home will have at least one kitchen. If the home is an efficiency or a studio apartment, designate the lights directly present in the kitchen area (area containing stove, refrigerator and sink) as the kitchen.

Bedroom (BR)

All bedrooms will be noted with a unique identifier (i.e. BR 1).

Every home will have at least one bedroom. If the home is an efficiency or a studio apartment, designate the lights directly present in the sleeping area (area containing bed) as the bedroom.

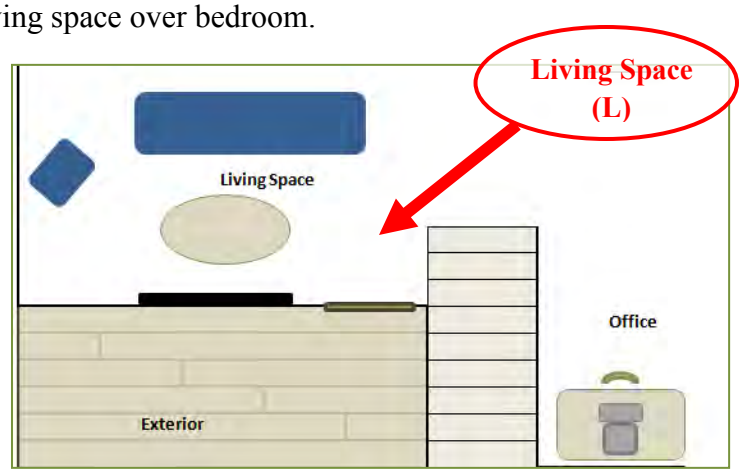
Bathroom (BT)

The bathrooms included can be full baths, half baths, or three-quarter baths. If a particular bathroom has two rooms (such as a separate shower and sink area), the lighting will be coded in both rooms as the same bathroom.

Every home will have at least one bathroom. Efficiency and studio apartments should have a separate bathroom. In the event that the bathroom is not separated from the rest of the home by walls and a door, designate the lights directly present in the bathroom area (area containing the shower, toilet and sink) as the bathroom.

Living Space (Living Room/Family Room) (L)

This room is the most commonly used area for family activities, such as watching television or entertaining. The form does not differentiate between living room and family room since this distinction can often be subjective. If the apartment is a studio or efficiency where the bedroom and living space are the same and have only one light, prioritize living space over bedroom.



Hallway (H)

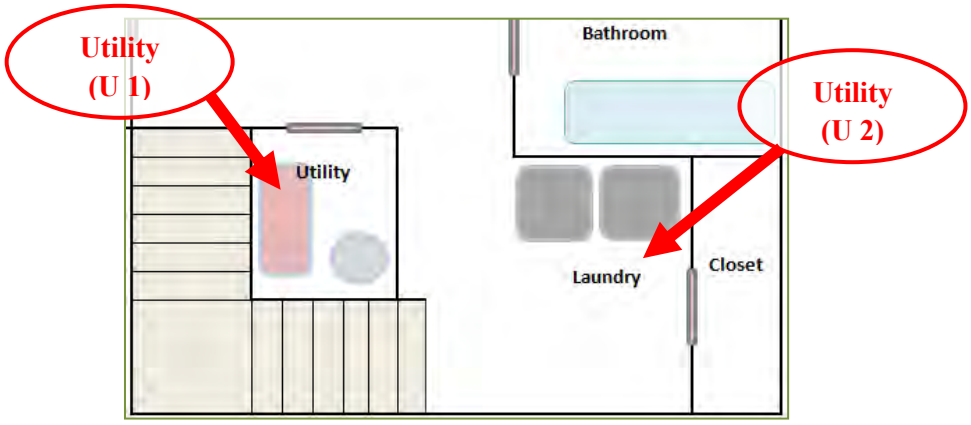
Hallways include all stairways with lights.

Foyer (F)

This category includes all entry ways, even those called mudrooms.

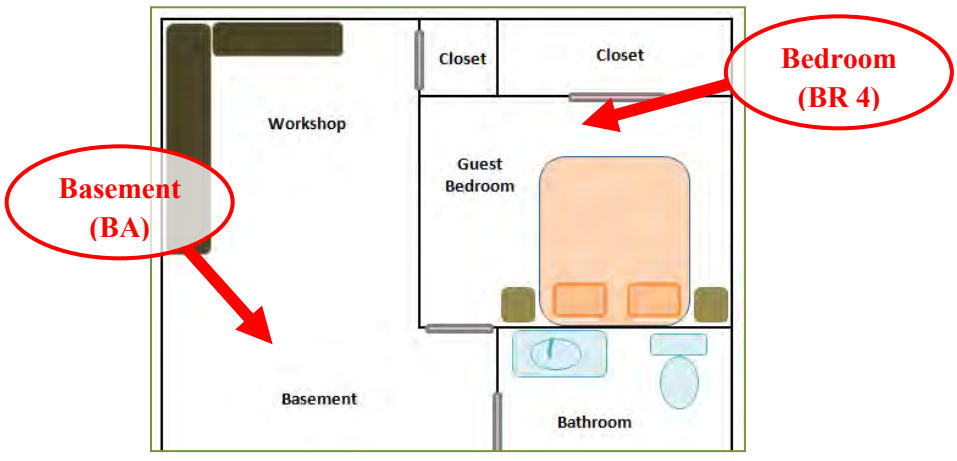
Utility (U)

The main purpose of this room is washing clothes. Technicians will also include furnace/HVAC areas as a utility room unless the furnace/HVAC is part of an unfinished one room basement. Do not include apartment building laundry rooms used by all tenants; only include those that are inside the homeowner's apartment.



Basement (BA)

The basement is the main room under the first floor. If there are bedrooms, bathrooms, closets, utility rooms, etc. in the basement, they will be coded and recorded as such.

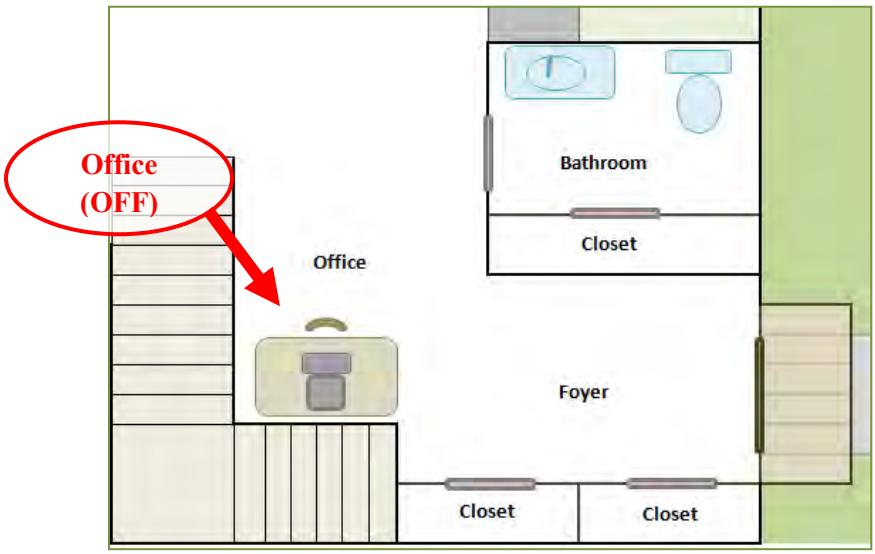


Garage (G)

In addition to a typical garage, a carport fits into this category. Bulbs found in garage door opening mechanisms will be included.

Office (OFF)

Technicians will collect lighting data in computer rooms, home offices, and parts of a great room that have office functions. In the notes column indicate whether the office is a separate room or part of a larger room. The primary function of this room appears to be doing something at a desk or computer.

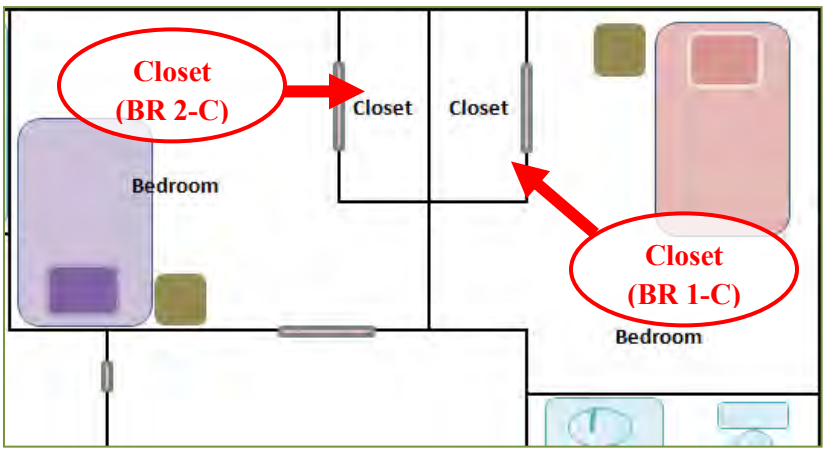


Den (DEN)

This category refers only to dens, libraries and other small, secluded rooms. If the room contains a full size couch, this would be considered a living space. Technicians should defer to the "Living Space" category if they cannot decide how a room should be categorized.

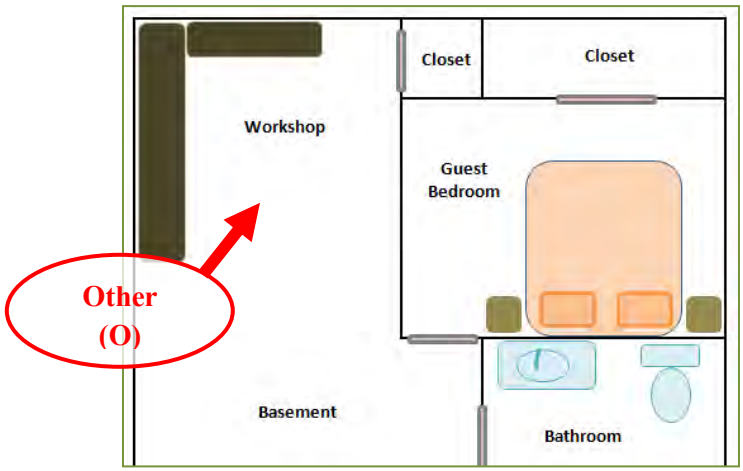
Closets ([Room Code]-C)

Technicians will collect lighting data for lamps in closets. Closets should be recorded separately from the spaces that contain them but with the name of the room included. For example, a closet in the master bedroom would be recorded as BR1-C.



Other (O)

Technicians will collect lighting data for lamps in other room types. In the notes column, describe the room type in more detail.



Primary Room

→ When multiple rooms of one type exist (ex. Bedrooms, bathrooms), record a "Y" in the "Primary" column to indicate the room used most frequently.

→ If it is not clear which room is used most frequently, ask the homeowner.

→ For bedrooms, the "Primary room" is the master bedroom.

→ The column can be left blank if only one room exists of that type.

Fixture Group

→ A fixture group includes all fixtures that are controlled by the same switch.

→ Number fixture groups in *each room type targeted for loggers* from 1, 2, 3, 4, etc. up to the number of fixture groups in each room of the same type

- Single family homes targeted room types: Dining rooms, exteriors, living spaces, other room #1, other room #2, bedrooms, bathrooms and kitchens.
- Multifamily homes targeted room types: Living spaces, dining rooms (or other room #1), other room #2, bedrooms, bathrooms, and kitchens.
- For "other" rooms #1 and #2 - group all remaining rooms together to number fixture groups for other room type.
- Ex. If a house has three bedrooms, start with fixture group #1 in BR1 and count through fixture group #8 (the last fixture group) which is in BR3.

→ Repeat fixture group number until all bulbs associated with it are recorded.

Control Type

→ Include control-type information for each light fixture using the codes below.

→ For dimmable and 3-way control types

- Test the fixture to make sure these specialty features are functional.
- If the control also has on/off capability, label it by its specialty feature.

Table 2: Control Type List

Control Types	Code	Details
On-Off	OF	Control can only turn a lamp on or off.
Dimmable	Dim	Control increases/decreases bulb brightness as it is turned or is moved up/down.
3-way	3W	Controls a fixture that uses a three-way bulb to produce three levels of light, switching the level with each turn (ex. 50-100-150 watts).
Wireless	W	Fixture is turned on by a remote control or a wall-mounted control that is not connected to the house's wiring.
Motion or Photo Sensor	MS	Fixture turns on when a moving object is detected.
None	None	Fixture has no control switch; the bulb is always on.
Breaker/Disconnect Plug	B	Fixture has no control switch; only turns on when plugged in.
Other	O	

Wall-Mounted Control

→ Record whether or not the control is wall mounted (Y/N)

→ Wall-Mounted controls are those that are permanently connected to the house's wiring (as opposed to controls that are mounted on the socket, base, or in-line with the cord or those that are controlled remotely).

→ If a fixture can be turned on/off by a wall-mounted control as well as a different control type, record this as a wall-mounted control (Y).

- Ex. A table lamp that has its own switch but can also be turned on/off by a wall mounted control.

Fixture Number

→ Number fixtures in each room from 1, 2, 3, 4, etc. up to the number of fixtures in the room.

→ **Do not** restart numbering of fixtures from 1 for each room. Fixtures should be numbered sequentially throughout the entire home such that when you number the final fixture in the home the total number of fixtures in the home should match the fixture number.

→ Repeat the fixture number until all bulbs associated with it are recorded.

→ **You do not need to capture fixtures inside appliances** like ovens, range hoods, refrigerators, or microwaves.

Multi-Switch

→ If a fixture is controlled by two separate wall-mounted switches (for example, a hallway light with switches at both ends of the hall), record this in the column provided (Y/N)

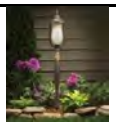
Fixture Type

→ Include fixture type information for each installed bulb using the codes below.

Table 3: Fixture Type List

Fixture	Code	Fixture	Code	Fixture	Code
Recessed	R	Wall Mount	WM	Walkway	W
Pendent	P	Night Light	NL	Exterior Flood	EF
Flush Mount	FM	Table Lamp	TL	Garage Door	G
Track	T	Floor Lamp	FL	Under Cabinet	U
Ceiling Fan	CF	Post Mount	PM	Other	O

Table 4: Fixture Type Exhibit

Fixture	Image	Fixture	Image
Recessed *(light bulb does not stick out of the plane of the ceiling)*		**Table Lamp** *(lamps that are put on tables)*	
Pendant *(fixture and bulb hangs from ceiling, i.e. chandelier)*		**Floor Lamp** *(lamps that are put on the floor)*	
Flush Mount *(fixture is flush with the ceiling)*		**Post Mount** *(exterior lights on a lamppost)*	
Track *(light bulbs on a strip/track)*		**Walkway** *(lights on a path outside the home)*	
Ceiling Fan *(lights attached to a ceiling fan)*		**Exterior Flood** *(fixtures that flood a large area with light, found on the side of home, above garage, or under peak of roof)*	
Wall Mount *(fixture attached to wall)*		**Garage Door**	
Night Light		**Under cabinet** *(lights under kitchen cabinets for lighting counter)*	

Bulb Type

→ Record bulb type information for each installed bulb using the codes below.
→ If socket is empty, record as "E."

Table 5: Bulb Types Code List

Bulb Type	Code	Bulb Type	Code
Incandescent	I	Halogen	H
CFL	CFL	Other	O
Fluorescent	F	Empty Socket	E
LED	LED		

Table 6: Bulb Types Exhibit

Bulb Types	Image	Description
Incandescent (I)		Bulbs have a filament that's heated to the point of glowing
Compact Fluorescent (CFL)		Bulbs are energy-efficient; use 67% less energy than incandescent bulbs and last longer. Covered CFLs have a plastic cover that conceals the traditional spiral shape. If you look closely at the bulb you will be able to see the spirals through the covering—especially when the bulb is turned on.
Fluorescent (F)		Bulbs are filled with mercury vapor that emits ultraviolet light when electricity is applied, then coating inside bulbs turns the UV rays into visible light
Light-Emitting Diode (LED)		Bulbs have a semiconductor chip so current flows through; light is released when an electron falls into a lower energy level. Some LEDs have a yellow filter.
Halogen (H)		More efficient type of incandescent bulb with filament sealed into a compact transparent envelope filled a small amount of halogen, allowing the filament to be at a higher temperature. Some halogens are virtually indistinguishable from regular incandescent bulbs. They may be smaller (ex. A-17 size instead of A-19) or can be distinguished by the presence of a glass tube around the filament (halogen) instead of the filament by itself (incandescent).

Bulb Shape

→ Include bulb shape information for each installed bulb using the codes below.

Table 7: Bulb Shape List

Bulb Shape	Code	Bulb Shape	Code
Twist/Spiral	T	Spot/Reflector/Flood	S
Globe	G	Circline	C
A-lamp	A	Tube	Tub
Bullet/Torpedo	B	Candle	Can
Bug light	Bug	Other [Specify]	O

Table 8: Bulb Shape Exhibit

Bulb Shape	Image	Bulb Shape	Image
Twist/Spiral (T)		**Spotlight/ Reflector/Flood (S)**	
Globe (G) *(e.g., for bathroom vanity fixtures)*		**Circline (C)**	
A-lamp (A) *(shaped like standard incandescent)*		**Tube Style (Tub)**	
Bullet/Torpedo (B) *(pointed top, standard screw base)*		**Candle (Can)** *(pointed top with a candelabra screw base)*	
Bug light (Bug) *(yellow color; do not confuse with LEDs with yellow filters)*			

Socket Type

→ Record socket type for each installed bulb using the codes below.

→ Socket type refers to the bulb base (circled in red in Table 10) and how the base attaches to the fixture.

Table 9: Socket Type List

Socket Type	Code
Medium Screw Base (Standard)	S
Small Screw Base (Candelabra)	Can
Pin Base	P
GU Pin Base	GU
Other	O

Table 10: Socket Type Exhibit

Socket	Image	Description
Medium Screw Base (S)		Light bulb screwed into socket
Small Screw Base [Candelabra] (Can)		Smaller screw base
Pin Base (P)		Pin on base of bulb sticks into socket
GU Base (GU)		Pin with larger head on base of bulb sticks into socket

Wattage

→ Record the wattage for each installed bulb.

Manufacturer

→ **CFL and LED bulbs ONLY:**
→ Record the manufacturer for each installed bulb.
→ If the manufacturer is not clear, ask the homeowner if they recall the manufacturer.

Model Number

→ **CFL and LED bulbs ONLY:**
→ Record the model number of installed CFL and LED bulbs.
→ Model numbers can include both numbers and letters.
→ Model numbers can usually be found on the base or near the base of the bulb.

When Purchased

→ **CFL and LED bulbs ONLY:**
→ Ask the homeowner:

<u>When</u> did you purchase this bulb?

1. January to February 2013
2. July to December 2012
3. January to June 2012
4. Before 2012

What Replaced

→ **CFL and LED bulbs ONLY if purchased in past year:**
→ Ask the homeowner:

<u>What</u> type of bulb was installed here before you installed this CFL or LED?

1. Incandescent
2. Halogen
3. CFL
4. LED
5. Something else (specify in notes)

Where Purchased

→ **CFL and LED bulbs ONLY:**

→ Ask the homeowner:

Where did you purchase this bulb?

- Record the store name.
- If the homeowner doesn't recall, ask what type of store they purchased the bulb from using Table 11 below.

Table 11: Store Types

Code	Store Type
A	Grocery store or supermarket, such as Shaw's, Stop n Shop, or Whole Foods
B	Warehouse store, such as Sam's Club, BJ's, or Costco
C	Home improvement store, such as Home Depot or Lowe's
D	Hardware store, such as True Value or ACE Hardware
E	Mass merchandise/discount department store, such as Wal-Mart, Kohl's, K-Mart, or Target
F	Drugstore, such as Walgreen's or CVS
G	Convenience store, such as 7-Eleven, White Hen Pantry, or Cumberland Farms
H	Specialty lighting or electrical store
I	Home furnishing store, such as a Bed, Bath, and Beyond, or Pottery Barn
J	Mail order catalogs
K	Through the Internet
L	Bargain store, such as the Building 19, Dollar Store, or Family Dollar
M	Office supply store, such as Office Depot or Staples
O	Other

Notes

→ Use this column to describe any feature labeled as "other."

→ Use this column to record any additional information that may be useful in the data analysis phase.

→ Ex. The resident refused access to certain rooms or fixtures; or lamp types cannot be determined unless a lighting fixture cover is removed (and the customer does not wish for this to be done).

4.3 Onsite Stored Bulbs Form

Package Group

→ A package group includes all stored bulbs that are in the same package.
→ Number package 1, 2, 3, 4, etc.
→ In the onsite form, repeat the package group number until all bulbs in the package are recorded. (The onsite form is one row per bulb, so a package group number is repeated in all rows until all bulbs are recorded)
→ If a bulb is not in a package, write "NA" in this column.

Bulb Type

→ Record bulb-type information for each stored bulb using the codes from Table 5.

Bulb Shape

→ Record bulb-shape information for each stored bulb using the codes from Table 7.

Base Type

→ Record the base type for each stored bulb using the socket type codes from Table 9.

Wattage

→ Record the wattage for each stored bulb.

Specialty Feature

→ **CFL and LED bulbs ONLY:**
→ In the column provided, record if the stored bulb is dimmable (Dim) or 3-way (3W).
→ If the bulb is not dimmable or 3-way, leave the column blank.

Manufacturer

→ **CFL and LED bulbs ONLY:**
→ Record the manufacturer for each stored bulb.
→ If the manufacturer is not clear, ask the homeowner if they recall the manufacturer.

Model Number

→ **CFL and LED bulbs ONLY:**
→ Record the model number of stored CFL and LED bulbs.
→ Model numbers can include both numbers and letters.
→ Model numbers can usually be found on the base or near the base of the bulb.

ENERGY STAR Label

→ **CFL and LED bulbs ONLY:**
→ In the column provided, record if the stored bulb has an ENERGY STAR label.

When Purchased

→ **CFL and LED bulbs ONLY:**
→ Ask the homeowner:

<u>When</u> did you purchase this bulb?

1. July to December 2012
2. January to June 2012
3. Before 2012

Where Purchased

→ **CFL and LED bulbs ONLY:**
→ Ask the homeowner:

<u>Where</u> did you purchase this bulb?

- Record the store name.
- If the homeowner doesn't recall, ask what type of store they purchased the bulb from using Table 11.

Online Purchase

→ **CFL and LED bulbs ONLY:**
→ If the bulb was purchased at the aforementioned store online, indicate this in the column provided.

Why Purchased and Stored

→ **100 Watt and 75 Watt Incandescent Bulbs ONLY:**

→ Ask the homeowner:

Did you purchase and store this particular wattage and type of bulb for any particular reason?

1. As a back-up/to replace 100w bulbs
2. As a back-up/to replace 75w bulbs
3. To have extras
4. Don't know/No reason
5. Other

Reason for Storage

Why are you storing this bulb? **(Allow for multiple responses)**

1. For future use
2. Do not plan to use
3. Plan to throw out/recycle
4. Other [Specify – record verbatim]
5. Refused
6. Don't know

Type of Bulb it will Replace

What type of bulb will this bulb likely replace?

1. CFL bulb
2. Incandescent bulb
3. Whichever needs replacing first
4. The same type of bulb as the stored bulb
5. Other [Specify – record verbatim]
6. Refused
7. Don't know

4.4 Logger Information and Location Form

→ Record room information for installed loggers:

- **Single Family Homes (8 loggers)**
  1. Dining room
  2. Exterior
  3. Living space
  4. Other room #1
  5. Other room #2
  6. Bedroom
  7. Bathroom
  8. Kitchen
- **Multifamily Homes (6 loggers)**
  1. Living space
  2. Other room #1
  3. Other room #2
  4. Bedroom
  5. Bathroom
  6. Kitchen

→ Record serial number for each logger on the line provided.

→ For "Other room #1" and "Other room #2", record the room code on the line provided.

→ Record room code for room types that have multiple rooms. Ex. If the main bedroom is "BR 3", record this code in the form below "Bedroom."

→ Record fixture and bulb characteristics for those lights on which you installed loggers.

4.5 LED Onsite Survey

This survey is to be filled out by the homeowner only in homes in which you find LED bulbs. Before installing light loggers, give the homeowner the LED onsite survey to fill out while you are installing.

