



ADVANCED EXCEL FOR ENERGY EFFICIENCY PROFESSIONALS

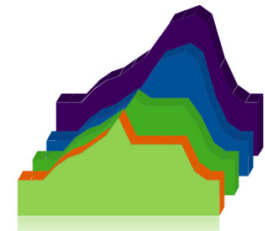
AEE NORTHERN OHIO CHAPTER
11/14/2014

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AGENDA

- About EEDM, Inc.
- Excel's use in Energy Engineering
- Excel Formulas and Functions
- Interval Data Analysis (IDA) Basics
- IDA Analysis using Microsoft Excel[®]



EEDM, Inc.

- Energy Efficiency & Demand Management
 - Training
 - Consulting
 - Implementation Assistance
- Training in Advanced Microsoft Excel® (on-line and classroom)
- Energy Efficiency and Demand Side Management (classroom)
 - Relevant or minimal theory; “cut to the chase”
 - Flexible tools
- Trained people from diverse organizations
 - Austin Energy, London Hydro, FP&L
 - Michaels Energy, Research into Action, Energy Control, Inc.
 - Burns and McDonnell, CB Richard Ellis, EnerNOC

WHY EXCEL?

- **CALCULATIONS/WHAT-IF ANALYSIS**
 - Complex calculations and “What-If” analysis
 - Many built-in functions + custom functions
- **CHARTING**
 - Variety of charts - Bar, line, pie, etc.
 - Custom formatting and dashboards
- **DATA ANALYSIS/DATABASE**
 - Sorting, filtering and connecting to external data
- **OTHER**
 - Seamless integration with other office applications
 - Collaborative environment - leave comments, call boxes, etc.

FUNCTIONS IN EXCEL

- Required to take advantage of Excel's power
- Opens door for creative data analysis and manipulation
- Excel 2013 has over 450 functions
- Relevancy to Energy Engineering
 - Proficient in ~ 100 functions
- Combine functions for greater potential
- User defined functions (UDF)
 - Steam properties
 - Psychrometric properties
 - Requires knowledge of VB

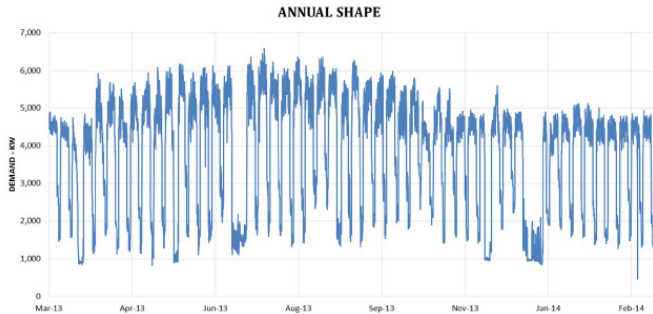
ENERGY ANALYTICS



Using Energy Analytics to Increase Value to Your Organization
Energy & Energy Information Management to Control Costs

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Income Statement Detail Understanding Interval Data

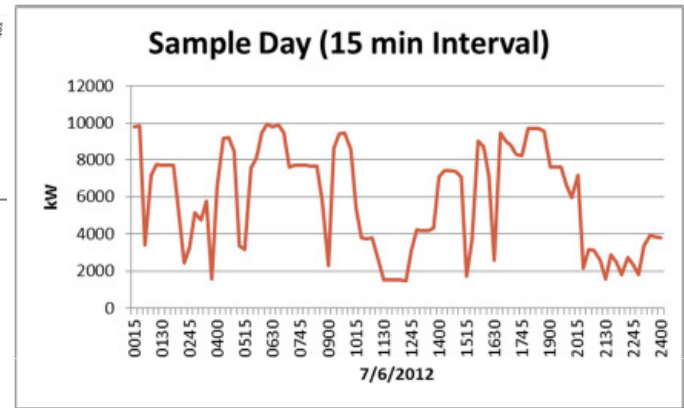
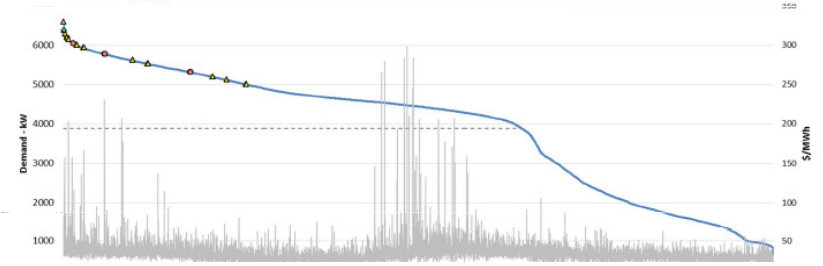
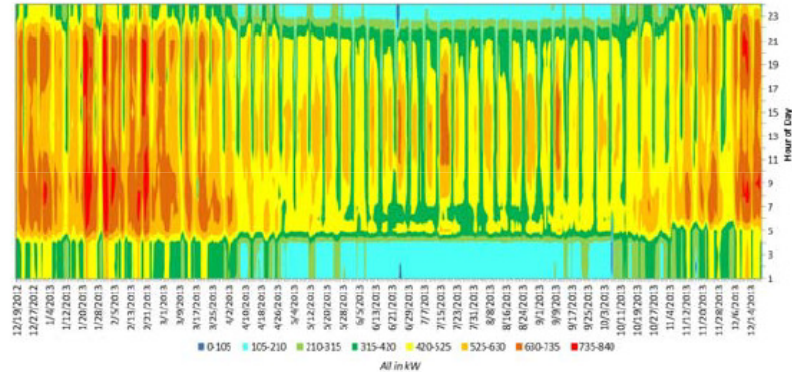
- Interval data – Forest or Trees?
- Heat maps
 - Show overall operating pattern and performance
- Duration curves
 - Show peak demands, operating levels, operating con
 - Allow for review of distribution demand management, transmission cost reductions, demand response and forests

loads and operating sche

le analysis

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DEMAND (HEAT) MAP



INTERVAL DATA ANALYSIS (IDA)

