

Analyzing Interval Data Using the Energy Charting and Metrics (ECAM) Tool

Adapted from a presentation by:

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Presentation Outline

- ECAM Capabilities
- Analysis of Interval Meter Data with ECAM

What is ECAM?

- A tool to assist with analysis of building performance data
- Facilitate the types of analyses that energy engineers, commissioning providers, and building operators might need to make
- “Semi-automation,” not complete automation of the analyses
- Because analyses is not completely automated, the tool is flexible, supporting additional analysis without limiting any normal spreadsheet functions

ECAM Version 2.0 New Features

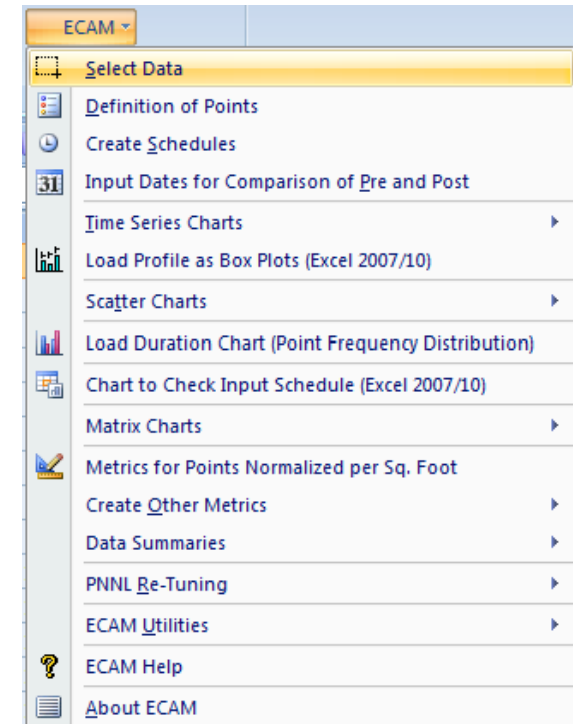
- Excel 2007/2010 compatibility
- Full time history chart, filterable to selected months or days
- Load profile as box plots
- Load duration chart (histograms/frequency distributions)
- Chart to check input schedule
- Matrix charts
- Metrics by daytype, occupancy, and month
- Data summaries
- Additional scheduling periods for startup and shutdown
- Integrated user guide/help
- PNNL re-tuning charts (See <http://buildingefficiency.labworks.org/large.stm> for more details)

ECAM Detection/Diagnostic Features

- Detection
 - Tool does not provide detection directly
 - Assists with performance tracking
 - Provides the ability to investigate the relationships between variables
- Diagnostics
 - Tool does not provide diagnostics
 - Future versions may provide some limited diagnostic capabilities, but this is not the focus of the tool
 - General intent is to maximize the user's ability to benefit from whatever data is available

Five Easy Steps

1. Select data from existing spreadsheet
2. Map points
3. Create schedules (optional)
4. Input energy project dates (optional)
5. Create metrics and charts

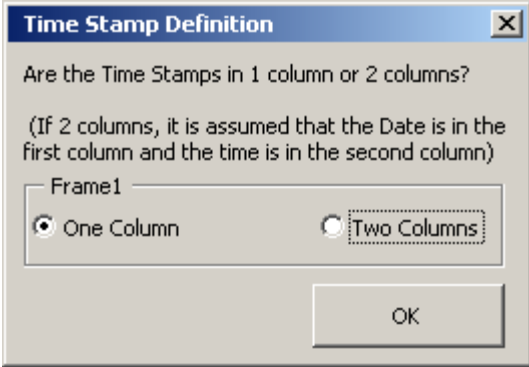


User's Data — Example

DateTime	Outside Dry Bulb	325 COMMON CHWS	326 COMMON CHWR	328 CHILLER 1 AMPS	342 COM CDW SUPPLY	343 COM CDW RETURN	345 A CHILLER ON	414 SCHWP-5 KW	415 SCHWP-6 KW	416 SCHWP-7 KW
8/23/04 12:00 AM	67.4	41.9	48.5	226.1	69.2	77.3	100	0	5	0.8
8/23/04 12:15 AM	67.5	42	48.7	224.3	69	77.1	100	0	4.8	1.3
8/23/04 12:30 AM	67.3	41.6	47.6	206.9	68.9	76.3	100	0	4.7	1.6
8/23/04 12:45 AM	67.1	41.8	47.7	206.7	68.5	75.8	100	0	4.6	1.3
8/23/04 1:00 AM	67.1	42.2	47.6	195.9	68.2	75	100	0	4.7	1.4
8/23/04 1:15 AM	67	41.8	47	193.8	68.1	74.8	100	0	4.6	0
8/23/04 1:30 AM	67	42	46.2	168.1	67.6	72.9	100	0	4.7	0
8/23/04 1:45 AM	66.8	41.9	45.3	152.1	67.5	71.9	100	0	4.6	0.6
8/23/04 2:00 AM	67	42.2	45.3	150.2	67.8	71.9	100	0	4.6	0.6
8/23/04 2:15 AM	67.1	42	48.5	0	67.6	74.6	100	0	4.8	0.9
8/23/04 2:30 AM	67.1	41.6	47.7	0	68.8	75.7	100	0	4.5	0.5
8/23/04 2:45 AM	67	42	48.4	0	68.2	75.1	100	0	4.7	0.8
8/23/04 3:00 AM	67.1	41.6	47.5	0	68.4	75.1	100	0	4.5	0.9
8/23/04 3:15 AM	67.2	41.7	47.5	0	68.3	74.8	100	0	4.7	0.8
8/23/04 3:30 AM	67.4	42.4	47.9	0	68.2	74.4	100	0	4.6	0.8
8/23/04 3:45 AM	67.4	43.5	48.6	0	68.3	73.8	100	0	4.7	0.9
8/23/04 4:00 AM	67.5	45	49.4	0	68.1	73	100	0	4.8	0

Step 1: Select data

1a.



Time Stamp Definition

Are the Time Stamps in 1 column or 2 columns?

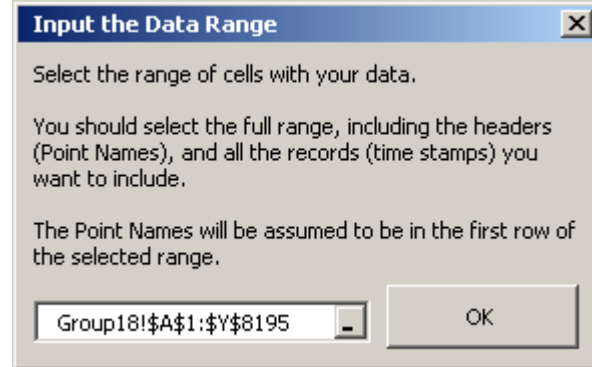
(If 2 columns, it is assumed that the Date is in the first column and the time is in the second column)

Frame1

☒ One Column ☐ Two Columns

OK

1b.



Input the Data Range

Select the range of cells with your data.

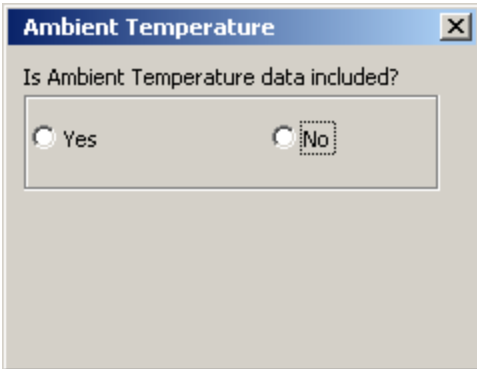
You should select the full range, including the headers (Point Names), and all the records (time stamps) you want to include.

The Point Names will be assumed to be in the first row of the selected range.

Group18!\$A\$1:\$Y\$8195

OK

1c.

