

# Utility Metering

Global Campus Energy Manager's Workshop

October 22, 2019

UC Davis Utilities, Data and Engineering

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# Overview

- Meter Database
- Data Validation
- Meter Verification

What meters do we have?

Is the data accurate?

# Meter Database – Web-based User Interface

**Meter UI**    Search by Meters    Search by Building    Pending    Documentation    User Name: cahall Status: ENGR    Logout

**All Meters**

× Column Picker (hide)    [Add Meter](#)    [Add Asset](#)    [Update](#)    [Replace](#)    [View](#)    *Tip: Hold shift when sorting to multi-sort!*    Number of filtered rows: 13 out of 1520    [Export Data](#)

<input checked="" type="checkbox"/> Active	<input checked="" type="checkbox"/> Commodity	<input checked="" type="checkbox"/> Meter Manufacturer	<input checked="" type="checkbox"/> Meter Model	<input checked="" type="checkbox"/> Meter Purpose	<input checked="" type="checkbox"/> Serial Number	<input checked="" type="checkbox"/> Meter Size	
Yes	type to filter	type to filter	type to filter	Shields	type to filter	type to filter	
▼ Yes	Chilled Water	Onicon	System 10	Meters partial CW use at Shields Library (west)	323048	10	
Asset Name	Asset Type	Zone Number (Facility Code)	Asset Number (CAAN)	E-CAP Number	Relationship	Meter Install Date	Meter Removal Date
Shields Library	Building	C010	3390	CW-00003	Partial-Sum	26-Apr-2016	
▶ Yes	Chilled Water	Onicon	System 10	Meters partial CW use at Shields Library (east)	374210	8	
▶ Yes	Condensate	Niagara Meter	Type 421	Meters partial SC use at Shields Library	1321554	1 1/2	
▶ Yes	Condensate	Niagara Meter	Type 413	Meters partial SC use at Shields Library	1715021	2	
▶ Yes	Domestic Water	Sensus	SRH	Meters partial DW use at Shields Library	64321991	3	
▶ Yes	Domestic Water	Sensus	SRH	Meters partial DW use at Shields Library	63418188	2	
▶ Yes	Domestic Water	Sensus	SRH	Meters partial DW use at Shields Library	65411759	2	
▶ Yes	Electricity	Power Measurement	ION7350	Meters partial EL use at Shields Library (East MSBE)	PC-0704A290-11	N/A	
▶ Yes	Electricity	Square D	ION7350	Meters partial EL use at Shields Library (Transformer D - MSHS)	LC-0804A609-11	N/A	
▶ Yes	Electricity	Power Measurement	3710 ACM	Meters partial EL use at Shields Library (Transformer G - MSLN)	24988	N/A	
▶ Yes	Electricity	Square D	ION7350	Meters partial EL use at Shields Library (Transformer E - MSLS)	LC-1106A152-11	N/A	
▶ Yes	Electricity	Power Measurement	3710 ACM	Meters partial EL use at Shields Library (Transformer F - MSHN)	PF-9701B039-01	N/A	