- Before giving the homeowner the survey:
  - → On page 1, circle the rooms in which you found screw in LED bulbs installed.
  - → On page 2, circle the rooms in which you found CFL bulbs installed. **If you did not find any installed CFLs, cross out question E.**
- If possible, the person in the home who most recently bought LED bulbs should fill out this survey.
- Instruct the homeowner to complete the survey as thoroughly as possible while you are installing the loggers.
- Collect the completed survey before providing homeowner with their incentive payment.

4.6 Homeowner Verification of Receipt of Incentive Payment

Have the homeowner sign the onsite form upon receiving their incentive check in the space provided on the cover page.

5 Logger Installation Instructions

5.1 Installation

- Install up to **eight** loggers on selected fixture groups in **single-family homes**
- Install up to **six** loggers on selected fixture groups in **multi-family homes**
- Use the data collection form to determine the total number of fixture groups. A fixture group refers to all fixtures controlled by the same switch.
- Take a picture of the fixture with the logger on it (in order for easy recognition when retrieving).
- If installation of the desired number of loggers is not possible, note the reason on the onsite form.
- If the resident objects to installing meters on any fixture group, note the reason on the intake sheet.

5.2 Room Prioritization

- **Single-family homes (8 loggers)**
  - → Install **one** logger in each of the following room types:
    1. Dining room
    2. Exterior
    3. Living space
    4. Bedroom
    5. Bathroom
    6. Kitchen
  - → Install **two** loggers in *other room types*. This includes any room that is **not** specified above (may include hallways, utility closets, offices, garages, etc.) If you have captured an area of room as part of another room (i.e. an office that is part of a great room) treat that area as a separate room.

- **Multi-family homes (6 loggers)**:
  - → Install **one** logger in each of the following room types:
    1. Living Space
    2. Bedroom
    3. Bathroom
    4. Kitchen
  - → Install **two** loggers in *other room types*. This includes any room that is **not** specified above (may include hallways, utility closets, offices, garages, etc.) **If the multi-family home has dining room/area, install ONE of the 'other room' loggers in the dining room or area.**

- **If any home does not include a specified room**, the logger allocated for that room will instead be assigned to a random fixture in a random room even if a logger is already installed in that room. **Install a maximum of two loggers in any one room.** If the randomly selected room already has two loggers installed assign the logger to the next room in order. (Ex1. If you roll a two but there are already two loggers in the dining room install the logger on the exterior. Ex2. If you roll a seven but there are already two loggers installed in other rooms, install the logger in a bedroom.)

- **Note**: Loggers must be installed on fixtures controlled by separate control devices. If a room only has one fixture device or if all fixtures in a room are connected to the same control, **do not install multiple loggers**. Instead, install only one logger and allocate the second logger to another randomly selected room. **Install a maximum of two loggers in any one room.** If the random room selected already has two loggers installed assign the logger to the next room sequentially. (Ex1. If you roll a two but there are already two loggers in the dining room install the logger on the exterior. Ex2. If you roll a seven but there are already two loggers installed in other rooms, install the logger in a bedroom.)

Table 12: Random Selection of Room

Single-Family (10-sided die)			Multi-Family (6-sided die)		
Room	**# Rolled**	**Probability**	**Room**	**# Rolled**	**Probability**
Dining Room	1 or 2	20%	Living Space	1 or 2	33%
Exterior	3 or 4	20%	Other	3	17%
Living Space	5 or 6	20%	Bedroom	4	17%
Other	7	10%	Bathroom	5	17%
Bedroom	8	10%	Kitchen	6	17%
Bathroom	9	10%			
Kitchen	10	10%			

5.3 Random Fixture Group Selection

- For **single-family** homes:
  - → If eight or fewer fixture groups are identified in the lighting audit, install a logger on one fixture in each fixture group.
  - → If more than eight fixture groups are identified, field technicians will use the following random selection method to determine which fixtures to meter.
  - → **If any home does not include a specified room**, the logger allocated for that room will instead be assigned to a random fixture in a random room even if a logger is already installed in that room.

- For **multi-family** homes:
  - → If six or fewer fixture groups are identified in the lighting audit, install a logger on one fixture in each fixture group.
  - → If more than six fixture groups are identified, field technicians will use the following random selection method to determine which fixtures to meter.
  - → **If any home does not include a specified room**, the logger allocated for that room will instead be assigned to a random fixture in a random room even if a logger is already installed in that room.

Random Selection Method

- Determine the number of fixture groups in a room from the audit.
  - → If there are multiple rooms of a given type (e.g., bedrooms or bathrooms), count all fixture groups in all of the rooms of that type.

- Based on the fixture group count, select the most appropriate die provided and roll it once to determine which fixture group that should have a logger installed.[1] For example, if the room type has five fixture groups, use the six-sided die. If the room has 18 fixture groups, use the 20-sided die and so forth.

- If the number of fixture groups in a room is less than the number rolled on the die, continue counting from fixture group 1. (Ex. If a room has 11 fixture groups you would roll the 20-sided die. If the die shows the number 12, fixture group 1 would be selected.)

- If the number of fixture groups in a room exceeds 20 than you will need to roll the die multiple times. The first roll will determine a starting point and the second number will determine how many fixture groups to count to before installing the logger. (Ex. If a room has 21 fixture groups you would roll the 20-sided die once and get a 15, you would then roll the die again and get an 8. In this example you would install the logger on the 2nd fixture group.)

- If a second logger needs to be installed in the same room, roll the die again, if you get the same number move to the next fixture group in the room.

- Choose a fixture and bulb to install the logger on in this fixture group
  - → While fixture groups are selected at random, you can install the logger on any light bulb in the selected fixture group.
  - → Try to pick a bulb that will not interfere with normal use of the light and will be easy to install a logger on.

[1] Field technicians will be provided with the four dice—30 sided, 20 sided, ten sided, and six sided.

Examples:

- If a bedroom has 10 fixture groups, the technician rolls the ten-sided die and rolls a four. The technician then identifies the fourth fixture group in the bedroom, and installs a logger.
- If a home has two exterior fixture groups, the technician rolls the six-sided die and rolls a five. Because there are only two fixtures on the exterior of this house, this means that the logger actually goes on the first fixture group (because if there are fewer fixture groups in the room than the random number, upon reaching the last fixture group in the room, one continues counting from the first group). Fixture group one contains three fixtures, one exposed on the eve of the home, one on the covered porch, and one on a 20' tall post in the yard. Since all three fixtures are controlled by the same control device (a wall switch), logging any one will give the same results. In this situation, the technician should install the logger on the covered porch as it is the easiest to reach and is protected from the elements.
- If an elegant bathroom has 16 fixture groups, the technician rolls the 20-sided die and rolls an 11. Fixture group 11 includes the ceiling fan and the vanity lights. In this situation, the technician should install the logger near a vanity bulb as they are easier to reach than the ceiling fan.

5.4 Other Metering Guidelines

- Resident agrees to allow installation of light loggers.
- Lights must be operating properly during site visit.
- Light loggers will be installed on fixtures in a way that is the least obtrusive to customers (based on resident preference/discretion).
  - → If logger cannot be installed on a fixture due to customer preference – try another fixture in the same fixture group – if no other fixtures in that fixture group exist choose the next fixture group in order.
- Light loggers will be installed where fixtures are easily accessible (e.g., not requiring more than a stepladder to access) and that are not fragile (e.g., crystal chandelier).
  - → If logger cannot be installed on a fixture due to inaccessibility – try another fixture in the same fixture group – if no other fixtures in that fixture group exist choose the next fixture group in order.
- When installing light loggers on fixtures, field technicians will take great care to minimize disturbances that could potentially invalidated the data.
  - → As needed, loggers will be positioned so only light from the fixture is recorded.

- → When it is difficult to eliminate exposure to ambient light, field technicians will attach a light pipe (fiber optic eye) to the logger, which prevents the logger from "seeing" ambient light.
- → Additionally, field technicians will secure loggers to fixtures using hard plastic cable ties, adhesive strips, and magnets.

5.5 Installing a Light Logger

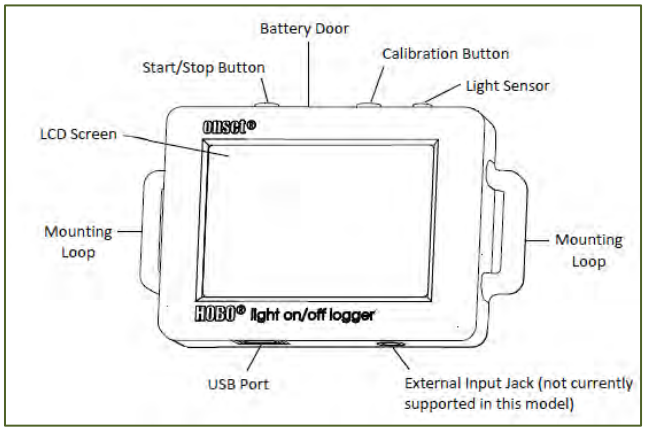
This study will utilize Hobo UX 90s and DENT TOU-L loggers to record on/off instances. The instructions provided below are specific to the Hobo UX 90s loggers. Installations of DENT TOU-L loggers follow the same deployment principles. To successfully install a light logger, the technician will perform the following steps:

1. **Identify the light to be metered.**
2. **Minimize impacts on the logger from other light sources.** If light from another bulb or from the sun can reach the light logger's sensor, it may record a false reading. To prevent this:
   - → Consider the path of the sun throughout the day.
   - → Consider reflection and refraction from nearby materials.
   - → Consider other fixtures nearby.
3. Before the logger is deployed, the screen should look like Figure 1. If the screen is different or blank, then there is a problem with the logger. Set it aside and choose another.

Figure 1: Logger Screen before Deployment

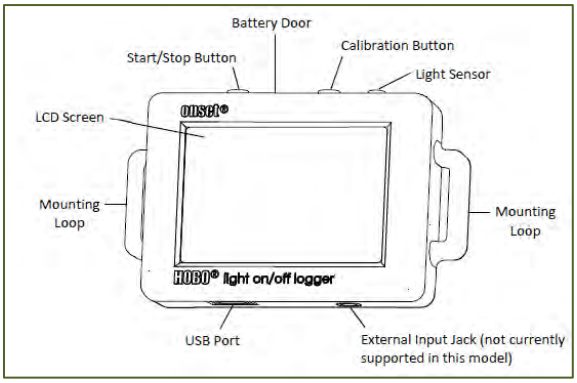
4. **Set the light logger.** To do this, press and hold the start/stop button for 3 seconds to start or stop logging data. (Figure 2).

Figure 2: Setting Light Logger



5. **Auto-calibrate the Light Logger** (Figure 3).

Figure 3: Auto-calibrating the Light Logger



- → After launching, deploy the logger near the light source to be monitored and turn the light source on.
- → Press the Calibrate button for 1 second. The LCD screen will display the signal strength of the light. The signal strength should ideally be at least 3 bars. Orient the logger as necessary to increase the signal strength.
- → Press the Calibrate button for 3 seconds while "HOLD" appears on the LCD screen. Move your hand away from the logger to prevent shadowing. The logger will count down to the auto-calibration and then display either "PASS" or "FAIL" after calibration is complete.
- → If the auto-calibration fails, point the sensor directly at the light source and then repeat these steps.
- → If you cannot get the logger to respond correctly in a given fixture, move on to the next fixture.
- → **Note:** The sensor is sensitive to lights that emit high amounts of infrared radiation like incandescent and halogen bulbs. It is best to use auto-calibration when possible when monitoring on/off conditions for lights with high infrared radiation.
- → **Note:** Auto calibration does not apply to DENT TOU-L loggers. DENT TOU-L loggers have sensitivity dials on them and a "sun" appears on the display when the logger is able to sense the light. Starting from the off position auditors increase the sensitivity while the light is on until the "sun" shows in the display.

6. When the logger is correctly responding to the light, assess the best mechanism to attach the logger to the light. The light logger can be attached with one or more of the following items:
   - → 3M Command Strips
   - → Zip ties
   - → Magnets on back of logger

   Avoid placing the light logger so it directly contacts the light. Place the sensor in an area with minimal potential to damage the fixture or light.

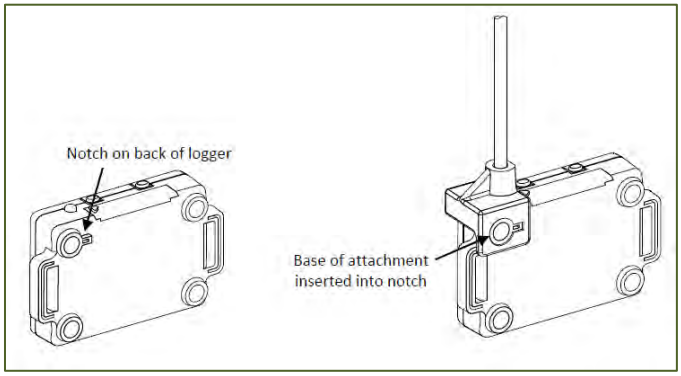
7. To ensure that the light logger is still responding, turn the light on and off, and verify the bulb icon appears and disappears.

Figure 4: Light On - Bulb On

8. If the light logger is in a location with significant sun exposure or other light sources, and you cannot get the logger to respond to the light, and then install the logger with the fiber optic attachment (light pipe). The light pipe connects to the back of the logger. Locate the notch in the upper left corner next to the mounting magnet. Insert the black base of the attachment into the notch so that the base clips onto the corner of the logger as shown in Figure 5.

9. **Light Pipe Deployment Guidelines** - follow these instructions when you need to use a light pipe:
   - → Make sure the end of the light pipe is as close to the light source as possible.
   - → Maximize the signal strength on the logger LCD screen by adjusting the light pipe while looking at the signal bars.
   - → Be sure to secure the light pipe after the signal has been optimized.
   - → Do not support the logger by the light pipe.
   - → Be sure that the pipe is seated all the way into the bracket before deployment.

Figure 5: Attached Light Pipe



   - → Set the logger, as described above.
   - → Attach the logger in a discrete area using the 3M Command Strip, Zip ties, or the magnets.

→ Direct the tip of the pipe as close as possible to brightest part of the light (see Figure 6).

Figure 6: Fiber Optic Eye Aimed at Brightest Part of Light

→ Do not bend the light pipe at sharp angles—this will damage it.

→ Turn the light off. If the bulb icon remains on, auto-calibrate the lighting logger again. The light may need to be turned on and off multiple times before the light logger is properly adjusted.

10. The loggers are configured to operate with the LCD screen off.

→ Once the logger is deployed, the screen will turn off after 10 minutes. You can reactivate the display for 10 minutes by pressing the start/stop button.

Installation Tips

- Install logger on the fixture in a way that is the least obtrusive to the homeowner.
- To minimize disturbances that could invalidate the data:
  - Position the light sensor so only light from the fixture is recorded;
  - Consider the path of the sun, reflection and refraction from nearby materials, and other fixtures;
  - Use a light pipe to focus in on the light source if the fixture is near a window or in a place where it is difficult to eliminate exposure to ambient light
- Be creative! While the magnets may be the easiest way to attach the logger to the fixture, it might not be the best placement to capture light – use the Velcro strip, zip ties, adhesive strips and magnets (or any combination of these) to install the logger in the optimum position.

Logger Numbers

3 possible versions of ID#s

Installation Examples: Good and Bad

Ceiling Fans

NO

Unable to focus on one bulb; captures too much ambient light

Unable to detect any light from bulbs

YES

If unable to place the logger closer, use light pipe to focus in on light source

Attached by magnets with light sensor pointed down toward the bulb

Wall Mounted Fixtures

NO

Logger is placed so the fixture blocks it from detecting light.

YES

Logger is placed next to the fixture with a light pipe curving around fixture to focus directly on the light source

Under Cabinet Fixtures

NO

Logger is installed away from the light source and the light sensor is up against the cabinet.

YES

Logger is placed with the light sensor facing the light source.

Table Lamps

NO

Logger is too far from light source, subject to external light, and obstructs use of the lamp.

YES

Logger is inside lamp and out of the homeowner's way.

Flush Mounts:

NO

Logger is too visible to homeowner.

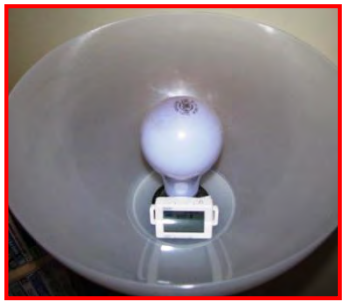
YES

Logger is installed on the base of the fixture;
NOTE: Loggers can melt if placed too close to bulbs in an enclosed fixture!

Logger is installed inside the lip of the light cover without being too visible to the homeowner.

Floor Lamps

NO



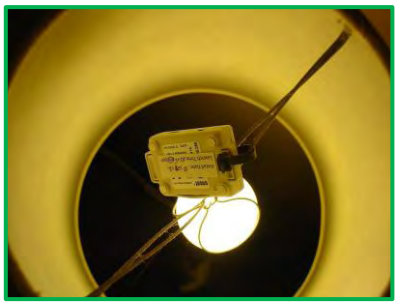
Logger is not attached to anything; it's also placed too close to the bulb and may melt.

Installed with light sensor facing away from the bulb.

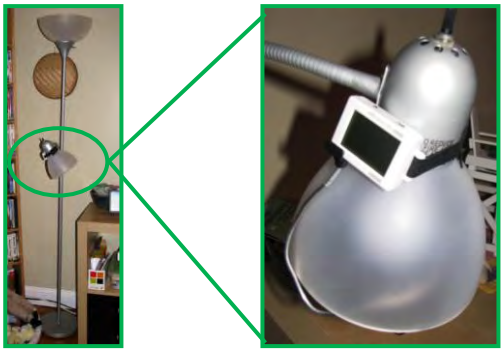
Logger is not focused in on any light source.

Floor Lamps (cont)

YES



Logger is attached to lamp shade with zip ties with the light sensor facing the bulb.



Logger is attached with the Velcro strip and uses a light pipe to focus in on the source.

Recessed

NO

Logger will not be able to accurately measure light from this fixture.

YES

This is a curved recessed fixture – logger is installed using a 3M strip on the Velcro strap to stick to the curved surface

---

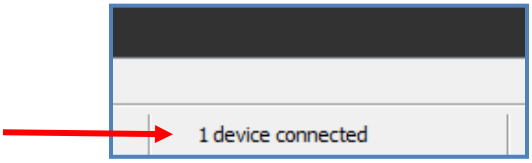
Melted Loggers

Logger was ~ 1in away from incandescent bulb and was too hot.

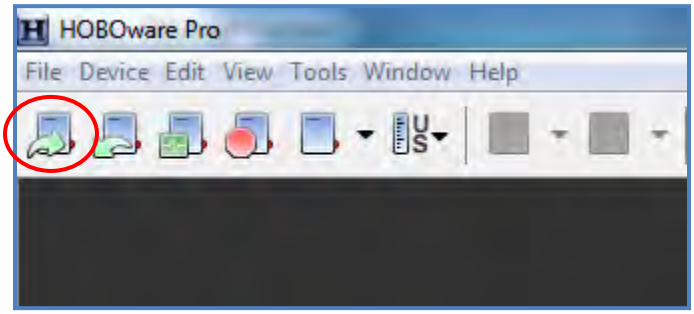
Moved to inside glass cover to distance it from the heat but still close enough to detect the light.

5.6 Resetting a Logger

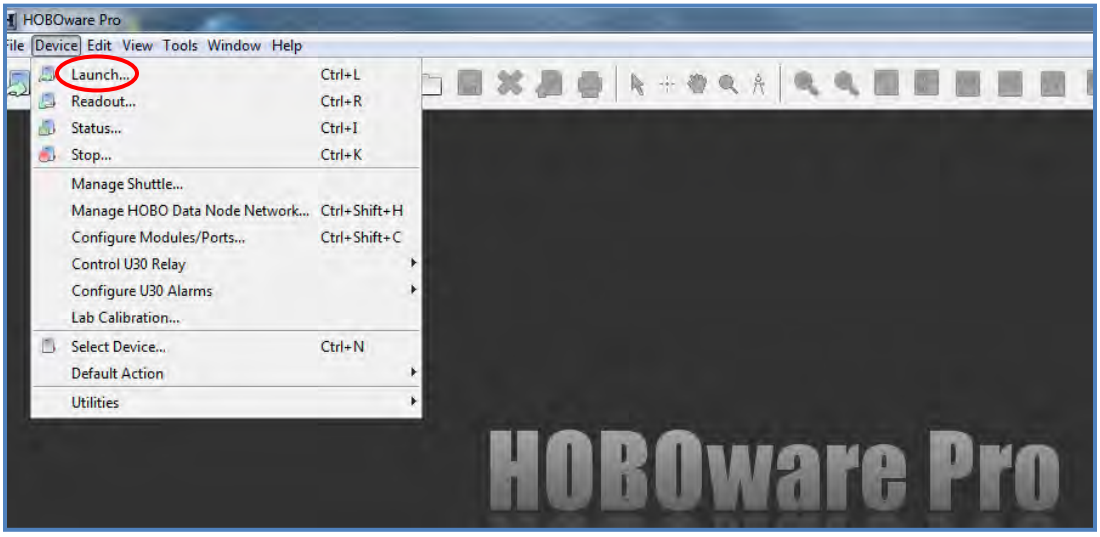
1. Open HOBOware Pro
2. Attach logger to computer with USB cord provided.
3. Once the logger is connected, you'll see this on the bottom right corner of your screen:



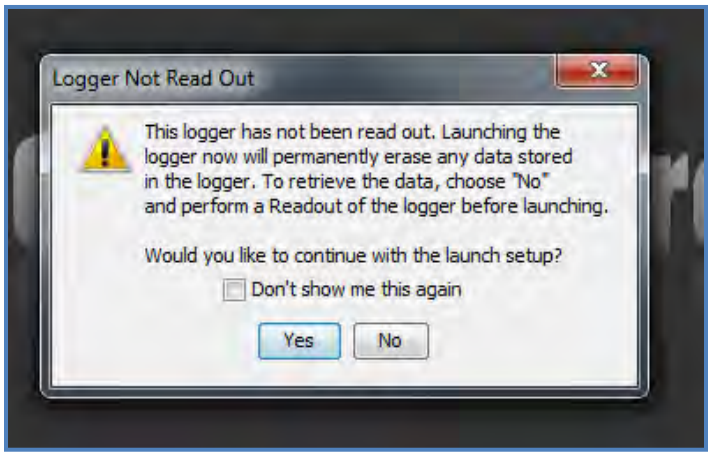
4. Click the **Launch Device** button



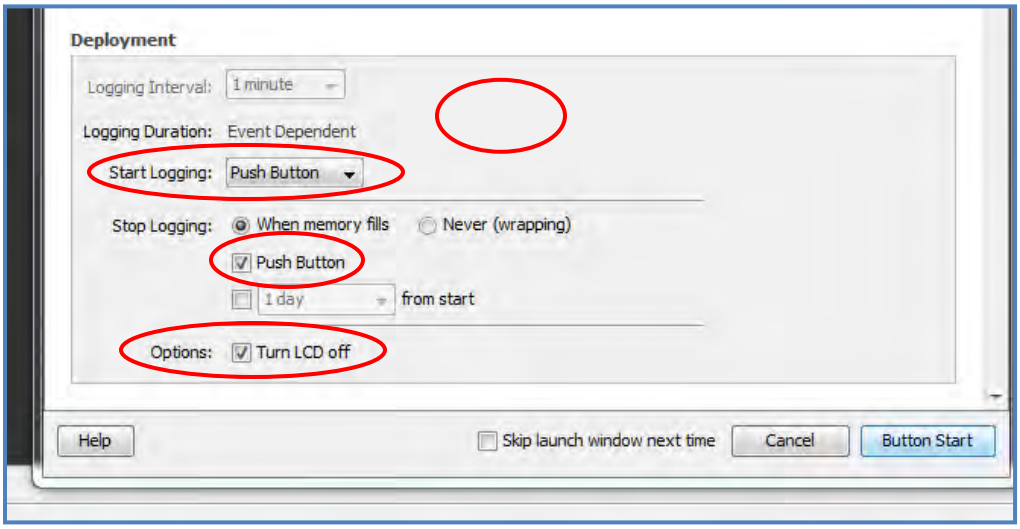
OR choose **Launch** from the **Device** dropdown menu:



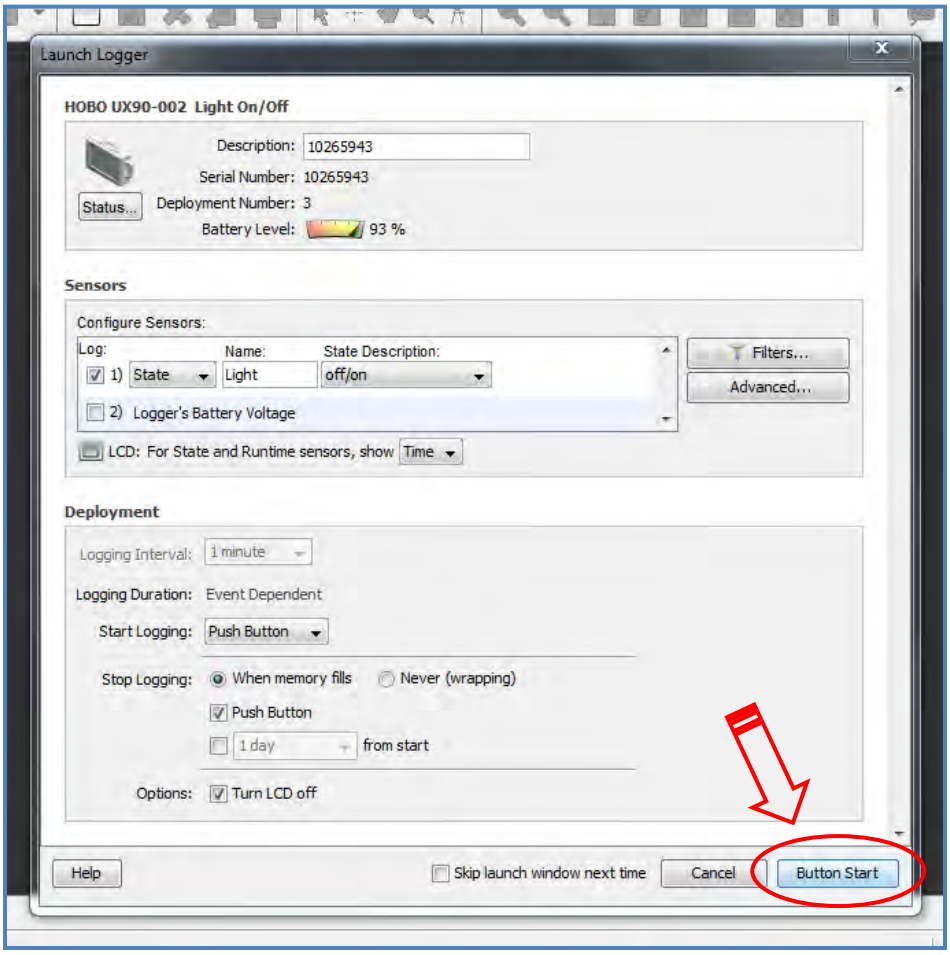
5. When you see the Logger Not Read Out screen, click YES. *(This is only to reset the logger so it is not necessary to read out the data)*



6. On the Launch Logger screen, make sure that:
   - → Start Logging is set to Push Button
   - → Stop Logging has the Push Button box checked
   - → Options has the Turn LCD Off box checked



7. Once the Launch Logger screen is set, click BUTTON START.



8. Logger is now reset now and can be calibrated again.

5.7 Logger Removal Protocols

Prior to removing light loggers, removal technicians will receive the logger installation data, which indicates the rooms and fixtures where loggers were installed in winter 2012. Field technicians will visit participants' homes in the summer of 2013 (six months later) to conduct logger removals and obtain additional data for the HOU analysis. Field technicians will also record *in situ* observations and photograph each logger prior to removal. The logger removal and data collection process includes the following:

- Photograph the logger prior to removal.
- Indicate the orientation of the sensor or fiber optic eye (e.g., Is the sensor directed towards the light source?)
- Perform a state test to determine whether or not the logger accurately records event data; turn the light on and off to ensure that the sun icon appears and disappears appropriately.
- Remove logger and review the total time on from logger screen.
- If the time on indicates extreme low use or extreme high use, ask the participant to verify, based on their own usage of the light fixture in question.
- Ask participant whether logger has fallen off the fixture or has otherwise been uninstalled prior to the technician's removal site visit; if so, ask participants to provide a date and time. **[Note: During the installation visit, participants will be asked to call and inform us if something does happen to the logger.]**
- Note the presence of windows and televisions/computers in rooms where loggers are installed.
- Note the condition of loggers upon removal and assess the battery status.
- Ask the participant to estimate typical usage for each metered fixture (e.g., 4 hours per day in the afternoon only).
- Record the presence of children under the age of 18 living in the home.
- If a logger is installed in a basement, record whether the basement is finished or unfinished.

After removing loggers, carefully pack and store loggers. Return the loggers to the project manager. Data from the loggers will be downloaded using appropriate software, raw data will be exported into CSV (comma separated values), and uploaded to the project's SharePoint site where analysts will access the data for review and analysis.

6 Quality Assurance and Control Procedures

As with all of our work, NMR endeavors to maintain a high quality work product. The sensitive nature of onsite work means that we take special precautions to ensure the quality of data collected and to avoid jeopardizing the relationship our clients have with their customers. To that end, we employ a number of steps to ensure that onsite technicians perform quality work that reflects well on NMR and our clients.

Our quality control and standard operating procedures begin well before a field technician ever steps foot in a customer's home. All of our field technicians receive rigorous project specific training. Training topics include project background, project specific data collection protocols, and customer service and interaction training. We also provide our scheduling staff with an overview of this training so that they know what customers will expect when they agree to participate and are able to answer any questions customers may have. We make every effort to ensure that customers are fully informed and avoid unnecessary surprises.

Below, we outline some of the specific quality control and training measures we will utilize for the Regional HOU study.

Quality Control and Training Measures:

- All field staff will receive training directly from NMR staff using training materials successfully implemented in similar onsite lighting saturation studies but tailored to the unique needs of the Regional Logger Study. Training for this project will include instruction on how to perform the following:
  - Identify various types and shapes of sockets, light bulbs, and controls
  - Examine light bulbs in a safe manner, including instructions on what equipment to bring to a home, working with covered fixtures, and clean-up of (especially CFLs and fluorescents) and compensation for bulbs and fixtures accidentally damaged during the visit
  - Ensure that they have located and inventoried all light bulbs (including stored bulbs) in the home through such procedures as creating a home schematic, mapping their route through the home, and documenting difficult-to-characterize lighting with pictures.
  - Correctly setup and install lighting loggers
- Training will also include some background on EISA and its requirements so that the field technician can answer questions he or she may receive on this topic while performing the inventory.
- The NMR project manager or a designated staff member will accompany each part-time field technician on their first day of site visits.
- The NMR project manager or a designated staff member will recruit participants and schedule appointments, assigning them to field staff based on location and work load.

- Each field staff member will be required to report his or her progress at the end of each day and forward hard copies of completed onsite forms to the NMR project manager for review each week.

In addition to reviewing the onsite forms, NMR staff will call 20% of participants to ensure that their experience with the field technician was satisfactory, and we will also revisit approximately 5% of the homes and repeat the data collection and observe logger installation to make sure the technician performed all tasks in a satisfactory manner.

7 Frequently Asked Questions

- **What is this device and how do I know what it does?**

  The device is called a "lighting logger." It is about the size of a business card but is ½ inch thick. **[SHOW CUSTOMER A LOGGER]** The type of lighting logger we use can tell when you turn you the light it is attached to on and off, but it does not collect any other information. If you want to know what the loggers look like, they can be found easily through a web search of the term "lighting logger." We will mainly be using the "HOBO" and "DENT" brands. It does not send any information wirelessly or emit any signals; it just records when the light is on or off.

- **What's in it for me and how long will this take?**
  We are offering $150 for your time when we install the loggers and $100 when we pick up the logger six months later. This is a total of $250. The visit should take around one hour, depending on the size of your house

- **What does the visit involve?**
  Technicians will walk around your home and count the various types of lighting products you have installed. They will also install some lighting loggers to record how often you use certain lights.

- **Where will the loggers be installed?**
  Technicians will install the loggers in a way so they do not interfere with normal use of lights. The loggers are very small and will not interfere in any way with the normal use of your lights.

- **When do you remove the loggers?**
  The loggers need to remain in place for six months. At the end of six months we will return to remove the loggers. We will schedule the visits at a time that is convenient for you.

- **What do I do if something happens to my light in the next six months?**

  → **A bulb with a logger burns out?**

  → **Something breaks?**

  → **The logger is removed?**

  If your light bulb burns out, replace the bulb as you normally would and continue to use the light as normal. The logger will not be affected.

  If, the logger is removed for any reason (falls off the fixture, uninstalled, something else) please call us and let us know. Please contact Kiersten von Trapp at 617-284-6230 x18. You can set the logger aside and we will collect it with the others when we return.

- **Why six months?**
  We need to record their lighting usage over time to account for differences in usage based on varying daylight conditions. Households use their lights differently during the winter months and summer months.
- **Who we are?**
  I am _____ and I work for the NMR, a consulting firm. We have been hired by [SPONSOR] to perform this study.
- **Purpose of Study?**
  - → Establish customer awareness of lighting options and changes in the lighting market
  - → Understand how people use the light bulbs in their home, as this has a large impact on how much energy households use.
  - → Determine current rates of use and storage for various light bulbs
  - → The results of the study will be used in planning for future energy needs in NYSERDA
- **How do I know you are legit?**
  NYSERDA is sponsoring this program and study. The contact person is Victoria Engel-Fowles. Her phone number is 518-862-1090 x3207 and her email address is vse@nyserda.org.

7.1 The Energy Independent and Security Act (EISA of 2007)

This section is meant to provide field technicians a brief overview of EISA and potential impacts on lighting. While knowledge of EISA is not crucial to field technicians performing their duties, EISA in-part prompted this study and it is possible that customers may ask questions about EISA during onsite visits.

Summary

The Energy Independence and Security Act (EISA) of 2007 sets maximum wattage levels by lumen output (that is, how bright the bulb is) for medium, screw-base bulbs that have a range from 310 to 2,600 lumens (Table 13). Bulbs not meeting these standards will be phased out over the next few years. This lumen range generally corresponds to the brightness of 40 Watt to 100 Watt incandescent bulbs, and it is primarily incandescent bulbs that will be phase out.

The standards started to go into effect under a phased approach that began in 2012, when general service bulbs (that is, typical bulbs) began to be required to use from 20 percent to 30 percent less energy than current incandescent bulbs. The law first applied to bulbs in the 1,490 to 2,600 lumen range, effectively banning the manufacture and import of general service 100 Watt incandescent bulbs in the United States after January 1, 2012. Over the next few years, the law will limit the manufacture and import of all general service incandescent bulbs between 40 and 100 Watts.

Table 13: EISA Phase-out Schedule – Stage 1

Rated Lumen Ranges	Typical Current Lamp Wattage	Maximum Rate Wattage	Minimum Rate Lifetime	Effective Date
1490-2600	100	72	1,000 hours	January 1, 2012
1050-1489	75	53	1,000 hours	January 1, 2013
750-1049	60	43	1,000 hours	January 1, 2014
310-749	40	29	1,000 hours	January 1, 2014

EISA prohibits the manufacture and import of incandescent bulbs, but not the sale of incandescent bulbs. Therefore, standard incandescent bulbs will remain available to consumers on retailers' shelves until all stock acquired before the relevant effective date, is sold. Additionally, as remaining stocks sell out, consumers will have the option of replacing higher-wattage incandescent bulbs with lower-wattage ones during the transition period. Some stores, however, have voluntarily chosen not to carry certain wattages of incandescent bulbs in anticipation of the law's implementation.

Important Details

- On December 19, 2007, President George W. Bush signed H.R. 6, the Energy Independence and Security Act of 2007, into law (Public Law 110-140).
- Sets maximum wattage levels by lumen output for medium, screw-base bulbs:
  - → 310 to 2,600 lumens, which roughly correspond to the brightness emitted by 40 Watt to 100 Watt incandescent bulbs
  - → Began to be implemented on January 1, 2012; during this study its main impact will be on 1,050 to 2,600 lumen bulbs (100 Watt and 75 Watt incandescent bulbs)

Manufacture vs. Sale

EISA prohibits the **manufacture** and **import** of incandescent bulbs but does **not** prohibit the **sale** of incandescent bulbs. So people can still buy incandescent bulbs until the current stock runs out, and they may also use lower wattage bulbs not yet covered by EISA to replace higher wattage ones when they are no longer available in stores.

Consumer Lighting Options

Consumers have a variety of options for replacement bulbs for those being phased out:

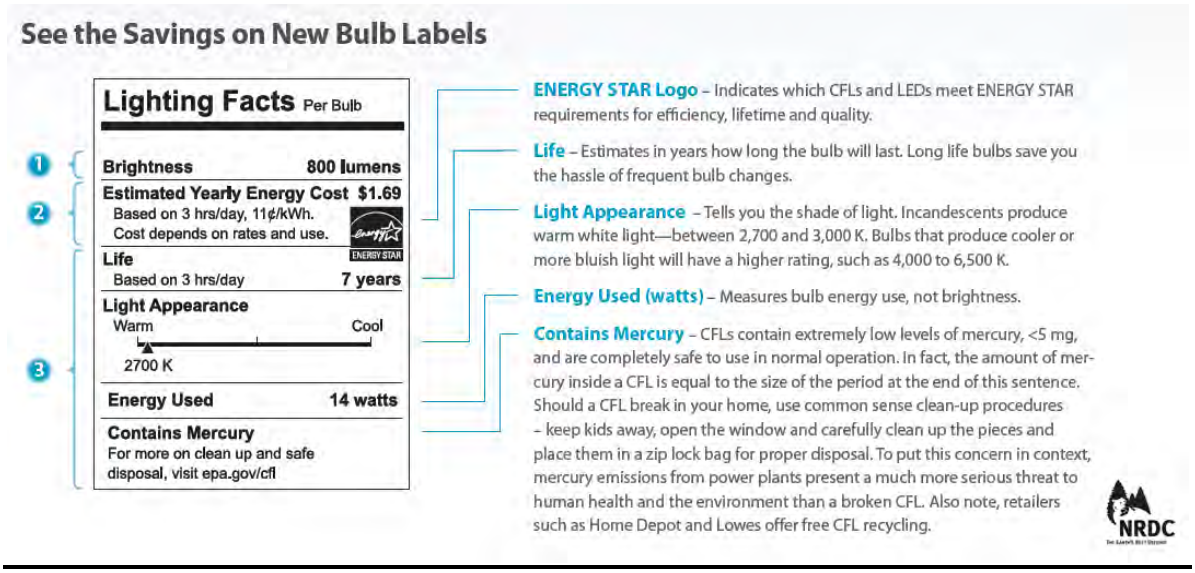
- Lower wattage incandescent bulbs (Cost is less than $1)
  - → Most similar to what many costumers are familiar with
- EISA-compliant halogen bulbs (Cost between $1.50 and $3.00)
  - → About 30% more efficient that standard incandescent bulbs
  - → Similar to standard incandescent bulbs in terms of appearance and light quality
- CFL bulbs (Cost between $1.00 and $3.00)
  - → More efficient than standard incandescent bulbs
  - → Some consumers concerned by mercury in CFL bulbs

- Non-directional LED bulbs (as opposed to spot and flood LEDs) (Cost between $10 and $20)
  - → Only a few on the market currently – still a developing technology
  - → While the price has been declining, still an expensive option and most consumers will not view LEDs as a viable replacement option until the price decreases.

Consumer Response

Consumer awareness of the EISA-mandated phase-out of incandescent bulbs and on how to choose light bulbs based on factors other than "wattage" (which most consumers equate with brightness) is relatively low. The Federal Trade Commission (FTC) has developed a new lighting facts label to help consumers make informed purchase decisions based on lumens instead of wattages and lifecycle costs.

Figure 7: FTC Lighting Facts Label



8 Mileage Tracking Form

NMR Group, Inc.

Regional Hours of Use Study
Time and Mileage

Time Sheet								
Task	Hours							Total Hours
	Mon	Tues	Wed	Thurs	Fri	Sat	Sun	
Training								
Onsite								
Travel								
Paper Work								
TOTAL:								

Mileage Log			
Date	Origination	Destination	Distance
		TOTAL:	

Name: _____ Week of: _____

Signature: _____ Date: _____

50-2 Howard Street, Somerville, MA 02144
Phone: (617) 284-6230 Fax: (617) 284-6239
www.nmrgroupinc.com

9 Reimbursement Form

Regional Hours of Use Study

Reimbursement Form

Homeowner Name: _____

Address: _____

_____

Phone: _____

Technician: _____

Date of Visit: _____ Time: _____

Description: _____

_____

- Please attach a receipt for the replacement light bulb to this form and mail this form and the receipt to:

  Attn: Kiersten von Trapp
  NMR Group Inc
  50-2 Howard St.
  Somerville, MA 02144

50-2 Howard Street, Somerville, MA 02144
Phone: (617) 284-6230 Fax: (617) 284-6239
www.nmrgroupinc.com

10 EPA Cleanup and Disposal Guidelines for CFLs

Cleanup and Disposal Guidelines
For Compact Fluorescent Light Bulbs (CFLs)
June 2008

What precautions should I take when using CFLs in my home?
CFLs are made of glass and can break if dropped or roughly handled. Be careful when removing the bulb from its packaging, installing it, or replacing it. Always screw and unscrew the light bulb by its base (not the glass), and never forcefully twist the CFL into a light socket. If a CFL breaks in your home, follow the clean-up recommendations below. Used CFLs should be disposed of properly (see below).

What should I do with a CFL when it burns out?
EPA recommends that consumers take advantage of available local recycling options for compact fluorescent light bulbs. EPA is working with CFL manufacturers and major U.S. retailers to expand recycling and disposal options. Consumers can contact their local municipal solid waste agency directly, or go to www.epa.gov/bulbrecycling or www.earth911.org to identify local recycling options.

If your state or local environmental regulatory agency permits you to put used or broken CFLs in the garbage, seal the bulb in two plastic bags and put it into the outside trash, or other protected outside location, for the next normal trash collection. Never send a fluorescent light bulb or any other mercury-containing product to an incinerator.

If your ENERGY STAR qualified CFL product burns out before it should, look at the CFL base to find the manufacturer's name. Visit the manufacturer's web site to find the customer service contact information to inquire about a refund or replacement. Manufacturers producing ENERGY STAR qualified CFLs are required to offer at least a two-year limited warranty (covering manufacturer defects) for CFLs used at home. In the future, save your receipts to document the date of purchase.

How should I clean up a broken fluorescent bulb?
Because CFLs contain a small amount of mercury, EPA recommends the following clean-up and disposal guidelines:

1. Before Clean-up: Air Out the Room

- Have people and pets leave the room, and don't let anyone walk through the breakage area on their way out.
- Open a window and leave the room for 15 minutes or more.
- Shut off the central forced-air heating/air conditioning system, if you have one.

2. Clean-Up Steps for Hard Surfaces

- Carefully scoop up glass fragments and powder using stiff paper or cardboard and place them in a glass jar with metal lid (such as a canning jar) or in a sealed plastic bag.
- Use sticky tape, such as duct tape, to pick up any remaining small glass pieces and powder.
- Wipe the area clean with damp paper towels or disposable wet wipes. Place towels in the glass jar or plastic bag.
- Do not use a vacuum or broom to clean up the broken bulb on hard surfaces.

3. Clean-up Steps for Carpeting or Rug:

- Carefully pick up glass fragments and place them in a glass jar with metal lid (such as a canning jar) or in a sealed plastic bag.
- Use sticky tape, such as duct tape, to pick up any remaining small glass fragments and powder.
- If vacuuming is needed after all visible materials are removed, vacuum the area where the bulb was broken.
- Remove the vacuum bag (or empty and wipe the canister), and put the bag or vacuum debris in a sealed plastic bag.

4. Clean-up Steps for Clothing, Bedding, etc.:

- If clothing or bedding materials come in direct contact with broken glass or mercury-containing powder from inside the bulb that may stick to the fabric, the clothing or bedding should be thrown away. Do not wash such clothing or bedding because mercury fragments in the clothing may contaminate the machine and/or pollute sewage.
- You can, however, wash clothing or other materials that have been exposed to the mercury vapor from a broken CFL, such as the clothing you are wearing when you cleaned up the broken CFL, as long as that clothing has not come into direct contact with the materials from the broken bulb.
- If shoes come into direct contact with broken glass or mercury-containing powder from the bulb, wipe them off with damp paper towels or disposable wet wipes. Place the towels or wipes in a glass jar or plastic bag for disposal.

5. Disposal of Clean-up Materials

- Immediately place all clean-up materials outdoors in a trash container or protected area for the next normal trash pickup.
- Wash your hands after disposing of the jars or plastic bags containing clean-up materials.
- Check with your local or state government about disposal requirements in your specific area. Some states do not allow such trash disposal. Instead, they require that broken and unbroken mercury-containing bulbs be taken to a local recycling center.

6. Future Cleaning of Carpeting or Rug: Air Out the Room During and After Vacuuming

- The next several times you vacuum, shut off the central forced-air heating/air conditioning system and open a window before vacuuming.
- Keep the central heating/air conditioning system shut off and the window open for at least 15 minutes after vacuuming is completed.
- For more information about compact fluorescent bulbs, visit http://www.energystar.gov/cfls

For more information about compact fluorescent bulbs and mercury, visit http://www.energystar.gov/mercury EPA is continually reviewing its clean-up and disposal recommendations for CFLs to ensure that the Agency presents the most up-to-date information for consumers and businesses.

Regional Hours of Use Study: Onsite Handbook

New York State

6/12/2013

Prepared for:

The Massachusetts Energy Efficiency Program Administrators

The Connecticut Energy Efficiency Board Evaluation Consultant

National Grid Rhode Island

The New York State Energy Research and Development Authority

50-2 Howard Street, Somerville, MA 02144
Phone: (617) 284-6230 Fax: (617) 284-6239
www.nmrgroupinc.com

Contents

Tables

1 Training Plan

- Independent Review of Materials – The purpose of this document is to provide all the information required to conduct site visits to collect the loggers installed for the Regional HOU Study. All field technicians should **review this document in its entirety prior to the over-the-phone training session.** *(1 hour)*
- Store Visit **[for new technicians only]** – All field technicians will go to a hardware, lighting, or big box retailer to familiarize themselves with various bulb types. *(1 hour)*
- Over-the-Phone Training Session – All field technicians will have an over-the-phone training session with the NMR program manager to review the protocols, onsite forms, and equipment required for this project. *(30 minutes)*

2 Background / Purpose of the Study

The parties responsible for evaluation of energy-efficiency programs in Massachusetts, Connecticut, Rhode Island, and New York have committed to conducting a study to estimate hours of use (HOU) of light bulbs in homes. The main objective of this study, therefore, is to estimate HOU, and we will do so by room type, not lighting type (technology) as many studies have done in the past. Our focus on room types assumes that people are likely to use their lights in a given room the same way regardless of the type of bulbs in the room.

To accomplish this objective, in the winter of 2012-2013 field technicians conducted an inventory of lighting to determine the number and type of bulbs installed in customers' homes, and installed a series of lighting loggers to capture information on how customers use lights in their homes. Technicians are now returning to the sites to collect the lighting loggers in order to retrieve the data for analysis.

NMR is scheduling the follow up visits for this study via telephone. As a field technician you will be provided with a list of customers to visit each week. This list will include the customer's name, telephone number, address, and an appointment time. You will also receive a check for each participant prior to visiting their home.

3 Onsite Protocol

Prior to removing light loggers, technicians will receive the logger installation data, which indicates the rooms, fixtures and bulb characteristics where loggers were installed in six months earlier; when available, the technicians will also receive the home schematic showing the exact location of the installed loggers.