- Load profiling
 - Analysis carried on yearly, monthly, weekly, and daily basis
 - Identify problems that impact energy consumption
- Peak and base load analysis
 - Size, timing, and duration of peak
 - Relationship between max and min load
 - Identify demand reduction potential
- Load duration curves and heat maps
 - Magnitude of peak loads
 - Clustering of peak timings

IDA TOOLS

- Energy Charting and Metrics Tool (ECAM)
- Smart Metering, Load Profiling & Demand Response - by Lindsay Audin through AEE
- Energy Lens by BizEE Software Limited
- Interval Data Analysis Tool (IDAT)

BizEE Energy Lens
Energy management made easy

- Energy Lens Software
- For Energy Consultants
- For In-House Energy Managers
- For Home Use
- Download Free Trial
- Buy Now
- Key Features
- Charts and Tables
- FAQ
- Interval Energy Data

Interval Data - Energy Data that's Packed with Information

Interval energy data contains a lot of information about a building's energy usage. Energy Lens makes it easy to turn the raw data into useful charts and figures (you can [download a free trial of Energy Lens](#) to give it a go).

But what exactly is interval energy data, how do you get it, and why should you be interested?

Interval energy data is a fine-grained record of energy consumption, with readings made at regular intervals throughout the day, every day.

[Try our Interval-Energy-Data-Analysis Software](#)

Interval energy data is collected by an interval meter, which, at the end of every interval period, records how much energy was used in the previous interval period.

Such data is often referred to as "interval data", "interval meter data", "demand interval data", "kW interval data", "electricity interval data" (electricity interval meters are particularly common), and other such variations. Common forms of interval data include 15-minute data and half-hourly data.

The picture below shows part of an Excel chart created by Energy Lens from 15-minute interval data. The fine-grained detail of the data is clear to see.

- [Why should we be interested?](#)
- [Where does it come from, and how do you access it?](#)
- [What format does it come in?](#)
- [How often should a business monitor it?](#)
- [Why do we need Energy Lens to benefit?](#)

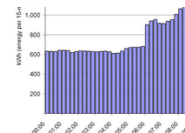
Why should we be interested in interval energy data?

If you're an **energy user** (a business or other organization), your interval data is invaluable for the **energy management** that can help you to reduce your energy consumption.

If you're an **energy consultant**, you're probably [analyzing interval data](#) already; such analysis can very quickly reveal a lot of information about the ways in which your clients use energy.

Where does interval data come from, and how do you access it?

Interval data comes from interval meters. In the last few years it has become very common for medi



Smart Metering, Load Profiling & Demand Response
Online Seminar



RESOURCES ABOUT THE CCC MEETINGS LOGIN

RESEARCH PROJECTS

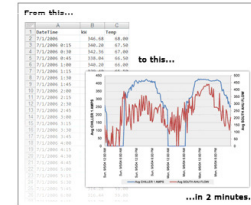
Tutorials

Energy Charting and Metrics (ECAM) Tool, version 2.0

What is ECAM?

ECAM is a Microsoft Excel[®]-based tool that facilitates the examination of energy information from buildings, and ultimately reduces the time spent analyzing utility meter data and system operational data. Starting from simple time-series data, ECAM automates a wide array of charting and analysis functionality.

The most common use of ECAM is to complete pre and post energy efficiency project regression analyses of utility interval meter data against outdoor air temperature. However, ECAM has additional applications that can be used independently, including analysis of a building's load profile, creating per-square-foot metrics of building energy use, and developing scatter charts based on occupancy or time of day. These applications can ultimately be used to better



"Before ECAM, we used to spend hours on creating the charts we need for detailed energy