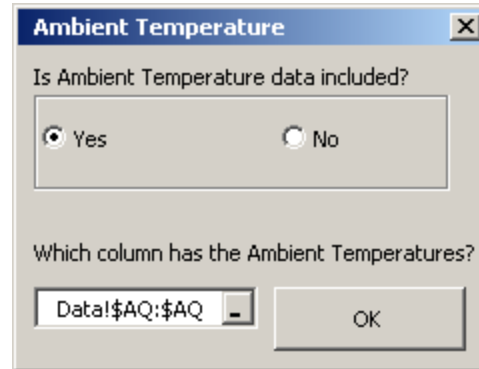


Ambient Temperature

Is Ambient Temperature data included?

☐ Yes ☒ No

1d.



Ambient Temperature

Is Ambient Temperature data included?

☒ Yes ☐ No

Which column has the Ambient Temperatures?

Data!\$AQ:\$AQ

OK

Step 2: Map points

Define Data by System, Equipment, and Measurement

Points List	Mapped Points	Subsystems	Subsystem Components	Component Measurements
OAT	Bldg1_TempOa	Bldg	Ambient	Bldg_TempOa
MT0704V.ACLG-SP.	Z1_TempSP	Meters		
MT0704V.AHTG-SP.		Cooling Plant		
MT0704V.BXHTCMD.	Z_Tl1_Rht%	Heating Plant		
MT0704V.FAN-C.COS		CHW Distribution		
MT0704V.SAD-C.	Z_Tl_Dmpr1_%op	HW Distribution		
MT0704V.SUP-FLO.		AHU		
MT0704V.SUPFLOSP		Zone		

Comp. ID: 1

Help
Map Point
Cancel
Done >

User's points are mapped to common point names as per
A Specifications Guide for Performance Monitoring Systems

Step 3: Create Schedule (optional)

Input Schedule Information

Annual Schedule | Week Schedules | Day Schedules

Schedule Name: All Year | Sch. #: 1

Monday: Mon
Tuesday: Tuesday through Thursday
Wednesday: Tuesday through Thursday
Thursday: Tuesday through Thursday
Friday: Friday
Saturday: Saturday
Sunday: Sunday and Holidays
Holiday: Sunday and Holidays

DaySchedule6
DaySchedule7
DaySchedule8
DaySchedule9

Schedule Properties

Annual Schedules | Week Schedules | Day Schedules

Currently Active Week Schedule: GndCor Occ 1/0 W1 | Type: Fraction

Week Schedule Name: GndCor Occ 1/0 W1
Type: Fraction

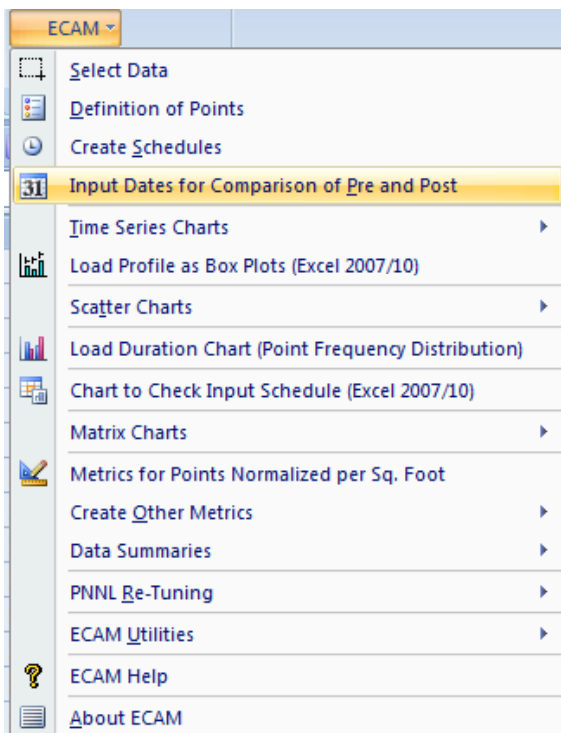
Daily Schedule Assignments

Monday: GndCor Occ 1/0 D1
Tuesday: GndCor Occ 1/0 D1
Wednesday: GndCor Occ 1/0 D1
Thursday: GndCor Occ 1/0 D1
Friday: GndCor Occ 1/0 D1
Saturday: GndCor Occ 1/0 D2
Sunday: GndCor Occ 1/0 D2
Holidays: GndCor Occ 1/0 D2
Heating Design Day: GndCor Occ 1/0 D1
Cooling Design Day: GndCor Occ 1/0 D1

Next Schedule
Done

Forms are similar to eQuest

Step 4: Input Energy Project Dates (optional)



Enter a date

Enter the date your energy project started, if any.
Use a format like mm/dd/yyyy.

11/14/2006

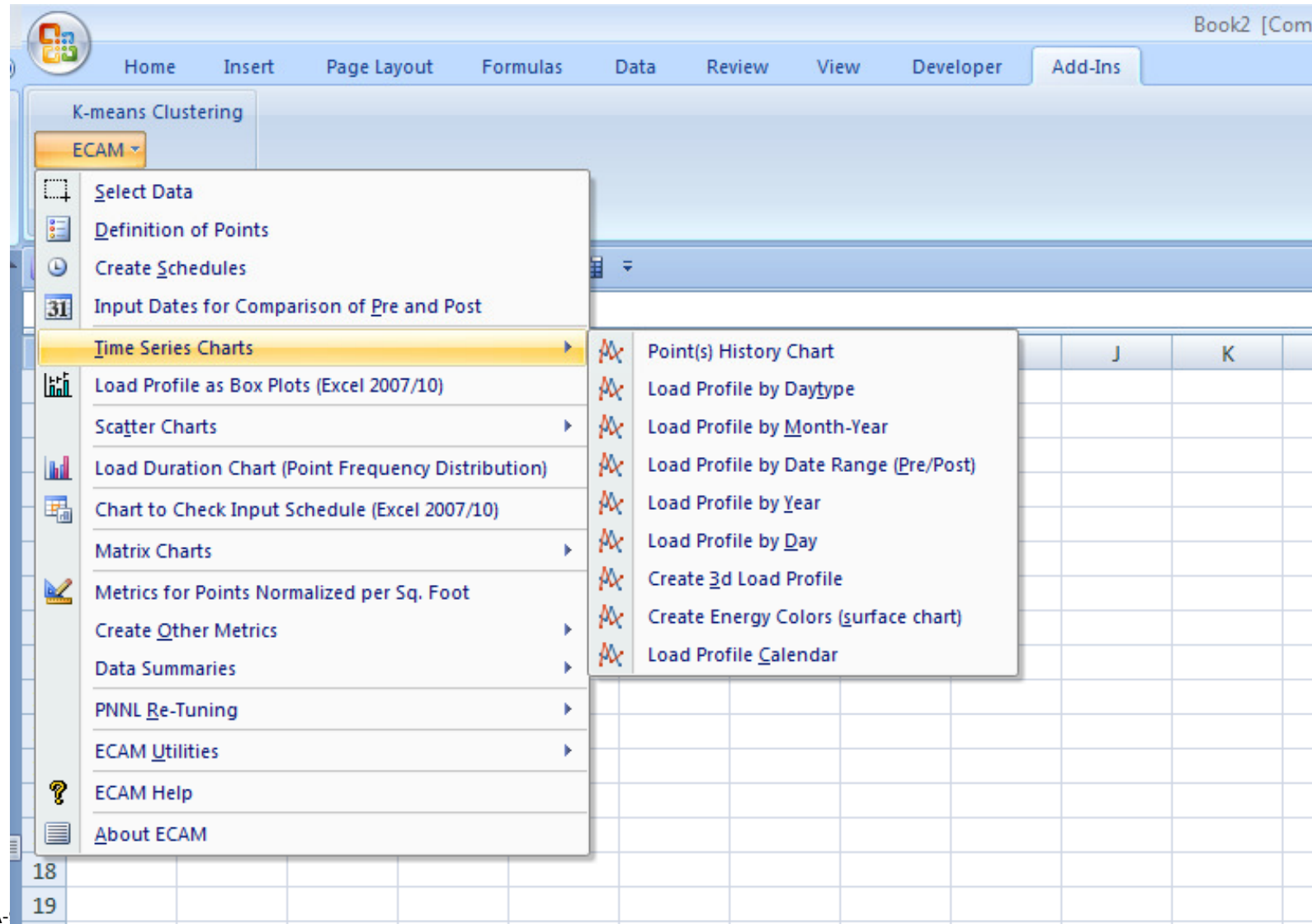
OK Cancel

Enter a date

Enter the date your energy project was completed, if any.
Use a format like mm/dd/yyyy.

