

CALIFORNIA COMMERCIAL END-USE SURVEY

Chapter 11

CONSULTANT REPORT

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Prepared By:
Itron, Inc.



This report is dedicated to the memory of Alan Fields, who served as the project manager until his death on February 3, 2004. Alan was a valued colleague and dear friend. He will be missed by his associates at Itron, the California Energy Commission, and the energy industry.

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Publication CEC-400-2006-005APA contains the following 10 appendices that accompany this report:

- Appendix A: Basic Survey Instrument**
- Appendix B: Annotated Survey Instrument**
- Appendix C: End-Use Mappings**
- Appendix D: Recruitment Letter**
- Appendix E: Recruitment Script**
- Appendix F: Short-Term Metering Protocols**
- Appendix G: Survey Database Layout**
- Appendix H: Non-HVAC End-Use Algorithms**
- Appendix I: Description of Forecasting Climate Zone Results Database**
- Appendix J: SIC Code to CEUS Building Type Mapping Table**

CHAPTER 11: SDG&E RESULTS BY SEGMENT

11.1 Introduction

This chapter summarizes the results of the CEUS analysis for the SDG&E service area. As noted in Chapter 7, *gas estimates relate to natural gas usage by customers in SDG&E's electric service area*. As such, they include some gas provided to these customers by other gas utilities, and exclude SDG&E gas served to customers in other electric service areas. Section 11.2 provides an overview of the composition of energy usage in the SDG&E electric service area by building type and end use. Section 11.3 presents electric and gas fuel shares, energy-use indices (EUIs), and energy intensities at the end-use level by building type. Section 11.4 provides 16-day hourly end-use electric shapes by building type. For all results presented in this chapter, the end uses and building types are as described in Chapter 7 of this report.

Additional results for the California Energy Commission Forecasting Climate Zones within the SDG&E service area (13) were also generated.¹ The database containing these results is described in Appendix I.

11.2 Overview of Energy Usage in the SDG&E Electric Service Area

Table 11-1, Figure 11-1, and Figure 11-2 depict the estimates of floor stock, whole-building energy intensities, and energy usage by building type for the SDG&E service area. Energy intensities and annual usage are weather-normalized. As noted in Chapter 7, these estimates refer to end-use consumption rather than necessarily purchases from utilities or other vendors. Estimates are based on the analysis year of 2002.

As shown, total commercial floor stock in the SDG&E electric service area is estimated to be just over 500 million square feet. The building types accounting for the largest percentage of total commercial floor stock are Miscellaneous (with approximately 21% of the total), Large Offices (16%) and Retail (12%).

Total commercial electric consumption is 8,491 GWh annually. The building types accounting for the largest percentage of total electricity consumption are Large Offices (20%), Miscellaneous (14%), and retail (13%). Natural gas usage is roughly 153 million therms (Mtherms) per year. Two building types account for over 41% of natural gas usage: Large Offices (23%) and Restaurants (18%).

¹ For the CEUS study, the single SDG&E FCZ was analyzed as “coastal” and “inland” sub-zones, designated as “S07” and “S10” respectively. The S07 sub-group included all premises located in Standards climate zones 6, 7 and 8, while the S10 sub-zone included premises located in Standards climate zones 10, 14, and 15. This approach was used in recognition of the varying climate regions within the SDG&E service territory.

Figure 11-3 and Figure 11-4 depict estimates of SDG&E service area electric and gas usage percentages by end use. The primary electric end uses are interior lighting (28%), cooling (16%), refrigeration (12%), and ventilation (11%). The primary natural gas end uses are water heating (32%) and space heating (30%).

Electric and gas usage and energy intensities by end use and building type are presented in Table 11-2 through Table 11-5. As indicated in Table 11-3, the highest overall electric end-use energy intensities are interior lighting (4.16 kWh per square foot), followed by cooling (2.38), refrigeration (1.79), and ventilation (1.66). According to Table 11-5, the highest natural gas end-use energy intensities are water heating (8.6 kBtu per square foot), space heating (7.9), and cooking (5.6).

EUIs by building type and end use are presented in Section 11-3.

Table 11-1: Overview of Energy Usage in the SDG&E Electric Service Area

Building Type	Floor Stock (kft ²)	Annual Energy Intensities			Total Annual Usage	
		Electricity (kWh/ft ²)	Natural Gas (therms/ft ²)	Natural Gas (kBtu/ft ²)	Electricity (GWh)	Natural Gas (Mtherms)
All Commercial	580,041	14.64	0.26	26.45	8,491	153.40
Small Office (<30k ft2)	59,429	12.13	0.02	2.07	721	1.20
Large Office (>=30k ft2)	89,827	19.23	0.39	38.86	1,727	34.90
Restaurant	15,604	43.73	1.77	176.82	682	27.60
Retail	72,428	15.49	0.02	2.44	1,122	1.80
Food Store	19,010	38.79	0.27	26.53	737	5.00
Refrigerated Warehouse	1,933	35.31	0.07	7.12	68	0.10
Unrefrigerated Warehouse	28,451	4.54	0.02	2.08	129	0.60
School	54,671	6.69	0.07	7.03	366	3.80
College	48,504	11.32	0.43	42.97	549	20.80
Health	35,163	18.92	0.61	61.02	665	21.50
Lodging	34,019	16.10	0.62	61.75	548	21.00
Miscellaneous	121,002	9.72	0.12	12.41	1,176	15.00
All Offices	149,257	16.40	0.24	24.21	2,448	36.10
All Warehouses	30,384	6.50	0.02	2.40	197	0.70