Prior to Visit

Before visiting a home, you should make sure that, at a minimum, you have the following:

- → Onsite handbook
- → Data Form & Home Schematic
- → Appointment sheet
- → Company Polo Shirt
- → ID Badge
- → GPS

Materials for Customer

- → FAQs and Info Sheet
- → NMR contact's business card
- → Check ($100)

CFL Clean up Kit

- → Sealable plastic bags
- → Disposable wipes
- → Vacuum
- → Duct tape
- → Flat brush

Logger Removal Kit

- → Camera
- → Flashlight
- → Pen/Pencils
- → Flat & Philips head screwdrivers
- → Insulated gloves
- → Shoe coverings
- → Latex gloves
- → Step ladder
- → Wire Cutters
- → Scissors
- → Cleaning rags
- → Adhesive Remover Solution with Scraper
- → Sealable sandwich bags
- → Trash bag

Arrival at Onsite

After the door is opened, immediately ascertain that the person at the door is the scheduled interviewee. Introduce yourself and hand him/her the business card.

- **Sample Introduction** *(not to be read verbatim)***:**
  "Hello, my name is _____, and I am working with NMR. NMR is working under contract with ***NYSERDA (the New York State Energy Research and Development Authority)****. I'm here to meet with _____. As mentioned on the phone, I'm here to walk through your home and collect the loggers that were installed on selected fixtures six months ago.* ***[Customer should be expecting inspector]****. During my visit I have a few wrap-up questions for you about the status of the loggers during the duration of the study, as well as some limited demographic questions. Today, in appreciation for your time, on behalf of* ***NYSERDA****, you'll also receive the second payment of $100. Do you have any questions regarding my visit?"*

Prior to Data Collection

- Give the customer a step by step description of what you'll be doing (show the data collection form as you explain)
  - → First I will remove the loggers installed in your home.
  - → Then I will ask you a few questions about the loggers as well as some demographic questions.
- The customer should not be surprised by any of this information as they have already been told what the study will consist of.

General sequence of data collection

- Logger Removal:
  - → Consult logger removal instructions.
  - → Check that the information provided for each logger is correct; record any discrepancies.
  - → For each logger, ask the homeowner, *"Were there any changes to this logger, light bulb, or fixture during the duration of its installation?"* and record response.
- Customer Survey:
  - → Ask the homeowner the demographic questions in the customer survey.
- After Data Collection:
  - → Thank the customer for his/her time
  - → Give him/her the $100 check.
  - → Have the customer sign off on your data collection form to indicate that you visited their home and provided him/her with a $100 check.
  - → Leave with the customer the "Logger Participant Frequently Asked Questions" one-page sheet.

4 Onsite Form Instructions

NMR will provide you with onsite forms specific to each site. These forms will be pre-filled with the logger ID number, room, fixture type, bulb type, bulb shape and socket type for each logger expected to be installed in each site.

Customer Information

→ Customer Name, Customer Address, and Customer ID will be provided on the sheet.

→ Fill in your name and the date and time of the appointment.

Site Specific Notes

→ NMR will include any known issue associated with a logger or household in this column (ex. The resident phoned NMR to report a logger had melted.)

→ If applicable, follow up on this comment with the homeowner.

Logger Retrieval Form

→ Using the information and home schematic (if applicable) provided by NMR, locate each logger installed in the home.

→ **Before removing the logger**, ask: ***Were there any changes to this bulb, logger, or fixture during the time the logger was installed?***

- If yes, take a photo of the logger and the replacement bulb
- Record any changes in the box provided (detailed instructions provided below)

→ **For each logger**, check that the pre-filled information is correct.

→ If there are any discrepancies between the expected and installed logger number, fixture, or bulb information provided, **fill in the actual information on the corresponding line below**.

→ **Record all information in clear, easy to read handwriting**

Logger ID

→ If a logger number has an asterisk (*), this number has been identified as one that **needs to be double checked** – record the correct logger number for each of these on the line below (even if it is the same).

→ **Always include a note for these loggers** (even if it is just "everything correct") so that we can confirm it was double-checked.

Room, Fixture Type, Bulb Type, Bulb Shape, Socket Type

→ Record any discrepancies in the row below the pre-filled information.

→ If a bulb has been changed, record the new bulb info in the box on the second page.

Light Pipe

→ For each logger, indicate if the logger has a light pipe attached (Y/N) in the space provided.

State Test

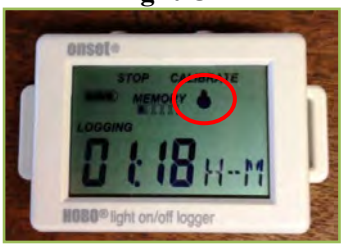
→ **<u>Before removing the logger</u>, perform a state test** to determine whether or not the logger accurately records event data.

- The logger screen will be blank – click one of the top buttons to make the screen appear (do not hold the button as that will stop the logger)
- Turn the fixture on and off; record whether the light bulb icon appears "on" and "off" appropriately (Pass/Fail).

→ If the battery is dead, or you are unable to complete the state test for a different reason, record this information in the box provided.

Light On

Light Off



Total Time

→ Record the total time either immediately before or immediately after removing the logger;

→ The time display shows the total amount of time the light has been on since logging began, ranging from seconds to days.

Hours & Minutes

1 hour, 18 minutes

Days & Hours

4 days, 17 hours (or 113 hours)

Usage Estimate

→ **<u>For each logger</u>**, ask the homeowner:

What was the typical usage for this fixture?

→ Record response in the column provided (Ex. 4 hours per day in the afternoon only).

→ **<u>Extreme Usage</u>:**

- Usage should be in the range of 70 to 800 hours - if the time on indicates extreme low use or extreme high use (anything above or below this range) **take photos of the fixture and the room.**
- Ex. If there is a window nearby, the logger may have been recording ambient light in addition to lamp usage.
- Do a quick calculation to see how the estimate compares to the total time:
  - The loggers have been in place approximately 150 days.
  - Ex. If the customer estimates 4 hours use per day, the total time should be in the range of 25 days (4 hours a day * 150 days = 600 hours. 600 hours/24 hours a day = 25 days).
- If the estimate and logger time are far apart, look for an explanation and ask the customer if they have any ideas that could explain the difference.

Record Changes

→ **<u>For each logger</u>**, ask the homeowner:

Were there any changes to this bulb, logger, or fixture during the time the logger was installed?

→ If "Yes", record the associated logger ID number and the date (or approximate date) the change occurred.

→ **If the bulb was replaced**, record the new bulb information in the space provided.

- For all bulb types record: Bulb type, shape, and wattage
- Ask: ***Was the new bulb a new purchase or was it a stored bulb?***
  1. Stored
  2. New Purchase
  3. Don't Know

Changes made since logger installation?		New Bulb				
Logger ID #	Date of Change	Bulb Type	Bulb Shape	Watts	Stored/ New	Other Change
12345678	4/13/13	CFL	T	13	New	

→ **If another change occurred**, record this information in the space provided for details.

Changes made since logger installation?		New Bulb				
Logger ID #	Date of Change	Bulb Type	Bulb Shape	Watts	Stored/ New	Other Change
87654321	2/4/13					Logger blew off fixture; home owner put it back up.

Customer Survey

→ Ask the homeowner:

- ***How many children under the age of 18 live in this household on a full time basis?*** *→ Record the number on the line provided.*

Additional Notes

→ Record any additional comments the homeowner may have or any other relevant observations in this column.

Customer Signature

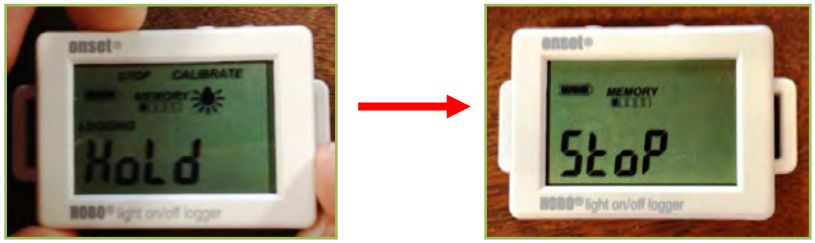
→ Have the homeowner sign the onsite form upon receiving their incentive check in the space provided on the cover page.

5 Logger Removal Protocols

5.1 Removing a Logger

To successfully remove a light logger, the technician will perform the following steps:

- Identify the fixture on which the logger is installed and locate the logger.
  - → If the customer offers to turn off the fixture and take it apart him/herself, **ALWAYS** let the customer do it.
  - → If there have been any changes to the bulb or fixture, take a photo of the bulb and fixture before removal.
- The logger screen should be blank when you find it; you can reactivate the display by quickly pressing the start/stop button. (Note: Do not hold the button for a few seconds, as that may turn the logger off)
- Remove the logger from the fixture **as carefully as possible**.
  - → If the customer offers to remove the logger from the fixture, let him/her do it.
  - → NMR will provide you with wire cutters and scissors to remove loggers installed with zip ties, as well as adhesive remover to remove any adhesive left from loggers installed with duct tape or 3M strips.
  - → Clean up all trash associated with logger removal; NMR will provide a small trash bag if there is not one easily accessible near the fixture.
- **Stopping a Logger**:
  - → Once you've removed the logger and recorded all the necessary data, stop the logger.
  - → Logging will end once you press the Start/Stop logging button for 3 seconds.



- **Light Pipes:**
  - → Some loggers will have light pipes attached to them. When you see one, inspect it to make sure it is still properly attached and pointing at the light bulb. If it is not, take a picture and make a note before removing the light pipe.
  - → To remove a light pipe: while holding the logger with the screen facing you, carefully push the base of the light pipe away from you:

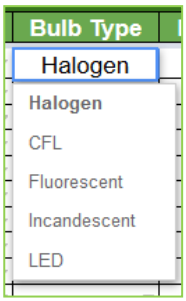
- **Packing Loggers:**
  - → **Put all loggers and the completed onsite form** from the site in one Ziploc bag and close the seal.
  - → The light pipes do not have to go in the site-specific Ziploc bag; all collected light pipes should be carefully packed together.

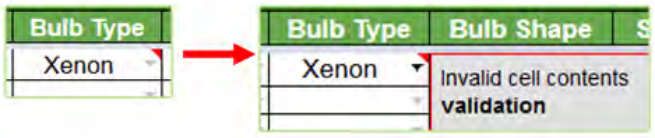
5.2 Removal Guidelines

- **Damage:**
  - → If you break or damage any fixtures, furniture, etc, give the customer the "Reimbursement Form."
  - → Note what was broken and contact the project manager as soon as possible to report the incident.
  - → Take a picture of the damage.
- **Broken Bulbs:**
  - → If you break any type of light bulb and/or if a broken CFL came into direct contact with clothing or bedding which subsequently needed to be thrown out, give the customer the "Reimbursement Form."
  - → Note what type of bulb was broken and contact the project manager as soon as possible to report the incident.
  - → Take a picture of the broken bulb and any other damage.
  - → **If a CFL or a fluorescent bulb should be broken**, refer to the "Cleanup and Disposal Guidelines for Compact Fluorescent Light Bulbs" of the Environmental Protection Agency (EPA) included in this packet.
- **Removing Bulbs or Fixture covers:**
  - → If the customer offers to turn off the fixture and take it apart him/herself, **ALWAYS** let the customer do it.
  - → **DO NOT TOUCH** if fixtures have cracked or damaged covers, or look delicate or easily breakable; if a logger is attached to such a fixture, proceed with caution with the homeowner present.
- **Burned Out Bulbs:**
  - → If a bulb is burned out, ask the customer the date (or approximate date) that the bulb burned out and record this in the appropriate spot on the onsite form.

5.3 Reporting Data

- At the end of each day, review the completed onsite forms to ensure that all necessary information is recorded and is clear and easy to read.
- **Entering Data into Google Docs:**
  - → Enter the completed onsite information into your Google doc for this project; all of your onsite data will be entered here.
  - → The Google doc has two tabs: **Logger Info** and **Customer Survey**. Enter the following information in each tab:
    - Logger Info:
      - Customer ID (repeat for all loggers associated with this ID)
      - Each Logger ID # and the correct information associated with each one
      - Any changes made since the loggers were installed – if no changes were made, enter an "N" under the "Change?" column.
    - Customer Survey:
      - Customer ID
      - Number of children under 18
      - Education
      - Additional Notes
  - → If provided, choose the correct information from the drop-down menu; if there is no drop-down menu, type in the recorded data.
    - Any onsite data that is not included in the drop-down menu can be typed in.
    - Ignore the red triangle that will appear in the upper right corner (and the comment box that appears when you scroll over the red triangle); this notifies you that the data entered is not in the list provided, but will not delete the cell contents.





- Upload, email, or text any photos to the NMR project manager at the end of each day with the associated Customer ID and Logger ID #.
- The NMR project manager will collect the loggers from you at the end of the project. Data from the loggers will be downloaded for review and analysis.

6 Quality Assurance and Control Procedures

As with all of our work, NMR endeavors to maintain a high quality work product. The sensitive nature of onsite work means that we take special precautions to ensure the quality of data collected and to avoid jeopardizing the relationship our clients have with their customers. To that end, to ensure that onsite technicians perform quality work that reflects well on NMR and our clients, the NMR project manager will:

- Review the onsite data entered on the Google doc at the end of each day.
- Call 20% of participants to ensure that their experience with the field technician was satisfactory.

7 Frequently Asked Questions

- **Who we are?**
  I am _____ and I work for NMR Group Inc, a consulting firm. We have been hired by NYSERDA to perform this study.
- **Purpose of Study?**
  The parties responsible for evaluation of energy-efficiency programs in Massachusetts, Connecticut, Rhode Island, and New York have committed to conducting a study to estimate hours of use (HOU) of light bulbs in homes. The main objectives of this study are as follows:
  - → Establish customer awareness of lighting options and changes in the lighting market
  - → Understand how people use the light bulbs in their home, as this has a large impact on how much energy households use.
  - → Determine current rates of use and storage for various light bulbs.
  - → The results of the study will be used in planning for future energy needs in Massachusetts, Connecticut, Rhode Island, and New York.
- **What happens with our data?**
  The lighting logger recorded when your light was turned on and off over the past six months. It did not collect any other information. When we download the data from the logger we will assign the information to a number (not a name) and no one will know that the data is for your home.
- **How can I find out the results?**

  The study results will be the property of NYSERDA and will become accessible to the public in the spring of 2014.
- **How do I know you are legit?**
  NYSERDA is sponsoring this program and study. The contact person is Victoria Engel-Fowles. Her phone number is 518-862-1090 x3207 and her email address is vse@nyserda.org.

8 EPA Cleanup and Disposal Guidelines for CFLs

Cleanup and Disposal Guidelines
For Compact Fluorescent Light Bulbs (CFLs)
June 2008

What precautions should I take when using CFLs in my home?
CFLs are made of glass and can break if dropped or roughly handled. Be careful when removing the bulb from its packaging, installing it, or replacing it. Always screw and unscrew the light bulb by its base (not the glass), and never forcefully twist the CFL into a light socket. If a CFL breaks in your home, follow the clean-up recommendations below. Used CFLs should be disposed of properly (see below).

What should I do with a CFL when it burns out?
EPA recommends that consumers take advantage of available local recycling options for compact fluorescent light bulbs. EPA is working with CFL manufacturers and major U.S. retailers to expand recycling and disposal options. Consumers can contact their local municipal solid waste agency directly, or go to www.epa.gov/bulbrecycling or www.earth911.org to identify local recycling options.

If your state or local environmental regulatory agency permits you to put used or broken CFLs in the garbage, seal the bulb in two plastic bags and put it into the outside trash, or other protected outside location, for the next normal trash collection. Never send a fluorescent light bulb or any other mercury-containing product to an incinerator.

If your ENERGY STAR qualified CFL product burns out before it should, look at the CFL base to find the manufacturer's name. Visit the manufacturer's web site to find the customer service contact information to inquire about a refund or replacement. Manufacturers producing ENERGY STAR qualified CFLs are required to offer at least a two-year limited warranty (covering manufacturer defects) for CFLs used at home. In the future, save your receipts to document the date of purchase.

How should I clean up a broken fluorescent bulb?
Because CFLs contain a small amount of mercury, EPA recommends the following clean-up and disposal guidelines:

1. Before Clean-up: Air Out the Room

- Have people and pets leave the room, and don't let anyone walk through the breakage area on their way out.
- Open a window and leave the room for 15 minutes or more.
- Shut off the central forced-air heating/air conditioning system, if you have one.

2. Clean-Up Steps for Hard Surfaces

- Carefully scoop up glass fragments and powder using stiff paper or cardboard and place them in a glass jar with metal lid (such as a canning jar) or in a sealed plastic bag.
- Use sticky tape, such as duct tape, to pick up any remaining small glass pieces and powder.
- Wipe the area clean with damp paper towels or disposable wet wipes. Place towels in the glass jar or plastic bag.
- Do not use a vacuum or broom to clean up the broken bulb on hard surfaces.

3. Clean-up Steps for Carpeting or Rug:

- Carefully pick up glass fragments and place them in a glass jar with metal lid (such as a canning jar) or in a sealed plastic bag.
- Use sticky tape, such as duct tape, to pick up any remaining small glass fragments and powder.
- If vacuuming is needed after all visible materials are removed, vacuum the area where the bulb was broken.
- Remove the vacuum bag (or empty and wipe the canister), and put the bag or vacuum debris in a sealed plastic bag.

4. Clean-up Steps for Clothing, Bedding, etc.:

- If clothing or bedding materials come in direct contact with broken glass or mercury-containing powder from inside the bulb that may stick to the fabric, the clothing or bedding should be thrown away. Do not wash such clothing or bedding because mercury fragments in the clothing may contaminate the machine and/or pollute sewage.
- You can, however, wash clothing or other materials that have been exposed to the mercury vapor from a broken CFL, such as the clothing you are wearing when you cleaned up the broken CFL, as long as that clothing has not come into direct contact with the materials from the broken bulb.
- If shoes come into direct contact with broken glass or mercury-containing powder from the bulb, wipe them off with damp paper towels or disposable wet wipes. Place the towels or wipes in a glass jar or plastic bag for disposal.

5. Disposal of Clean-up Materials

- Immediately place all clean-up materials outdoors in a trash container or protected area for the next normal trash pickup.
- Wash your hands after disposing of the jars or plastic bags containing clean-up materials.
- Check with your local or state government about disposal requirements in your specific area. Some states do not allow such trash disposal. Instead, they require that broken and unbroken mercury-containing bulbs be taken to a local recycling center.

6. Future Cleaning of Carpeting or Rug: Air Out the Room During and After Vacuuming

- The next several times you vacuum, shut off the central forced-air heating/air conditioning system and open a window before vacuuming.
- Keep the central heating/air conditioning system shut off and the window open for at least 15 minutes after vacuuming is completed.
- For more information about compact fluorescent bulbs, visit http://www.energystar.gov/cfls

For more information about compact fluorescent bulbs and mercury, visit http://www.energystar.gov/mercury EPA is continually reviewing its clean-up and disposal recommendations for CFLs to ensure that the Agency presents the most up-to-date information for consumers and businesses.

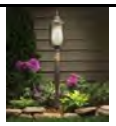
9 Onsite Reference Exhibits

Fixture Type

Table 1: Fixture Type List

Fixture	Code	Fixture	Code	Fixture	Code
Recessed	R	Wall Mount	WM	Walkway	W
Pendent	P	Night Light	NL	Exterior Flood	EF
Flush Mount	FM	Table Lamp	TL	Garage Door	G
Track	T	Floor Lamp	FL	Under Cabinet	U
Ceiling Fan	CF	Post Mount	PM	Other	O

Table 2: Fixture Type Exhibit

Fixture	Image	Fixture	Image
Recessed *(light bulb does not stick out of the plane of the ceiling)*		**Table Lamp** *(lamps that are put on tables)*	
Pendant *(fixture and bulb hangs from ceiling, i.e. chandelier)*		**Floor Lamp** *(lamps that are put on the floor)*	
Flush Mount *(fixture is flush with the ceiling)*		**Post Mount** *(exterior lights on a lamppost)*	
Track *(light bulbs on a strip/track)*		**Walkway** *(lights on a path outside the home)*	
Ceiling Fan *(lights attached to a ceiling fan)*		**Exterior Flood** *(fixtures that flood a large area with light, found on the side of home, above garage, or under peak of roof)*	
Wall Mount *(fixture attached to wall)*		**Garage Door**	
Night Light		**Under cabinet** *(lights under kitchen cabinets for lighting counter)*	

Bulb Type

Table 3: Bulb Types Code List

Bulb Type	Code	Bulb Type	Code
Incandescent	I	Halogen	H
CFL	CFL	Other	O
Fluorescent	F	Empty Socket	E
LED	LED		

Table 4: Bulb Types Exhibit

Bulb Types	Image	Description
Incandescent (I)		Bulbs have a filament that's heated to the point of glowing
Compact Fluorescent (CFL)		Bulbs are energy-efficient; use 67% less energy than incandescent bulbs and last longer. Covered CFLs have a plastic cover that conceals the traditional spiral shape. If you look closely at the bulb you will be able to see the spirals through the covering—especially when the bulb is turned on.
Fluorescent (F)		Bulbs are filled with mercury vapor that emits ultraviolet light when electricity is applied, then coating inside bulbs turns the UV rays into visible light
Light-Emitting Diode (LED)		Bulbs have a semiconductor chip so current flows through; light is released when an electron falls into a lower energy level. Some LEDs have a yellow filter.
Halogen (H)		More efficient type of incandescent bulb with filament sealed into a compact transparent envelope filled a small amount of halogen, allowing the filament to be at a higher temperature. Some halogens are virtually indistinguishable from regular incandescent bulbs. They may be smaller (ex. A-17 size instead of A-19) or can be distinguished by the presence of a glass tube around the filament (halogen) instead of the filament by itself (incandescent).

Bulb Shape

Table 5: Bulb Shape List

Bulb Shape	Code	Bulb Shape	Code
Twist/Spiral	T	Spot/Reflector/Flood	S
Globe	G	Circline	C
A-lamp	A	Tube	Tub
Bullet/Torpedo	B	Candle	Can
Bug light	Bug	Other [Specify]	O

Table 6: Bulb Shape Exhibit

Bulb Shape	Image	Bulb Shape	Image
Twist/Spiral (T)		**Spotlight/ Reflector/Flood (S)**	
Globe (G) *(e.g., for bathroom vanity fixtures)*		**Circline (C)**	
A-lamp (A) *(shaped like standard incandescent)*		**Tube Style (Tub)**	
Bullet/Torpedo (B) *(pointed top, standard screw base)*		**Candle (Can)** *(pointed top with a candelabra screw base)*	
Bug light (Bug) *(yellow color; do not confuse with LEDs with yellow filters)*			

Socket Type

Table 7: Socket Type List

Socket Type	Code
Medium Screw Base (Standard)	S
Small Screw Base (Candelabra)	Can
Pin Base	P
GU Pin Base	GU
Other	O

Table 8: Socket Type Exhibit

Socket	Image	Description
Medium Screw Base (S)		Light bulb screwed into socket
Small Screw Base [Candelabra] (Can)		Smaller screw base
Pin Base (P)		Pin on base of bulb sticks into socket
GU Base (GU)		Pin with larger head on base of bulb sticks into socket

Logger Numbers

Table 9: Types of Logger ID Numbers

Regional Hours of Use Study: Onsite Handbook

Rhode Island

11/26/2012

50-2 Howard Street, Somerville, MA 02144
Phone: (617) 284-6230 Fax: (617) 284-6239
www.nmrgroupinc.com

Contents

Tables

Figures

Overview of Handbook

The purpose of this document is to provide all the information required to conduct site visits for the Regional HOU Study. This document will be provided to all field technicians and will be used as the main reference material for in-person field technician training conducted for this study. This document contains the following sections:

- Training Plan
  - → Independent Training Steps
  - → In-person Training Session Outline
- Background / Purpose of the Study
- Onsite Protocol
- Onsite Form Instructions (included as separate Appendix)
  - → Example Completed Saturation Forms (included as separate Appendix)
- Logger Installation Instructions
- Quality Assurance and Control Procedures
- Frequently Asked Questions
  - → The Energy Independence and Security Act (EISA) of 2007
- Mileage Tracking Form
- Reimbursement Form
- EPA Cleanup and Disposal Guidelines for Compact Fluorescent Light Bulbs (CFLs)

All field technicians should review this document in its entirety prior to the in-person training session. This document contains independent training exercises that all technicians will be expected to complete prior to in-person training.