OK Cancel

Step 5: Create Metrics or Charts



Preprocessing of Data

- Time stamp disaggregation
- Daytyping
- Occupancy
- Pre/Post Energy Project
- Normalizations
- Calculations

ECAM Metrics Creation Capabilities

In ECAM, metrics are typically data averaged over a particular time period

- Can be normalized:
 - Building area (e.g. W/sqft)
 - Cooling tons (e.g. kW/ton)
 - cfm (e.g. Watts/cfm)
 - gpm (e.g. gpm/ton)
- Can be filtered by:
 - Year
 - Month
 - Pre/post time periods
 - Daytype
 - Time of day
 - Occupancy
 - Weather conditions
 - Status of equipment
 - Combinations

All filters and many normalizations are automatically set up by ECAM

Automatic Creation Of Additional Fields For Metrics

- Equipment Status
- Demand (kW)
- Chilled water tons
- Watts per square foot
- CFM per square foot
- kW per ton
- gpm per ton
- from demand (kW) or current (amps)
- from current (amps) approximate calculation
- whenever flows and temperatures are available
- for all electrical demand points (kW)
- for all air flow points
- for all related points
- for all related points

Interval Data Visualization

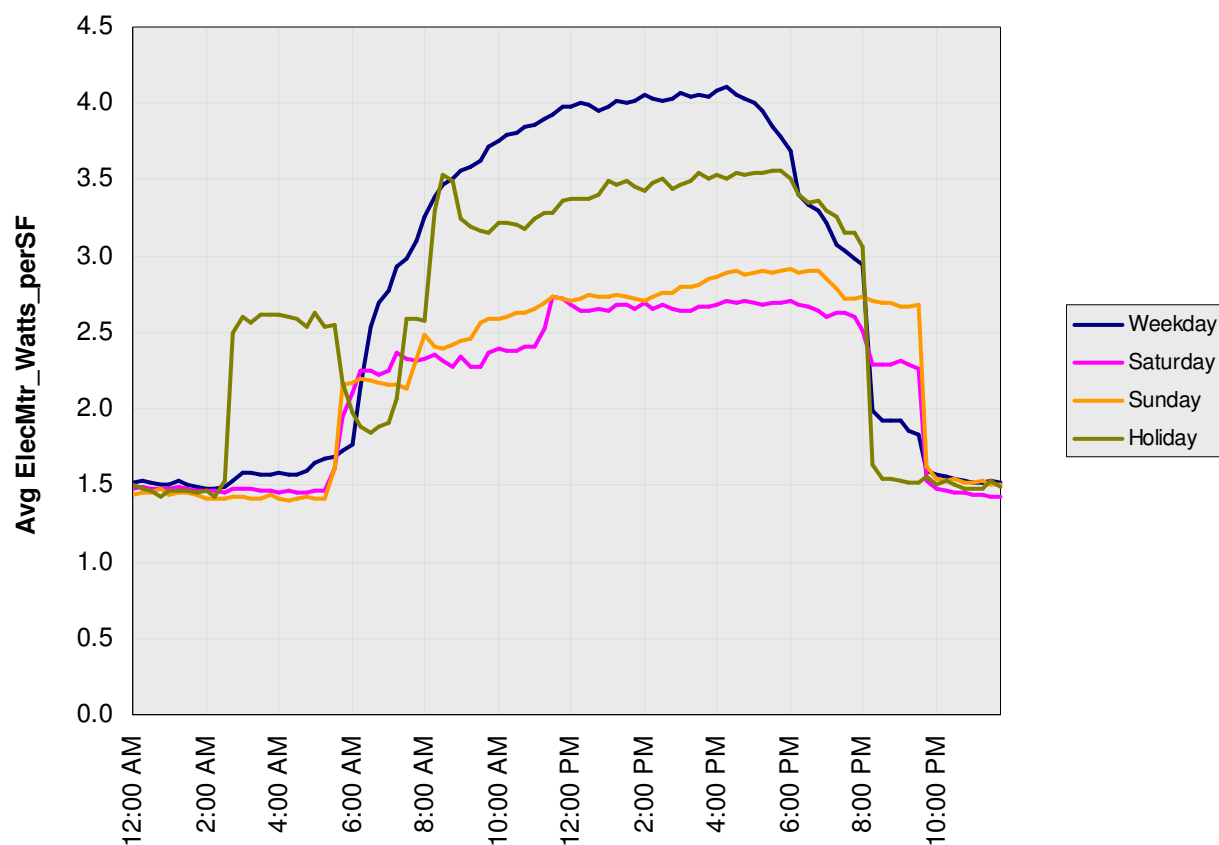
- Load profiles
 - Raw data
 - Averages
 - Pre/post
 - By daytype
 - Calendars
- Scatter charts
 - Raw data
 - Averages
 - Pre/post
 - By daytype
 - By occupancy
 - By time of day
 - Choice of independent variable
 - Multiple points

Filtering capabilities are provided
for all types of charts

Load Profile by Daytype

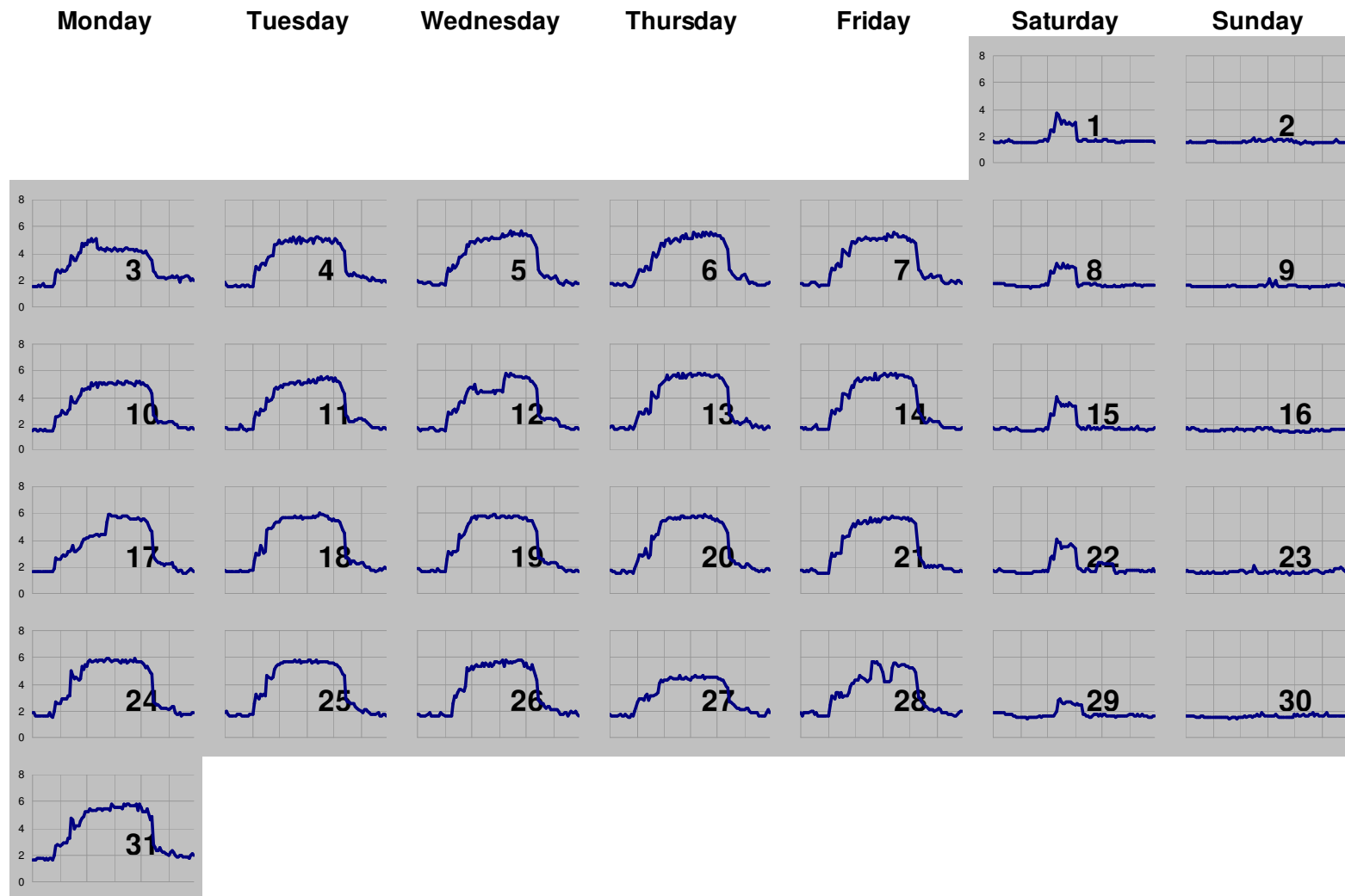
Year	(All)
Month	(All)
MonthYr	Sep 2006
Weekday	(All)
Day	(All)
Holiday	(All)
5degBin	(All)
1degBin	(All)
TempRng	(All)