Figure 11-1: Electricity Use by Building Type

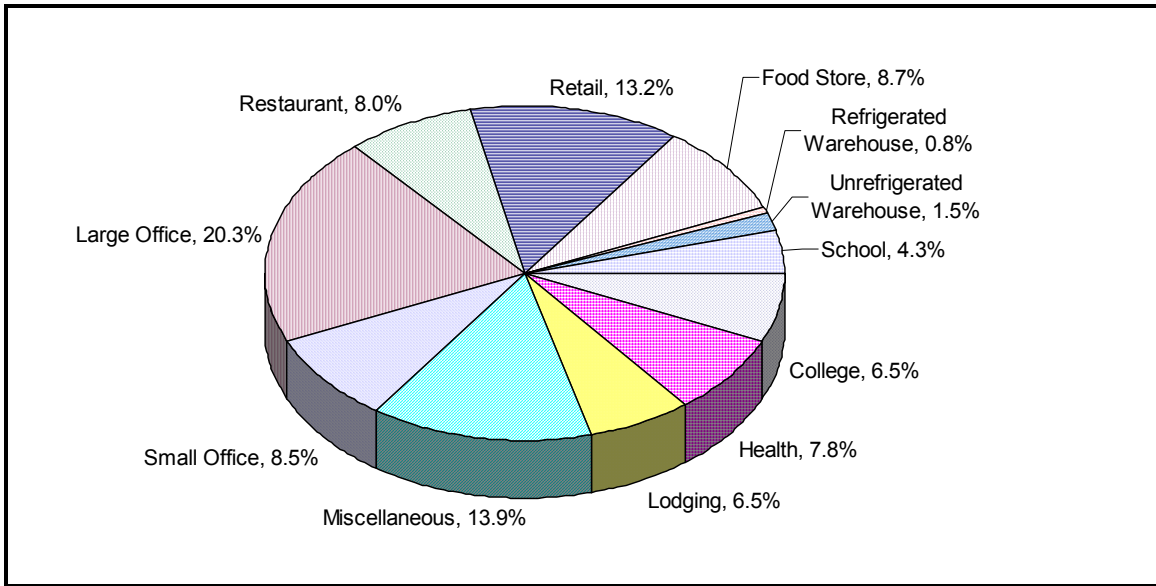


Figure 11-2: Natural Gas Usage by Building Type

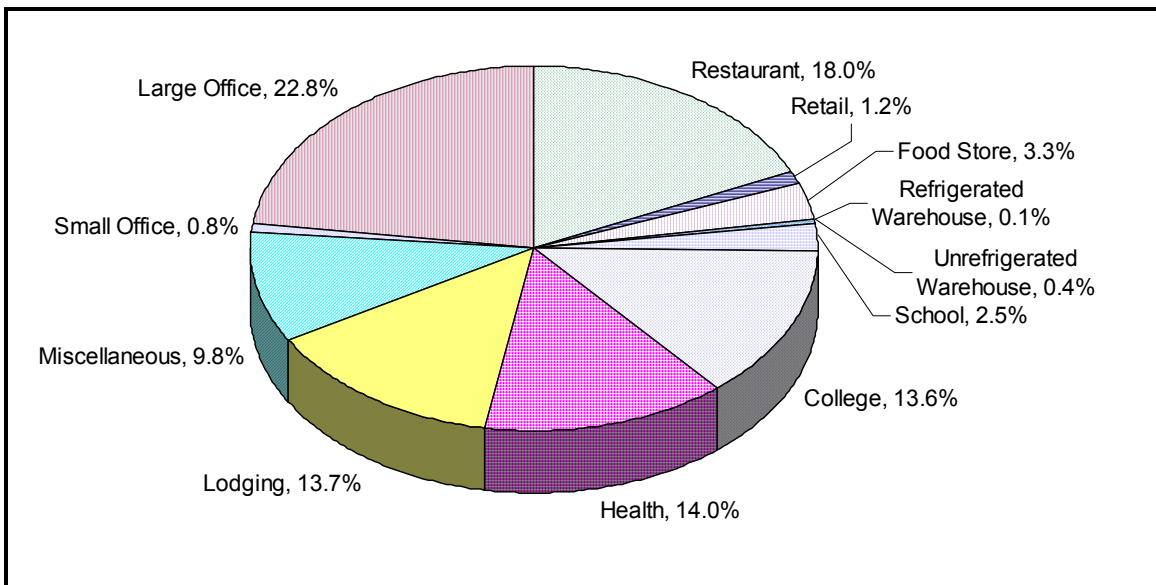


Figure 11-3: Electric Usage by End Use

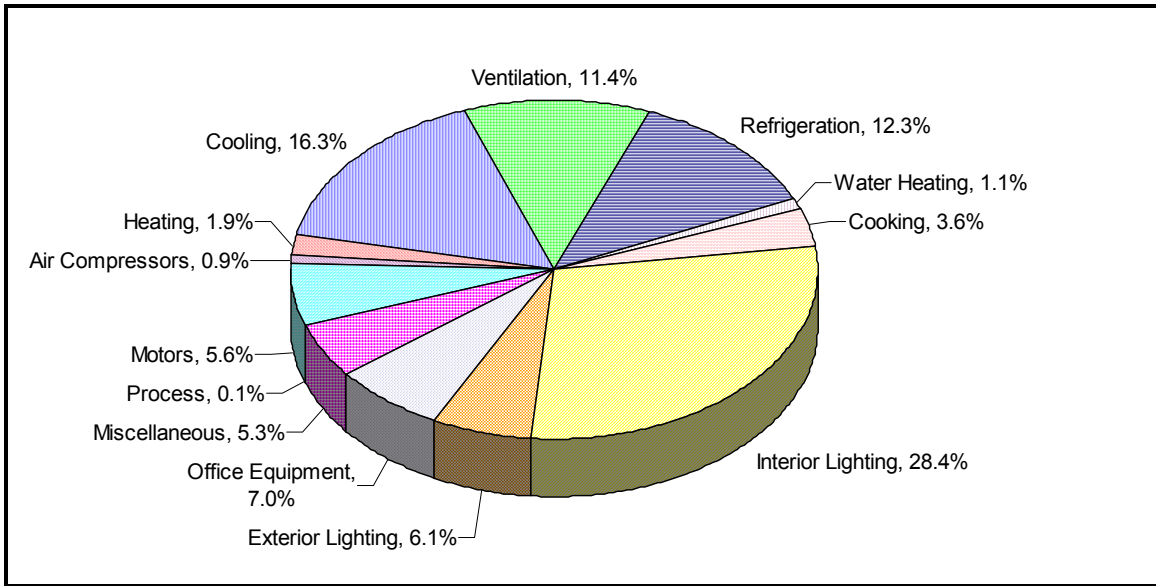
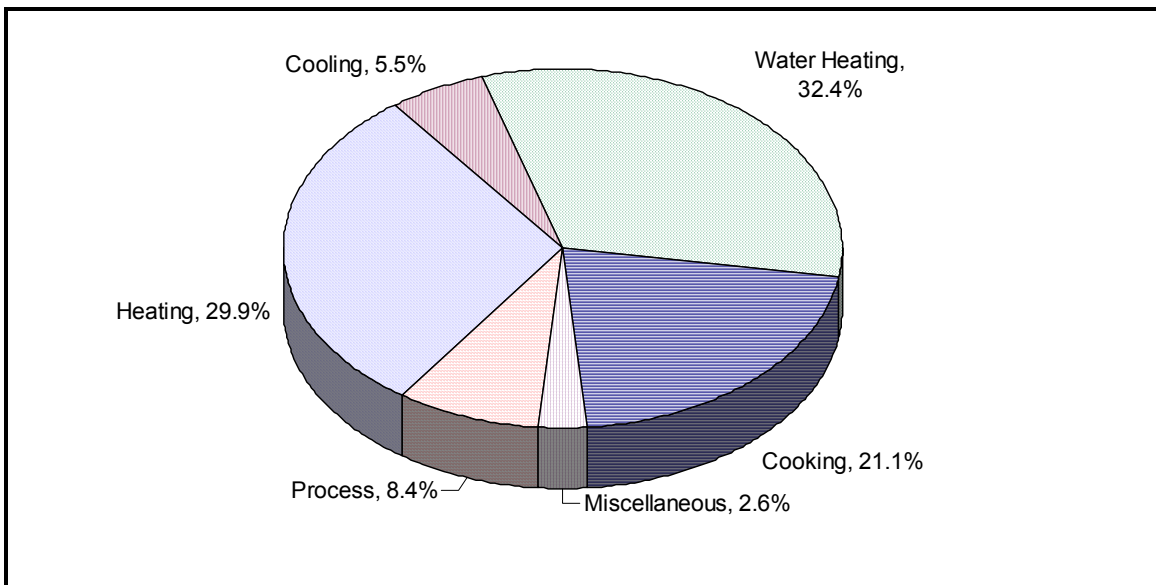


Figure 11-4: Natural Gas Usage by End Use



California Commercial End-Use Survey

Table 11-2: Electric Usage (GWh) by Building Type and End Use

Building Type	Heat	Cool	Vent.	Refrig.	WH	Cook	Int. Ltg.	Ext. Ltg.	Office Equip.	Misc.	Air Comp.	Motors	Proc.	Total
All Commercial	162.10	1,380.50	965.60	1,041.00	93.60	304.70	2,411.60	520.50	597.50	452.30	6.60	477.30	77.40	8490.60
Small Office	18.00	134.20	63.40	45.30	21.70	10.60	234.10	47.60	132.30	10.80	0.00	0.40	2.30	720.60
Large Office	43.40	382.60	294.80	64.10	15.00	13.10	399.90	51.20	265.50	94.10	1.20	92.10	10.30	1727.10
Restaurant	2.30	100.30	65.90	161.60	8.10	157.40	105.80	30.20	11.60	37.90	0.00	0.80	0.30	682.30
Retail	6.30	174.90	117.30	103.10	18.60	18.50	486.80	89.00	41.80	39.90	0.00	15.70	10.10	1121.90
Food Store	0.40	40.90	41.60	433.40	1.50	27.00	148.50	19.00	7.50	14.90	0.00	2.80	0.00	737.40
Refrigerated Warehouse	0.20	1.30	3.60	43.90	0.30	0.20	8.10	0.90	0.70	0.70	0.00	8.20	0.20	68.30
Unrefrigerated Warehouse	0.70	18.40	12.70	9.80	2.60	3.40	56.20	6.80	8.70	4.60	0.80	3.80	0.80	129.10
School	12.00	53.90	46.40	22.30	5.60	4.60	145.20	37.70	27.60	6.40	0.00	2.40	1.60	365.70
College	38.50	116.20	37.10	28.60	1.00	17.30	157.70	67.90	25.50	11.60	0.00	42.60	5.10	549.10
Health	16.00	147.90	101.80	21.40	3.80	7.60	172.80	16.20	28.20	108.60	0.40	35.30	5.30	665.30
Lodging	13.80	114.10	99.40	35.10	0.10	30.90	175.80	19.70	3.70	36.30	0.00	18.10	0.90	547.80
Miscellaneous	10.70	95.80	81.60	72.20	15.50	14.20	320.80	134.20	44.30	86.70	4.20	255.20	40.70	1176.00
All Offices	61.30	516.80	358.20	109.50	36.60	23.60	633.90	98.80	397.80	104.80	1.20	92.50	12.60	2447.70
All Warehouses	0.80	19.70	16.30	53.70	2.90	3.60	64.20	7.70	9.30	5.30	0.80	12.00	1.00	197.40

California Commercial End-Use Survey

Table 11-3: Electric Energy Intensities (kWh/ft²-yr) by Building Type and End Use

Building Type	Total	Heat	Cool	Vent.	Refrig.	WH	Cook	Int. Ltg.	Ext. Ltg.	Office Equip.	Misc.	Air Comp.	Motors	Proc.
All Commercial	14.64	0.28	2.38	1.66	1.79	0.16	0.53	4.16	0.90	1.03	0.78	0.01	0.82	0.13
Small Office	12.13	0.30	2.26	1.07	0.76	0.37	0.18	3.94	0.80	2.23	0.18	0.00	0.01	0.04
Large Office	19.23	0.48	4.26	3.28	0.71	0.17	0.15	4.45	0.57	2.96	1.05	0.01	1.03	0.11
Restaurant	43.73	0.15	6.43	4.22	10.36	0.52	10.08	6.78	1.94	0.75	2.43	0.00	0.05	0.02
Retail	15.49	0.09	2.42	1.62	1.42	0.26	0.26	6.72	1.23	0.58	0.55	0.00	0.22	0.14
Food Store	38.79	0.02	2.15	2.19	22.80	0.08	1.42	7.81	1.00	0.40	0.78	0.00	0.14	0.00
Refrigerated Warehouse	35.31	0.09	0.68	1.86	22.72	0.16	0.12	4.18	0.46	0.36	0.34	0.00	4.25	0.09
Unrefrigerated Warehouse	4.54	0.02	0.65	0.45	0.34	0.09	0.12	1.97	0.24	0.30	0.16	0.03	0.13	0.03
School	6.69	0.22	0.99	0.85	0.41	0.10	0.08	2.66	0.69	0.50	0.12	0.00	0.04	0.03
College	11.32	0.79	2.40	0.77	0.59	0.02	0.36	3.25	1.40	0.53	0.24	0.00	0.88	0.10
Health	18.92	0.45	4.21	2.89	0.61	0.11	0.22	4.92	0.46	0.80	3.09	0.01	1.00	0.15
Lodging	16.10	0.41	3.35	2.92	1.03	0.00	0.91	5.17	0.58	0.11	1.07	0.00	0.53	0.03
Miscellaneous	9.72	0.09	0.79	0.67	0.60	0.13	0.12	2.65	1.11	0.37	0.72	0.03	2.11	0.34
All Offices	16.40	0.41	3.46	2.40	0.73	0.25	0.16	4.25	0.66	2.67	0.70	0.01	0.62	0.08
All Warehouses	6.50	0.03	0.65	0.54	1.77	0.09	0.12	2.11	0.25	0.31	0.17	0.03	0.39	0.03

Table 11-4: Natural Gas Usage (Mtherms) by Building Type and End Use

Building Type	Heat	Cool	WH	Cook	Misc.	Proc.	Total
All Commercial	45.80	8.50	49.70	32.40	4.00	12.90	153.40
Small Office	0.40	0.00	0.50	0.00	0.00	0.30	1.20
Large Office	22.70	2.40	3.80	0.20	0.10	5.60	34.90
Restaurant	0.50	0.00	5.50	21.60	0.00	0.00	27.60
Retail	0.60	0.00	0.40	0.70	0.00	0.10	1.80
Food Store	0.90	0.00	1.20	2.90	0.00	0.00	5.00
Refrigerated Warehouse	0.00	0.00	0.10	0.00	0.00	0.00	0.10
Unrefrigerated Warehouse	0.50	0.00	0.10	0.00	0.00	0.00	0.60
School	2.40	0.00	1.10	0.30	0.00	0.00	3.80
College	7.20	5.80	5.30	1.90	0.70	0.00	20.80
Health	4.90	0.30	13.70	1.60	0.50	0.30	21.50
Lodging	1.60	0.00	15.60	2.50	1.10	0.10	21.00
Miscellaneous	4.00	0.00	2.30	0.70	1.60	6.40	15.00
All Offices	23.10	2.40	4.30	0.20	0.20	5.90	36.10
All Warehouses	0.50	0.00	0.20	0.00	0.00	0.00	0.70

Table 11-5: Natural Gas Usage Intensities (kBtu/ft²-yr) by Building Type and End Use

Building Type	Total	Heat	Cool	WH	Cook	Misc.	Proc.
All Commercial	26.5	7.9	1.5	8.6	5.6	0.7	2.2
Small Office	2.1	0.7	0.0	0.9	0.0	0.0	0.4
Large Office	38.9	25.3	2.7	4.2	0.2	0.2	6.3
Restaurant	176.8	3.0	0.0	35.4	138.4	0.0	0.0
Retail	2.4	0.8	0.0	0.6	0.9	0.0	0.2
Food Store	26.5	4.8	0.0	6.3	15.4	0.0	0.0
Refrigerated Warehouse	7.1	2.2	0.0	4.9	0.0	0.0	0.0
Unrefrigerated Warehouse	2.1	1.7	0.0	0.2	0.0	0.1	0.0
School	7.0	4.5	0.0	2.1	0.5	0.0	0.0
College	43.0	14.9	11.9	11.0	3.8	1.3	0.0
Health	61.0	14.1	0.9	39.1	4.7	1.3	1.0
Lodging	61.7	4.8	0.0	45.8	7.5	3.2	0.4
Miscellaneous	12.4	3.3	0.0	1.9	0.6	1.3	5.3
All Offices	24.2	15.5	1.6	2.9	0.1	0.1	4.0
All Warehouses	2.4	1.8	0.0	0.5	0.0	0.1	0.0

11.3 Segment-Level Fuel Shares, EUIs, and Energy Intensities

This section provides EUIs, fuel shares, and energy intensities for the building types and end uses defined in Chapter 7. Results are not presented in this section for the “All Offices” and “All Warehouses” building types.

All Commercial

Estimated total floor stock for all commercial buildings in the SDG&E service area is just over 580 million square feet. Electric and natural gas EUIs, fuel shares and energy intensities for the overall SDG&E commercial sector are presented in Table 11-6 and Table 11-7.