1 Training Plan

Training for this project consists of both independent and in-person training. A brief outline of training activities is included below. Additional detail about each step of training is covered in later sections. The first training step is to thoroughly review this document in its entirety.

1.1 Independent Training *(approximately three hours – total)*

- Review of Materials – field technician will spend one hour reviewing materials contained in this document.
- Store Visit – field technician will go to a hardware, lighting, or big box retailer to familiarize themselves with various bulb types. This activity will require about one hour.
- Mock Site Visit – after reviewing materials and completing the store visit, field technician will spend 30 minutes to an hour conducting a mock lighting audit for his/her home. As he/she is conducting the audit, he/she should reference the protocol to address any questions that arise. Once complete, he/she will send the completed site visit forms to the project manager for review.

1.2 In-person Training *(approximately four hours – total)*

- Questions and Answers – field technicians will be provided with the opportunity to ask questions about materials or the study that came up during independent training. Field technicians are also encouraged to ask questions during the remainder of the training session. *(20 minutes)*
- Review of Materials – the trainer will walk field technicians through the protocols, onsite forms, and equipment required for this project. *(45 minutes)*
- Administrative Matters – the trainer will review administrative procedures with field technicians. *(20 minutes)*
- Mock Site Visit – the trainer will act as a customer participating in the study and the field technician will go through the steps of conducting a site visit. *(30 minutes)*
- Walk-Along Visit – the trainer will walk-along with the field technician on their first site visit to observe them in the field. *(2 hours)*

2 Background / Purpose of the Study

The parties responsible for evaluation of energy-efficiency programs in Massachusetts, Connecticut, Rhode Island, and New York have committed to conducting a study to estimate hours of use (HOU) of light bulbs in homes. The main objective of this study, therefore, is to estimate HOU, and we will do so by room type, not lighting type (technology) as many studies have done in the past. Our focus on room types assumes that people are likely to use their lights in a given room the same way regardless of the type of bulbs in the room.

To accomplish this objective, field technicians will perform two interrelated tasks: 1) conduct an inventory of lighting to determine the number and type of bulbs currently installed in customers' homes, and 2) install a series of lighting loggers to capture information on how customers use lights in their homes. These two tasks are interrelated because in order to install loggers in a random selection of light fixtures, we must first identify all of the light fixtures in a customer's home.

NMR is recruiting and scheduling participants for this study via telephone. During the recruiting and scheduling, customers are provided with the following project details:

> *Energy Efficiency Program Administrators are offering you the opportunity to take part in an important study. We are offering eligible households $50 to allow a trained technician to visit their homes to gather more information about the lighting products they use. The visit should take about an hour. The visit would involve a trained technician walking through your home and recording the types of lighting products that you are using. The technician will also attach some very small devices to several light sockets in your home to record lighting usage. Most lamp or fixture shades will block the devices from view, so they won't affect your decor. They also won't affect how your lights work. When the technician returns to remove these devices in six months, you'll receive $100 to participate in the study. Participation in the study will require two visits, the first about an hour in length and the second a shorter visit of about 30 minutes, six months later. During the visits, there will be no attempt to sell you anything. The information gathered will be used to evaluate and improve the energy efficiency programs offered by your electric utility.*

As a field technician you will not recruit customers. Instead, you will be provided with a list of customers to visit each week. This list will include the customer's name, telephone number, address, and an appointment time. You should also receive a check or a gift card for each participant prior to visiting their home, participants will receive two separate checks (or gift cards) one for the first visit (installation) and one for the second visit six months later (removal).

3 Onsite Protocol

This section outlines the procedures field technicians will follow when performing the lighting inventories and installing the loggers. These protocols cover both the lighting inventory and the selection of fixtures for loggers. The protocols for installing lighting loggers differ between single-family and multi-family as noted throughout this section.

3.1 Prior to Visit

Before visiting a home, you should make sure that, at a minimum, you have the following:

Onsite Handbook
Onsite data form
Appointment sheet
Company Polo Shirt
ID Badge
Cell Phone

Data Collection Kit
Camera
Flashlight
Pen
Sharpie
Flat & Philips head screwdrivers
Insulated gloves
Shoe coverings
Latex gloves
Step ladder
Example CFL bulb
6, 10, 20-, and 30-sided Dice

Materials for Customer
FAQs and Info Sheet
NMR contact's business card
Check

Logger Installation Kit
Logger installation instructions
Zip ties
Adhesive 3M pads
Light loggers
8 *loggers for single-family*
6 *loggers for multi-family*
Light pipes
Logger labels
Sealable sandwich bags

CFL Clean up Kit
Sealable plastic bags
Disposable wipes
Vacuum
Duct tape
Flat brush

3.2 Arrival at Onsite

After the door is opened, immediately ascertain that the person at the door is the scheduled interviewee. Introduce yourself and hand him/her the business card.

- **Sample Introduction** *(not to be read verbatim)***:**
  *Hello, my name is _____, and I am working with NMR Group, Inc. NMR is working under contract with **National Grid**. I'm here to meet with _____. As mentioned on the phone, I'm here to walk through your home and record the types of lighting fixtures and bulbs installed in each socket. **[Customer should be expecting you]**. During my visit I'll also be installing a few lighting loggers to capture hours of use **[show customer a logger]**. In six months another technician will return to collect the loggers that I install. The loggers can only tell when a light is turned on and off, they do not record anything else. In appreciation for your time, on behalf of **National Grid**, we are offering you a payment of $50 today and $100 when we return in six months to remove the loggers. Do you have any questions regarding my visit?*

Prior to Data Collection

- Give the customer a step by step description of what you'll be doing (show the data collection form and a logger as you explain)
  - → First I need to walk around the outside of your home and record the types of lights.
  - → Then I will cover the bulbs inside your home – room by room – including bulbs in storage.
  - → After counting all of the lights I need determine which fixtures to install the loggers on.
- The customer should not be surprised by any of this information as they have already been told what the study will consist of. However, if the customer is uncomfortable with the visit and refuses to allow you to conduct the inventory or install the loggers, courteously explain that you will be unable to provide the incentive check if they do not participate. If they still refuse, ask if it would be ok to have your supervisor call them to discuss the project with them. Immediately inform your supervisor of the situation and whether or not the customer is expecting a call from your supervisor.
  - → Customers must participate in both aspects of the study—the lighting inventory and the lighting logger study.

General sequence of data collection

1. Installed bulbs - Exterior:
   → Walk around the outside of the home in a clockwise direction.
   → Record information on all exterior lighting sockets.

2. Installed bulb - Interior:
   → Next, proceed through the inside of the home in a clockwise direction.
   → Begin with foyer (entry way).
   → Go through each room and part of the home systematically, in a clockwise direction (or as clockwise as is possible).

3. Stored Bulbs**:**
   → **Ask:** *"Now, I would like to see all light bulbs and fixtures that are not currently installed. This would include those you have bought and not yet installed as well as those that were installed and then removed."*
   → Record information on all bulbs in storage.

4. Logger Installation:
   → Consult logger installation instructions.
   → Install loggers on selected fixtures (with customer's approval of placement).

5. After Data Collection:
   → Thank the customer for his/her time
   → Give him/her the $50 check (or gift card).
   → Remind the customer that when we return in six months to retrieve the loggers we will provide them with a check (or gift card) for $100.
   → Have the customer sign off on your data collection form to indicate that you visited their home and provided him/her with a $50 check (or gift card).
   → Leave with the customer the "Logger Participant Frequently Asked Questions" one-page sheet.

Data Collection Guidelines

- **<u>All recorded information must be legible</u>.**
- **What information to collect:**
  - → **All lights that use electricity** (meaning they are plugged in or hard wired) must be captured, including night lights.
    - Ex. Solar landscaping lights that also use electricity from electric lines, ***capture*** *the information*; solar landscaping lights that don't use any electricity lines at all, ***do not*** *capture*.
  - → **DO NOT** capture lights that run **only** on batteries like flashlights (even if the batteries are rechargeable).
  - → **DO NOT** capture information for temporary seasonal lights or lighting displays. This could include strings of lights such as holiday lights as well as novelty lights like plug in candles, yard decorations, holiday village displays, etc. Ask the customer if it is permanent or a seasonal holiday light.
- **Removing Bulbs or Fixture covers:**
  - → **<u>Never remove a cover or bulb without permission from the customer.</u>**
  - → If any fixture is covered and/or the bulb is not immediately visible, ask the customer if the bulb is easily accessible. If yes, ask if you can turn off the fixture and take it apart to see the light bulb.
  - → If the customer offers to turn off the fixture and take it apart him/herself, **ALWAYS** let the customer do it.
  - → If the customer refuses to let you do it and does not offer to do it him/herself; the fixture is damaged or delicate; or the fixture is inaccessible given your equipment, ask the customer for his/her best guess of the information needed on the form.
  - → **DO NOT TOUCH** if fixtures have cracked or damaged covers, or look delicate or easily breakable.
- **Burned Out Bulbs:**
  - → If a bulb is burned out, ask the customer if he/she intends to replace the bulb.
    - If the answer is yes, treat the burned out bulb as if it's currently working and record all.
    - If customer does not intend to replace them OR purposely unscrews some bulbs so that they don't turn on, treat them as if they were an empty socket.

- **Broken Bulbs:**
  - → If you break any type of light bulb and/or if a broken CFL came into direct contact with clothing or bedding which subsequently needed to be thrown out, give the customer the "Reimbursement Form."
  - → Note what type of bulb was broken and contact the project manager as soon as possible to report the incident.
  - → Take a picture of the broken bulb and any other damage.
  - → **If a CFL or a fluorescent bulb should be broken**, refer to the "Cleanup and Disposal Guidelines for Compact Fluorescent Light Bulbs" of the Environmental Protection Agency (EPA) included in this packet.
- **Unplugged Fixtures:**
  - → If the interviewee has unplugged light fixtures in storage areas, ask the customer if he/she uses the fixture.
    - o If the answer is no, then treat the light bulbs in the fixture as if they are in storage (record it in the CFL in Storage Form if the bulb is a CFL and do not record it if it is not a CFL).
    - o If the answer is yes, then record the fixture in the "installed lighting" form and denote when it is used in the "season" column.

4 Onsite Form Instructions

This section provides specific details about how the onsite form should be completed by field technicians.

4.1 Home Schematic

→ Draw a **CLEAR** diagram of the house on the sheets provided as you go through the home, labeling each room on the diagram (in order to locate loggers on the follow up visit).

→ If the home has multiple levels create a separate diagram for each level, including the basement and/or attic.

→ If the attic or any other room in the home is not accessible, still include it in the diagram but record it as "inaccessible".

→ **Indicate the location within a room of any fixtures that have loggers installed by marking the diagram with an X.**

4.2 Onsite Saturation Form

Program Participation

Before filling out the onsite form, ask the homeowner: **Have you participated in any programs that replaced bulbs in your house with energy efficient bulbs?**

- Yes
- No

→ If "Yes", ask which programs they participated in and record their responses.

Room Descriptions

→ Choose from the codes below.

→ You may use a downward arrow to indicate the same room for more than one line.

→ If a home has a great room or a single room with several purposes, look at the particular usage of the light and record the lamps accordingly.

→ When in doubt of a room's purpose ask the customer how they would describe the room.

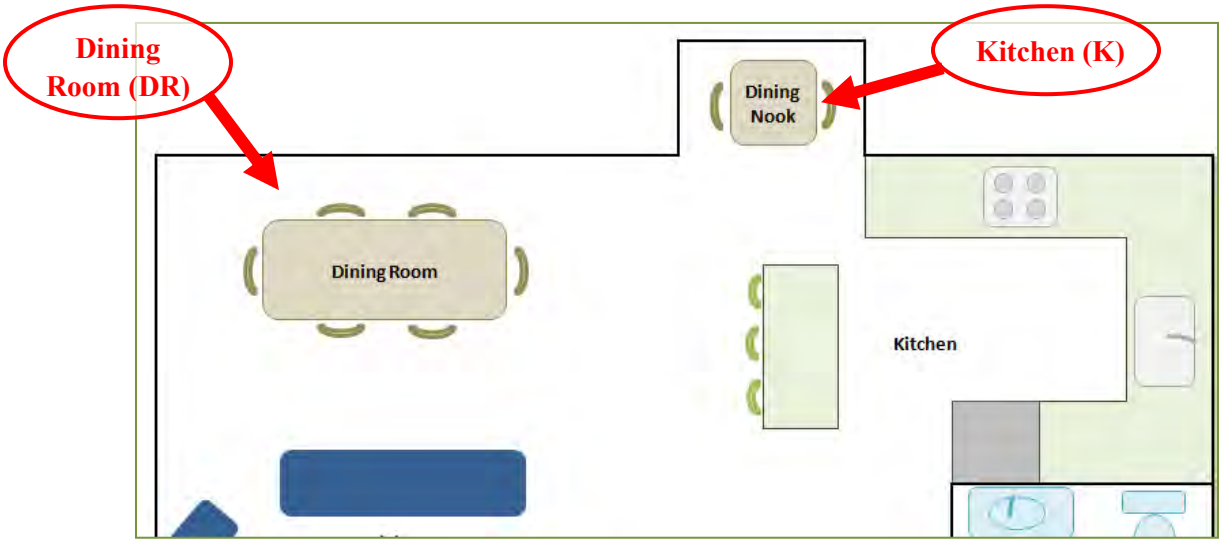
→ If there are multiple rooms of the same type add a number after the code (ex. BR1, BR2).

Table 1: Room Type List

Room	Code	Room	Code	Room	Code
Dining Room	DR	Living Space	L	Garage	G
Exterior	E	Hallway	H	Office	OFF
Kitchen	K	Foyer	F	Den	DEN
Bedroom	BR	Utility	U	Closet	[Room code] -C
Bathroom	BT	Basement	BA	Other [Specify]	O

Dining Room (DR)

A dining room is any room where the primary purpose is eating. Substantial dining areas that are not separated from other rooms in the home directly by walls and doors are still considered a dining room if they are set apart from other rooms. Observations of a dining area attached to the kitchen, such as a dining nook, will be labeled as a kitchen.



Exterior (E)

Technicians will audit lamps that are attached to the home and those that are owned by the customer. These include lampposts not attached to the home and light lamps that are part of driveway entrances. Exterior includes sheds, greenhouses, and other storage facilities and exterior buildings owned by the customer **except garages** which have their own category discussed below.

While all homes have exteriors not all lights on all homes are directly controlled by the person who lives there. Only capture exterior lights if they are directly controlled by the person who lives in the home we are visiting. Lighting in common areas of apartment buildings (interior/exterior) and lights not controlled on the exterior of townhomes are examples of exterior lights that we do not need to capture.

Kitchen (K)

Technicians will include the lights that are primarily used in a kitchen area or inside the kitchen, such as a counter with bar stools or a small kitchen table. However, technicians will not include the light under the range hood or in the refrigerator.

Every home will have at least one kitchen. If the home is an efficiency or a studio apartment, designate the lights directly present in the kitchen area (area containing stove, refrigerator and sink) as the kitchen.

Bedroom (BR)

All bedrooms will be noted with a unique identifier (i.e. BR 1).

Every home will have at least one bedroom. If the home is an efficiency or a studio apartment, designate the lights directly present in the sleeping area (area containing bed) as the bedroom.

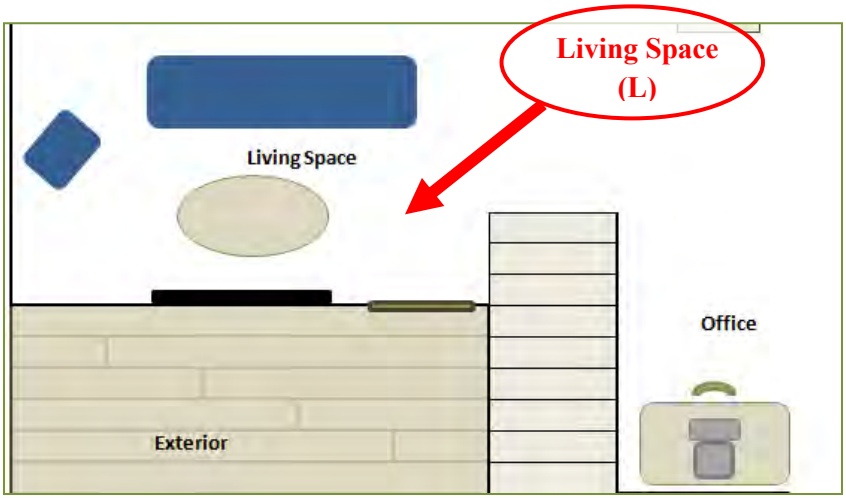
Bathroom (BT)

The bathrooms included can be full baths, half baths, or three-quarter baths. If a particular bathroom has two rooms (such as a separate shower and sink area), the lighting will be coded in both rooms as the same bathroom.

Every home will have at least one bathroom. Efficiency and studio apartments should have a separate bathroom. In the event that the bathroom is not separated from the rest of the home by walls and a door, designate the lights directly present in the bathroom area (area containing the shower, toilet and sink) as the bathroom.

Living Space (Living Room/Family Room) (L)

This room is the most commonly used area for family activities, such as watching television or entertaining. The form does not differentiate between living room and family room since this distinction can often be subjective.



Hallway (H)

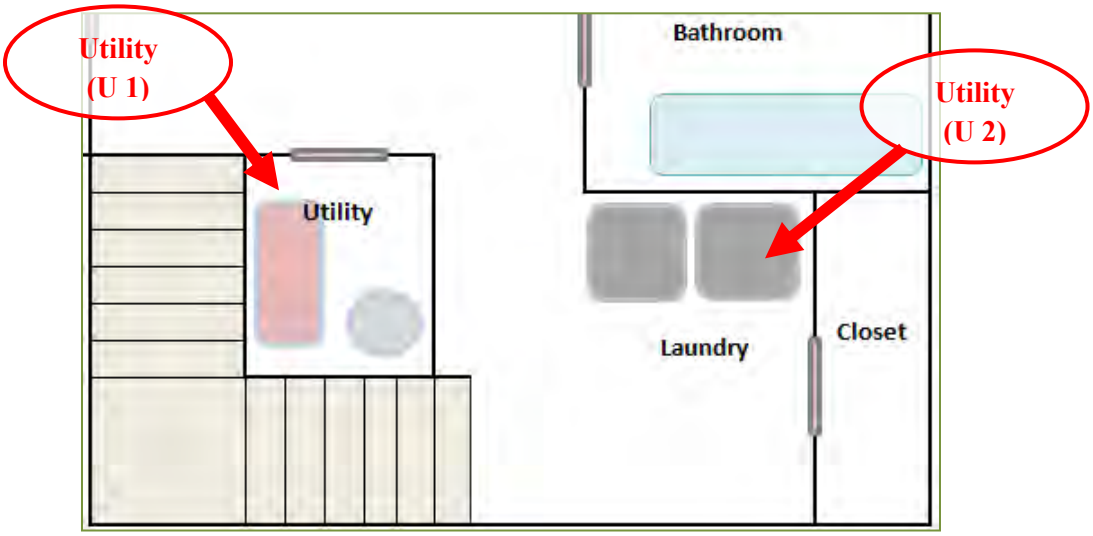
Hallways include all stairways with lights.

Foyer (F)

This category includes all entry ways, even those called mudrooms.

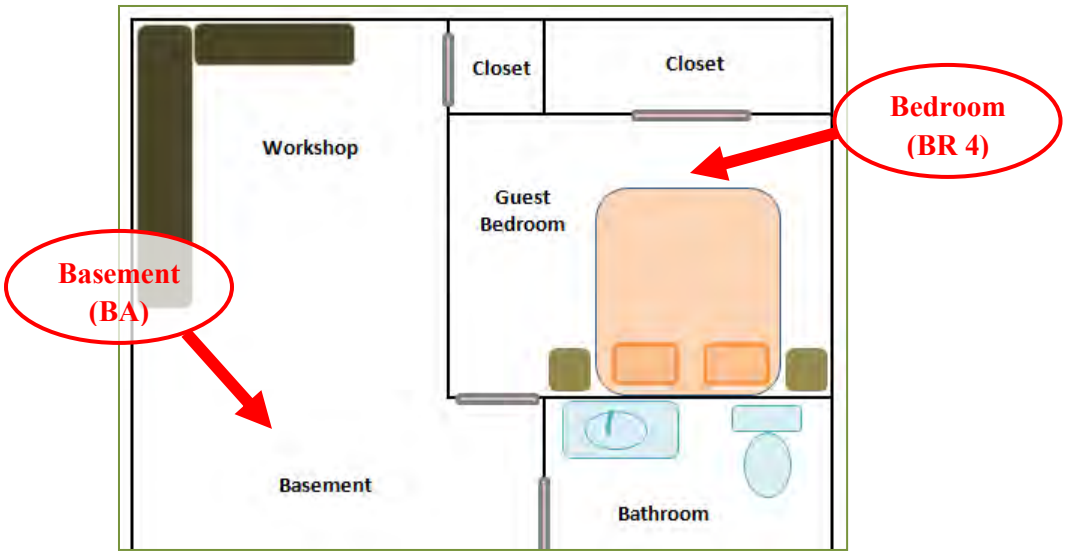
Utility (U)

The main purpose of this room is washing clothes. Technicians will also include furnace/HVAC areas as a utility room unless the furnace/HVAC is part of an unfinished one room basement.



Basement (BA)

The basement is the main room under the first floor. If there are bedrooms, bathrooms, closets, utility rooms, etc. in the basement, they will be coded and recorded as such.

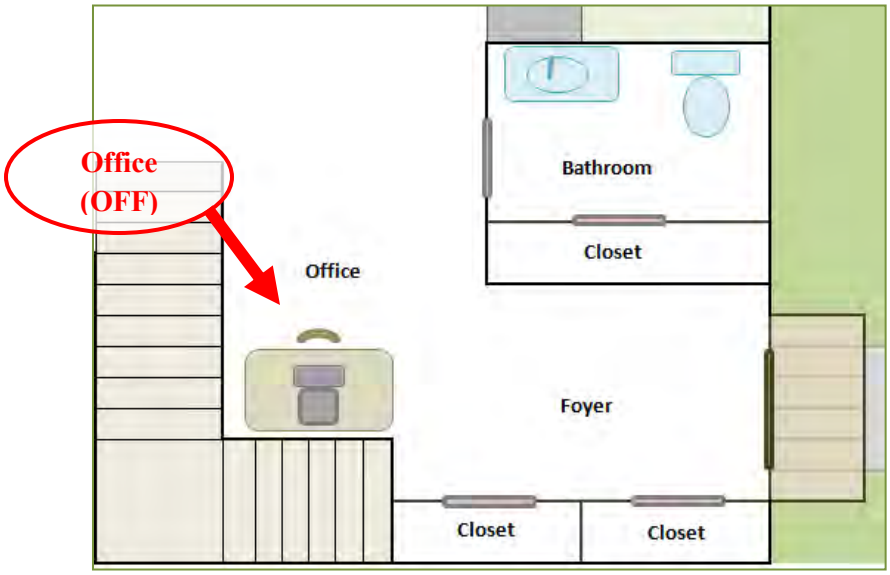


Garage (G)

In addition to a typical garage, a carport fits into this category. Bulbs found in garage door opening mechanisms will be included.

Office (OFF)

Technicians will collect lighting data in computer rooms, home offices, and parts of a great room that have office functions. In the notes column indicate whether the office is a separate room or part of a larger room. The primary function of this room appears to be doing something at a desk or computer.