Filtering Options

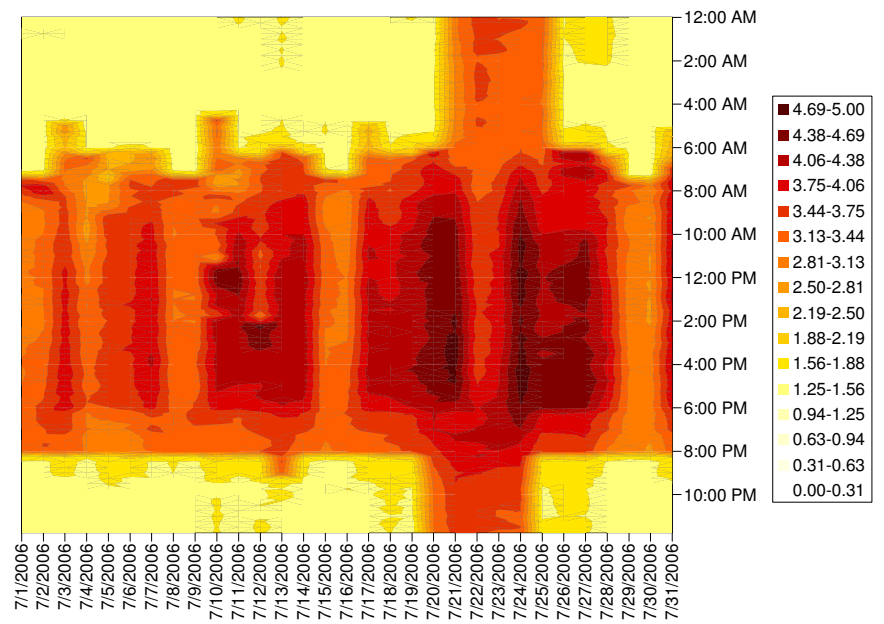
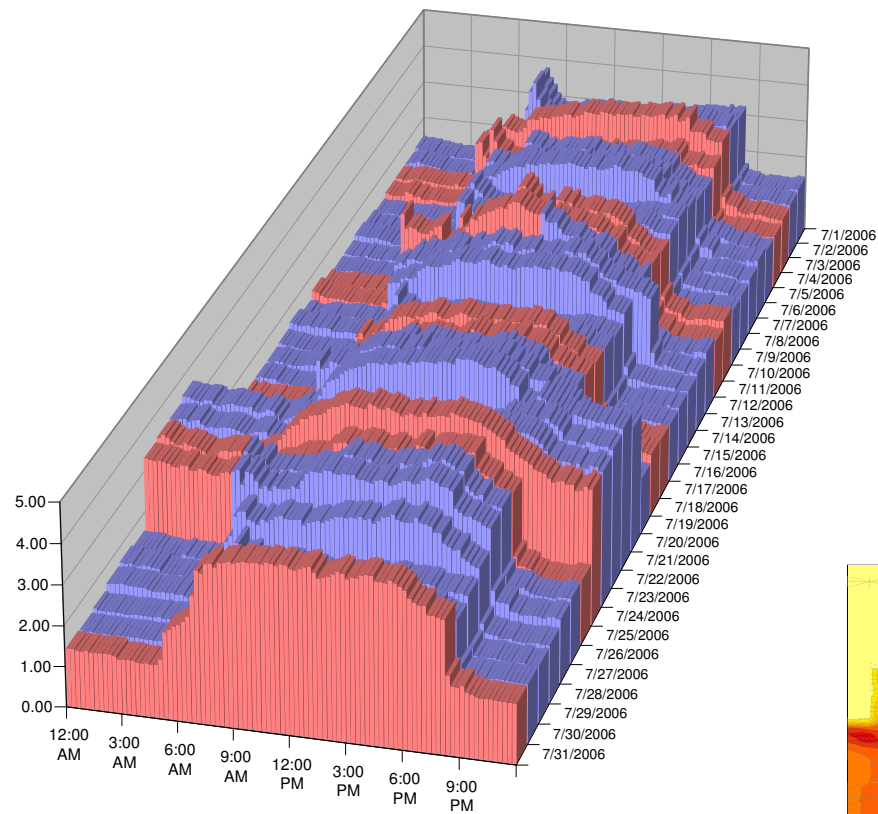