Table 11-6: All Commercial Electric EUIs, Fuel Shares, and EIs

End Use	Electric EUI (kWh/End-Use ft ²)	Electric Fuel Share	Electric EI (kWh/ft ²)
Heating	0.52	53.90	0.28
Cooling	3.37	70.60	2.38
Ventilation	2.20	75.60	1.66
Water Heating	0.31	52.90	0.16
Cooking	0.56	94.60	0.53
Refrigeration	1.85	97.20	1.79
Interior Lighting	4.16	100.00	4.16
Office Equipment	1.03	99.70	1.03
Exterior Lighting	0.97	92.30	0.90
Miscellaneous	1.02	76.10	0.78
Process	0.44	2.60	0.01
Motors	1.40	58.80	0.82
Air Compressors	0.37	36.40	0.13
All End Uses			14.64

Table 11-7: All Commercial Natural Gas EUIs, Fuel Shares, and EIs

End Use	Natural Gas EUI (kBtu/End-Use ft ²)	Natural Gas Fuel Share	Natural Gas EI (kBtu/ft ²)
Heating	16.72	47.20	7.90
Cooling	20.76	7.10	1.47
Water Heating	14.80	57.90	8.57
Cooking	15.24	36.70	5.59
Miscellaneous	3.62	19.20	0.69
Process	55.48	4.00	2.23
All End Uses			26.45

Small Offices

Estimated total floor stock in small office buildings (defined as premises with total floor area less than 30,000 square feet) is just over 59 million square feet. Based on the electric intensities in Table 11-8, the largest electric end uses in this building type are interior lighting, cooling and office equipment. As shown in Table 11-9, the largest gas end use is water heating, followed fairly closely by space heating.

Table 11-8: Small Office Electric EUIs, Fuel Shares, and EIs

End Use	Electric EUI (kWh/End-Use ft ²)	Electric Fuel Share	Electric EI (kWh/ft ²)
Heating	0.38	80.00	0.30
Cooling	2.44	92.60	2.26
Ventilation	1.14	93.40	1.07
Water Heating	0.52	70.30	0.37
Cooking	0.19	92.20	0.18
Refrigeration	0.87	87.20	0.76
Interior Lighting	3.94	100.00	3.94
Office Equipment	2.23	100.00	2.23
Exterior Lighting	1.46	54.70	0.80
Miscellaneous	0.54	33.80	0.18
Process	0.00	0.00	0.00
Motors	0.70	0.90	0.01
Air Compressors	0.44	8.90	0.04
All End Uses	-	-	12.13

Table 11-9: Small Office Natural Gas EUIs, Fuel Shares, and EIs

End Use	Natural Gas EUI (kBtu/End-Use ft ²)	Natural Gas Fuel Share	Natural Gas EI (kBtu/ft ²)
Heating	10.18	6.70	0.68
Cooling	0.00	0.00	0.00
Water Heating	18.08	5.10	0.92
Cooking	0.00	0.00	0.00
Miscellaneous	0.29	10.90	0.03
Process	215.01	0.20	0.44
All End Uses			2.07

Large Offices

Estimated total floor stock in large office buildings (defined as premises with total floor area of 30,000 square feet or more) is almost 90 million square feet. As indicated by Table 11-10, the largest electric end uses in this building type are interior lighting, cooling and ventilation. As shown in Table 11-11, the predominant gas end use is space heating.

Table 11-10: Large Office Electric EUIs, Fuel Shares, and EIs

End Use	Electric EUI (kWh/End-Use ft ²)	Electric Fuel Share	Electric EI (kWh/ft ²)
Heating	0.69	70.40	0.48
Cooling	4.76	89.50	4.26
Ventilation	3.56	92.10	3.28
Water Heating	0.27	62.80	0.17
Cooking	0.15	96.00	0.15
Refrigeration	0.73	97.70	0.71
Interior Lighting	4.45	100.00	4.45
Office Equipment	2.96	100.00	2.96
Exterior Lighting	0.57	100.00	0.57
Miscellaneous	1.64	64.00	1.05
Process	0.40	3.40	0.01
Motors	1.11	92.50	1.03
Air Compressors	0.25	45.90	0.11
All End Uses			19.23

Table 11-11: Large Office Natural Gas EUIs, Fuel Shares, and EIs

End Use	Natural Gas EUI (kBtu/End-Use ft ²)	Natural Gas Fuel Share	Natural Gas EI (kBtu/ft ²)
Heating	37.72	67.10	25.31
Cooling	54.22	4.90	2.67
Water Heating	6.86	61.20	4.20
Cooking	1.26	18.10	0.23
Miscellaneous	0.77	21.30	0.16
Process	50.56	12.40	6.29
All End Uses			38.86

Restaurants

Estimated total floor stock in large restaurants just over 15.6 million square feet. As indicated by Table 11-12, the largest electric end uses in this building type are refrigeration, cooking, and interior lighting. As shown in Table 11-13, the predominant gas end use is cooking.

Table 11-12: Restaurant Electric EUIs, Fuel Shares, and EIs

End Use	Electric EUI (kWh/End-Use ft ²)	Electric Fuel Share	Electric EI (kWh/ft ²)
Heating	0.53	28.30	0.15
Cooling	9.33	68.90	6.43
Ventilation	5.69	74.30	4.22
Water Heating	1.73	30.00	0.52
Cooking	10.59	95.20	10.08
Refrigeration	10.36	100.00	10.36
Interior Lighting	6.78	100.00	6.78
Office Equipment	0.78	95.60	0.75
Exterior Lighting	2.24	86.50	1.94
Miscellaneous	3.99	60.80	2.43
Process	0.00	0.00	0.00
Motors	0.39	13.60	0.05
Air Compressors	0.46	4.80	0.02
All End Uses			43.73

Table 11-13: Restaurant Natural Gas EUIs, Fuel Shares, and EIs

End Use	Natural Gas EUI (kBtu/End-Use ft ²)	Natural Gas Fuel Share	Natural Gas EI (kBtu/ft ²)
Heating	6.77	44.20	2.99
Cooling	0.00	0.00	0.00
Water Heating	46.12	76.70	35.36
Cooking	173.65	79.70	138.43
Miscellaneous	1.40	2.70	0.04
Process	0.00	0.00	0.00
All End Uses			176.82

Retail

Estimated total floor stock in retail is just over 72 million square feet. As indicated by Table 11-14, the largest electric end uses in this building type are interior lighting, cooling, and ventilation. As shown in Table 11-15, cooking and space heating account for most of the gas usage, although the overall gas energy intensity is low in this building type.

Table 11-14: Retail Electric EUIs, Fuel Shares, and EIs

End Use	Electric EUI (kWh/End-Use ft ²)	Electric Fuel Share	Electric EI (kWh/ft ²)
Heating	0.34	25.30	0.09
Cooling	3.88	62.30	2.42
Ventilation	2.40	67.60	1.62
Water Heating	0.48	53.30	0.26
Cooking	0.29	89.40	0.26
Refrigeration	1.52	93.30	1.42
Interior Lighting	6.72	100.00	6.72
Office Equipment	0.58	100.00	0.58
Exterior Lighting	1.37	89.50	1.23
Miscellaneous	0.97	56.70	0.55
Process	0.00	0.00	0.00
Motors	0.77	28.20	0.22
Air Compressors	0.47	29.50	0.14
All End Uses			15.49

Table 11-15: Retail Natural Gas EUIs, Fuel Shares, and EIs

End Use	Natural Gas EUI (kBtu/End-Use ft ²)	Natural Gas Fuel Share	Natural Gas EI (kBtu/ft ²)
Heating	2.30	33.10	0.76
Cooling	0.00	0.00	0.00
Water Heating	2.71	21.70	0.59
Cooking	10.59	8.80	0.93
Miscellaneous	0.02	1.30	0.00
Process	6.53	2.50	0.16
All End Uses			2.44

Food Stores

Estimated total floor stock in retail is just over 19 million square feet. As indicated by Table 11-16, the predominant electric end use in this building type is refrigeration. As shown in Table 11-17, cooking and weater heating account for most of the gas usage.

Table 11-16: Food Store Electric EUIs, Fuel Shares, and EIs

End Use	Electric EUI (kWh/End-Use ft ²)	Electric Fuel Share	Electric EI (kWh/ft ²)
Heating	0.16	12.20	0.02
Cooling	3.93	54.80	2.15
Ventilation	3.99	54.80	2.19
Water Heating	0.56	14.00	0.08
Cooking	1.54	92.30	1.42
Refrigeration	22.80	100.00	22.80
Interior Lighting	7.81	100.00	7.81
Office Equipment	0.40	100.00	0.40
Exterior Lighting	1.13	88.00	1.00
Miscellaneous	0.82	95.90	0.78
Process	0.00	0.00	0.00
Motors	0.50	28.60	0.14
Air Compressors	0.00	0.00	0.00
All End Uses			38.79

Table 11-17: Food Store Natural Gas EUIs, Fuel Shares, and EIs

End Use	Natural Gas EUI (kBtu/End-Use ft ²)	Natural Gas Fuel Share	Natural Gas EI (kBtu/ft ²)
Heating	18.12	26.60	4.82
Cooling	0.00	0.00	0.00
Water Heating	9.09	69.10	6.28
Cooking	27.68	55.70	15.41
Miscellaneous	0.14	14.80	0.02
Process	0.00	0.00	0.00
All End Uses			26.53

Refrigerated Warehouses

Estimated total floor stock in refrigerated warehouses is just under 2 million square feet. As indicated by Table 11-18, the predominant electric end use in this building type is refrigeration. As shown in Table 11-19, water heating and space heating account for virtually all of this sector's gas usage.

Table 11-18: Refrigerated Warehouse Electric EUIs, Fuel Shares, and EIs

End Use	Electric EUI (kWh/End-Use ft ²)	Electric Fuel Share	Electric EI (kWh/ft ²)
Heating	1.84	4.70	0.09
Cooling	4.65	14.60	0.68
Ventilation	4.58	40.60	1.86
Water Heating	0.41	39.60	0.16
Cooking	0.12	100.00	0.12
Refrigeration	22.72	100.00	22.72
Interior Lighting	4.18	100.00	4.18
Office Equipment	0.36	100.00	0.36
Exterior Lighting	0.46	100.00	0.46
Miscellaneous	0.41	83.80	0.34
Process	0.00	0.00	0.00
Motors	7.04	60.40	4.25
Air Compressors	2.32	3.90	0.09
All End Uses			35.31

Table 11-19: Refrigerated Warehouse Natural Gas EUIs, Fuel Shares, and EIs

End Use	Natural Gas EUI (kBtu/End-Use ft ²)	Natural Gas Fuel Share	Natural Gas EI (kBtu/ft ²)
Heating	5.47	40.60	2.22
Cooling	0.00	0.00	0.00
Water Heating	8.07	60.40	4.88
Cooking	0.04	56.50	0.02
Miscellaneous	0.00	0.00	0.00
Process	0.00	0.00	0.00
All End Uses			7.12

Unrefrigerated Warehouses

Estimated total floor stock in unrefrigerated warehouses is just over 28 million square feet. As indicated by Table 11-20, the major electric end use in this building type is interior lighting, followed by cooling and ventilation. As shown in Table 11-21, space heating accounts for most of this sector’s gas usage.