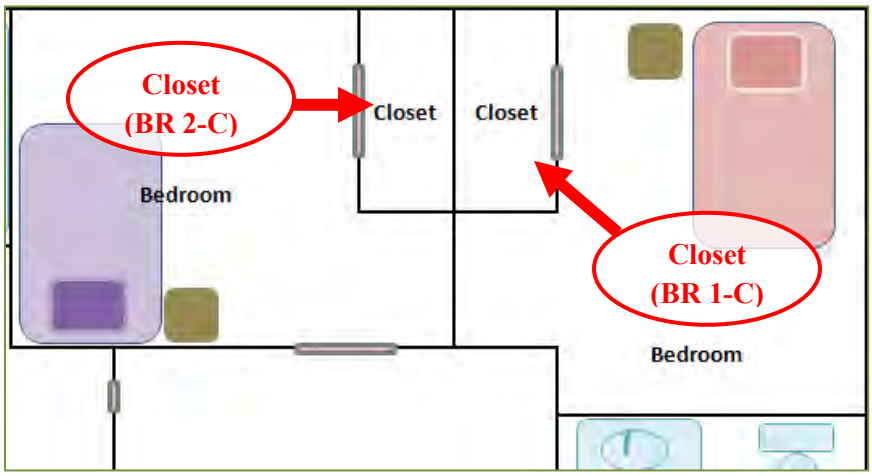


Den (DEN)

This category includes dens, libraries and other small, secluded rooms.

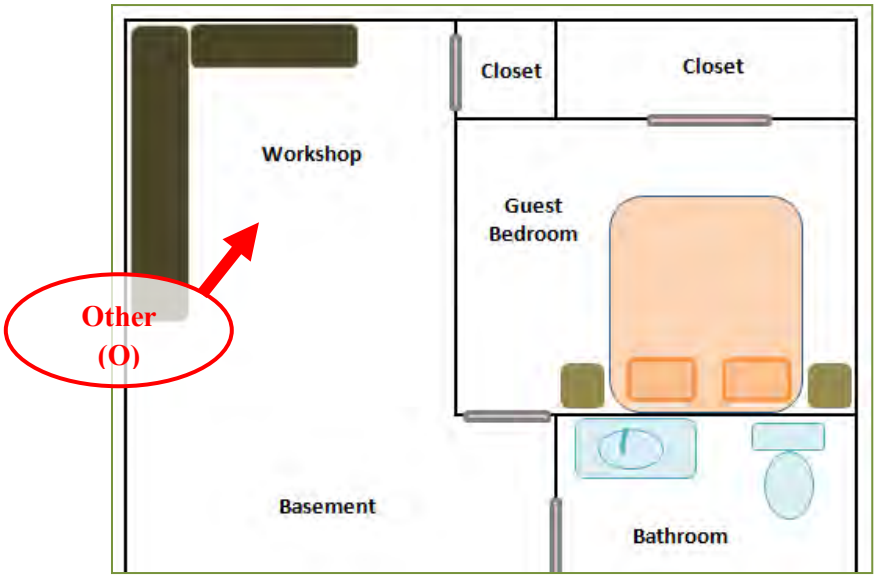
Closets ([Room Code]-C)

Technicians will collect lighting data for lamps in closets. Closets should be recorded separately from the spaces that contain them but with the name of the room included. For example, a closet in the master bedroom would be recorded as BR1-C.



Other (O)

Technicians will collect lighting data for lamps in other room types. In the notes column, describe the room type in more detail.



Primary Room

→ When multiple rooms of one type exist (ex. Bedrooms, bathrooms), record a "Y" in the "Primary" column to indicate the room used most frequently

Control Type

→ Include control-type information for each light fixture using the codes below.

Table 2: Control Type List

Control Types	Code
On-Off	OF
Dimmable	Dim
3-way	3W
Motion or Photo Sensor	MS
None (always on)	None
Breaker/Disconnect Plug (no switch)	B
Other	O

Wall-Mounted Control

→ Record whether or not the control is wall mounted (Y/N)

Fixture Number

→ Number fixtures in each room from 1, 2, 3, 4, etc. up to the number of fixtures in the room.

→ **Do not** restart numbering of fixtures from 1 for each room. Fixtures should be numbered sequentially throughout the entire home such that when you number the final fixture in the home the total number of fixtures in the home should match the fixture number.

→ Repeat the fixture number until all bulbs associated with it are recorded.

Fixture Group

→ A fixture group includes all fixtures that are controlled by the same switch.

→ Number fixture groups in each room from 1, 2, 3, 4, etc. up to the number of fixture groups in the room.

→ Restart numbering of fixture groups from 1 for each room.

→ In the onsite form, repeat the fixture group number until all bulbs associated with it are recorded. (The onsite form is one row per bulb, so a fixture group number is repeated all rows until all bulbs are recorded)

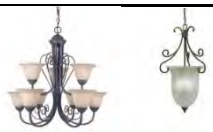
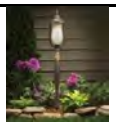
Fixture Type

→ Include fixture type information for each installed bulb using the codes below.

Table 3: Fixture Type List

Fixture	Code	Fixture	Code	Fixture	Code
Recessed	R	Wall Mount	WM	Walkway	W
Pendent	P	Night Light	NL	Exterior Flood	EF
Flush Mount	FM	Table Lamp	TL	Garage Door	G
Track	T	Floor Lamp	FL	Under Cabinet	U
Ceiling	CF	Post Mount	PM	Other	O

Table 4: Fixture Type Exhibit

Fixture	Image	Fixture	Image
Recessed *(light bulb does not stick out of the plane of the ceiling)*		**Table Lamp** *(lamps that are put on tables)*	
Pendant *(fixture and bulb hangs from ceiling, i.e. chandelier)*		**Floor Lamp** *(lamps that are put on the floor)*	
Flush Mount *(fixture is flush with the ceiling)*		**Post Mount** *(exterior lights on a lamppost)*	
Track *(light bulbs on a strip/track)*		**Walkway** *(lights on a path outside the home)*	
Ceiling Fan *(lights attached to a ceiling fan)*		**Exterior Flood** *(fixtures that flood a large area with light, found on the side of home, above garage, or under peak of roof)*	
Wall Mount *(fixture attached to wall)*		**Garage Door**	
Night Light		**Under cabinet** *(lights under kitchen cabinets for lighting counter)*	

Bulb Type

→ Record bulb type information for each installed bulb using the codes below.
→ If socket is empty, record as "E."

Table 5: Bulb Types Code List

Bulb Type	Code	Bulb Type	Code
Incandescent	I	Halogen	H
CFL	CFL	Other	O
Fluorescent	F	Empty Socket	E
LED	LED		

Table 6: Bulb Types Exhibit

Bulb Types	Image	Description
Incandescent (I)		Bulbs have a filament that's heated to the point of glowing
Compact Fluorescent (CFL)		Bulbs are energy-efficient; use 67% less energy than incandescent bulbs and last longer. Covered CFLs have a plastic cover that conceals the traditional spiral shape. If you look closely at the bulb you will be able to see the spirals through the covering—especially when the bulb is turned on.
Fluorescent (F)		Bulbs are filled with mercury vapor that emits ultraviolet light when electricity is applied, then coating inside bulbs turns the UV rays into visible light
Light-Emitting Diode (LED)		Bulbs have a semiconductor chip so current flows through; light is released when an electron falls into a lower energy level. Some LEDs have a yellow filter.
Halogen (H)		More efficient type of incandescent bulb with filament sealed into a compact transparent envelope filled a small amount of halogen, allowing the filament to be at a higher temperature. Some halogens are virtually indistinguishable from regular incandescent bulbs. They may be smaller (ex. A-17 size instead of A-19) or can be distinguished by the presence of a glass tube around the filament (halogen) instead of the filament by itself (incandescent).

Bulb Shape

→ Include bulb shape information for each installed bulb using the codes below.

Table 7: Bulb Shape List

Bulb Shape	Code	Bulb Shape	Code
Twist/Spiral	T	Spot/Reflector/Flood	S
Globe	G	Circline	C
A-lamp	A	Tube	Tub
Bullet/Torpedo	B	Other [Specify]	O
Bug light	Bug		

Table 8: Bulb Shape Exhibit

Bulb Shape	Image	Bulb Shape	Image
Twist/Spiral (T)		**Bug light (Bug)** *(yellow color; do not confuse with LEDs with yellow filters)*	
Globe (G) *(e.g., for bathroom vanity fixtures)*		**Spotlight/ Reflector/Flood (S)**	
A-lamp (A) *(shaped like standard incandescent)*		**Circline (C)**	
Bullet/Torpedo (B) *(pointed top, standard screw base)*		**Tube Style (Tub)**	

Socket Type

→ Record socket type for each installed bulb using the codes below.

→ Socket type refers to the bulb base (circled in red in Table 10) and how the base attaches to the fixture.

Table 9: Socket Type List

Socket Type	Code
Medium Screw Base (Standard)	S
Small Screw Base (Candelabra)	Can
Pin Base	P
GU Pin Base	GU
Other	O

Table 10: Socket Type Exhibit

Socket	Image	Description
Medium Screw Base (S)		Light bulb screwed into socket
Small Screw Base [Candelabra] (Can)		Smaller screw base
Pin Base (P)		Pin on base of bulb sticks into socket
GU Base (GU)		Pin with larger head on base of bulb sticks into socket

Notes

→ Use this column to describe any feature labeled as "other."
→ Use this column to record any additional information that may be useful in the data analysis phase.
→ Ex1. The resident refused access to certain rooms or fixtures; or lamp types cannot be determined unless a lighting fixture cover is removed (and the customer does not wish for this to be done).

4.3 Onsite Stored Bulbs Form

Package Group

→ A package group includes all stored bulbs that are in the same package.
→ Number package 1, 2, 3, 4, etc..
→ In the onsite form, repeat the package group number until all bulbs in the package are recorded. (The onsite form is one row per bulb, so a package group number is repeated in all rows until all bulbs are recorded)
→ If a bulb is not in a package, write "NA" in this column.

Bulb Type

→ Record bulb-type information for each stored bulb using the codes from Table 5.

Bulb Shape

→ Record bulb-shape information for each stored bulb using the codes from Table 7.

Base Type

→ Record the base type for each stored bulb using the socket type codes from Table 9.

Customer Survey

Collect the homeowner's responses to following about each stored bulb:

Removed?

A. Had this bulb been installed in a fixture and later removed?
- Yes (Y)
- No (N)

Room

B. **[If A=Y]** ***What room was this bulb removed from?***

- Record appropriate room code from Table 1.

Reason for Removal

C. ***Why did you remove this bulb?*** **(Allow for multiple responses)**

1. Did not fit/work with fixture
2. Bulb burned out/broke
3. Did not like appearance/light/brightness
4. Other [Specify – record verbatim]
5. Refused
6. Don't know

Reason for Storage

D. ***Why are you storing this bulb?*** **(Allow for multiple responses)**

1. For future use
2. Do not plan to use
3. Plan to throw out/recycle
4. Other [Specify – record verbatim]
5. Refused
6. Don't know

Type of bulb it will replace

E. ***What type of bulb will this bulb likely replace?***

1. CFL bulb
2. Incandescent bulb
3. Whichever needs replacing first
4. The same type of bulb as the stored bulb
5. Other [Specify – record verbatim]
6. Refused
7. Don't know

4.4 Logger Information and Location Form

→ Record room information for installed loggers:

- **Single Family Homes (8 loggers)**
  1. Dining room
  2. Exterior
  3. Living space
  4. Other room #1
  5. Other room #2
  6. Bedroom
  7. Bathroom
  8. Kitchen
- **Multifamily Homes (6 loggers)**
  1. Living space
  2. Other room #1
  3. Other room #2
  4. Bedroom
  5. Bathroom
  6. Kitchen

→ For "Other room #1" and "Other room #2", record the room code on the line provided.

→ Record room code for room types that have multiple rooms. Ex. If the main bedroom is "BR 3", record this code in the form below "Bedroom."

→ Record fixture and bulb characteristics for those lights on which you installed loggers.

5 Logger Installation Instructions

5.1 Installation

- Install up to **eight** loggers on selected fixture groups in **single-family homes**
- Install up to **six** loggers on selected fixture groups in **multi-family homes**
- Use the data collection form to determine the total number of fixture groups. A fixture group refers to all fixtures controlled by the same switch.
- Take a picture of the fixture with the logger on it (in order for easy recognition when retrieving).
- If installation of the desired number of loggers is not possible, note the reason on the onsite form.
- If the resident objects to installing meters on any fixture group, note the reason on the intake sheet.

5.2 Room Prioritization

- **Single-family homes (8 loggers)**
  - → Install **one** logger in each of the following room types:
    1. Dining room
    2. Exterior
    3. Living space
    4. Bedroom
    5. Bathroom
    6. Kitchen
  - → Install **two** loggers in *other room types*. This includes any room that is **not** specified above (may include hallways, utility closets, offices, garages, etc.) If you have captured an area of room as part of another room (i.e. an office that is part of a great room) treat that area as a separate room.
- **Multi-family homes (6 loggers)**:
  - → Install **one** logger in each of the following room types:
    1. Living Space
    2. Bedroom
    3. Bathroom
    4. Kitchen
  - → Install **two** loggers in *other room types*. This includes any room that is **not** specified above (may include hallways, utility closets, offices, garages, etc.)
- **If any home does not include a specified room**, the logger allocated for that room will instead be assigned to a random fixture in a random room even if a logger is already installed in that room. **Install a maximum of two loggers in any one room.** If the randomly selected room already has two loggers installed assign the logger to the next room in order. (Ex1. If you roll a two but there are already two loggers in the dining room install the logger on the exterior. Ex2. If you roll a seven but there are already two loggers installed in other rooms, install the logger in a bedroom.)

- **Note**: Loggers must be installed on fixtures controlled by separate control devices. If a room only has one fixture device or if all fixtures in a room are connected to the same control, **do not install multiple loggers**. Instead, install only one logger and allocate the second logger to another randomly selected room. **Install a maximum of two loggers in any one room.** If the random room selected already has two loggers installed assign the logger to the next room sequentially. (Ex1. If you roll a two but there are already two loggers in the dining room install the logger on the exterior. Ex2. If you roll a seven but there are already two loggers installed in other rooms, install the logger in a bedroom.)

Table 11: Random Selection of Room

Single-Family (10-sided die)			Multi-Family (6-sided die)		
Room	**# Rolled**	**Probability**	**Room**	**# Rolled**	**Probability**
Dining Room	1 or 2	20%	Living Space	1 or 2	33%
Exterior	3 or 4	20%	Other	3	17%
Living Space	5 or 6	20%	Bedroom	4	17%
Other	7	10%	Bathroom	5	17%
Bedroom	8	10%	Kitchen	6	17%
Bathroom	9	10%			
Kitchen	10	10%			

5.3 Random Fixture Group Selection

- For **single-family** homes:
  - → If eight or fewer fixture groups are identified in the lighting audit, install a logger on one fixture in each fixture group.
  - → If more than eight fixture groups are identified, field technicians will use the following random selection method to determine which fixtures to meter.

- For **multi-family** homes:
  - → If six or fewer fixture groups are identified in the lighting audit, install a logger on one fixture in each fixture group.
  - → If more than six fixture groups are identified, field technicians will use the following random selection method to determine which fixtures to meter.

Random Selection Method

1. Determine the number of fixture groups in a room from the audit.
2. Each room type of interest in a household will be assigned a random start number.
   - → The random start number is the fixture group number from which to begin the random count, based on possible ranges of fixture groups.
   - → If there are multiple rooms of a given type (e.g., bedrooms or bathrooms), count all fixture groups in all of the rooms of that type.

3. Based on the fixture group count, select the most appropriate die provided and roll it once to determine which fixture group that should have a logger installed.[1] For example, if the room type has five fixture groups, use the six-sided die. If the room has 18 fixture groups, use the 20-sided die and so forth.

4. If the number of fixture groups in a room is less than the random start number, continue counting from fixture group 1. (Ex. If a room has 11 fixture groups you would roll the 20-sided die. If the die shows the number 12, fixture group 1 would be selected.)

5. If the number of fixture groups in a room exceeds 20 than you will need to roll the die multiple times. The first roll will determine a starting point and the second number will determine how many fixture groups to count to before installing the logger. (Ex. If a room has 21 fixture groups you would roll the 20-sided die once and get a 15, you would then roll the die again and get an 8. In this example you would install the logger on the 2nd fixture group.)

6. If a second logger needs to be installed in the same room, roll the die again, if you get the same number move to the next fixture group in the room.

7. Choose a fixture and bulb to install the logger on in this fixture group
   → While fixture groups are selected at random, you can install the logger on any light bulb in the selected fixture group.
   → Try to pick a bulb that will not interfere with normal use of the light and will be easy to install a logger on.

Examples

- If a bedroom has 10 fixture groups, the technician rolls the ten-sided die and rolls a four. The technician then identifies the fourth fixture group in the bedroom, and installs a logger.

- If a home has two exterior fixture groups, the technician rolls the six-sided die and rolls a five. Because there are only two fixtures on the exterior of this house, this means that the logger actually goes on the first fixture group (because if there are fewer fixture groups in the room than the random number, upon reaching the last fixture group in the room, one continues counting from the first group). Fixture group one contains three fixtures, one exposed on the eve of the home, one on the covered porch, and one on a 20' tall post in the yard. Since all three fixtures are controlled by the same control device (a wall switch), logging any one will give the same results. In this situation, the technician should install the logger on the covered porch as it is the easiest to reach and is protected from the elements.

[1] Field technicians will be provided with the four dice—30 sided, 20 sided, ten sided, and six sided.

- If an elegant bathroom has 16 fixture groups, the technician rolls the 20-sided die and rolls an 11. Fixture group 11 includes the ceiling fan and the vanity lights. In this situation, the technician should install the logger near a vanity bulb as they are easier to reach than the ceiling fan.

5.4 Other Metering Guidelines

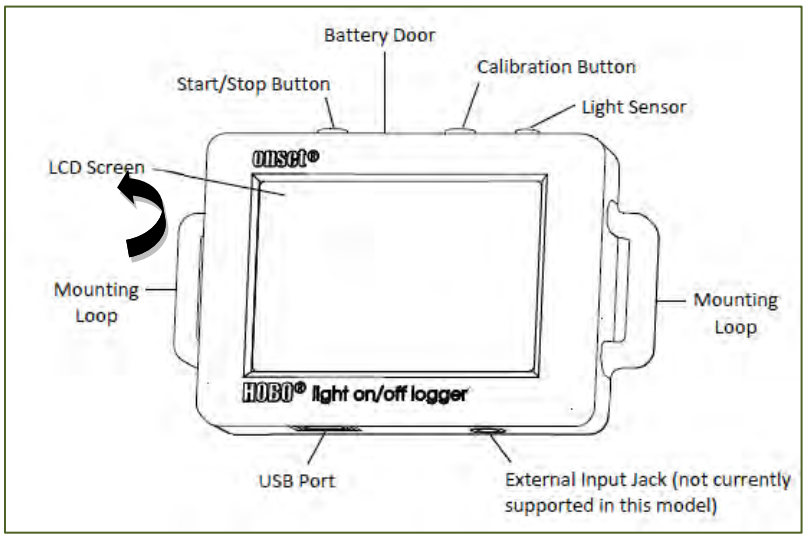
- Resident agrees to allow installation of light loggers.
- Lights must be operating properly during site visit.
- Light loggers will be installed on fixtures in a way that is the least obtrusive to customers (based on resident preference/discretion).
  - → If logger cannot be installed on a fixture due to customer preference – try another fixture in the same fixture group – if no other fixtures in that fixture group exist choose the next fixture group in order.
- Light loggers will be installed where fixtures are easily accessible (e.g., not requiring more than a stepladder to access) and that are not fragile (e.g., crystal chandelier).
  - → If logger cannot be installed on a fixture due to inaccessibility – try another fixture in the same fixture group – if no other fixtures in that fixture group exist choose the next fixture group in order.
- When installing light loggers on fixtures, field technicians will take great care to minimize disturbances that could potentially invalidated the data.
  - → As needed, loggers will be positioned so only light from the fixture is recorded.
  - → When it is difficult to eliminate exposure to ambient light, field technicians will attach a fiber optic eye to the logger, which prevents the logger from "seeing" ambient light.
  - → Additionally, field technicians will secure loggers to fixtures using hard plastic cable ties, adhesive strips, and magnets.

5.5 Installing a Light Logger

This study will utilize Hobo UX 90s and DENT TOU-L loggers to record on/off instances. The instructions provided below are specific to the Hobo UX 90s loggers. Installations of DENT TOU-L loggers follow the same deployment principles. To successfully install a light logger, the technician will perform the following steps:

1. Identify the light to be metered.
2. Minimize impacts on the logger from other light sources:
   → Consider the path of the sun throughout the day.
   → Consider reflection and refraction from nearby materials.
   → Consider other fixtures nearby.
3. Set the light logger. To do this, press and hold the start/stop button for 3 seconds to start or stop logging data. (Figure 1).

Figure 1: Setting Light Logger

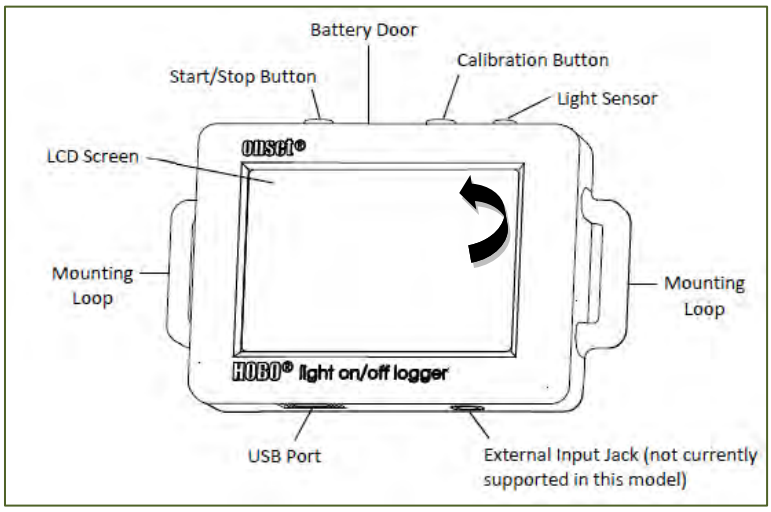


4. Record the date and time the unit was set on the provided labels (Figure 2).
   → This is ***very important***; without knowing the exact time and date the logger was installed, the data will be unusable.
   → Attach a label on the back or bottom of the logger. DO NOT place the label over light sensor or on the LCD screen.

Figure 2: Labeling Date and Time on Light Logger

5. Auto-calibrate the Light Logger Figure 3.

Figure 3: Auto-calibrating the Light Logger



→ After launching, deploy the logger near the light source to be monitored and turn the light source on.

→ Press the Calibrate button for 1 second. The LCD screen will display the signal strength of the light. The signal strength should ideally be at least 3 bars. Orient the logger as necessary to increase the signal strength.

→ Press the Calibrate button for 3 seconds while "HOLD" appears on the LCD screen. Move your hand away from the logger to prevent shadowing. The logger will count down to the auto-calibration and then display either "PASS" or "FAIL" after calibration is complete.

→ If the auto-calibration fails, point the sensor directly at the light source and then repeat these steps.

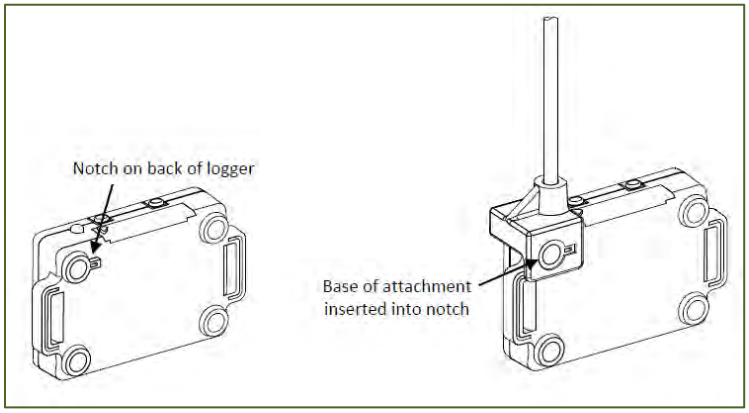
→ If you cannot get the logger to respond correctly in a given fixture, move on to the next fixture.