Calendar Load Profile

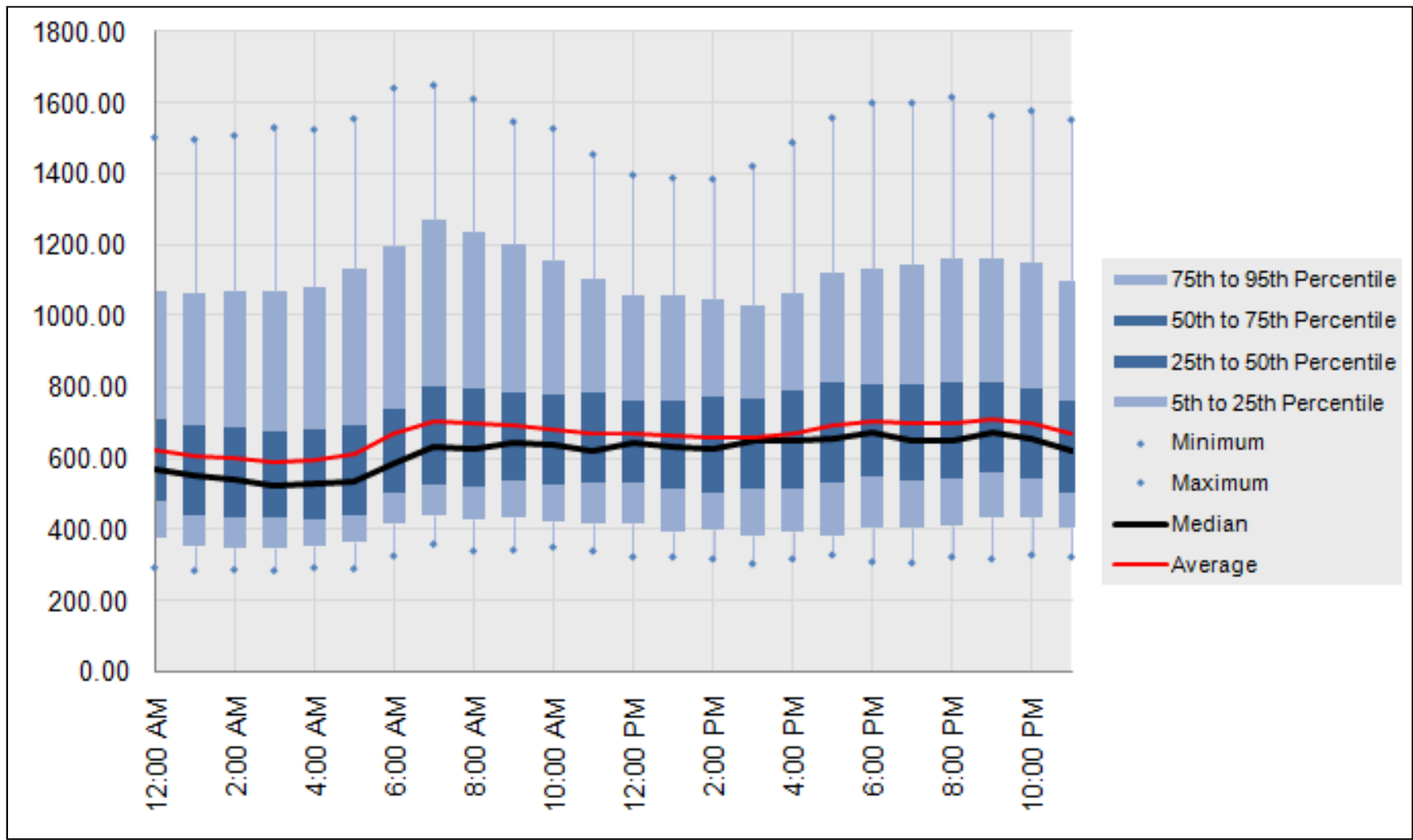
October



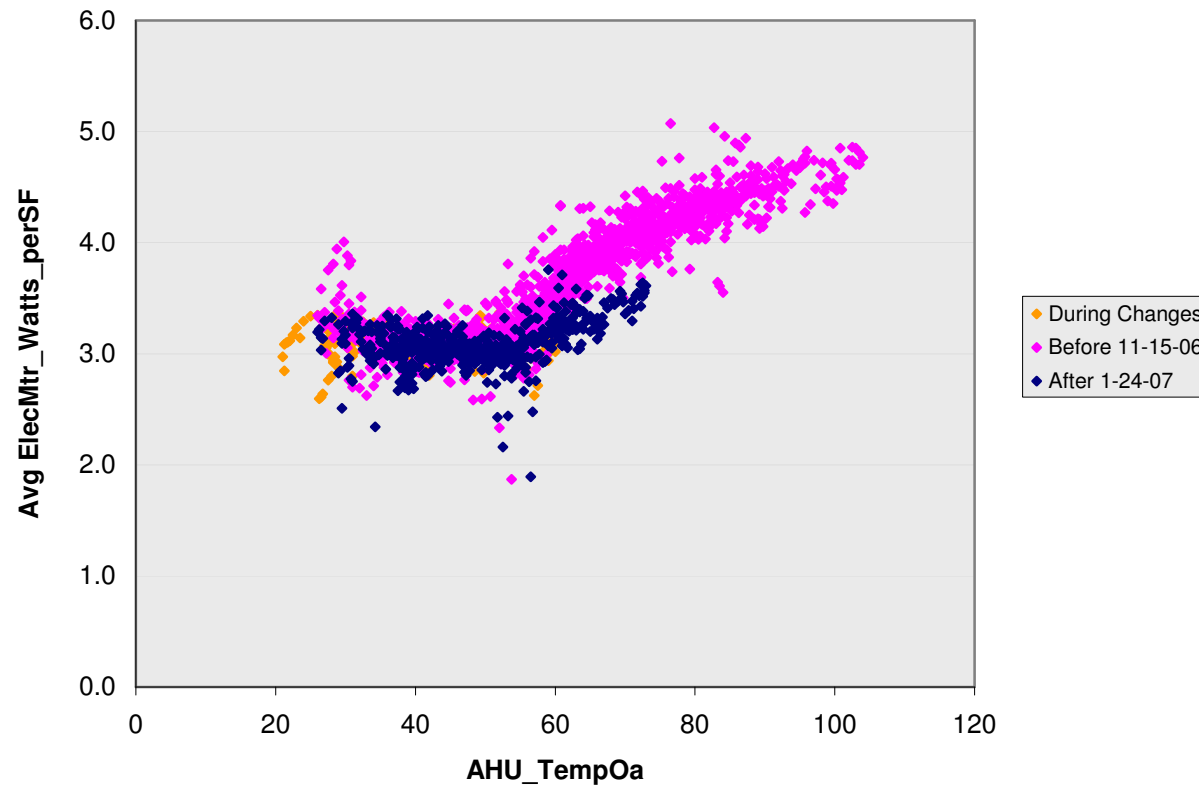
3-D Load Profile



Box Plot Load Profile



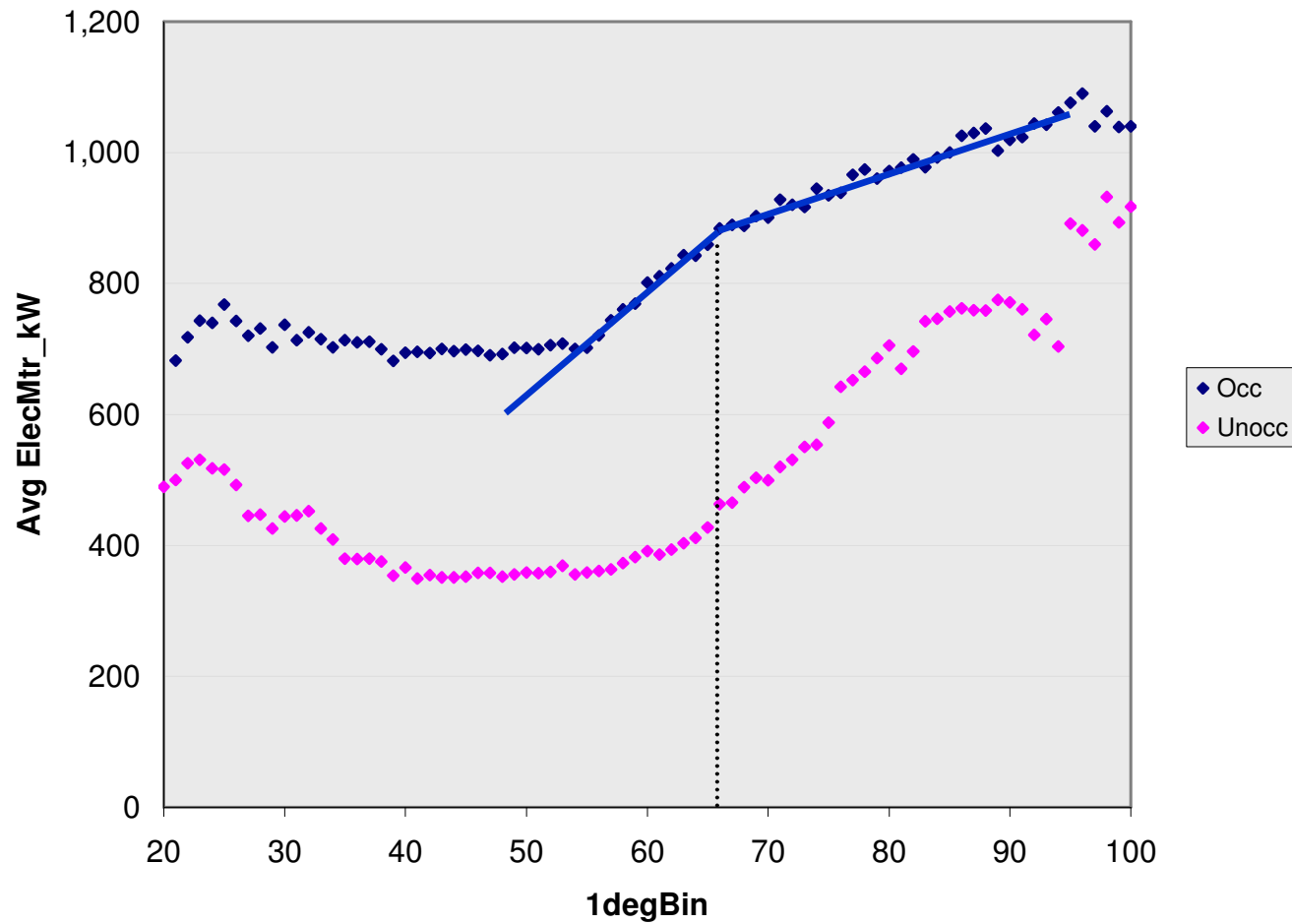
Scatter Chart by Date Range



Excel won't create
Scatter Charts based on
PivotTables (PivotCharts).