Table 11-20: Unrefrigerated Warehouse Electric EUIs, Fuel Shares, and EIs

End Use	Electric EUI (kWh/End-Use ft ²)	Electric Fuel Share	Electric EI (kWh/ft ²)
Heating	0.20	11.70	0.02
Cooling	2.59	25.00	0.65
Ventilation	1.79	25.00	0.45
Water Heating	0.12	74.70	0.09
Cooking	0.12	100.00	0.12
Refrigeration	0.35	99.30	0.34
Interior Lighting	1.97	100.00	1.97
Office Equipment	0.31	99.30	0.30
Exterior Lighting	0.25	97.80	0.24
Miscellaneous	0.21	76.20	0.16
Process	0.81	3.60	0.03
Motors	0.20	65.60	0.13
Air Compressors	0.10	27.40	0.03
All End Uses			4.54

Table 11-21: Unrefrigerated Warehouse Natural Gas EUIs, Fuel Shares, and EIs

End Use	Natural Gas EUI (kBtu/End-Use ft ²)	Natural Gas Fuel Share	Natural Gas EI (kBtu/ft ²)
Heating	8.44	20.60	1.73
Cooling	0.00	0.00	0.00
Water Heating	0.66	35.00	0.23
Cooking	0.00	0.00	0.00
Miscellaneous	7.62	1.60	0.12
Process	0.00	0.00	0.00
All End Uses			2.08

Schools

Estimated total floor stock in schools unrefrigerated warehouses is over 54 million square feet. As indicated by Table 11-22, the major electric end use in this building type is interior lighting, followed by cooling and ventilation. As shown in Table 11-23, space heating accounts for most of this sector’s gas usage.

Table 11-22: School Electric EUIs, Fuel Shares, and EIs

End Use	Electric EUI (kWh/End-Use ft ²)	Electric Fuel Share	Electric EI (kWh/ft ²)
Heating	0.27	80.70	0.22
Cooling	1.17	84.10	0.99
Ventilation	0.96	88.80	0.85
Water Heating	0.13	80.10	0.10
Cooking	0.08	100.00	0.08
Refrigeration	0.41	100.00	0.41
Interior Lighting	2.66	100.00	2.66
Office Equipment	0.50	100.00	0.50
Exterior Lighting	0.69	100.00	0.69
Miscellaneous	0.12	100.00	0.12
Process	0.00	0.00	0.00
Motors	0.08	55.10	0.04
Air Compressors	0.13	23.10	0.03
All End Uses			6.69

Table 11-23: School Natural Gas EUIs, Fuel Shares, and EIs

End Use	Natural Gas EUI (kBtu/End-Use ft ²)	Natural Gas Fuel Share	Natural Gas EI (kBtu/ft ²)
Heating	6.84	65.10	4.45
Cooling	0.00	0.00	0.00
Water Heating	2.61	80.20	2.09
Cooking	0.66	73.40	0.49
Miscellaneous	0.00	0.00	0.00
Process	0.00	0.00	0.00
All End Uses			7.03

Colleges

Estimated total floor stock in colleges is just over 48 million square feet. As indicated by Table 11-24, the major electric end use in this building type is interior lighting, followed by cooling and exterior lighting. As shown in Table 11-25, this sector’s gas usage is split fairly evenly among space heating, water heating and cooling.

Table 11-24: College Electric EUIs, Fuel Shares, and EIs

End Use	Electric EUI (kWh/End-Use ft ²)	Electric Fuel Share	Electric EI (kWh/ft ²)
Heating	0.97	81.90	0.79
Cooling	2.96	80.90	2.40
Ventilation	0.93	81.90	0.77
Water Heating	0.02	97.70	0.02
Cooking	0.36	100.00	0.36
Refrigeration	0.59	100.00	0.59
Interior Lighting	3.25	100.00	3.25
Office Equipment	0.53	100.00	0.53
Exterior Lighting	1.41	99.60	1.40
Miscellaneous	0.25	95.90	0.24
Process	0.05	0.70	0.00
Motors	0.90	97.30	0.88
Air Compressors	0.11	94.30	0.10
All End Uses			11.32

Table 11-25: College Natural Gas EUIs, Fuel Shares, and EIs

End Use	Natural Gas EUI (kBtu/End-Use ft ²)	Natural Gas Fuel Share	Natural Gas EI (kBtu/ft ²)
Heating	18.62	79.90	14.88
Cooling	15.99	74.70	11.94
Water Heating	11.56	95.00	10.98
Cooking	4.06	94.30	3.82
Miscellaneous	1.42	94.30	1.34
Process	0.00	0.00	0.00
All End Uses			42.96

Health

Estimated total floor stock in health is just over 35 million square feet. As indicated by Table 11-26, the major electric end use in this building type is interior lighting, followed by cooling miscellaneous (mostly medical equipment). As shown in Table 11-27, water heating accounts for most of this sector's gas usage.

Table 11-26: Health Electric EUIs, Fuel Shares, and EIs

End Use	Electric EUI (kWh/End-Use ft ²)	Electric Fuel Share	Electric EI (kWh/ft ²)
Heating	0.66	69.10	0.45
Cooling	4.54	92.70	4.21
Ventilation	3.05	95.00	2.89
Water Heating	0.47	23.10	0.11
Cooking	0.22	100.00	0.22
Refrigeration	0.61	100.00	0.61
Interior Lighting	4.92	100.00	4.92
Office Equipment	0.80	100.00	0.80
Exterior Lighting	0.46	99.60	0.46
Miscellaneous	3.21	96.30	3.09
Process	0.10	9.80	0.01
Motors	1.19	84.50	1.00
Air Compressors	0.37	40.50	0.15
All End Uses			18.92

Table 11-27: Health Natural Gas EUIs, Fuel Shares, and EIs

End Use	Natural Gas EUI (kBtu/End-Use ft ²)	Natural Gas Fuel Share	Natural Gas EI (kBtu/ft ²)
Heating	16.54	85.10	14.07
Cooling	83.29	1.10	0.93
Water Heating	42.07	92.90	39.10
Cooking	5.48	85.50	4.68
Miscellaneous	5.97	21.50	1.28
Process	12.31	7.80	0.96
All End Uses			61.02

Lodging

Estimated total floor stock in lodging is just over 34 million square feet. As indicated by Table 11-28, the major electric end use in this building type is interior lighting, followed by cooling and ventilation. As shown in Table 11-29, water heating account for most of this sector’s gas usage.

Table 11-28: Lodging Electric EUIs, Fuel Shares, and EIs

End Use	Electric EUI (kWh/End-Use ft ²)	Electric Fuel Share	Electric EI (kWh/ft ²)
Heating	0.47	85.70	0.41
Cooling	3.73	89.90	3.35
Ventilation	3.21	91.00	2.92
Water Heating	0.05	5.40	0.00
Cooking	0.92	99.10	0.91
Refrigeration	1.03	100.00	1.03
Interior Lighting	5.17	100.00	5.17
Office Equipment	0.11	98.10	0.11
Exterior Lighting	0.58	100.00	0.58
Miscellaneous	1.07	100.00	1.07
Process	0.00	0.00	0.00
Motors	0.58	91.70	0.53
Air Compressors	0.08	33.60	0.03
All End Uses			16.10

Table 11-29: Lodging Natural Gas EUIs, Fuel Shares, and EIs

End Use	Natural Gas EUI (kBtu/End-Use ft ²)	Natural Gas Fuel Share	Natural Gas EI (kBtu/ft ²)
Heating	8.62	56.10	4.83
Cooling	0.00	0.00	0.00
Water Heating	50.09	91.50	45.81
Cooking	11.34	65.80	7.46
Miscellaneous	6.19	52.00	3.22
Process	5.35	8.00	0.43
All End Uses			61.75

Miscellaneous

Estimated total floor stock in the miscellaneous building type is 121 million square feet. As indicated by Table 11-30, the major electric end use in this building type is interior lighting, followed motors and exterior lighting. As shown in Table 11-31, process and space heating account for most of this sector’s gas usage.

Table 11-30: Miscellaneous Electric EUIs, Fuel Shares, and EIs

End Use	Electric EUI (kWh/End-Use ft ²)	Electric Fuel Share	Electric EI (kWh/ft ²)
Heating	0.30	29.60	0.09
Cooling	1.84	43.00	0.79
Ventilation	1.19	56.70	0.67
Water Heating	0.39	32.60	0.13
Cooking	0.13	89.20	0.12
Refrigeration	0.60	98.80	0.60
Interior Lighting	2.65	100.00	2.65
Office Equipment	0.37	100.00	0.37
Exterior Lighting	1.16	95.90	1.11
Miscellaneous	0.84	84.90	0.72
Process	0.58	6.00	0.03
Motors	3.58	58.90	2.11
Air Compressors	0.80	41.80	0.34
All End Uses			9.72

Table 11-31: Miscellaneous Natural Gas EUIs, Fuel Shares, and EIs

End Use	Natural Gas EUI (kBtu/End-Use ft ²)	Natural Gas Fuel Share	Natural Gas EI (kBtu/ft ²)
Heating	9.05	36.20	3.28
Cooling	0.00	0.00	0.00
Water Heating	3.14	59.60	1.87
Cooking	2.60	23.00	0.60
Miscellaneous	16.17	8.30	1.34
Process	133.80	4.00	5.32
All End Uses			12.41

11.4 Segment-Level Hourly End-Use Electric Shapes

This section presents 16-day hourly stacked end-use graphs from DrCEUS for the basic set of building types (that is, excluding “All Offices” and “All Warehouses”). The 16-day type basis (4 day types X 4 seasons), as defined in Chapter 7, are as follows:

- **Four Day Types.** Typical Day (weekday), Hot Day (weekday), Cold Day (weekday) and Weekend (Saturday, Sunday, and holidays). Note that the Hot and Cold day types are the hottest\coldest² *single* days during a season, whereas the Typical and Weekend day types are an *average* of all days of those respective types during the season.
- **Four Seasons.** Winter (December through February), Spring (March through May), Summer (June through September), Fall (October through November).

Only electric hourly end-use shapes are presented here, although gas end-use hourly shapes are also available from DrCEUS.

² The hottest/coldest days are determined as the first weekday during a season that has the highest or lowest hourly temperature.