× **Manufacturing Info**

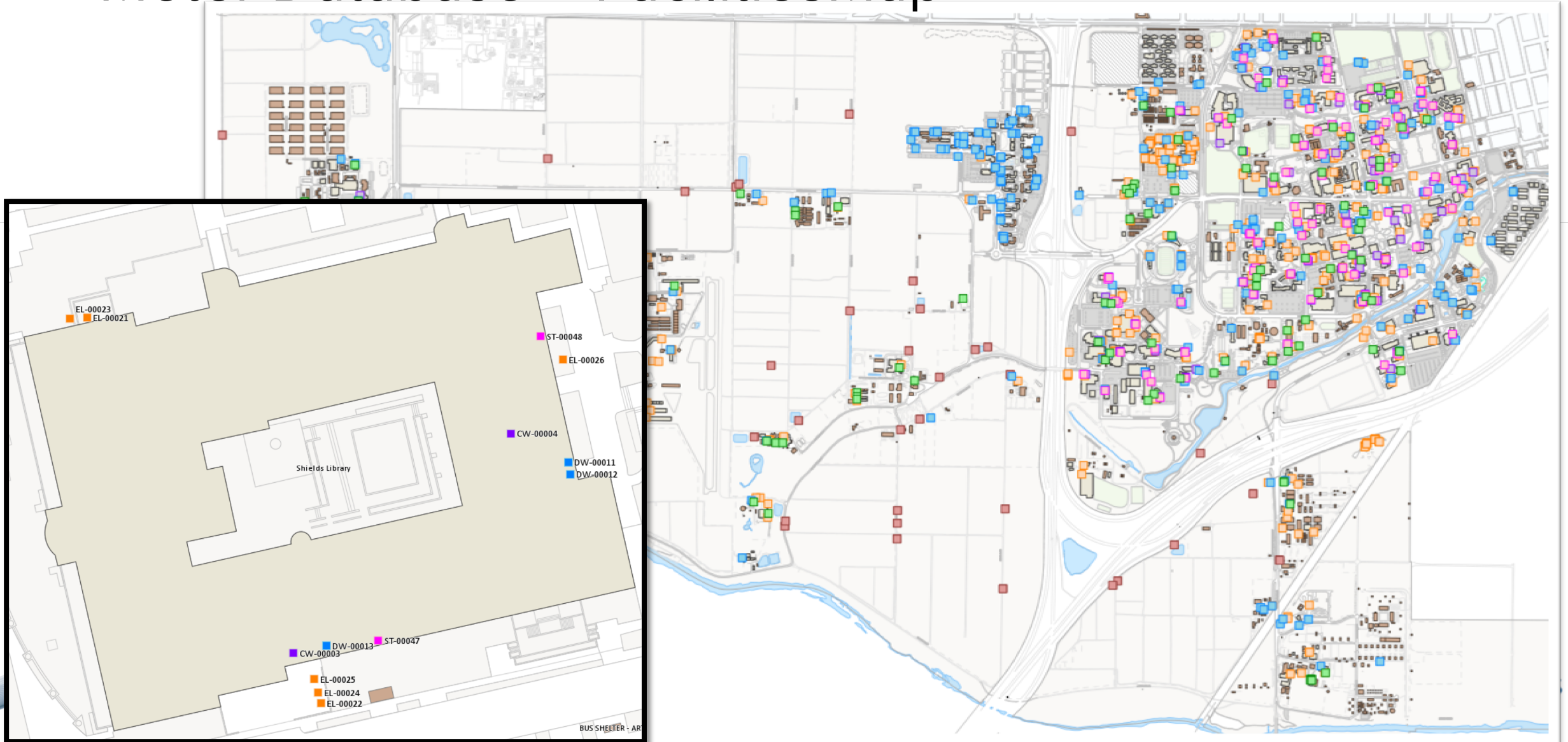
- Select All
- Class
- CT Ratio
- Flowmeter Serial Number
- Measure Unit
- Meter Manufacturer
- Meter Model
- Meter Size
- Meter Technology
- Model Number/Specifier
- Multiplier
- Pulse
- Pulse Unit
- Regulator Position
- Roll Over
- Volt In