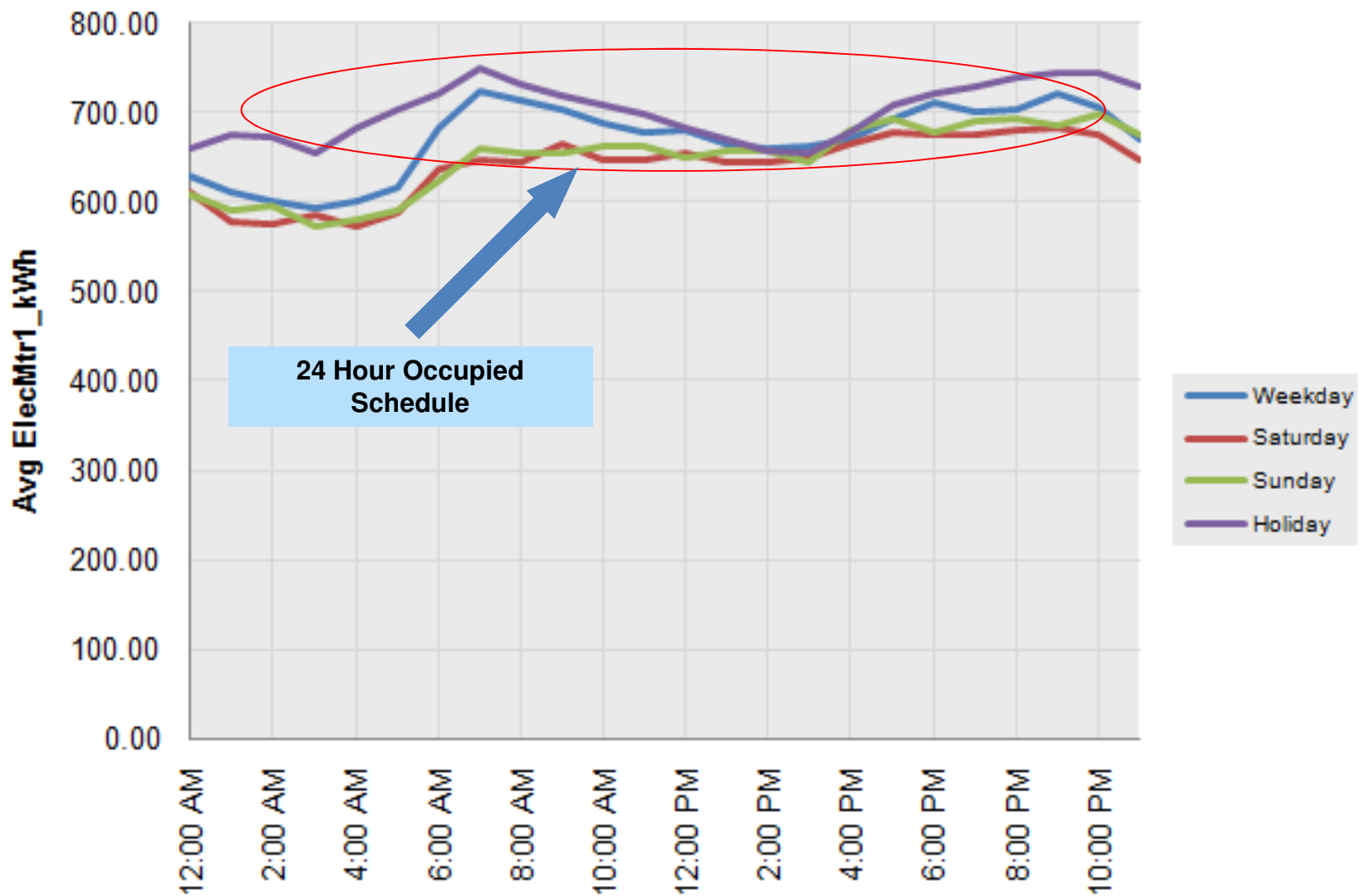
ECAM includes
Scatter Charts based on
PivotTables.