Figure 11-5: All Commercial 16-Day Hourly End-Use Shapes

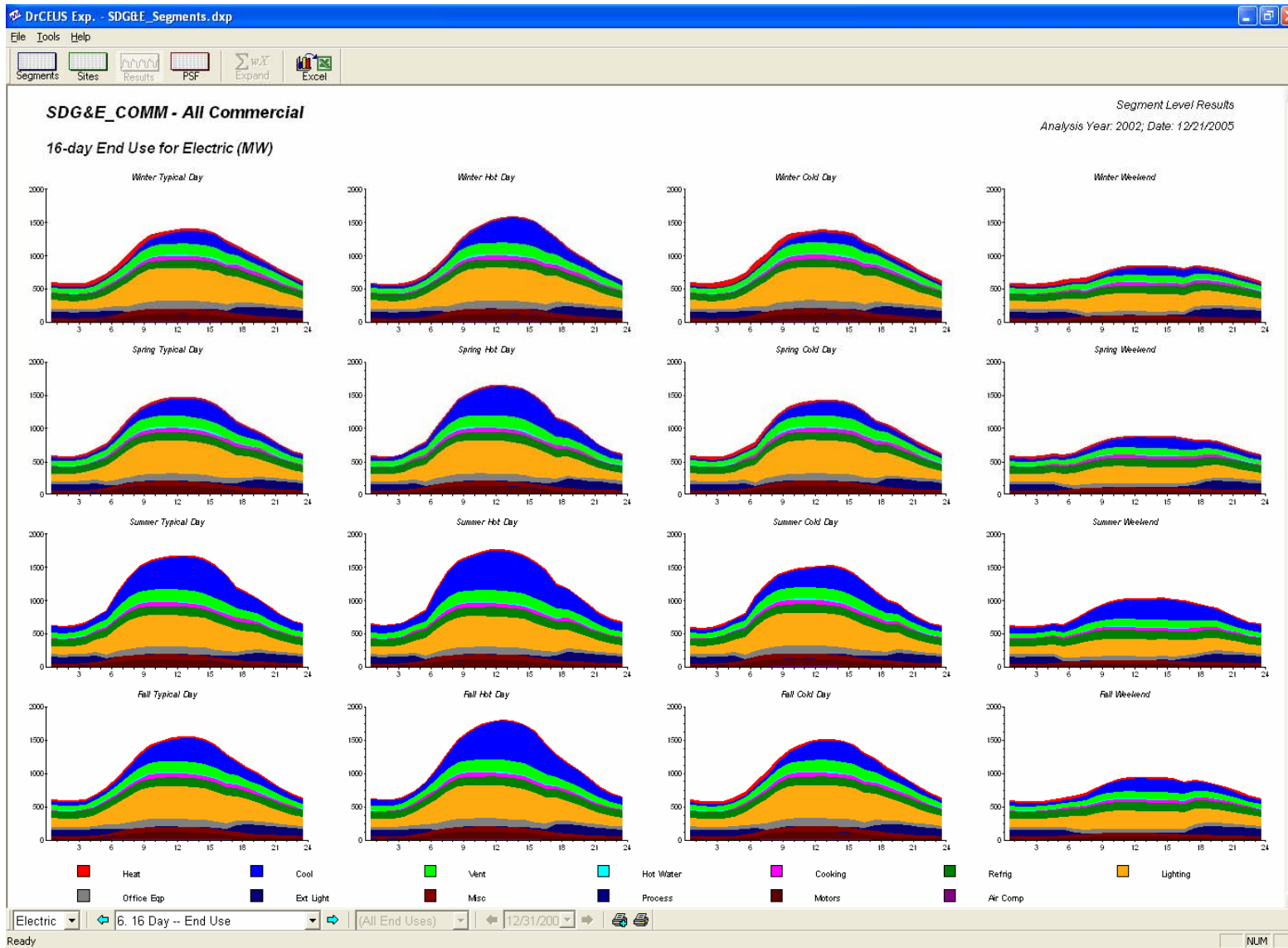


Figure 11-6: Small Office 16-Day Hourly End-Use Shapes

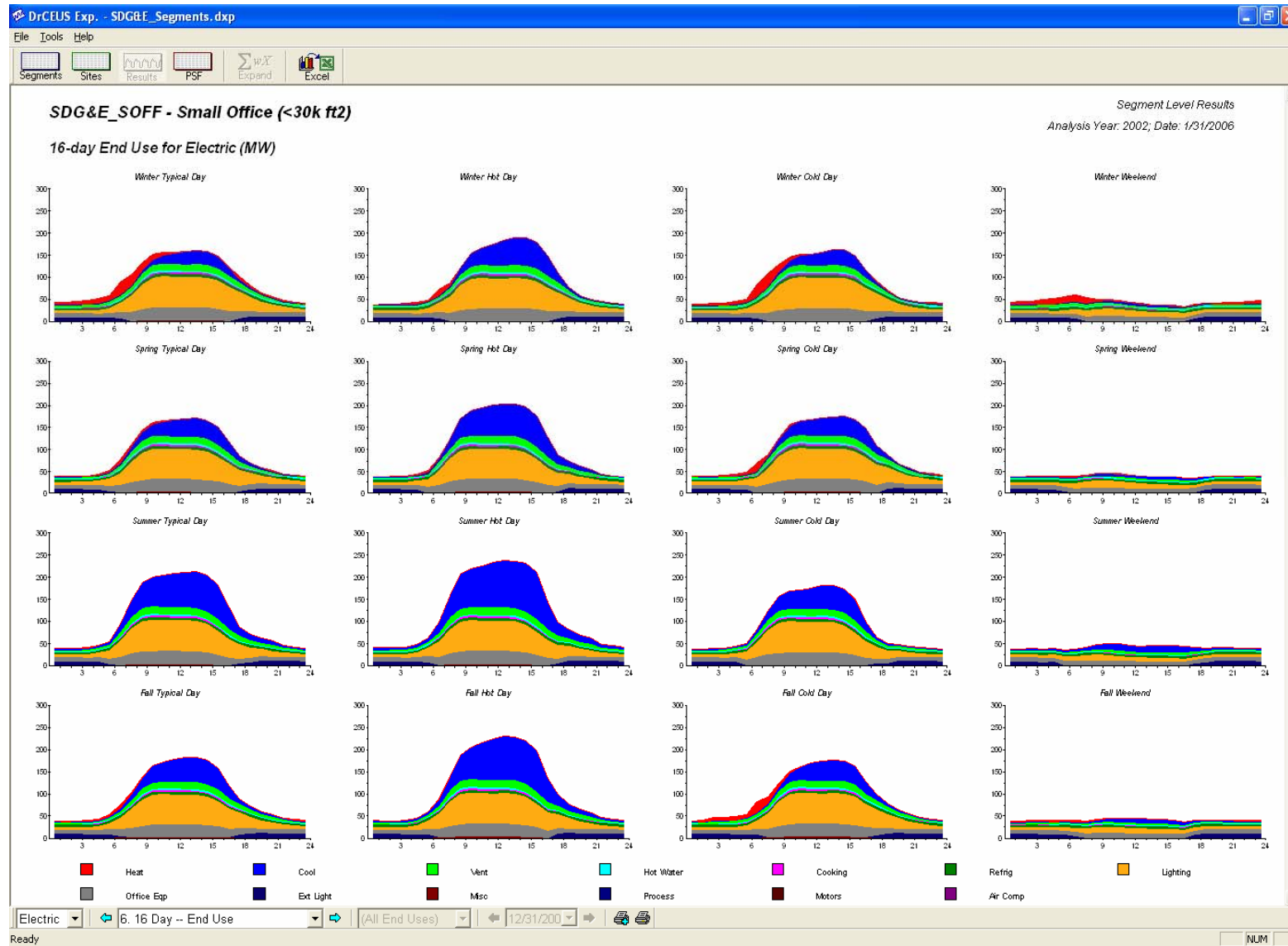


Figure 11-7: Large Office 16-Day Hourly End-Use Shapes

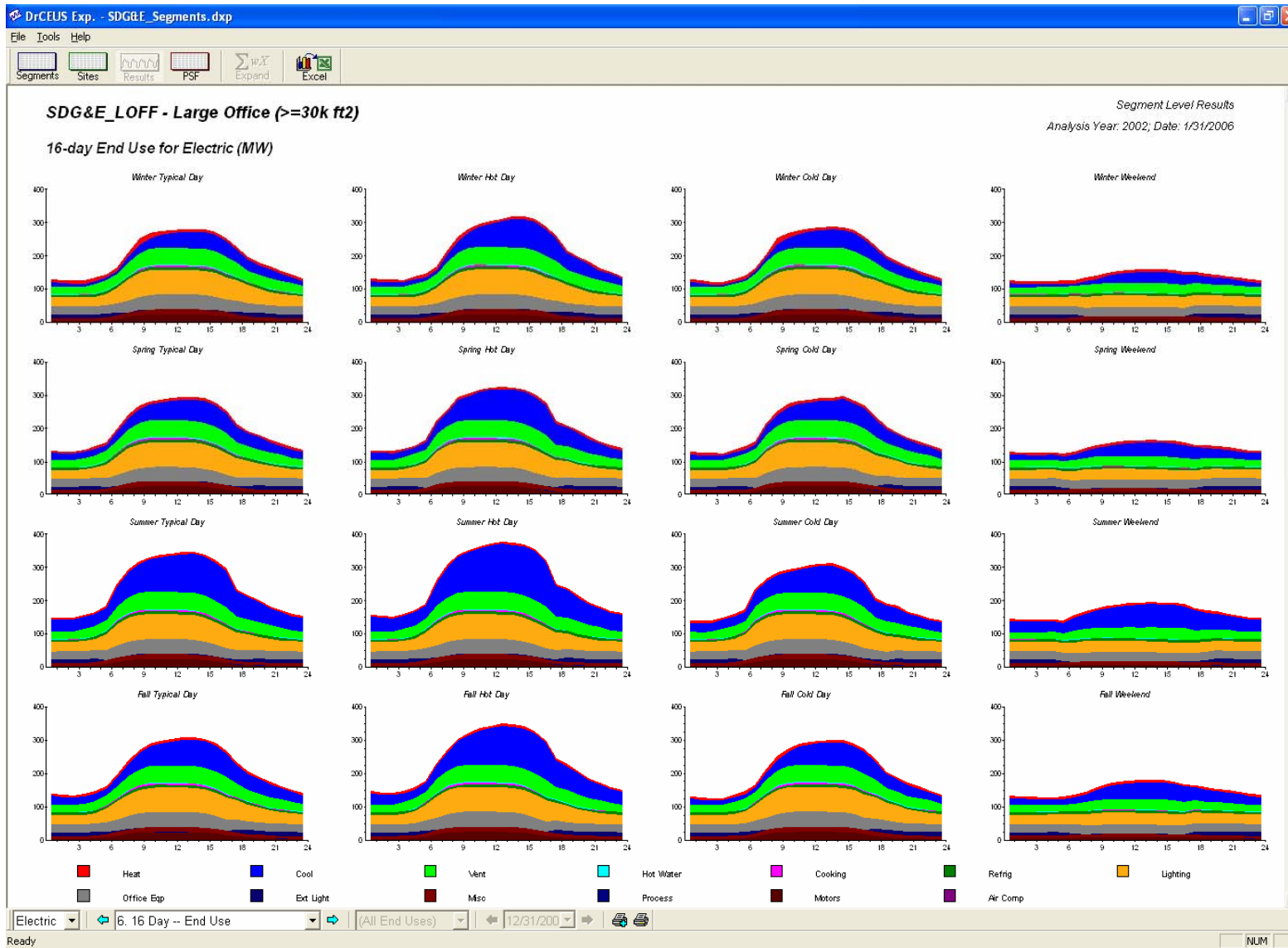