Realtime Distance Learning For Energy-Involved Professionals

presented by
AEE The Association of Energy Engineers

GETTING STARTED WITH IDA

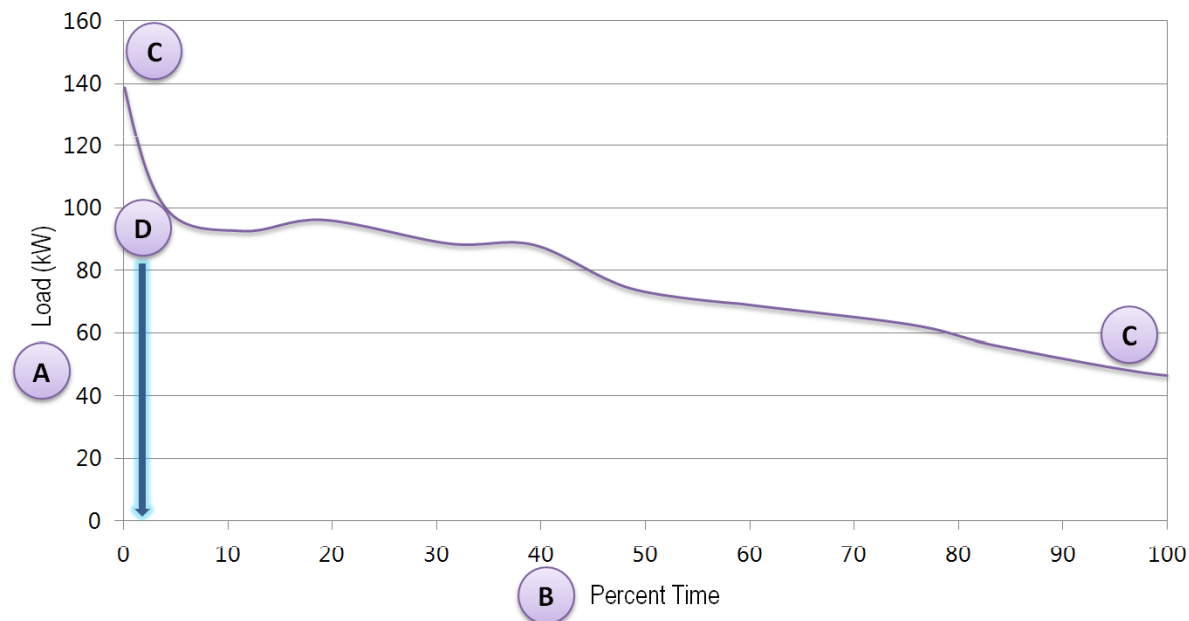
- Input Data
 - kW or kWh
 - 1 kWh over 30 minutes = 1kWh
 - 1 kW over 30 minutes = $1 \times 0.5 = 0.5$ kWh
 - Data for one year
- Understand facility operation to understand energy profiles
 - Occupancy and operating schedules
 - HVAC and lighting systems
 - Energy consuming equipment/process

ANALYZING IDA OUTPUT

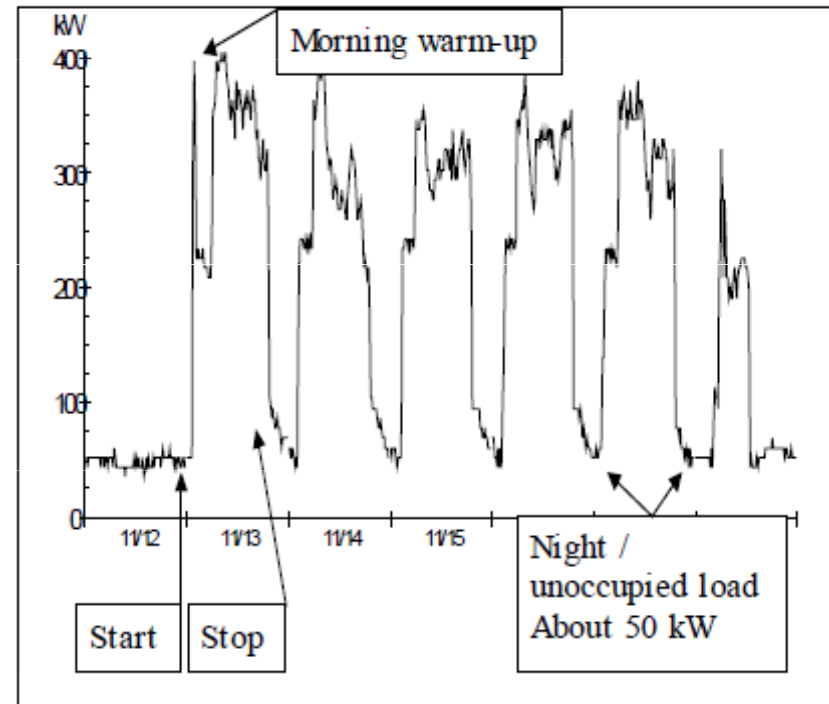
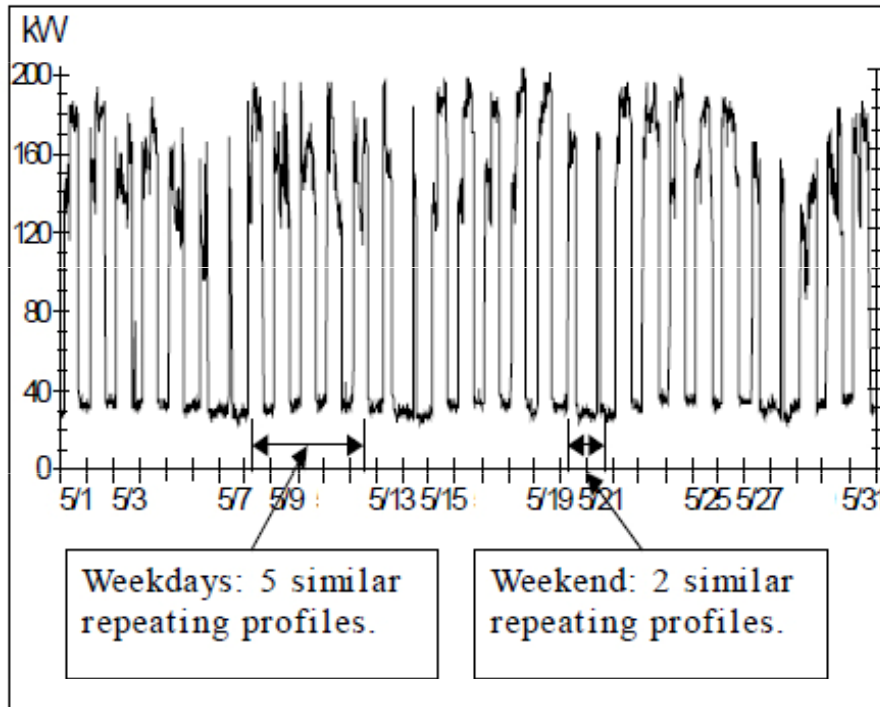
- Derive key characteristics and answer key questions
 - Magnitude of energy use and load demand
 - Energy use profile
 - Weather impact
 - Building operating characteristics
 - Base load and variable load
 - Load spikes