Scatter Chart by Occupancy with Binned Weather

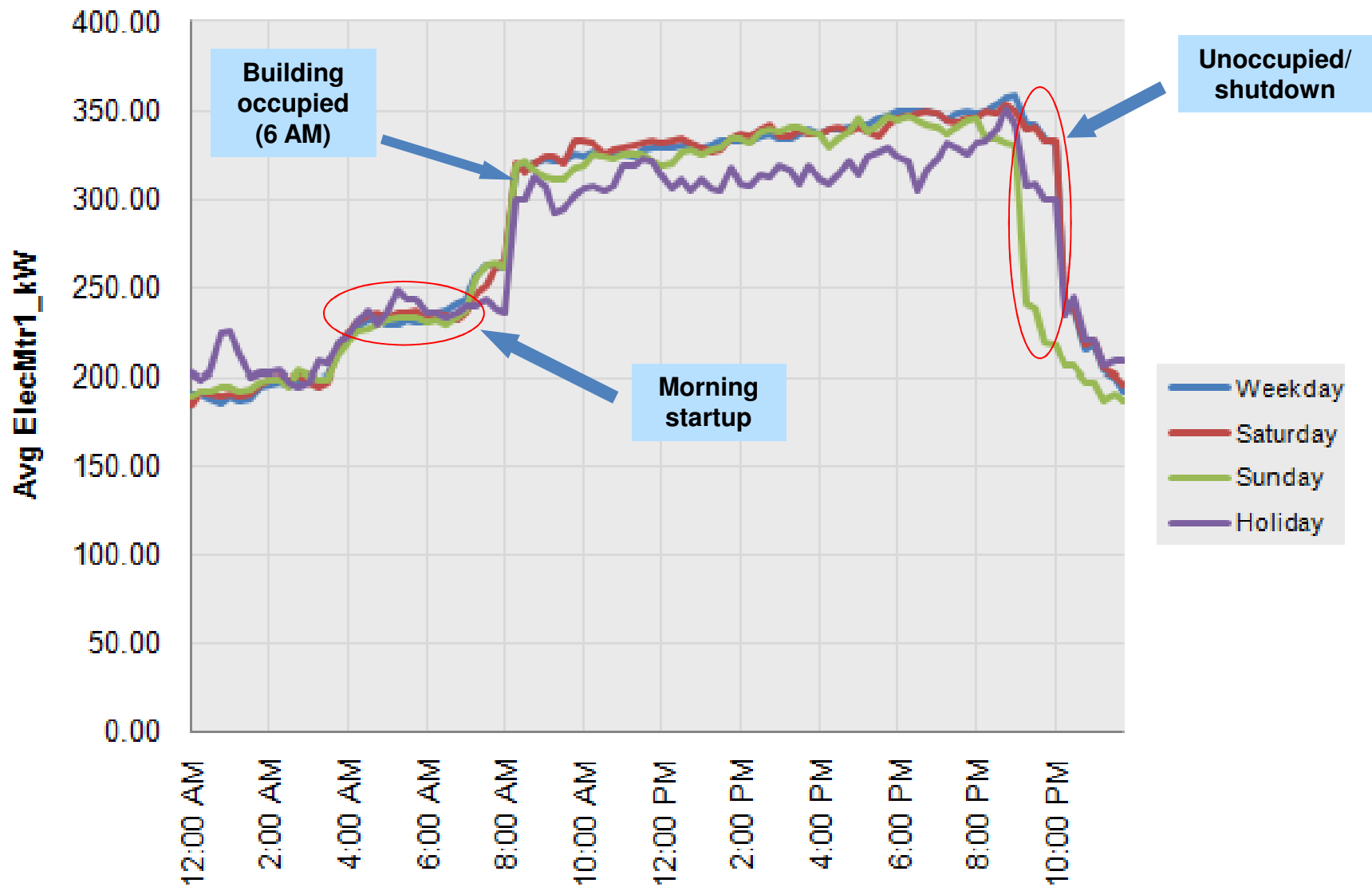


INTERVAL METER DATA ANALYSIS EXAMPLES

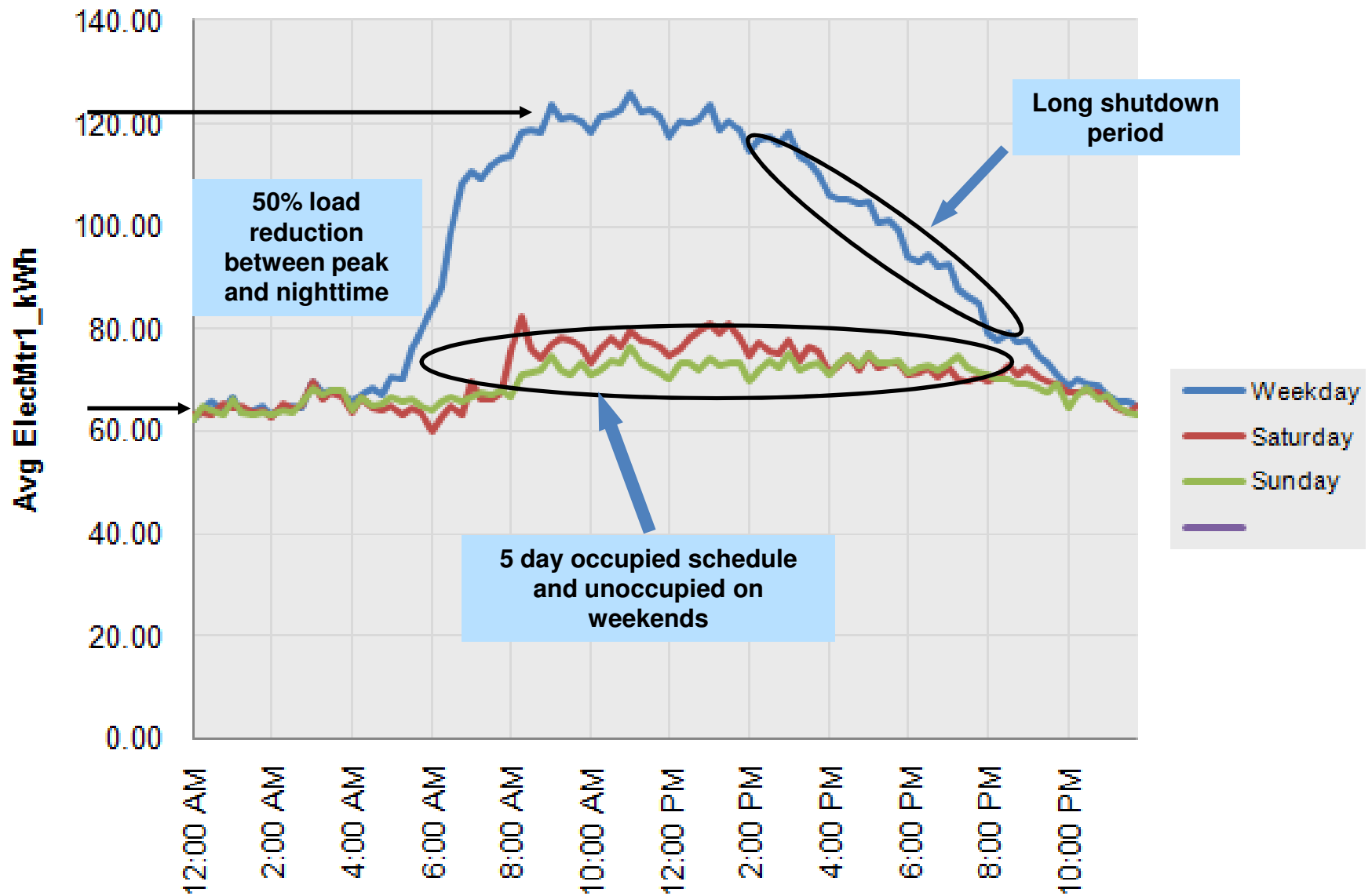
Example: Load Profile by Daytype



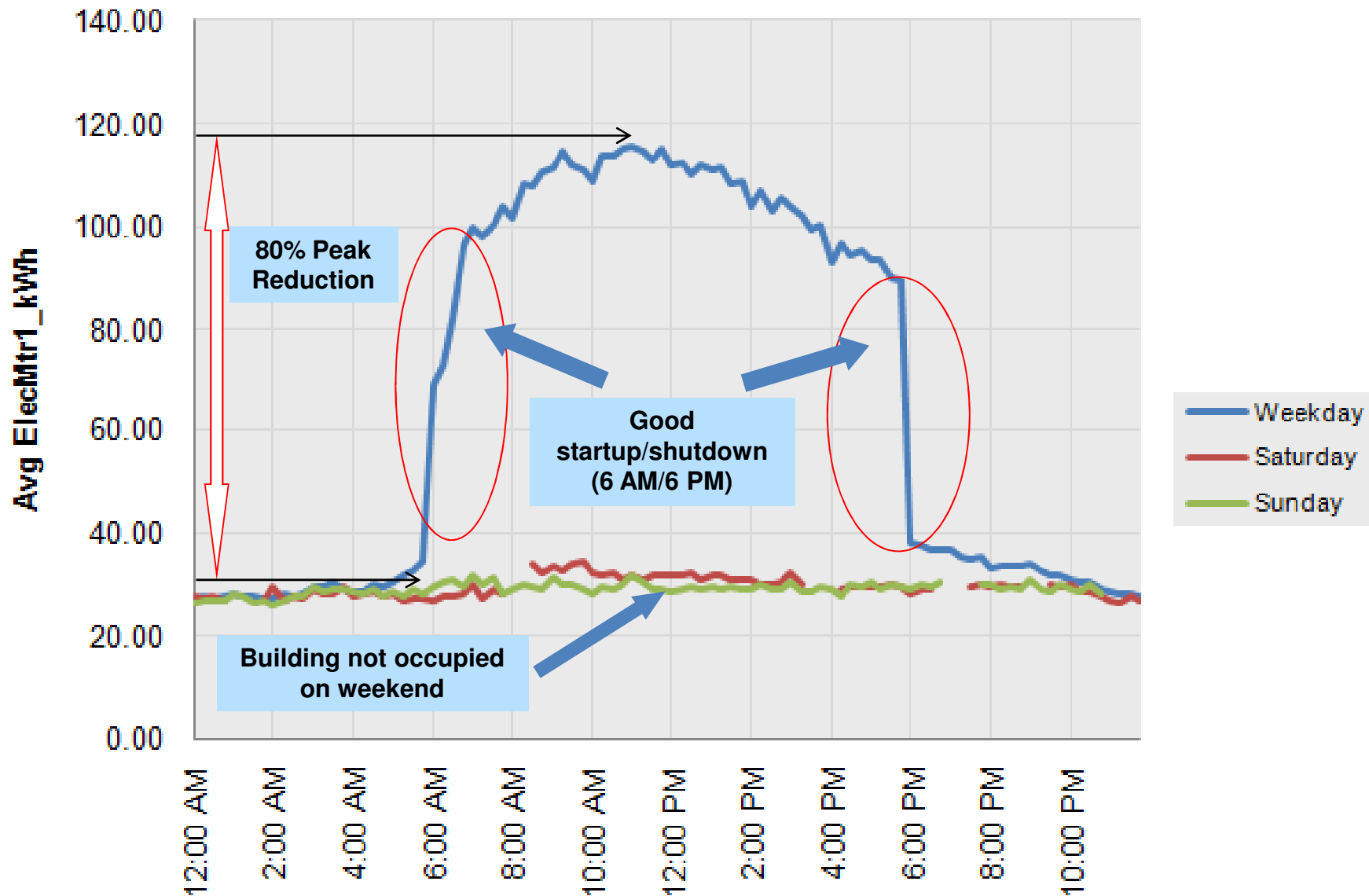
Example: Load Profile by Daytype



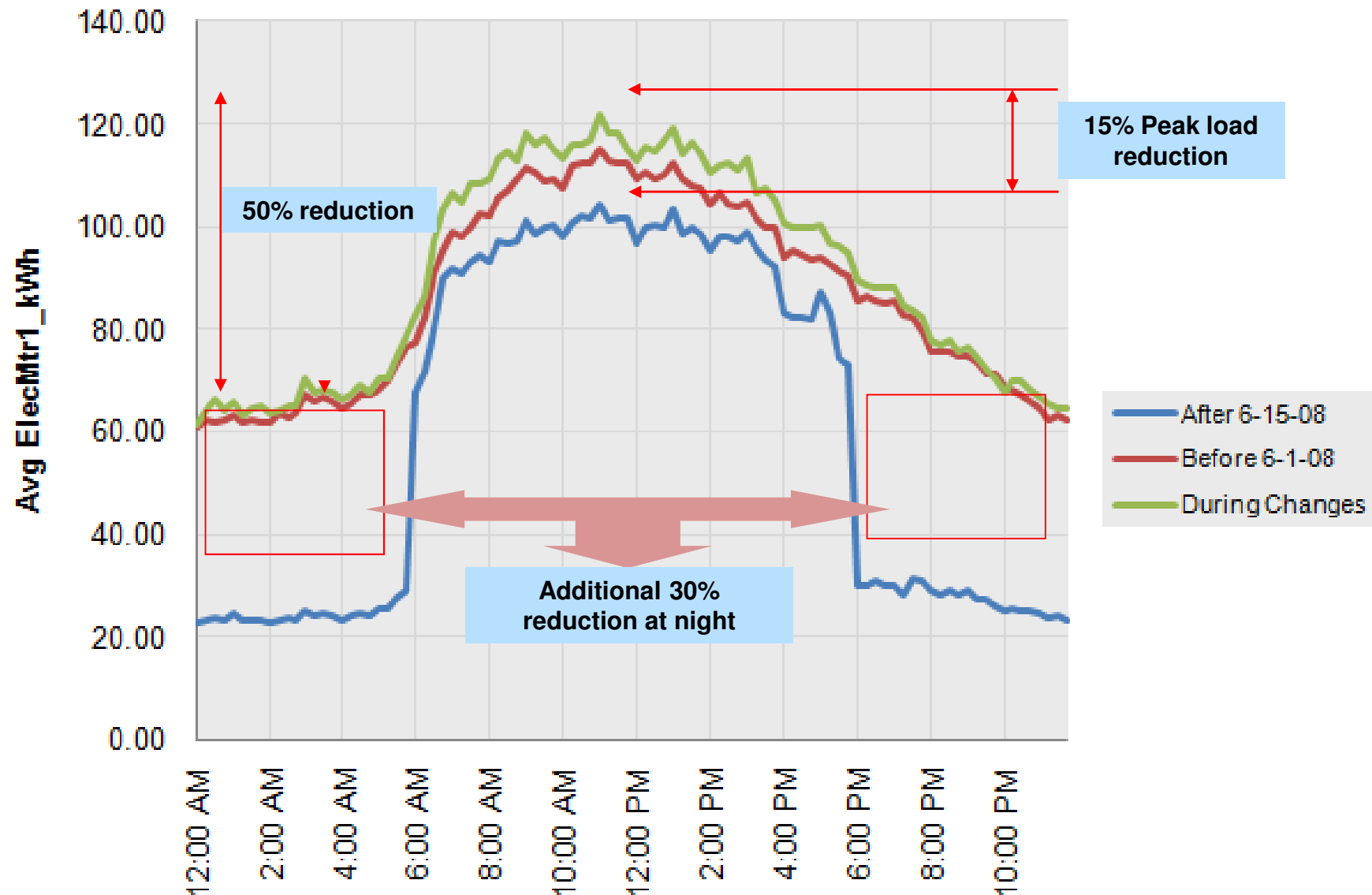