Figure 11-8: Restaurant 16-Day Hourly End-Use Shapes

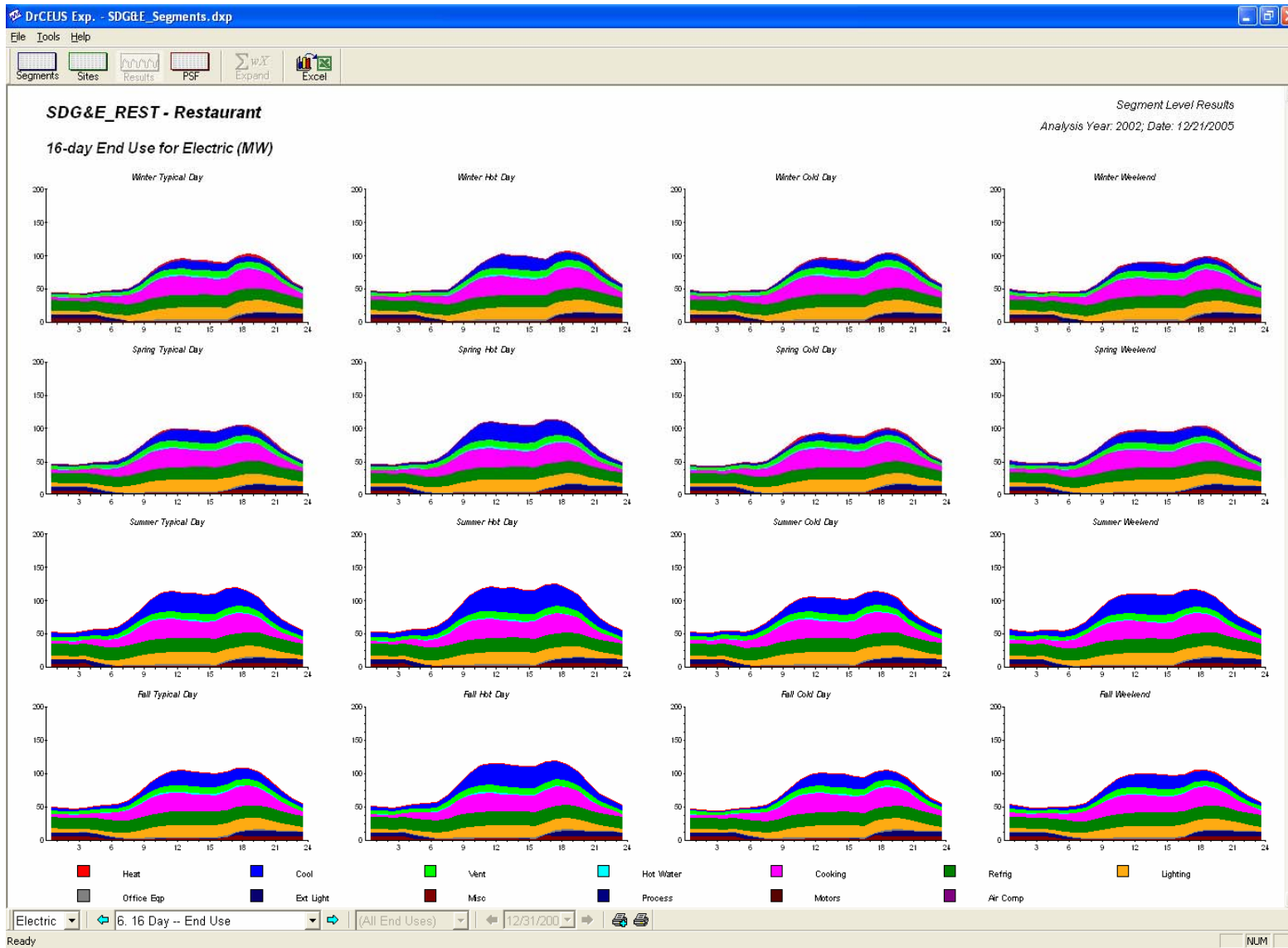


Figure 11-9: Retail 16-Day Hourly End-Use Shapes

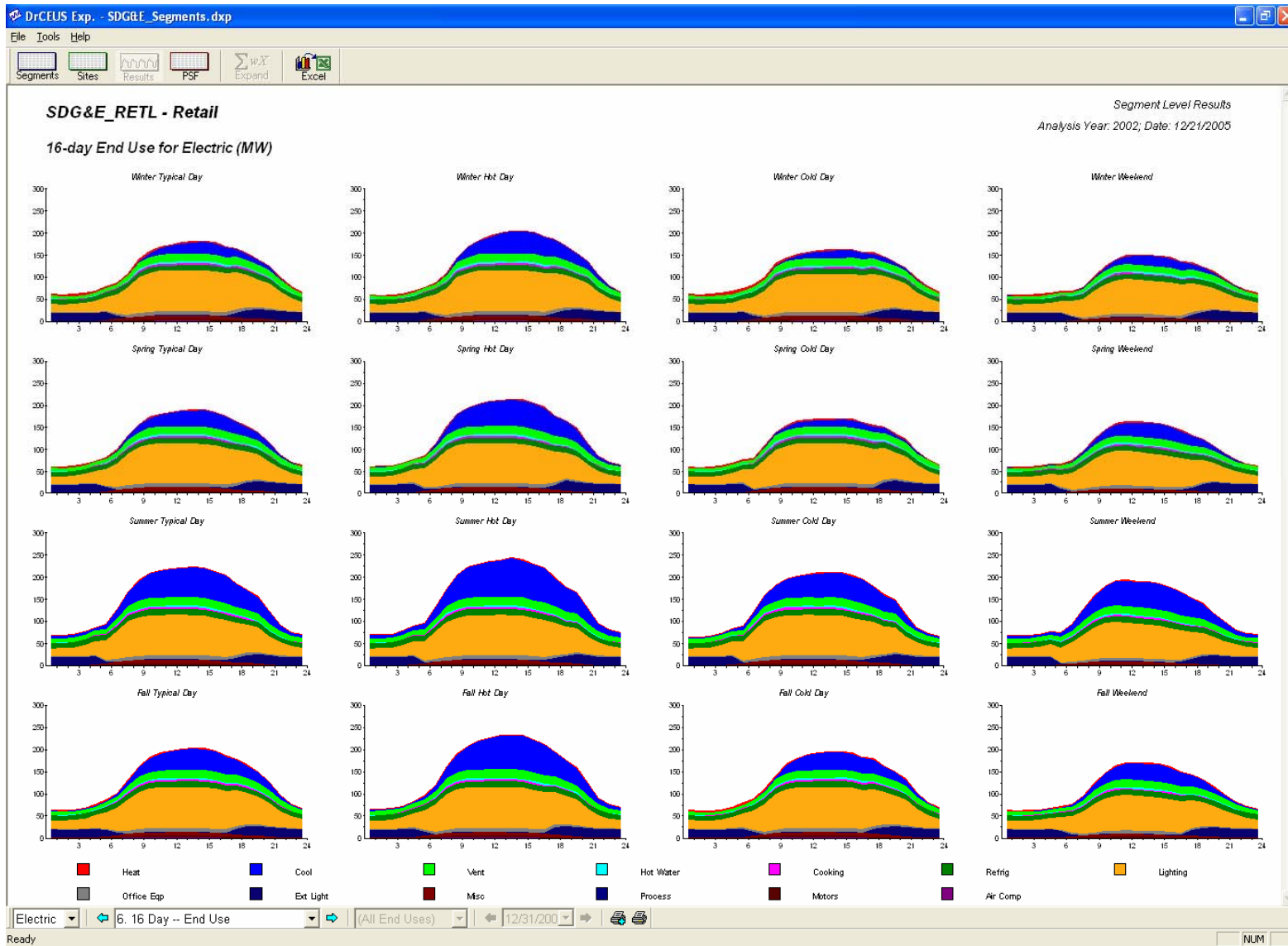


Figure 11-10: Food Store 16-Day Hourly End-Use Shapes

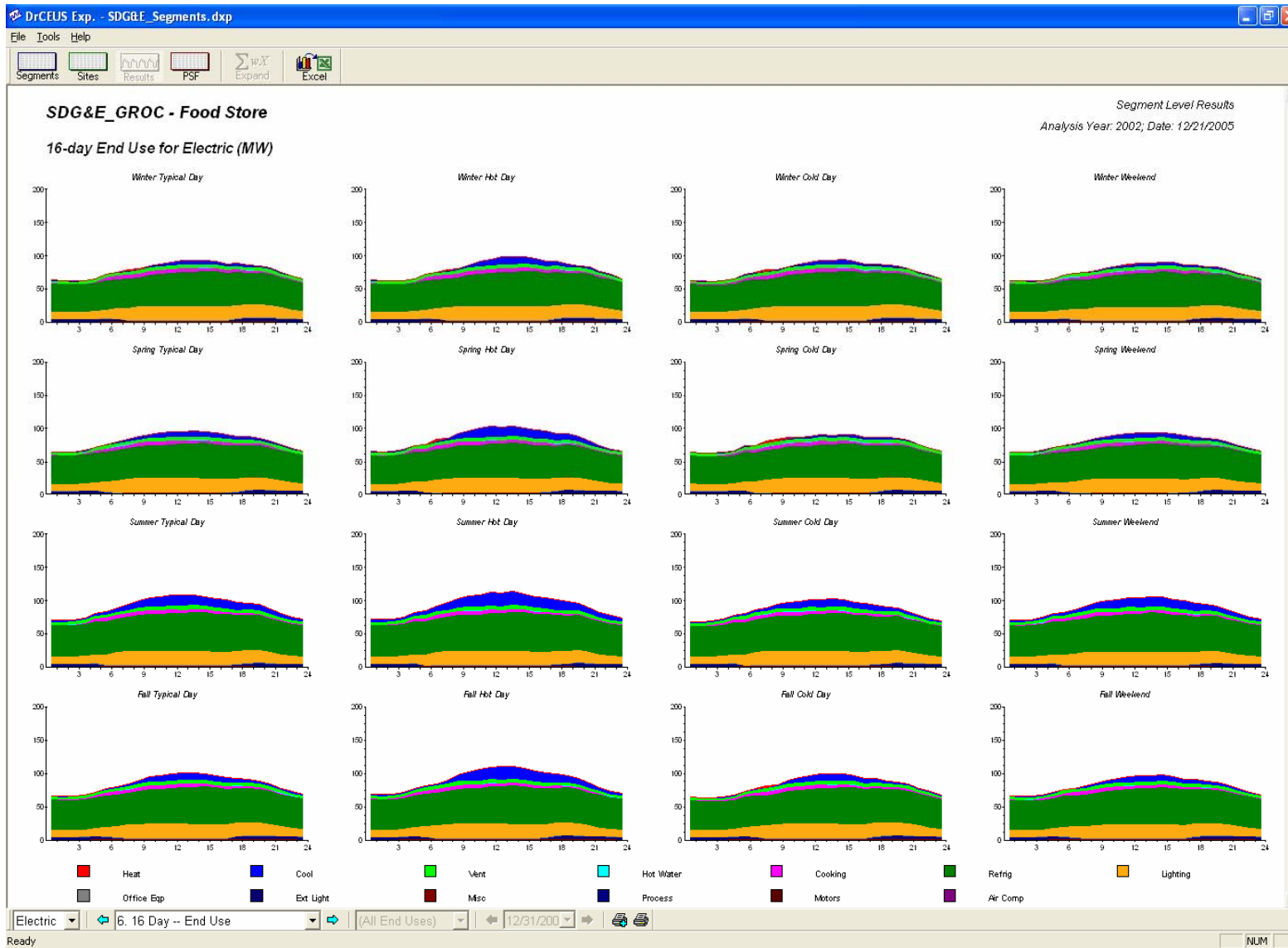


Figure 11-11: Refrigerated Warehouse 16-Day Hourly End-Use Shapes