- → **Note:** The sensor is sensitive to lights that emit high amounts of infrared radiation like incandescent and halogen bulbs. It is best to use auto-calibration when possible when monitoring on/off conditions for lights with high infrared radiation.
- → **Note:** Auto calibration does not apply to DENT TOU-L loggers. DENT TOU-L loggers have sensitivity dials on them and a "sun" appears on the display when the logger is able to sense the light. Starting from the off position auditors increase the sensitivity while the light is on until the "sun" shows in the display.

6. When the logger is correctly responding to the light, assess the best mechanism to attach the logger to the light. The light logger can be attached with one or more of the following items:
   - → 3M Command Strips
   - → Zip ties
   - → Magnets on top of logger

   Avoid placing the light logger so it directly contacts the light. Place the sensor in an area with minimal potential to damage the fixture or light.
7. To ensure that the light logger is still responding, turn the light on and off, and verify the bulb icon appears and disappears.
8. If the light logger is in a location with significant sun exposure or other light sources, and you cannot get the logger to respond to the light, and then install the logger with the fiber optic attachment (light pipe). The light pipe connects to the back of the logger. Locate the notch in the upper left corner next to the mounting magnet. Insert the black base of the attachment into the notch so that the base clips onto the corner of the logger as shown in Figure 4.
9. Deployment Guidelines - follow these tips for successful deployment:
   - → Make sure the end of the light pipe is as close to the light source as possible.
   - → Maximize the signal strength on the logger LCD screen by adjusting the light pipe while looking at the signal bars.
   - → Be sure to secure the light pipe after the signal has been optimized.
   - → Do not support the logger by the light pipe.
   - → Be sure that the pipe is seated all the way into the bracket before deployment.

Figure 4: Attached Fiber Optic Eye



→ Set the logger, as described above.

→ Attach the logger in a discrete area using the 3M Command Strip, Zip ties, or a magnet.

→ Direct the tip of the eye as close as possible to brightest part of the light (see Figure 5).

Figure 5: Fiber Optic Eye Aimed at Brightest Part of Light

→ Do not bend the fiber optic eye on sharp angles—this will damage the eye.

→ With the light is turned on, adjust the logger sensitivity to the maximum setting, so that the bulb symbol displays (see Figure 6).

Figure 6: Light On - Bulb On

→ Turn the light off. If the bulb icon remains on, auto-calibrate the lighting logger again. The light may need to be turned on and off multiple times before the light logger is properly adjusted.

10. The loggers are configured to operate with the LCD screen off. Before the logger is deployed, the screen should look like this:

Figure 7: Logger Screen after 10 Minutes

→ Once the logger is deployed, the screen will turn off after 10 minutes. You can reactivate the display for 10 minutes by pressing the start/stop button.

Additional Placement Examples

Figure 8 illustrates the preferred placement of a lighting logger for permanent dome-style fixtures, which Figure 9 shows an inappropriate placement as this would be very visible to the customer. Figure 10, Figure 11, and Figure 12 show additional preferred logger placement examples.

Figure 8: Dome Style Fixture – Remove Dome

Figure 9: DO NOT Place Logger in Bottom of Dome

Figure 10: Logger Secured in Lamp with Zip Ties

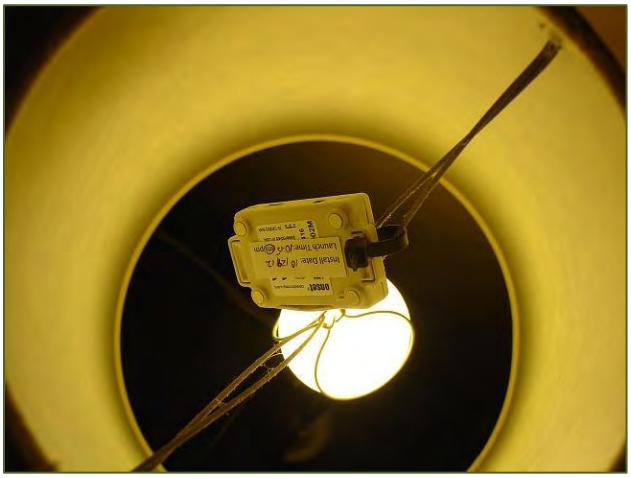


Figure 11: Logger Secured in Lamp with Magnets

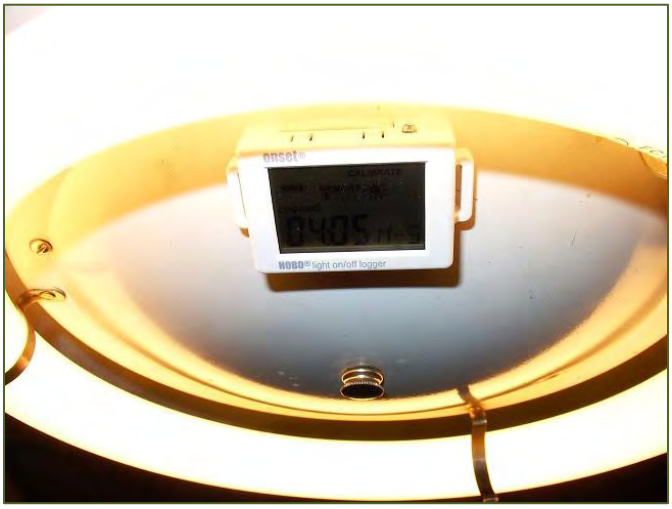


Figure 12: Logger Secured in Lamp with Command Strips

5.6 Logger Removal Protocols

Prior to removing light loggers, removal technicians will receive the logger installation data, which indicates the rooms and fixtures where loggers were installed in winter 2012. Field technicians will visit participants' homes in the summer of 2013 (six months later) to conduct logger removals and obtain additional data for the HOU analysis. Field technicians will also record *in situ* observations and photograph each logger prior to removal. The logger removal and data collection process includes the following:

- Photograph the logger prior to removal.
- Indicate the orientation of the sensor or fiber optic eye (e.g., Is the sensor directed towards the light source?)
- Perform a state test to determine whether or not the logger accurately records event data; turn the light on and off to ensure that the sun icon appears and disappears appropriately.
- Remove logger and review the total time on from logger screen.
- If the time on indicates extreme low use or extreme high use, ask the participant to verify, based on their own usage of the light fixture in question.
- Ask participant whether logger has fallen off the fixture or has otherwise been uninstalled prior to the technician's removal site visit; if so, ask participants to provide a date and time. **[Note: During the installation visit, participants will be asked to call and inform us if something does happen to the logger.]**
- Note the presence of windows and televisions/computers in rooms where loggers are installed.
- Note the condition of loggers upon removal and assess the battery status.
- Ask the participant to estimate typical usage for each metered fixture (e.g., 4 hours per day in the afternoon only).
- Record the presence of children under the age of 18 living in the home.
- If a logger is installed in a basement, record whether the basement is finished or unfinished.

After removing loggers, carefully pack and store loggers. Return the loggers to the project manager. Data from the loggers will be downloaded using appropriate software, raw data will be exported into CSV (comma separated values), and uploaded to the project's SharePoint site where analysts will access the data for review and analysis.

6 Quality Assurance and Control Procedures

As with all of our work, NMR endeavors to maintain a high quality work product. The sensitive nature of onsite work means that we take special precautions to ensure the quality of data collected and to avoid jeopardizing the relationship our clients have with their customers. To that end, we employ a number of steps to ensure that onsite technicians perform quality work that reflects well on NMR and its clients.

Our quality control and standard operating procedures begin well before a field technician ever steps foot in a customer's home. All of our field technicians receive rigorous project specific training. Training topics include project background, project specific data collection protocols, and customer service and interaction training. We also provide our scheduling staff with an overview of this training so that they know what customers will expect when they agree to participate and are able to answer any questions customers may have. We make every effort to ensure that customers are fully informed and avoid unnecessary surprises.

Below, we outline some of the specific quality control and training measures we will utilize for the Regional HOU study.

Quality Control and Training Measures:

- All field staff will receive training directly from NMR staff using training materials successfully implemented in similar onsite lighting saturation studies but tailored to the unique needs of the Regional Logger Study. Training for this project will include instruction on how to perform the following:
    - Identify various types and shapes of sockets, light bulbs, and controls
    - Examine light bulbs in a safe manner, including instructions on what equipment to bring to a home, working with covered fixtures, and clean-up of (especially CFLs and fluorescents) and compensation for bulbs and fixtures accidentally damaged during the visit
    - Ensure that they have located and inventoried all light bulbs (including stored bulbs) in the home through such procedures as creating a home schematic, mapping their route through the home, and documenting difficult-to-characterize lighting with pictures,
    - Correctly setup and install lighting loggers
- Training will also include some background on EISA and its requirements so that the field technician can answer questions he or she may receive on this topic while performing the inventory.
- NMR staff will accompany each part-time field technician on their first day of site visits.
- NMR staff will recruit participants and schedule appointments, assigning them to field staff based on location and work load.
- Each field staff member will be required to report his or her progress at the end of each day and forward hard copies of completed onsite forms to NMR staff for review each week.

In addition to reviewing the onsite forms, NMR staff will call 20% of participants to ensure that their experience with the field technician was satisfactory, and we will also revisit approximately 5% of the homes and repeat the data collection and observe logger installation to make sure the technician performed all tasks in a satisfactory manner.

7 Frequently Asked Questions

- **What is this device and how do I know what it does?**

  The device is called a "lighting logger." It is about the size of a business card but is ½ inch thick. **[SHOW CUSTOMER A LOGGER]** The type of lighting logger we use can tell when you turn you the light it is attached to on and off, but it does not collect any other information. If you want to know what the loggers look like, they can be found easily through a web search of the term "lighting logger." We will mainly be using the "HOBO" and "DENT" brands.

- **What's in it for me and how long will this take?**
  We are offering $50 for your time when we install the loggers and $100 when we pick up the logger six months later. This is a total of $150. The visit should take around one hour, depending on the size of your house

- **What does the visit involve?**
  Technicians will walk around your home and count the various types of lighting products you have installed. They will also install some lighting loggers to record how often you use certain lights.

- **Where will the loggers be installed?**
  Technicians will install the loggers in a way so they do not interfere with normal use of lights. The loggers are very small and will not interfere in any way with the normal use of your lights.

- **When do you remove the loggers?**
  The loggers need to remain in place for six months. At the end of six months we will return to remove the loggers. We will schedule the visits at a time that is convenient for you.

- **Why six months?**
  We need to record their lighting usage over time to account for differences in usage based on varying daylight conditions. Households use their lights differently during the winter months and summer months.

- **Who we are?**
  I am _____ and I work for the NMR Group, Inc., a consulting firm. We have been hired by National Grid to perform this study.

- **Purpose of Study?**
  - → Establish customer awareness of lighting options and changes in the lighting market
  - → Understand how people use the light bulbs in their home, as this has a large impact on how much energy households use.
  - → Determine current rates of use and storage for various light bulbs.
  - → The results of the study will be used in planning for future energy needs in Rhode Island.
- **How do I know you are legit?**
  National Grid is sponsoring this program and study. The contact person is Jeremy Newberger: 781-907-1548 or Jeremy.Newberger@nationalgrid.com.

7.1 The Energy Independent and Security Act (EISA of 2007)

This section is meant to provide field technicians a brief overview of EISA and potential impacts on lighting. While knowledge of EISA is not crucial to field technicians performing their duties, EISA in-part prompted this study and it is possible that customers may ask questions about EISA during onsite visits.

Summary

The Energy Independence and Security Act (EISA) of 2007 sets maximum wattage levels by lumen output (that is, how bright the bulb is) for medium, screw-base bulbs that have a range from 310 to 2,600 lumens (Table 12). Bulbs not meeting these standards will be phased out over the next few years. This lumen range generally corresponds to the brightness of 40 Watt to 100 Watt incandescent bulbs, and it is primarily incandescent bulbs that will be phase out.

The standards started to go into effect under a phased approach that began in 2012, when general service bulbs (that is, typical bulbs) began to be required to use from 20 percent to 30 percent less energy than current incandescent bulbs. The law first applied to bulbs in the 1,490 to 2,600 lumen range, effectively banning the manufacture and import of general service 100 Watt incandescent bulbs in the United States after January 1, 2012. Over the next few years, the law will limit the manufacture and import of all general service incandescent bulbs between 40 and 100 Watts.

Table 12: EISA Phase-out Schedule – Stage 1

Rated Lumen Ranges	Typical Current Lamp Wattage	Maximum Rate Wattage	Minimum Rate Lifetime	Effective Date
1490-2600	100	72	1,000 hours	January 1, 2012
1050-1489	75	53	1,000 hours	January 1, 2013
750-1049	60	43	1,000 hours	January 1, 2014
310-749	40	29	1,000 hours	January 1, 2014

EISA prohibits the manufacture and import of incandescent bulbs, but not the sale of incandescent bulbs. Therefore, standard incandescent bulbs will remain available to consumers on retailers' shelves until all stock acquired before the relevant effective date, is sold. Additionally, as remaining stocks sell out, consumers will have the option of replacing higher-wattage incandescent bulbs with lower-wattage ones during the transition period. Some stores, however, have voluntarily chosen not to carry certain wattages of incandescent bulbs in anticipation of the law's implementation.

Important Details

- On December 19, 2007, President George W. Bush signed H.R. 6, the Energy Independence and Security Act of 2007, into law (Public Law 110-140).
- Sets maximum wattage levels by lumen output for medium, screw-base bulbs:
  - → 310 to 2,600 lumens, which roughly correspond to the brightness emitted by 40 Watt to 100 Watt incandescent bulbs
  - → Began to be implemented on January 1, 2012; during this study its main impact will be on 1,050 to 2,600 lumen bulbs (100 Watt and 75 Watt incandescent bulbs)

Manufacture vs. Sale

EISA prohibits the **manufacture** and **import** of incandescent bulbs but does **not** prohibit the **sale** of incandescent bulbs. So people can still buy incandescent bulbs until the current stock runs out, and they may also use lower wattage bulbs not yet covered by EISA to replace higher wattage ones when they are no longer available in stores.

Consumer Lighting Options

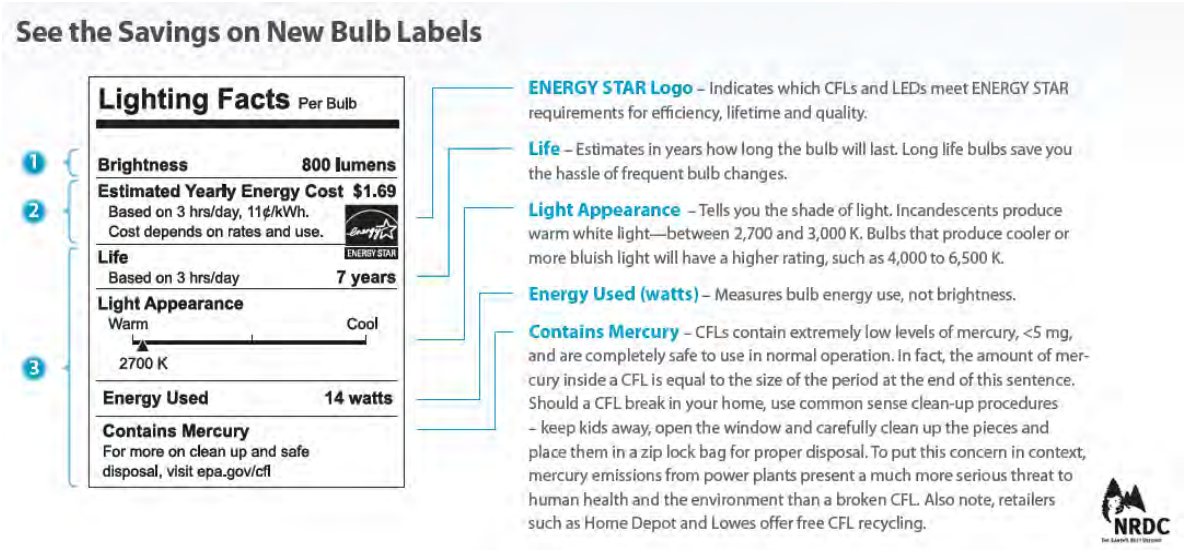
Consumers have a variety of options for replacement bulbs for those being phased out:

- Lower wattage incandescent bulbs (Cost is less than $1)
  - → Most similar to what many costumers are familiar with
- EISA-compliant halogen bulbs (Cost between $1.50 and $3.00)
  - → About 30% more efficient that standard incandescent bulbs
  - → Similar to standard incandescent bulbs in terms of appearance and light quality
- CFL bulbs (Cost between $1.00 and $3.00)
  - → More efficient than standard incandescent bulbs
  - → Some consumers concerned by mercury in CFL bulbs
- Non-directional LED bulbs (as opposed to spot and flood LEDs) (Cost between $10 and $20)
  - → Only a few on the market currently – still a developing technology
  - → While the price has been declining, still an expensive option and most consumers will not view LEDs as a viable replacement option until the price decreases.

Consumer Response

Consumer awareness of the EISA-mandated phase-out of incandescent bulbs and on how to choose light bulbs based on factors other than "wattage" (which most consumers equate with brightness) is relatively low. The Federal Trade Commission (FTC) has developed a new lighting facts label to help consumers make informed purchase decisions based on lumens instead of wattages and lifecycle costs.

Figure 13: FTC Lighting Facts Label



8 Mileage Tracking Form

NMR Group, Inc.

Regional Hours of Use Study
Time and Mileage

Time Sheet								
Task	Hours							Total Hours
	Mon	Tues	Wed	Thurs	Fri	Sat	Sun	
Training								
Onsite								
Travel								
Paper Work								
TOTAL:								

Mileage Log			
Date	Origination	Destination	Distance
		TOTAL:	

Name: _____ Week of: _____

Signature: _____ Date: _____

50-2 Howard Street, Somerville, MA 02144
Phone: (617) 284-6230 Fax: (617) 284-6239
www.nmrgroupinc.com

9 Reimbursement Form

NMR Group, Inc.

Regional Hours of Use Study

Reimbursement Form

Homeowner Name: _____

Address: _____

_____

Phone: _____

Technician: _____

Date of Visit: _____ Time: _____

Description: _____

_____

- Please attach a receipt for the replacement light bulb to this form and mail this form and the receipt to:

  Attn: Kiersten von Trapp
  NMR Group Inc
  50-2 Howard St.
  Somerville, MA 02144

50-2 Howard Street, Somerville, MA 02144
Phone: (617) 284-6230 Fax: (617) 284-6239
www.nmrgroupinc.com

10 EPA Cleanup and Disposal Guidelines for CFLs

Cleanup and Disposal Guidelines
For Compact Fluorescent Light Bulbs (CFLs)
June 2008

What precautions should I take when using CFLs in my home?
CFLs are made of glass and can break if dropped or roughly handled. Be careful when removing the bulb from its packaging, installing it, or replacing it. Always screw and unscrew the light bulb by its base (not the glass), and never forcefully twist the CFL into a light socket. If a CFL breaks in your home, follow the clean-up recommendations below. Used CFLs should be disposed of properly (see below).

What should I do with a CFL when it burns out?
EPA recommends that consumers take advantage of available local recycling options for compact fluorescent light bulbs. EPA is working with CFL manufacturers and major U.S. retailers to expand recycling and disposal options. Consumers can contact their local municipal solid waste agency directly, or go to www.epa.gov/bulbrecycling or www.earth911.org to identify local recycling options.

If your state or local environmental regulatory agency permits you to put used or broken CFLs in the garbage, seal the bulb in two plastic bags and put it into the outside trash, or other protected outside location, for the next normal trash collection. Never send a fluorescent light bulb or any other mercury-containing product to an incinerator.

If your ENERGY STAR qualified CFL product burns out before it should, look at the CFL base to find the manufacturer's name. Visit the manufacturer's web site to find the customer service contact information to inquire about a refund or replacement. Manufacturers producing ENERGY STAR qualified CFLs are required to offer at least a two-year limited warranty (covering manufacturer defects) for CFLs used at home. In the future, save your receipts to document the date of purchase.

How should I clean up a broken fluorescent bulb?
Because CFLs contain a small amount of mercury, EPA recommends the following clean-up and disposal guidelines:

1. Before Clean-up: Air Out the Room

- Have people and pets leave the room, and don't let anyone walk through the breakage area on their way out.
- Open a window and leave the room for 15 minutes or more.
- Shut off the central forced-air heating/air conditioning system, if you have one.

2. Clean-Up Steps for Hard Surfaces

- Carefully scoop up glass fragments and powder using stiff paper or cardboard and place them in a glass jar with metal lid (such as a canning jar) or in a sealed plastic bag.
- Use sticky tape, such as duct tape, to pick up any remaining small glass pieces and powder.
- Wipe the area clean with damp paper towels or disposable wet wipes. Place towels in the glass jar or plastic bag.
- Do not use a vacuum or broom to clean up the broken bulb on hard surfaces.

3. Clean-up Steps for Carpeting or Rug:

- Carefully pick up glass fragments and place them in a glass jar with metal lid (such as a canning jar) or in a sealed plastic bag.
- Use sticky tape, such as duct tape, to pick up any remaining small glass fragments and powder.
- If vacuuming is needed after all visible materials are removed, vacuum the area where the bulb was broken.
- Remove the vacuum bag (or empty and wipe the canister), and put the bag or vacuum debris in a sealed plastic bag.

4. Clean-up Steps for Clothing, Bedding, etc.:

- If clothing or bedding materials come in direct contact with broken glass or mercury-containing powder from inside the bulb that may stick to the fabric, the clothing or bedding should be thrown away. Do not wash such clothing or bedding because mercury fragments in the clothing may contaminate the machine and/or pollute sewage.
- You can, however, wash clothing or other materials that have been exposed to the mercury vapor from a broken CFL, such as the clothing you are wearing when you cleaned up the broken CFL, as long as that clothing has not come into direct contact with the materials from the broken bulb.
- If shoes come into direct contact with broken glass or mercury-containing powder from the bulb, wipe them off with damp paper towels or disposable wet wipes. Place the towels or wipes in a glass jar or plastic bag for disposal.

5. Disposal of Clean-up Materials

- Immediately place all clean-up materials outdoors in a trash container or protected area for the next normal trash pickup.
- Wash your hands after disposing of the jars or plastic bags containing clean-up materials.
- Check with your local or state government about disposal requirements in your specific area. Some states do not allow such trash disposal. Instead, they require that broken and unbroken mercury-containing bulbs be taken to a local recycling center.

6. Future Cleaning of Carpeting or Rug: Air Out the Room During and After Vacuuming

- The next several times you vacuum, shut off the central forced-air heating/air conditioning system and open a window before vacuuming.
- Keep the central heating/air conditioning system shut off and the window open for at least 15 minutes after vacuuming is completed.
- For more information about compact fluorescent bulbs, visit http://www.energystar.gov/cfls

For more information about compact fluorescent bulbs and mercury, visit http://www.energystar.gov/mercury EPA is continually reviewing its clean-up and disposal recommendations for CFLs to ensure that the Agency presents the most up-to-date information for consumers and businesses.

Regional Hours of Use Study: Onsite Handbook

Rhode Island

6/12/2013

Prepared for:

The Massachusetts Energy Efficiency Program Administrators

The Connecticut Energy Efficiency Board Evaluation Consultant

National Grid Rhode Island

The New York State Energy Research and Development Authority

50-2 Howard Street, Somerville, MA 02144
Phone: (617) 284-6230 Fax: (617) 284-6239
www.nmrgroupinc.com

Contents

Tables

1 Training Plan

- Independent Review of Materials – The purpose of this document is to provide all the information required to conduct site visits to collect the loggers installed for the Regional HOU Study. All field technicians should **review this document in its entirety prior to the over-the-phone training session.** *(1 hour)*
- Store Visit **[for new technicians only]** – All field technicians will go to a hardware, lighting, or big box retailer to familiarize themselves with various bulb types. *(1 hour)*
- Over-the-Phone Training Session – All field technicians will have an over-the-phone training session with the NMR program manager to review the protocols, onsite forms, and equipment required for this project. *(30 minutes)*

2 Background / Purpose of the Study

The parties responsible for evaluation of energy-efficiency programs in Massachusetts, Connecticut, Rhode Island, and New York have committed to conducting a study to estimate hours of use (HOU) of light bulbs in homes. The main objective of this study, therefore, is to estimate HOU, and we will do so by room type, not lighting type (technology) as many studies have done in the past. Our focus on room types assumes that people are likely to use their lights in a given room the same way regardless of the type of bulbs in the room.