Example: Typical Office Building



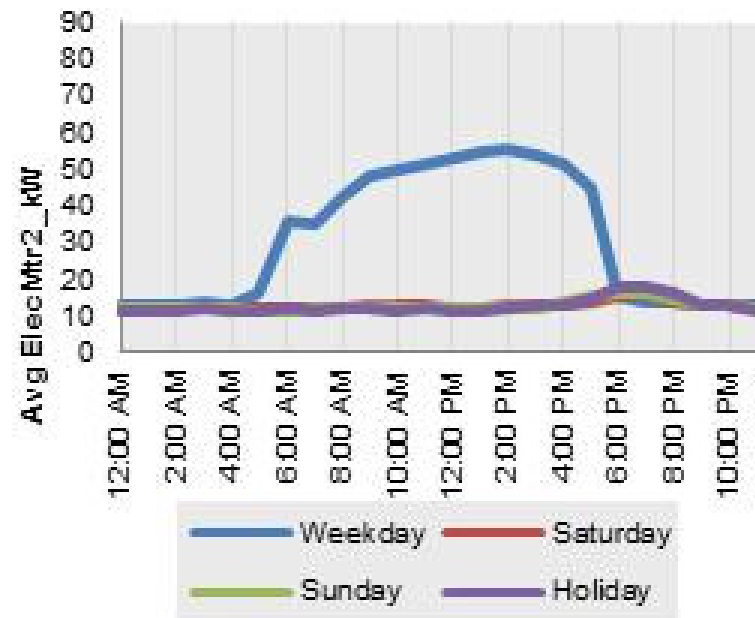
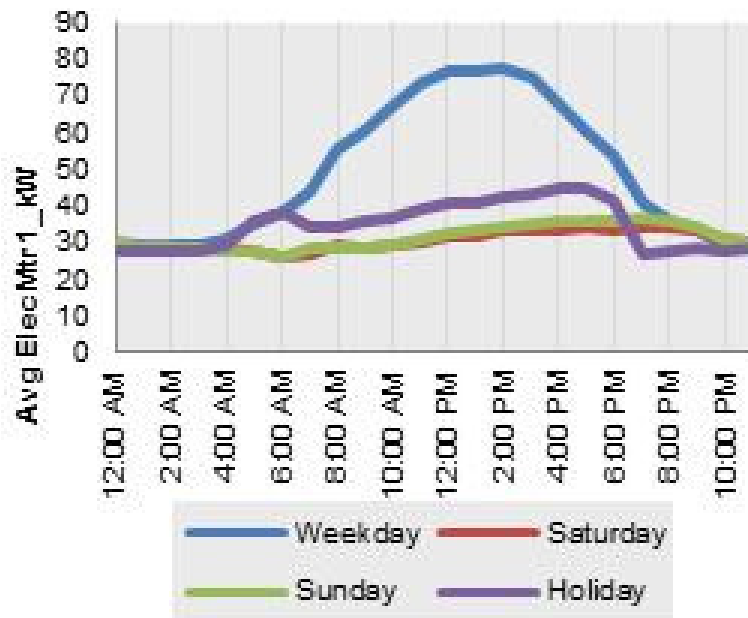
Example: Good Office Building



Example: Comparing data before and after improvements



Comparing Consumption from Two Identical Buildings



Comparing Regression Analysis from Two Identical Buildings