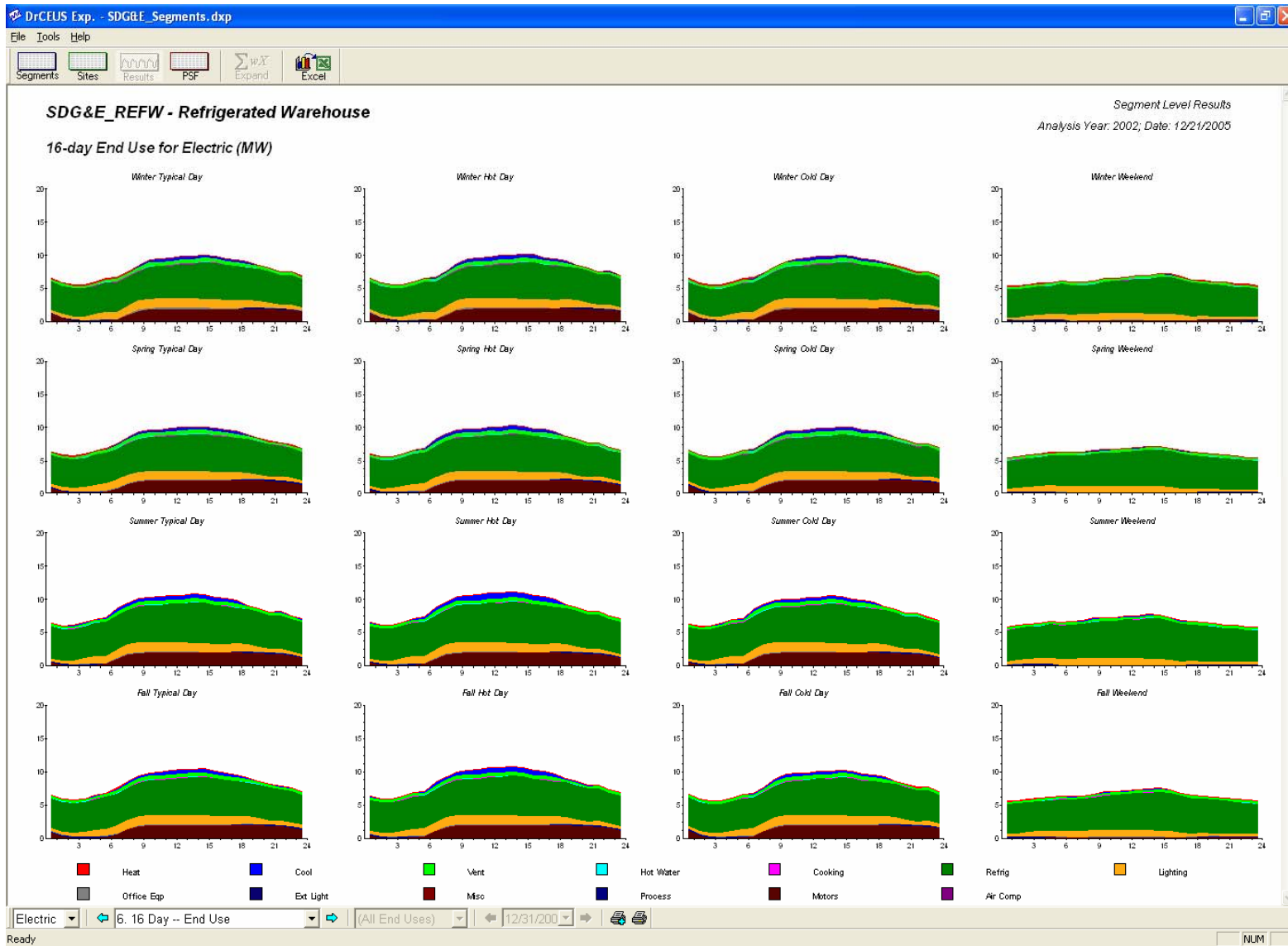


Figure 11-12: Unrefrigerated Warehouse 16-Day Hourly End-Use Shapes

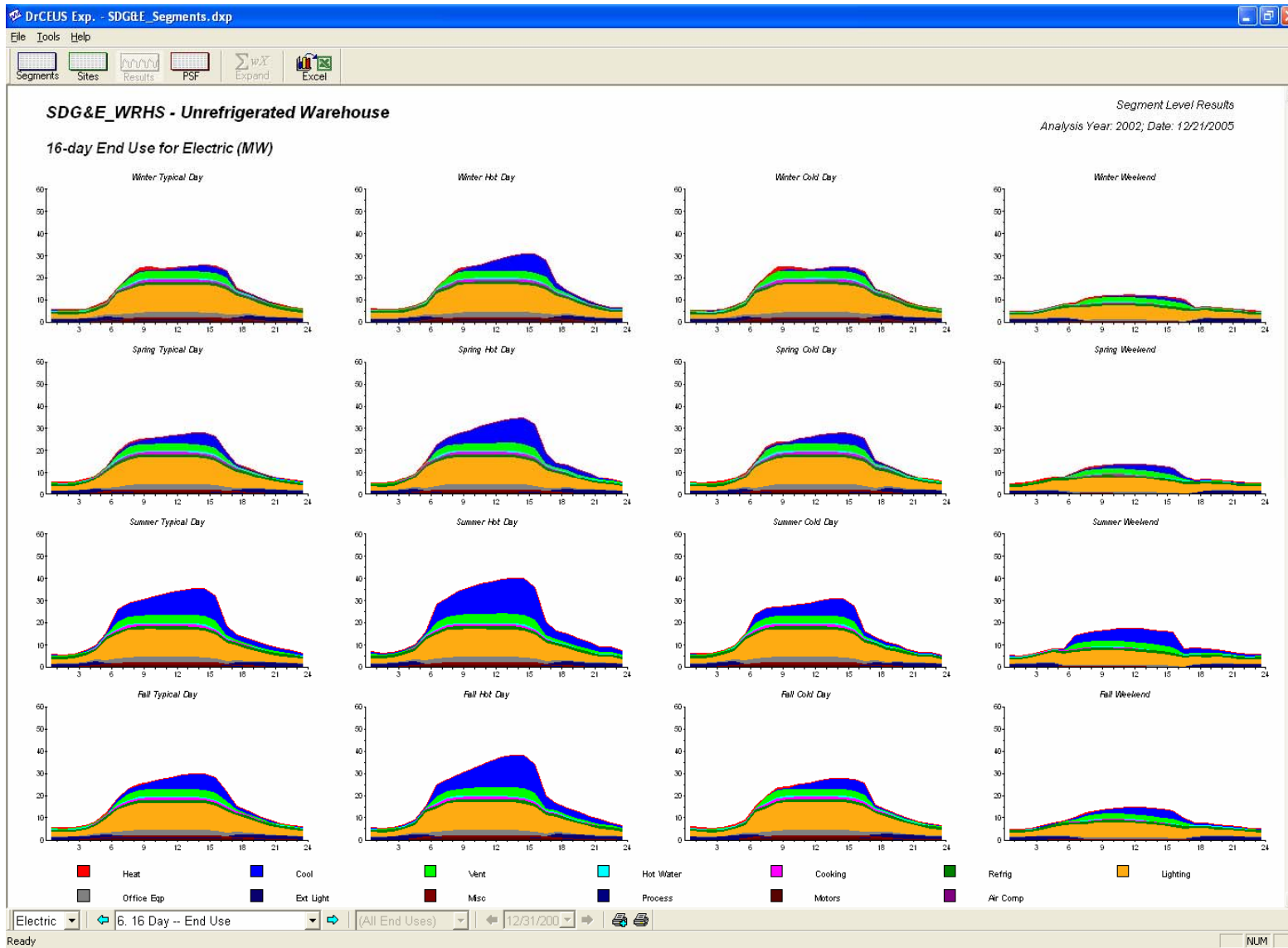


Figure 11-13: School 16-Day Hourly End-Use Shapes

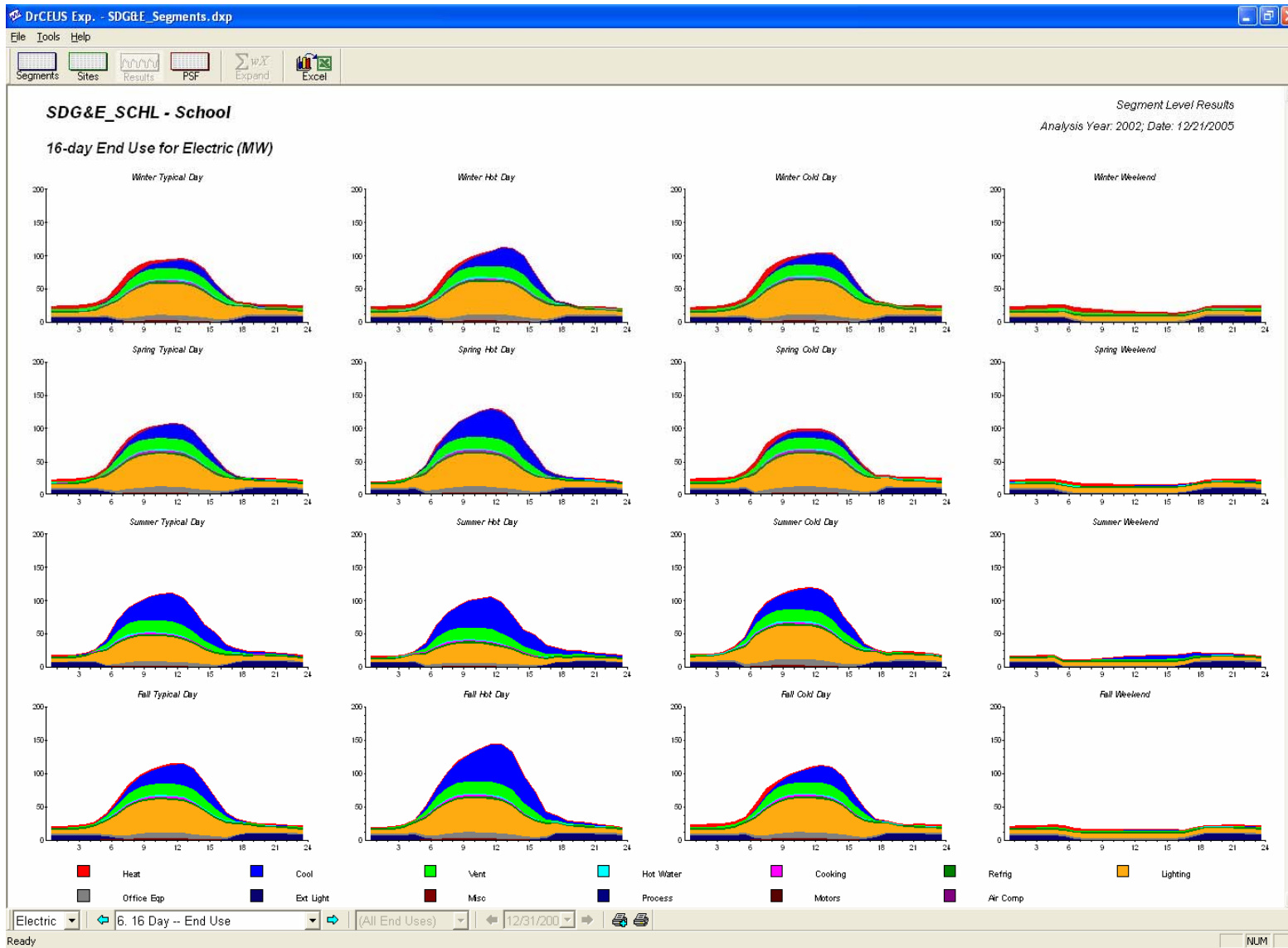


Figure 11-14: College 16-Day Hourly End-Use Shapes