To accomplish this objective, in the winter of 2012-2013 field technicians conducted an inventory of lighting to determine the number and type of bulbs installed in customers' homes, and installed a series of lighting loggers to capture information on how customers use lights in their homes. Technicians are now returning to the sites to collect the lighting loggers in order to retrieve the data for analysis.

NMR is scheduling the follow up visits for this study via telephone. As a field technician you will be provided with a list of customers to visit each week. This list will include the customer's name, telephone number, address, and an appointment time. You will also receive a check for each participant prior to visiting their home.

3 Onsite Protocol

Prior to removing light loggers, technicians will receive the logger installation data, which indicates the rooms, fixtures and bulb characteristics where loggers were installed in six months earlier; when available, the technicians will also receive the home schematic showing the exact location of the installed loggers.

Prior to Visit

Before visiting a home, you should make sure that, at a minimum, you have the following:

- → Onsite handbook
- → Data Form & Home Schematic
- → Appointment sheet
- → Company Polo Shirt
- → ID Badge
- → GPS

Materials for Customer

- → FAQs and Info Sheet
- → NMR contact's business card
- → Check ($100)

CFL Clean up Kit

- → Sealable plastic bags
- → Disposable wipes
- → Vacuum
- → Duct tape
- → Flat brush

Logger Removal Kit

- → Camera
- → Flashlight
- → Pen/Pencils
- → Flat & Philips head screwdrivers
- → Insulated gloves
- → Shoe coverings
- → Latex gloves
- → Step ladder
- → Wire Cutters
- → Scissors
- → Cleaning rags
- → Adhesive Remover Solution with Scraper
- → Sealable sandwich bags
- → Trash bag

Arrival at Onsite

After the door is opened, immediately ascertain that the person at the door is the scheduled interviewee. Introduce yourself and hand him/her the business card.

- **Sample Introduction** *(not to be read verbatim)***:**
  *"Hello, my name is _____, and I am working with NMR. NMR is working under contract with **National Grid**. I'm here to meet with _____. As mentioned on the phone, I'm here to walk through your home and collect the loggers that were installed on selected fixtures six months ago. **[Customer should be expecting inspector]**. During my visit I have a few wrap-up questions for you about the status of the loggers during the duration of the study, as well as some limited demographic questions. Today, in appreciation for your time, on behalf of **National Grid**, you'll also receive the second payment of $100. Do you have any questions regarding my visit?"*

Prior to Data Collection

- Give the customer a step by step description of what you'll be doing (show the data collection form as you explain)
  - → First I will remove the loggers installed in your home.
  - → Then I will ask you a few questions about the loggers as well as some demographic questions.
- The customer should not be surprised by any of this information as they have already been told what the study will consist of.

General sequence of data collection

- Logger Removal:
  - → Consult logger removal instructions.
  - → Check that the information provided for each logger is correct; record any discrepancies.
  - → For each logger, ask the homeowner, *"Were there any changes to this logger, light bulb, or fixture during the duration of its installation?"* and record response.
- Customer Survey:
  - → Ask the homeowner the demographic questions in the customer survey.
- After Data Collection:
  - → Thank the customer for his/her time
  - → Give him/her the $100 check.
  - → Have the customer sign off on your data collection form to indicate that you visited their home and provided him/her with a $100 check.
  - → Leave with the customer the "Logger Participant Frequently Asked Questions" one-page sheet.

4 Onsite Form Instructions

NMR will provide you with onsite forms specific to each site. These forms will be pre-filled with the logger ID number, room, fixture type, bulb type, bulb shape and socket type for each logger expected to be installed in each site.

Customer Information

→ Customer Name, Customer Address, and Customer ID will be provided on the sheet.

→ Fill in your name and the date and time of the appointment.

Site Specific Notes

→ NMR will include any known issue associated with a logger or household in this column (ex. The resident phoned NMR to report a logger had melted.)

→ If applicable, follow up on this comment with the homeowner.

Logger Retrieval Form

→ Using the information and home schematic (if applicable) provided by NMR, locate each logger installed in the home.

→ **Before removing the logger**, ask: ***Were there any changes to this bulb, logger, or fixture during the time the logger was installed?***

- If yes, take a photo of the logger and the replacement bulb
- Record any changes in the box provided (detailed instructions provided below)

→ **For each logger**, check that the pre-filled information is correct.

→ If there are any discrepancies between the expected and installed logger number, fixture, or bulb information provided, **fill in the actual information on the corresponding line below**.

→ **Record all information in clear, easy to read handwriting**

Logger ID

→ If a logger number has an asterisk (*), this number has been identified as one that **needs to be double checked** – record the correct logger number for each of these on the line below (even if it is the same).

→ **Always include a note for these loggers** (even if it is just "everything correct") so that we can confirm it was double-checked.

Room, Fixture Type, Bulb Type, Bulb Shape, Socket Type

→ Record any discrepancies in the row below the pre-filled information.

→ If a bulb has been changed, record the new bulb info in the box on the second page.

Light Pipe

→ For each logger, indicate if the logger has a light pipe attached (Y/N) in the space provided.

State Test

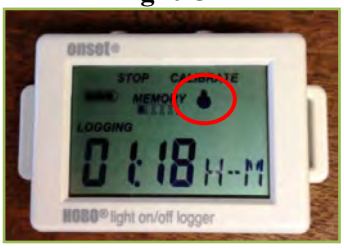
→ **<u>Before removing the logger</u>, perform a state test** to determine whether or not the logger accurately records event data.

- The logger screen will be blank – click one of the top buttons to make the screen appear (do not hold the button as that will stop the logger)
- Turn the fixture on and off; record whether the light bulb icon appears "on" and "off" appropriately (Pass/Fail).

→ If the battery is dead, or you are unable to complete the state test for a different reason, record this information in the box provided.

Light On

Light Off



Total Time

→ Record the total time either immediately before or immediately after removing the logger;

→ The time display shows the total amount of time the light has been on since logging began, ranging from seconds to days.

Hours & Minutes

1 hour, 18 minutes

Days & Hours

4 days, 17 hours (or 113 hours)

Usage Estimate

→ **<u>For each logger</u>**, ask the homeowner:

What was the typical usage for this fixture?

→ Record response in the column provided (Ex. 4 hours per day in the afternoon only).

→ **<u>Extreme Usage</u>:**

- Usage should be in the range of 70 to 800 hours - if the time on indicates extreme low use or extreme high use (anything above or below this range) **take photos of the fixture and the room.**
- Ex. If there is a window nearby, the logger may have been recording ambient light in addition to lamp usage.
- Do a quick calculation to see how the estimate compares to the total time:
  - The loggers have been in place approximately 150 days.
  - Ex. If the customer estimates 4 hours use per day, the total time should be in the range of 25 days (4 hours a day * 150 days = 600 hours. 600 hours/24 hours a day = 25 days).
- If the estimate and logger time are far apart, look for an explanation and ask the customer if they have any ideas that could explain the difference.

Record Changes

→ **<u>For each logger</u>**, ask the homeowner:

Were there any changes to this bulb, logger, or fixture during the time the logger was installed?

→ If "Yes", record the associated logger ID number and the date (or approximate date) the change occurred.

→ **If the bulb was replaced**, record the new bulb information in the space provided.

- For all bulb types record: Bulb type, shape, and wattage
- Ask: ***Was the new bulb a new purchase or was it a stored bulb?***
  1. Stored
  2. New Purchase
  3. Don't Know

Changes made since logger installation?		New Bulb				
Logger ID #	Date of Change	Bulb Type	Bulb Shape	Watts	Stored/ New	Other Change
12345678	4/13/13	CFL	T	13	New	

→ **If another change occurred**, record this information in the space provided for details.

Changes made since logger installation?		New Bulb				
Logger ID #	Date of Change	Bulb Type	Bulb Shape	Watts	Stored/ New	Other Change
87654321	2/4/13					Logger blew off fixture; home owner put it back up.

Customer Survey

→ Ask the homeowner:

- ***How many children under the age of 18 live in this household on a full time basis?*** *→ Record the number on the line provided.*

Additional Notes

→ Record any additional comments the homeowner may have or any other relevant observations in this column.

Customer Signature

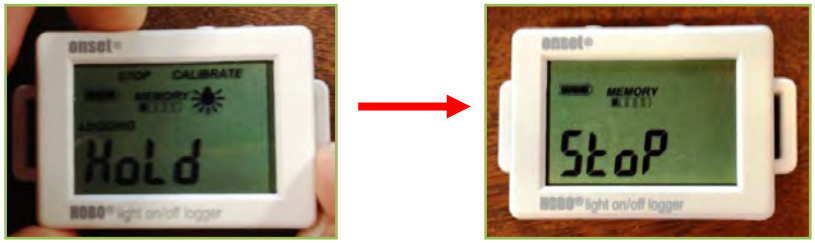
→ Have the homeowner sign the onsite form upon receiving their incentive check in the space provided on the cover page.

5 Logger Removal Protocols

5.1 Removing a Logger

To successfully remove a light logger, the technician will perform the following steps:

- Identify the fixture on which the logger is installed and locate the logger.
  - → If the customer offers to turn off the fixture and take it apart him/herself, **ALWAYS** let the customer do it.
  - → If there have been any changes to the bulb or fixture, take a photo of the bulb and fixture before removal.
- The logger screen should be blank when you find it; you can reactivate the display by quickly pressing the start/stop button. (Note: Do not hold the button for a few seconds, as that may turn the logger off)
- Remove the logger from the fixture **as carefully as possible**.
  - → If the customer offers to remove the logger from the fixture, let him/her do it.
  - → NMR will provide you with wire cutters and scissors to remove loggers installed with zip ties, as well as adhesive remover to remove any adhesive left from loggers installed with duct tape or 3M strips.
  - → Clean up all trash associated with logger removal; NMR will provide a small trash bag if there is not one easily accessible near the fixture.
- **Stopping a Logger**:
  - → Once you've removed the logger and recorded all the necessary data, stop the logger.
  - → Logging will end once you press the Start/Stop logging button for 3 seconds.



- **Light Pipes:**
  - → Some loggers will have light pipes attached to them. When you see one, inspect it to make sure it is still properly attached and pointing at the light bulb. If it is not, take a picture and make a note before removing the light pipe.
  - → To remove a light pipe: while holding the logger with the screen facing you, carefully push the base of the light pipe away from you:

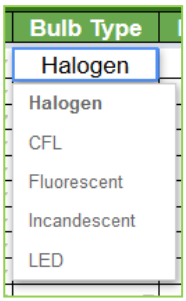
- **Packing Loggers:**
  - → **Put all loggers and the completed onsite form** from the site in one Ziploc bag and close the seal.
  - → The light pipes do not have to go in the site-specific Ziploc bag; all collected light pipes should be carefully packed together.

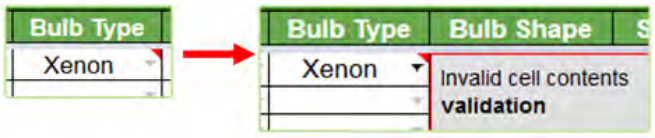
5.2 Removal Guidelines

- **Damage:**
  - → If you break or damage any fixtures, furniture, etc, give the customer the "Reimbursement Form."
  - → Note what was broken and contact the project manager as soon as possible to report the incident.
  - → Take a picture of the damage.
- **Broken Bulbs:**
  - → If you break any type of light bulb and/or if a broken CFL came into direct contact with clothing or bedding which subsequently needed to be thrown out, give the customer the "Reimbursement Form."
  - → Note what type of bulb was broken and contact the project manager as soon as possible to report the incident.
  - → Take a picture of the broken bulb and any other damage.
  - → **If a CFL or a fluorescent bulb should be broken**, refer to the "Cleanup and Disposal Guidelines for Compact Fluorescent Light Bulbs" of the Environmental Protection Agency (EPA) included in this packet.
- **Removing Bulbs or Fixture covers:**
  - → If the customer offers to turn off the fixture and take it apart him/herself, **ALWAYS** let the customer do it.
  - → **DO NOT TOUCH** if fixtures have cracked or damaged covers, or look delicate or easily breakable; if a logger is attached to such a fixture, proceed with caution with the homeowner present.
- **Burned Out Bulbs:**
  - → If a bulb is burned out, ask the customer the date (or approximate date) that the bulb burned out and record this in the appropriate spot on the onsite form.

5.3 Reporting Data

- At the end of each day, review the completed onsite forms to ensure that all necessary information is recorded and is clear and easy to read.
- **Entering Data into Google Docs:**
  - → Enter the completed onsite information into your Google doc for this project; all of your onsite data will be entered here.
  - → The Google doc has two tabs: **Logger Info** and **Customer Survey**. Enter the following information in each tab:
    - Logger Info:
      - Customer ID (repeat for all loggers associated with this ID)
      - Each Logger ID # and the correct information associated with each one
      - Any changes made since the loggers were installed – if no changes were made, enter an "N" under the "Change?" column.
    - Customer Survey:
      - Customer ID
      - Number of children under 18
      - Education
      - Additional Notes
  - → If provided, choose the correct information from the drop-down menu; if there is no drop-down menu, type in the recorded data.
    - Any onsite data that is not included in the drop-down menu can be typed in.
    - Ignore the red triangle that will appear in the upper right corner (and the comment box that appears when you scroll over the red triangle); this notifies you that the data entered is not in the list provided, but will not delete the cell contents.





- Upload, email, or text any photos to the NMR project manager at the end of each day with the associated Customer ID and Logger ID #.
- The NMR project manager will collect the loggers from you at the end of the project. Data from the loggers will be downloaded for review and analysis.

6 Quality Assurance and Control Procedures

As with all of our work, NMR endeavors to maintain a high quality work product. The sensitive nature of onsite work means that we take special precautions to ensure the quality of data collected and to avoid jeopardizing the relationship our clients have with their customers. To that end, to ensure that onsite technicians perform quality work that reflects well on NMR and our clients, the NMR project manager will:

- Review the onsite data entered on the Google doc at the end of each day.
- Call 20% of participants to ensure that their experience with the field technician was satisfactory.

7 Frequently Asked Questions

- **Who we are?**
  I am _____ and I work for NMR Group Inc, a consulting firm. We have been hired by National Grid to perform this study.
- **Purpose of Study?**
  The parties responsible for evaluation of energy-efficiency programs in Massachusetts, Connecticut, Rhode Island, and New York have committed to conducting a study to estimate hours of use (HOU) of light bulbs in homes. The main objectives of this study are as follows:
  - → Establish customer awareness of lighting options and changes in the lighting market
  - → Understand how people use the light bulbs in their home, as this has a large impact on how much energy households use.
  - → Determine current rates of use and storage for various light bulbs.
  - → The results of the study will be used in planning for future energy needs in Massachusetts, Connecticut, Rhode Island, and New York.
- **What happens with our data?**
  The lighting logger recorded when your light was turned on and off over the past six months. It did not collect any other information. When we download the data from the logger we will assign the information to a number (not a name) and no one will know that the data is for your home.
- **How can I find out the results?**
  The study results will be the property of National Grid and will become accessible to the public in the spring of 2014.
- **How do I know you are legit?**
  National Grid is sponsoring this program and study. The contact person is Jeremy Newberger: 781-907-1548 or Jeremy.Newberger@nationalgrid.com.

8 EPA Cleanup and Disposal Guidelines for CFLs

Cleanup and Disposal Guidelines
For Compact Fluorescent Light Bulbs (CFLs)
June 2008

What precautions should I take when using CFLs in my home?
CFLs are made of glass and can break if dropped or roughly handled. Be careful when removing the bulb from its packaging, installing it, or replacing it. Always screw and unscrew the light bulb by its base (not the glass), and never forcefully twist the CFL into a light socket. If a CFL breaks in your home, follow the clean-up recommendations below. Used CFLs should be disposed of properly (see below).

What should I do with a CFL when it burns out?
EPA recommends that consumers take advantage of available local recycling options for compact fluorescent light bulbs. EPA is working with CFL manufacturers and major U.S. retailers to expand recycling and disposal options. Consumers can contact their local municipal solid waste agency directly, or go to www.epa.gov/bulbrecycling or www.earth911.org to identify local recycling options.

If your state or local environmental regulatory agency permits you to put used or broken CFLs in the garbage, seal the bulb in two plastic bags and put it into the outside trash, or other protected outside location, for the next normal trash collection. Never send a fluorescent light bulb or any other mercury-containing product to an incinerator.

If your ENERGY STAR qualified CFL product burns out before it should, look at the CFL base to find the manufacturer's name. Visit the manufacturer's web site to find the customer service contact information to inquire about a refund or replacement. Manufacturers producing ENERGY STAR qualified CFLs are required to offer at least a two-year limited warranty (covering manufacturer defects) for CFLs used at home. In the future, save your receipts to document the date of purchase.

How should I clean up a broken fluorescent bulb?
Because CFLs contain a small amount of mercury, EPA recommends the following clean-up and disposal guidelines:

1. Before Clean-up: Air Out the Room

- Have people and pets leave the room, and don't let anyone walk through the breakage area on their way out.
- Open a window and leave the room for 15 minutes or more.
- Shut off the central forced-air heating/air conditioning system, if you have one.

2. Clean-Up Steps for Hard Surfaces

- Carefully scoop up glass fragments and powder using stiff paper or cardboard and place them in a glass jar with metal lid (such as a canning jar) or in a sealed plastic bag.
- Use sticky tape, such as duct tape, to pick up any remaining small glass pieces and powder.
- Wipe the area clean with damp paper towels or disposable wet wipes. Place towels in the glass jar or plastic bag.
- Do not use a vacuum or broom to clean up the broken bulb on hard surfaces.

3. Clean-up Steps for Carpeting or Rug:

- Carefully pick up glass fragments and place them in a glass jar with metal lid (such as a canning jar) or in a sealed plastic bag.
- Use sticky tape, such as duct tape, to pick up any remaining small glass fragments and powder.
- If vacuuming is needed after all visible materials are removed, vacuum the area where the bulb was broken.
- Remove the vacuum bag (or empty and wipe the canister), and put the bag or vacuum debris in a sealed plastic bag.

4. Clean-up Steps for Clothing, Bedding, etc.:

- If clothing or bedding materials come in direct contact with broken glass or mercury-containing powder from inside the bulb that may stick to the fabric, the clothing or bedding should be thrown away. Do not wash such clothing or bedding because mercury fragments in the clothing may contaminate the machine and/or pollute sewage.
- You can, however, wash clothing or other materials that have been exposed to the mercury vapor from a broken CFL, such as the clothing you are wearing when you cleaned up the broken CFL, as long as that clothing has not come into direct contact with the materials from the broken bulb.
- If shoes come into direct contact with broken glass or mercury-containing powder from the bulb, wipe them off with damp paper towels or disposable wet wipes. Place the towels or wipes in a glass jar or plastic bag for disposal.

5. Disposal of Clean-up Materials

- Immediately place all clean-up materials outdoors in a trash container or protected area for the next normal trash pickup.
- Wash your hands after disposing of the jars or plastic bags containing clean-up materials.
- Check with your local or state government about disposal requirements in your specific area. Some states do not allow such trash disposal. Instead, they require that broken and unbroken mercury-containing bulbs be taken to a local recycling center.

6. Future Cleaning of Carpeting or Rug: Air Out the Room During and After Vacuuming

- The next several times you vacuum, shut off the central forced-air heating/air conditioning system and open a window before vacuuming.
- Keep the central heating/air conditioning system shut off and the window open for at least 15 minutes after vacuuming is completed.
- For more information about compact fluorescent bulbs, visit http://www.energystar.gov/cfls

For more information about compact fluorescent bulbs and mercury, visit http://www.energystar.gov/mercury EPA is continually reviewing its clean-up and disposal recommendations for CFLs to ensure that the Agency presents the most up-to-date information for consumers and businesses.

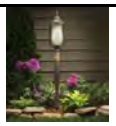
9 Onsite Reference Exhibits

Fixture Type

Table 1: Fixture Type List

Fixture	Code	Fixture	Code	Fixture	Code
Recessed	R	Wall Mount	WM	Walkway	W
Pendent	P	Night Light	NL	Exterior Flood	EF
Flush Mount	FM	Table Lamp	TL	Garage Door	G
Track	T	Floor Lamp	FL	Under Cabinet	U
Ceiling Fan	CF	Post Mount	PM	Other	O

Table 2: Fixture Type Exhibit

Fixture	Image	Fixture	Image
Recessed *(light bulb does not stick out of the plane of the ceiling)*		**Table Lamp** *(lamps that are put on tables)*	
Pendant *(fixture and bulb hangs from ceiling, i.e. chandelier)*		**Floor Lamp** *(lamps that are put on the floor)*	
Flush Mount *(fixture is flush with the ceiling)*		**Post Mount** *(exterior lights on a lamppost)*	
Track *(light bulbs on a strip/track)*		**Walkway** *(lights on a path outside the home)*	
Ceiling Fan *(lights attached to a ceiling fan)*		**Exterior Flood** *(fixtures that flood a large area with light, found on the side of home, above garage, or under peak of roof)*	
Wall Mount *(fixture attached to wall)*		**Garage Door**	
Night Light		**Under cabinet** *(lights under kitchen cabinets for lighting counter)*	

Bulb Type

Table 3: Bulb Types Code List

Bulb Type	Code	Bulb Type	Code
Incandescent	I	Halogen	H
CFL	CFL	Other	O
Fluorescent	F	Empty Socket	E
LED	LED		

Table 4: Bulb Types Exhibit

Bulb Types	Image	Description
Incandescent (I)		Bulbs have a filament that's heated to the point of glowing
Compact Fluorescent (CFL)		Bulbs are energy-efficient; use 67% less energy than incandescent bulbs and last longer. Covered CFLs have a plastic cover that conceals the traditional spiral shape. If you look closely at the bulb you will be able to see the spirals through the covering—especially when the bulb is turned on.
Fluorescent (F)		Bulbs are filled with mercury vapor that emits ultraviolet light when electricity is applied, then coating inside bulbs turns the UV rays into visible light
Light-Emitting Diode (LED)		Bulbs have a semiconductor chip so current flows through; light is released when an electron falls into a lower energy level. Some LEDs have a yellow filter.
Halogen (H)		More efficient type of incandescent bulb with filament sealed into a compact transparent envelope filled a small amount of halogen, allowing the filament to be at a higher temperature. Some halogens are virtually indistinguishable from regular incandescent bulbs. They may be smaller (ex. A-17 size instead of A-19) or can be distinguished by the presence of a glass tube around the filament (halogen) instead of the filament by itself (incandescent).

Bulb Shape

Table 5: Bulb Shape List

Bulb Shape	Code	Bulb Shape	Code
Twist/Spiral	T	Spot/Reflector/Flood	S
Globe	G	Circline	C
A-lamp	A	Tube	Tub
Bullet/Torpedo	B	Candle	Can
Bug light	Bug	Other [Specify]	O

Table 6: Bulb Shape Exhibit

Bulb Shape	Image	Bulb Shape	Image
Twist/Spiral (T)		**Spotlight/ Reflector/Flood (S)**	
Globe (G) *(e.g., for bathroom vanity fixtures)*		**Circline (C)**	
A-lamp (A) *(shaped like standard incandescent)*		**Tube Style (Tub)**	
Bullet/Torpedo (B) *(pointed top, standard screw base)*		**Candle (Can)** *(pointed top with a candelabra screw base)*	
Bug light (Bug) *(yellow color; do not confuse with LEDs with yellow filters)*			

Socket Type

Table 7: Socket Type List

Socket Type	Code
Medium Screw Base (Standard)	S
Small Screw Base (Candelabra)	Can
Pin Base	P
GU Pin Base	GU
Other	O

Table 8: Socket Type Exhibit

Socket	Image	Description
Medium Screw Base (S)		Light bulb screwed into socket
Small Screw Base [Candelabra] (Can)		Smaller screw base
Pin Base (P)		Pin on base of bulb sticks into socket
GU Base (GU)		Pin with larger head on base of bulb sticks into socket

Logger Numbers

Table 9: Types of Logger ID Numbers