LOAD DURATION CURVE

- (A) A one year load duration curve is plotted, with load on the y-axis
- (B) The x-axis indicates the percent time that the load was at or greater than the y-value
- (C) The base load is never less than ~ 48 kW and the maximum load is about 140 kW
- (D) The peak demand above 120 kW is only 2-3% of the time throughout the year

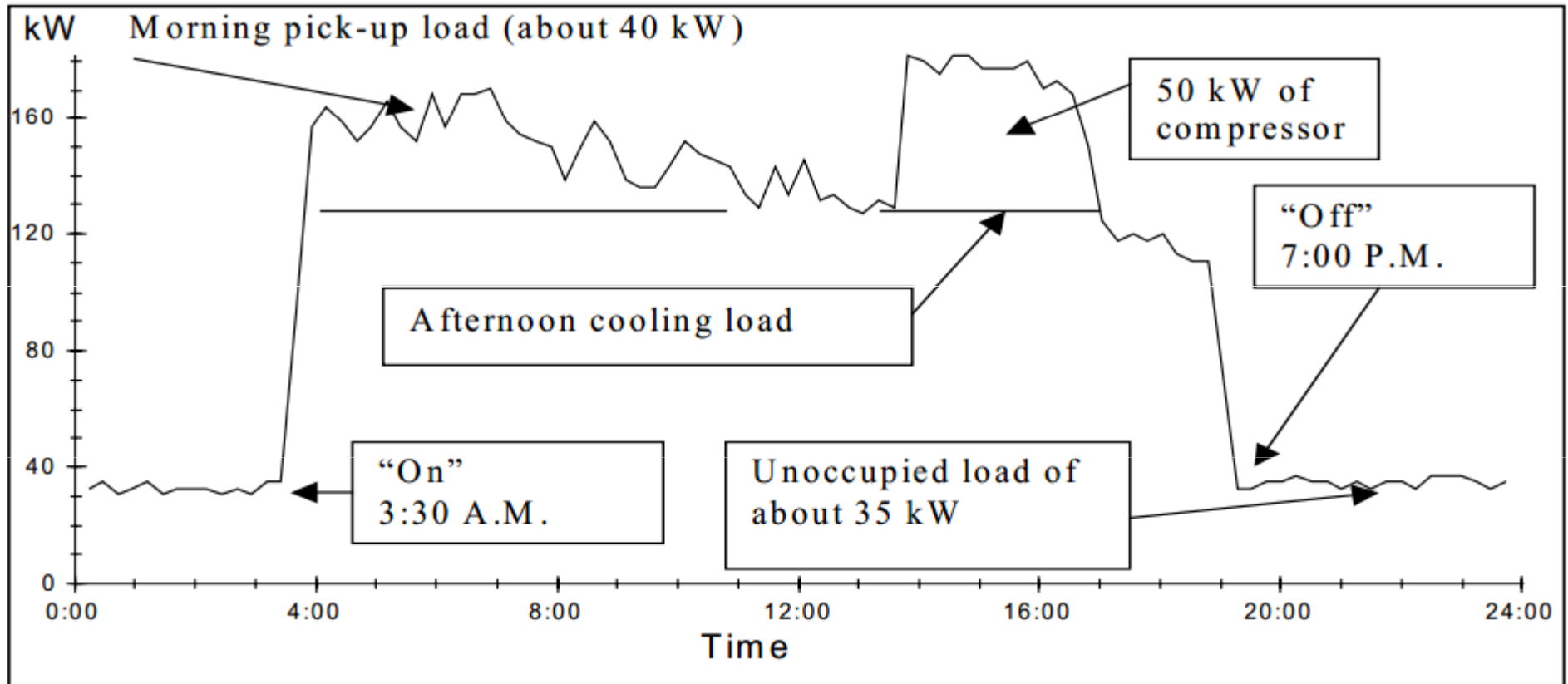


WHAT TO LOOK FOR IN INTERVAL DATA?