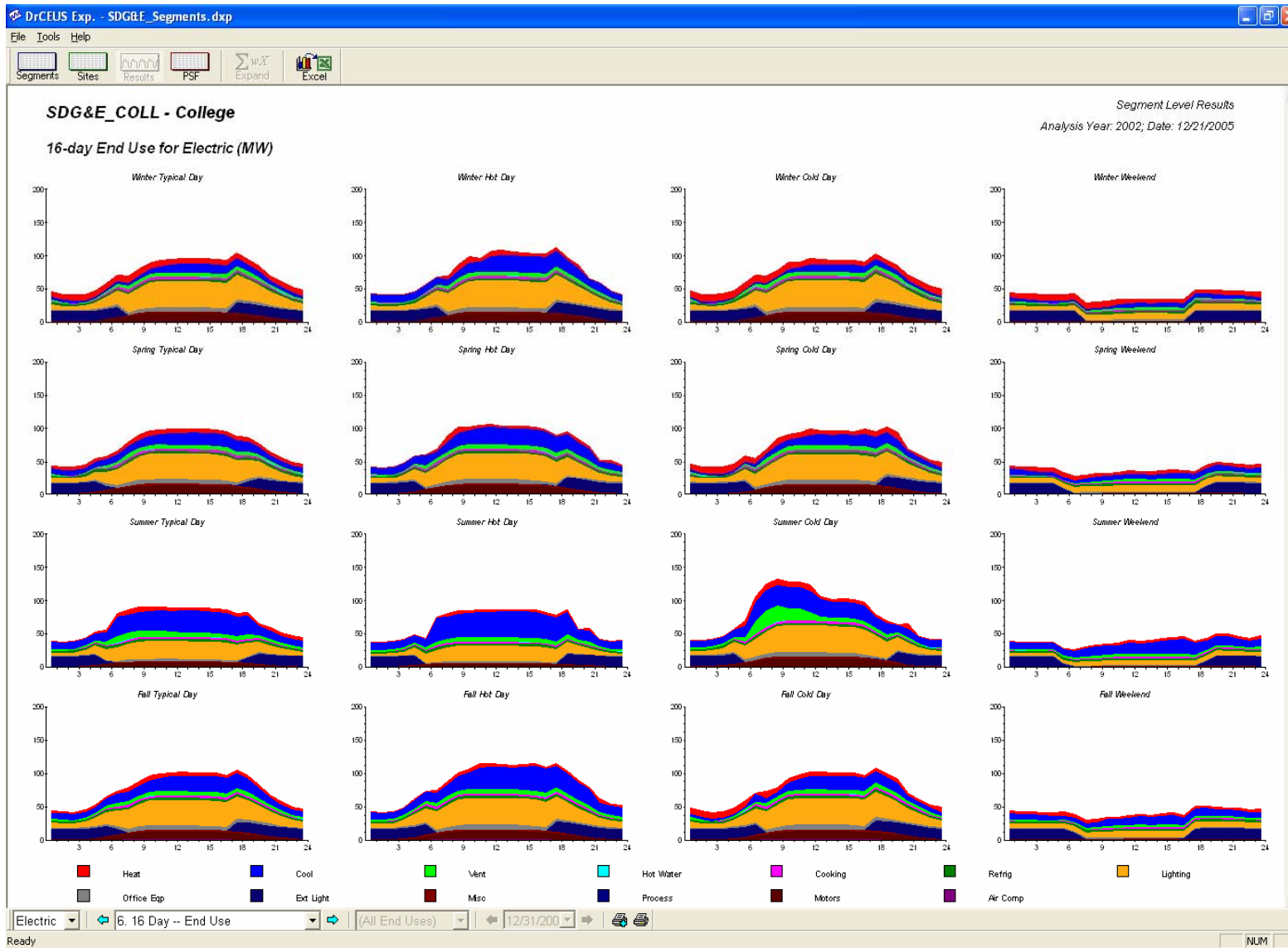


Figure 11-15: Health 16-Day Hourly End-Use Shapes

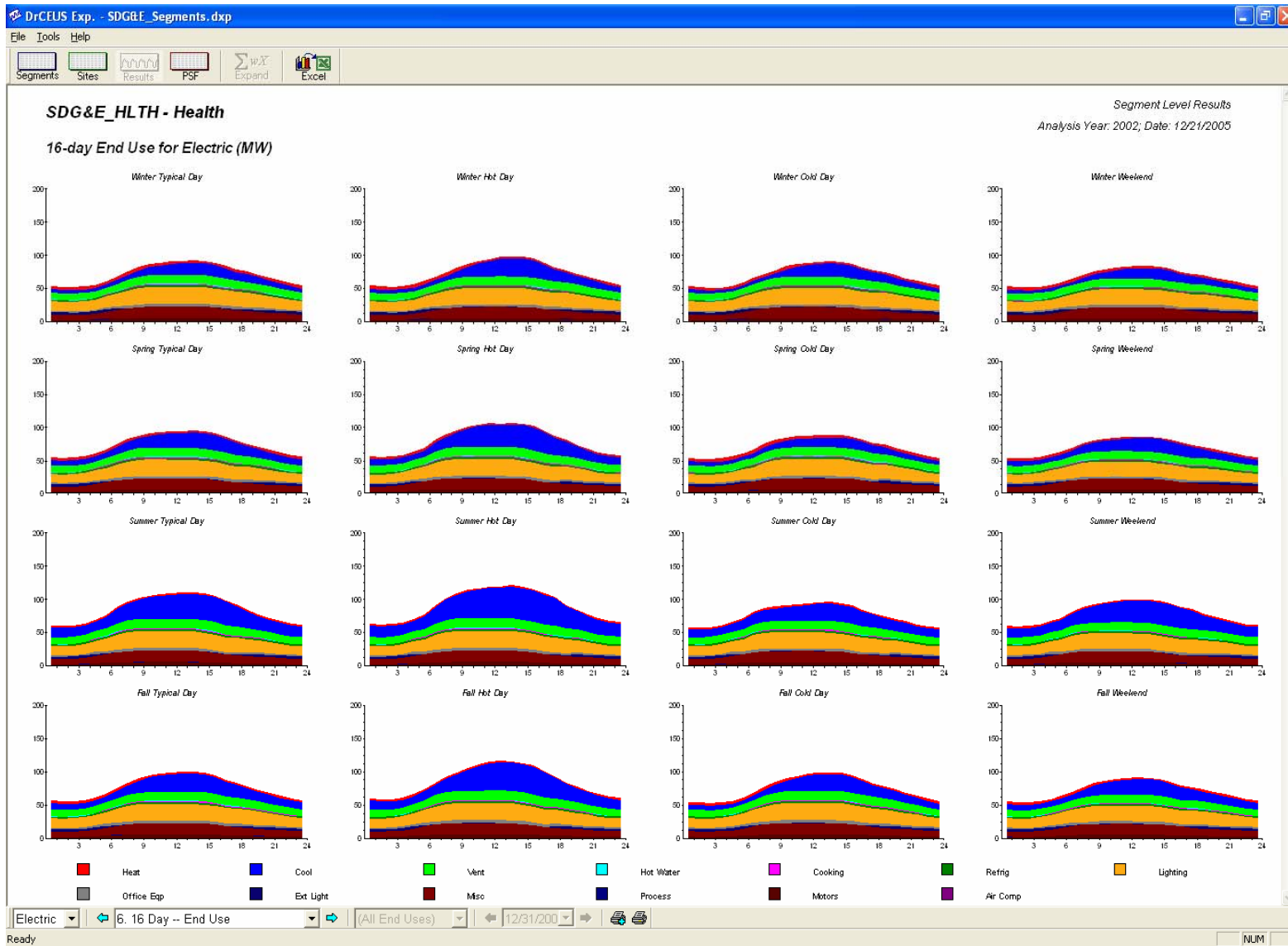


Figure 11-16: Lodging 16-Day Hourly End-Use Shapes

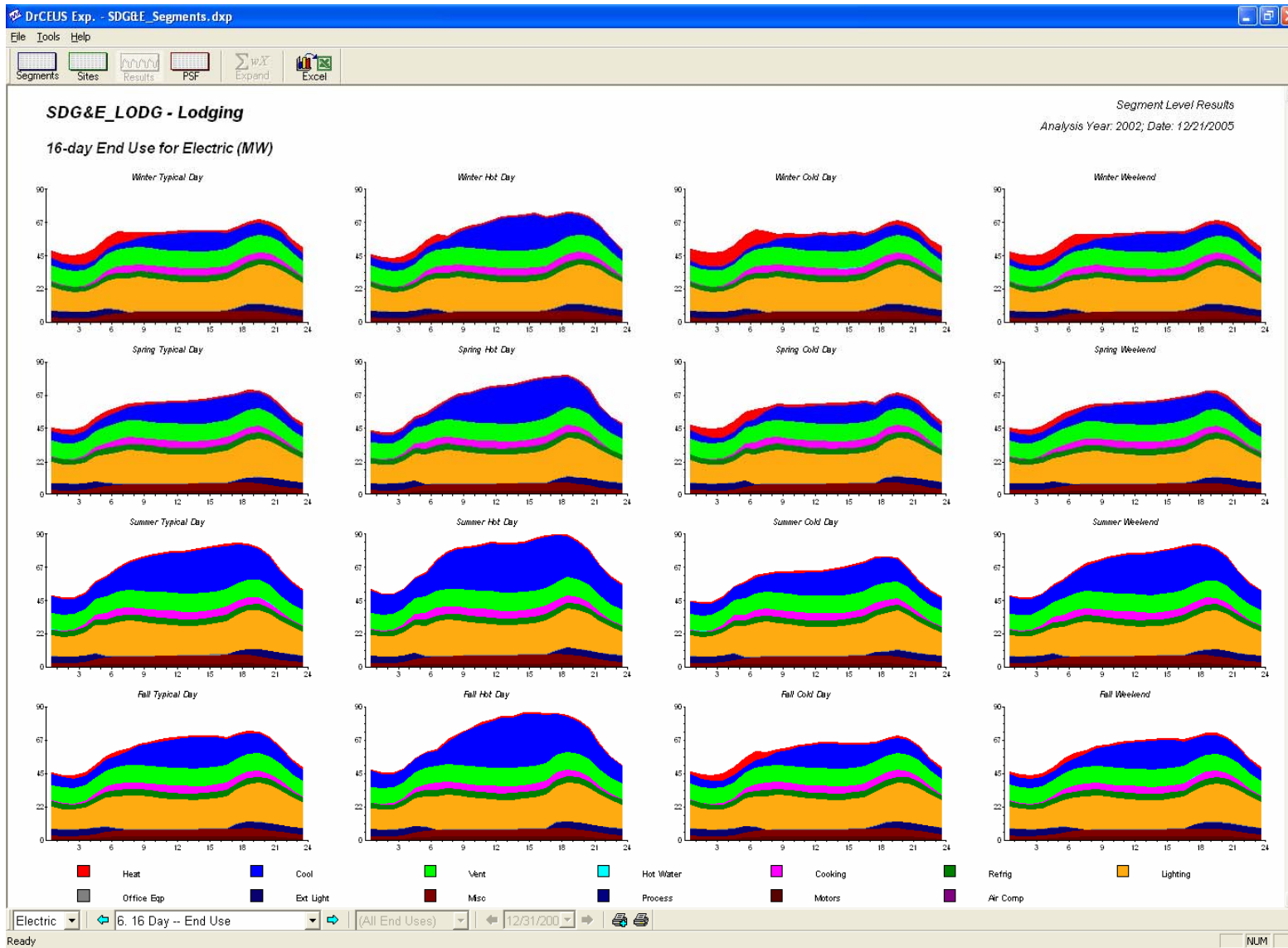


Figure 11-17: Miscellaneous 16-Day Hourly End-Use Shapes