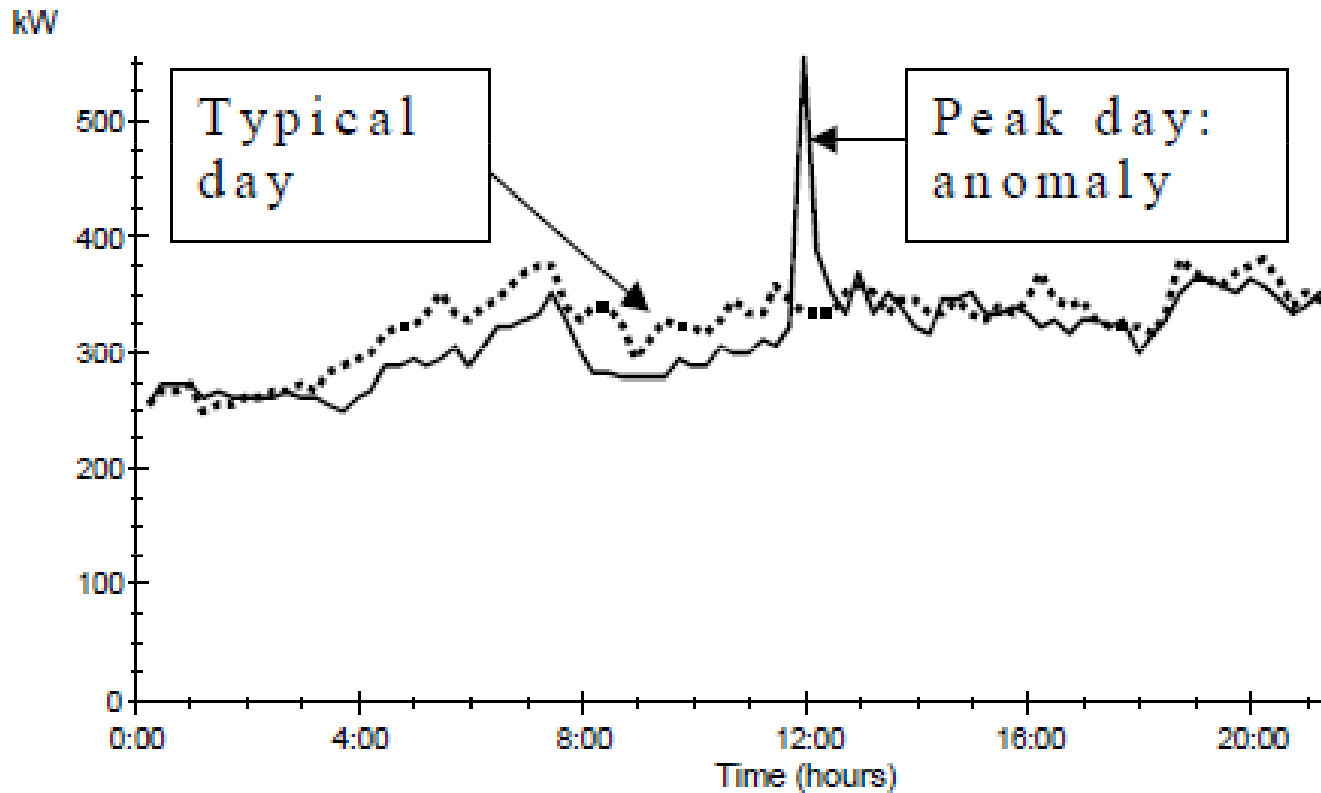
Source: "Using Interval Data as a Diagnostic Tool", Will Price and Reid Hart, Eugene Water & Electric Board

WHAT TO LOOK FOR IN INTERVAL DATA?



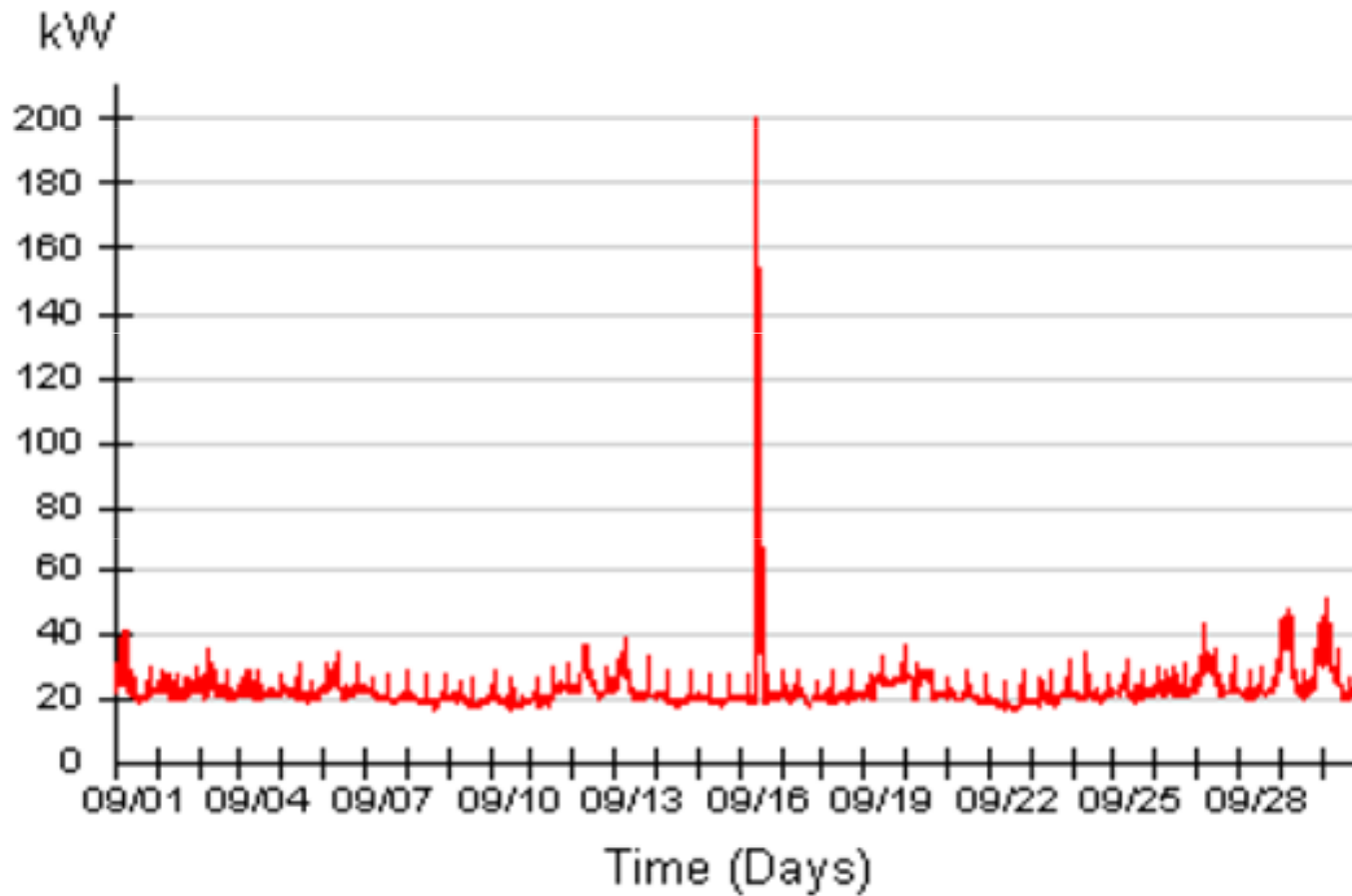
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ENERGY USE PROFILES



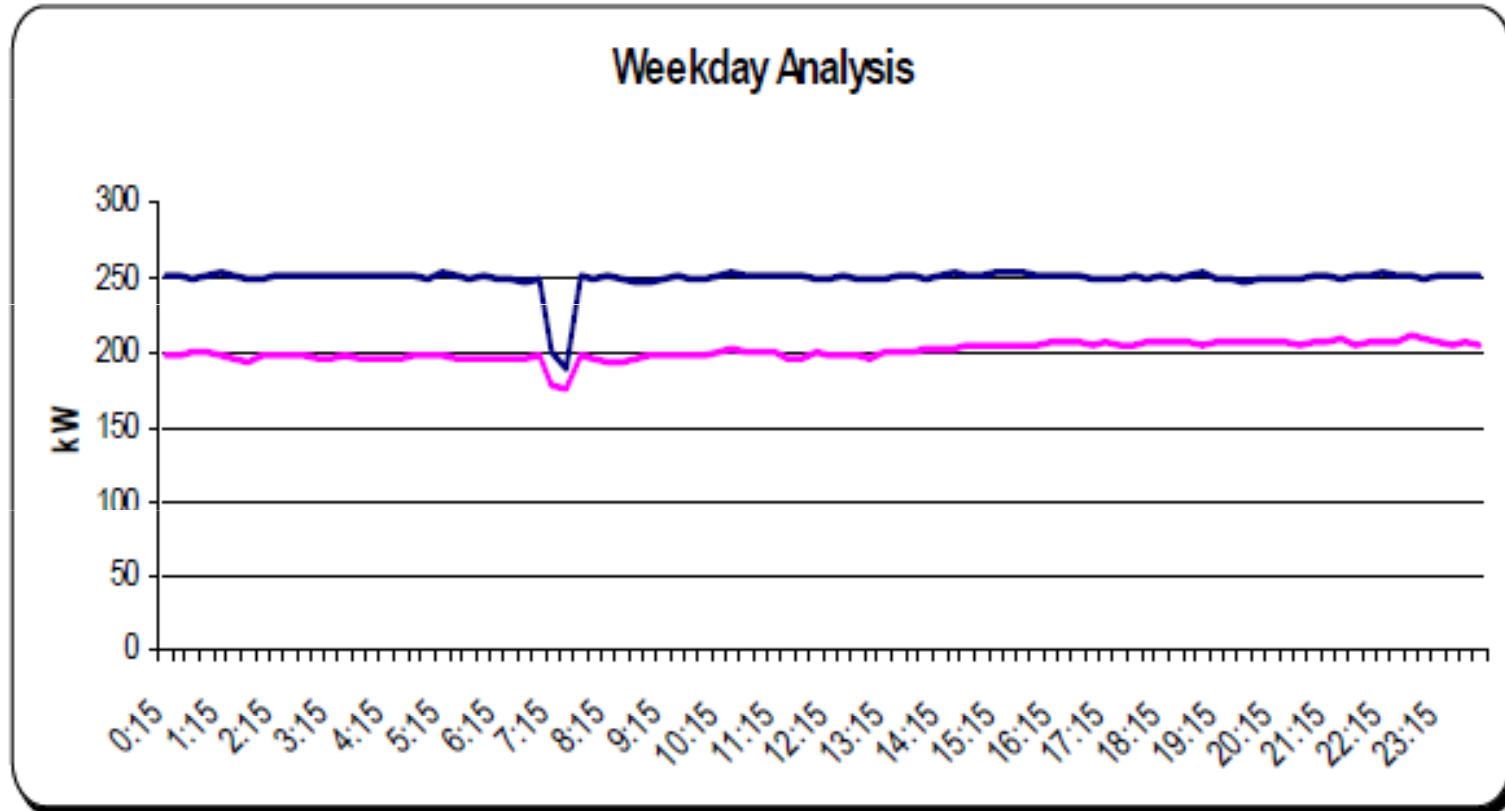
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ENERGY USE PROFILES



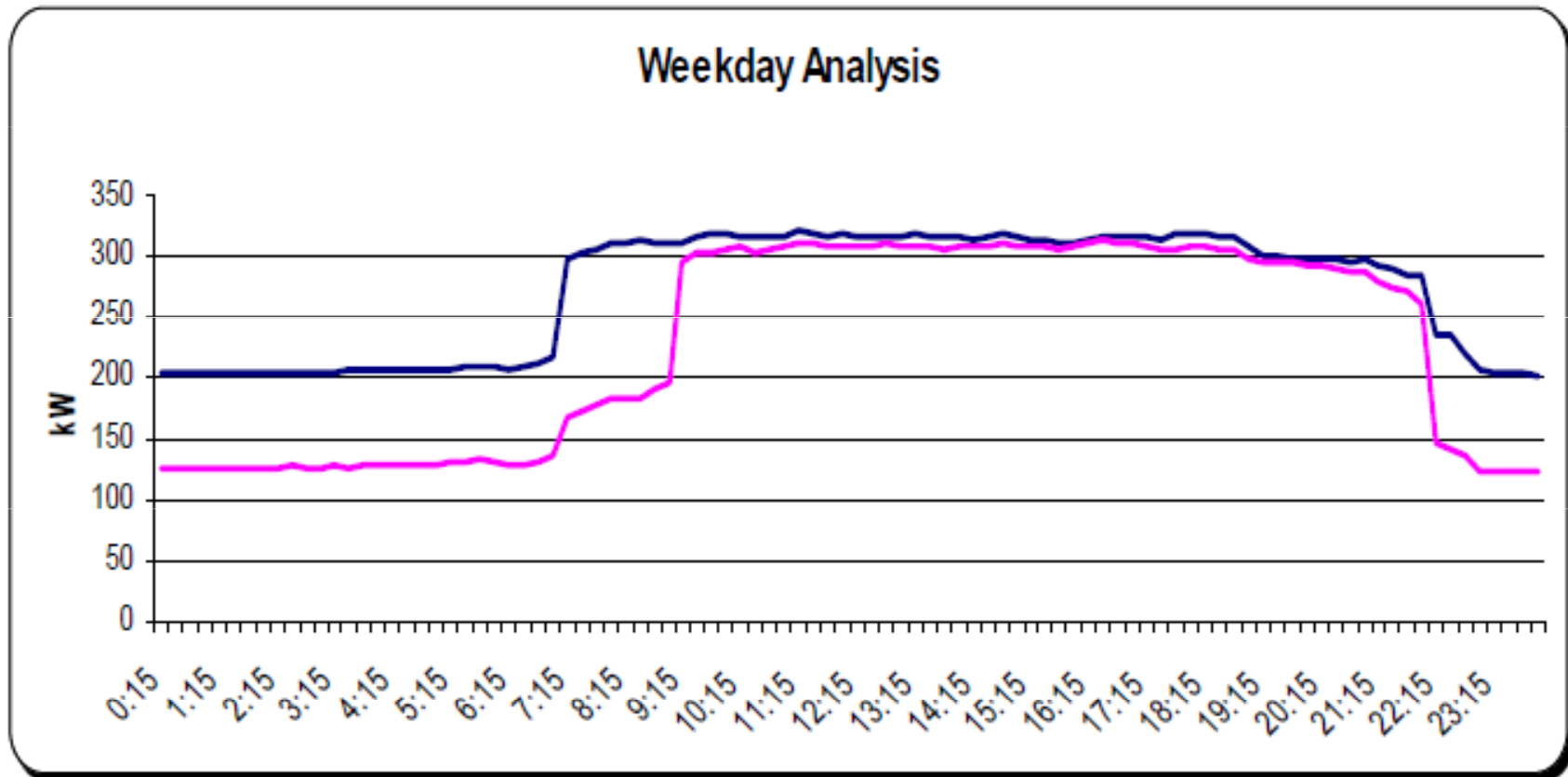
Source: NGrid

ENERGY USE PROFILES



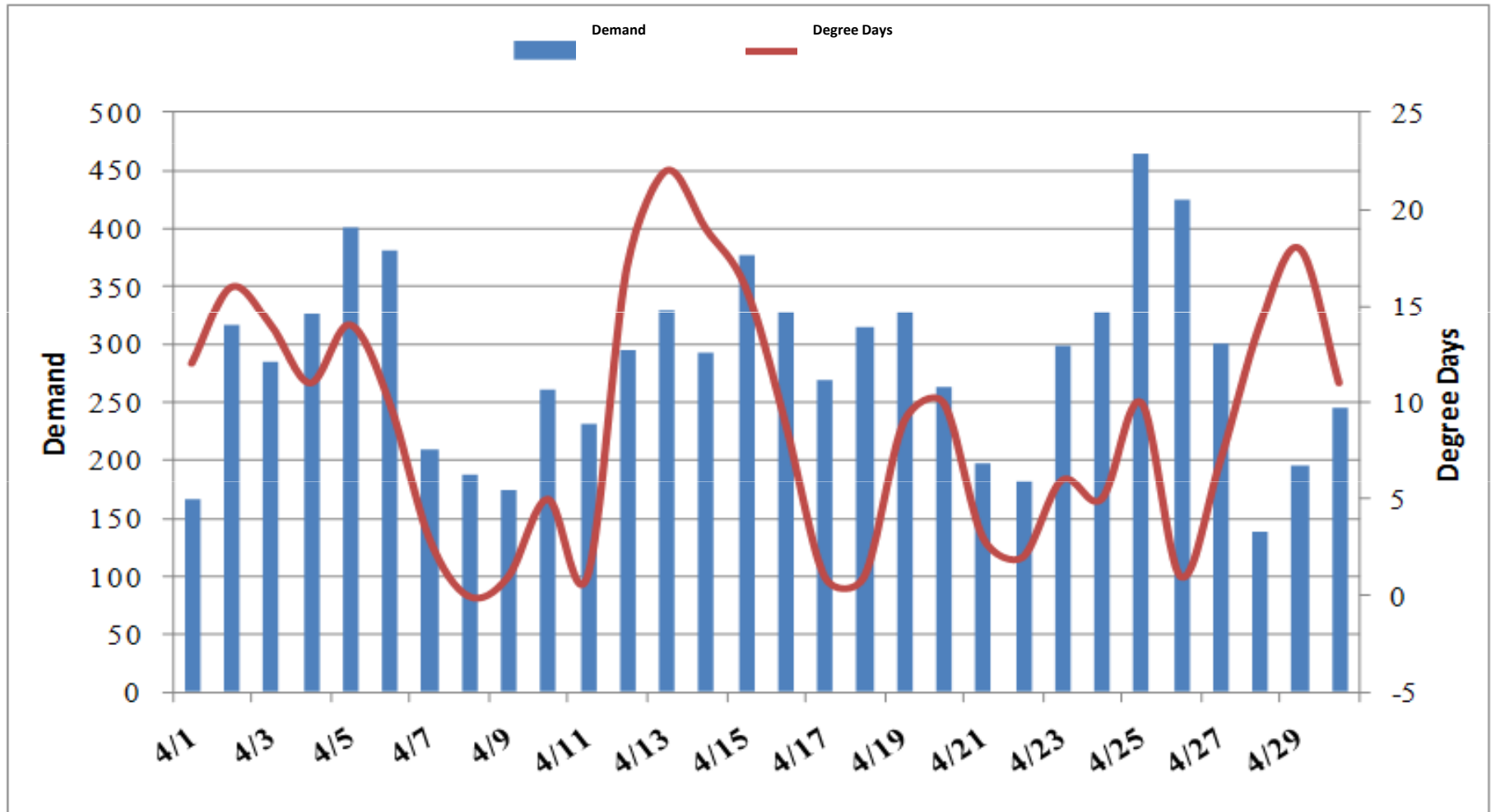
Source: NGrid

ENERGY USE PROFILES



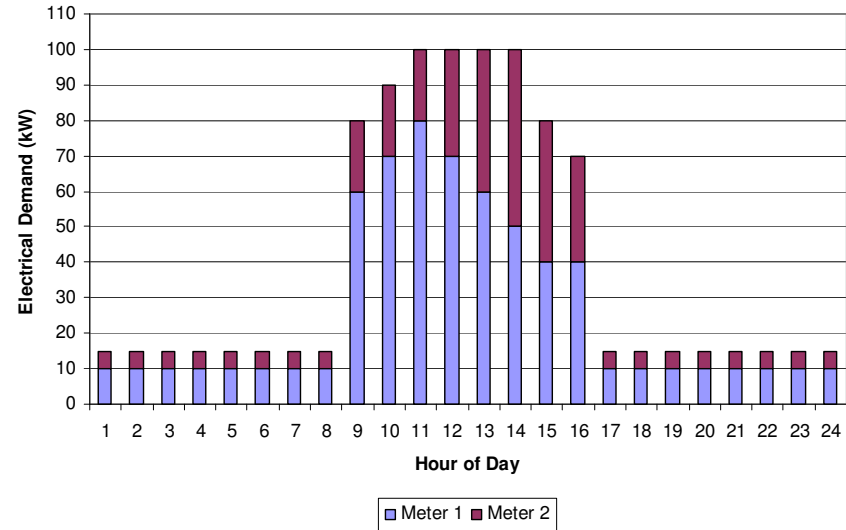
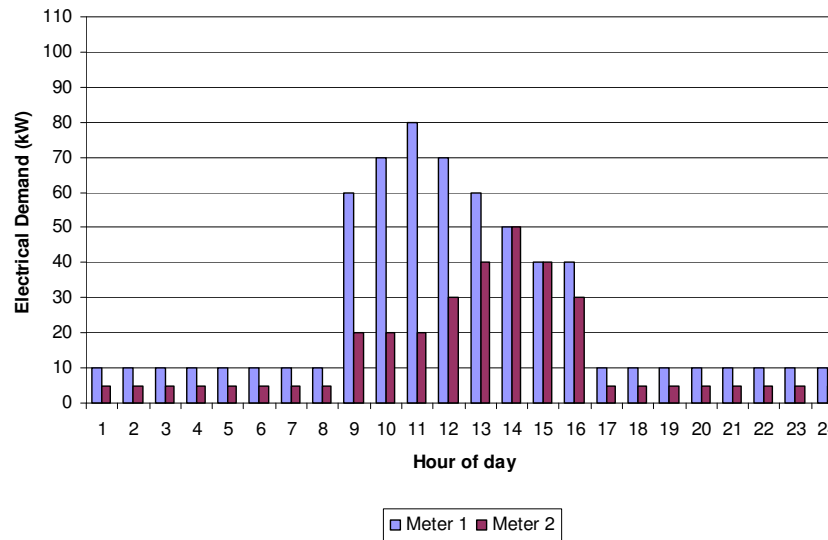
Source: NGrid

ENERGY USE PROFILES



Source: KPPC

METER CONSOLIDATION



- Billed demand with two meters
= 80 kW + 50 kW = 130 kW
- Billed demand with one meter = ~ 100 kW

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