× **Connection Info**

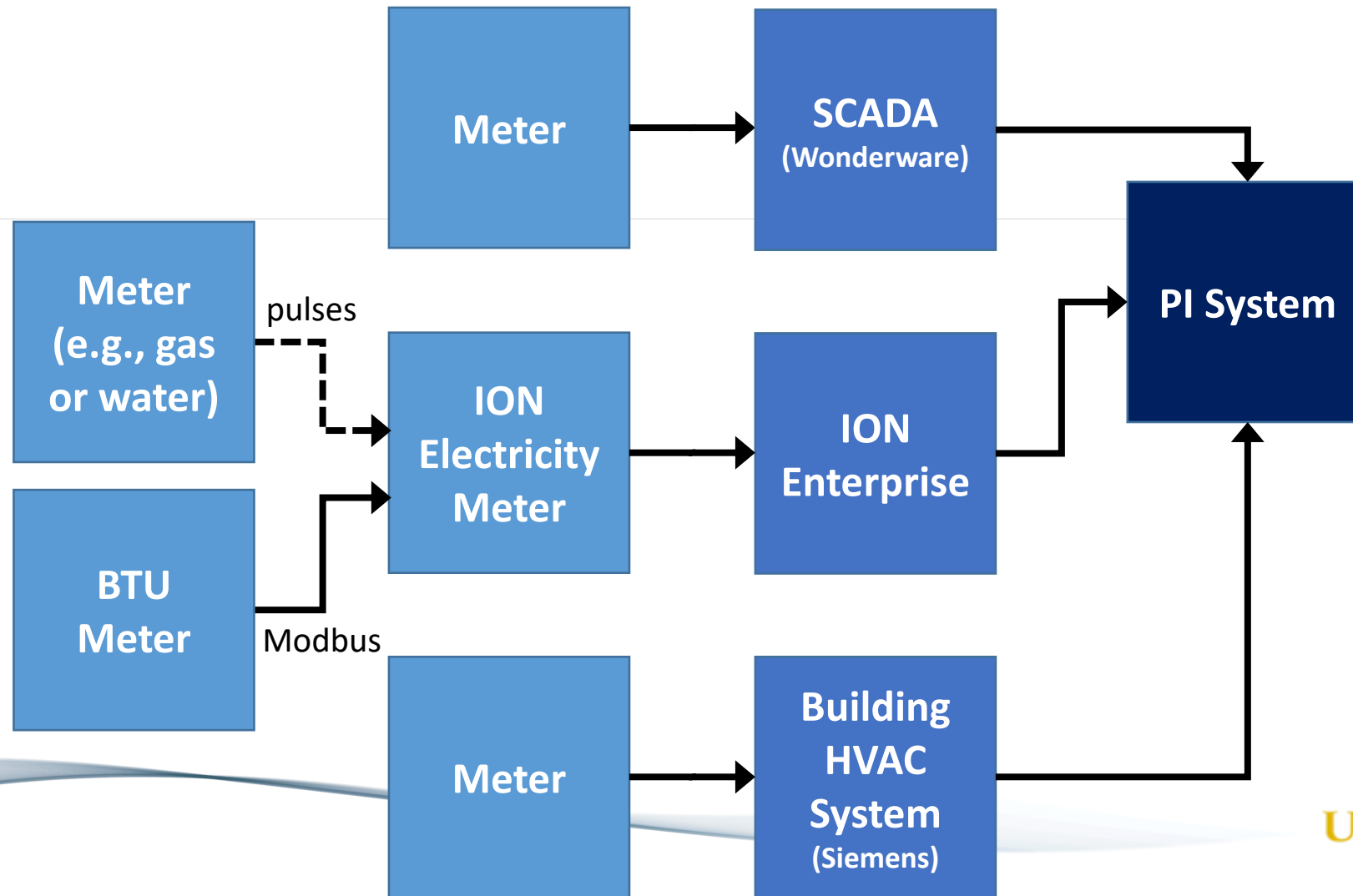
- Select All
- Can Connect
- Com Setup
- Connected System

Previous    Page 1 of 1    20 rows    Next

# Meter Database – FacilitiesMap



# Background: Meter and Data System Architecture



# Data Validation

Question	Validation Process
Is the meter communicating?	“Bad” and “Stale” Notifications
Is the data realistic?	Energy Balance
Is the meter failing?	Models

# Data Validation - Notification of Bad Meter Data

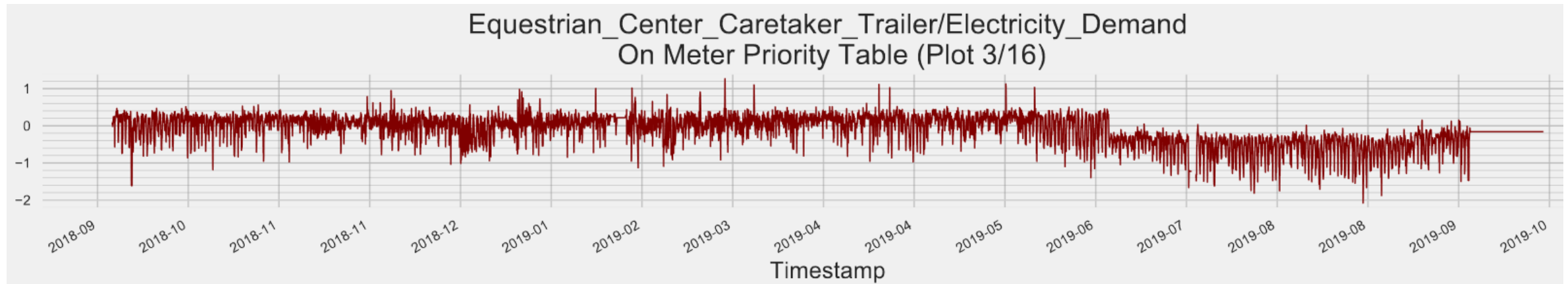
## BAD or STALE event frames in PI with notifications for Critical Meters

Generation Mode:  Event Frame Template:

Name	Expression	True for	Severity
Start triggers			
StartTrigger1	<code>TagVal('Totalizer','*')=TagVal('Totalizer','*-10m')</code>	Not Set	Critical

Buttons: Add... Evaluate

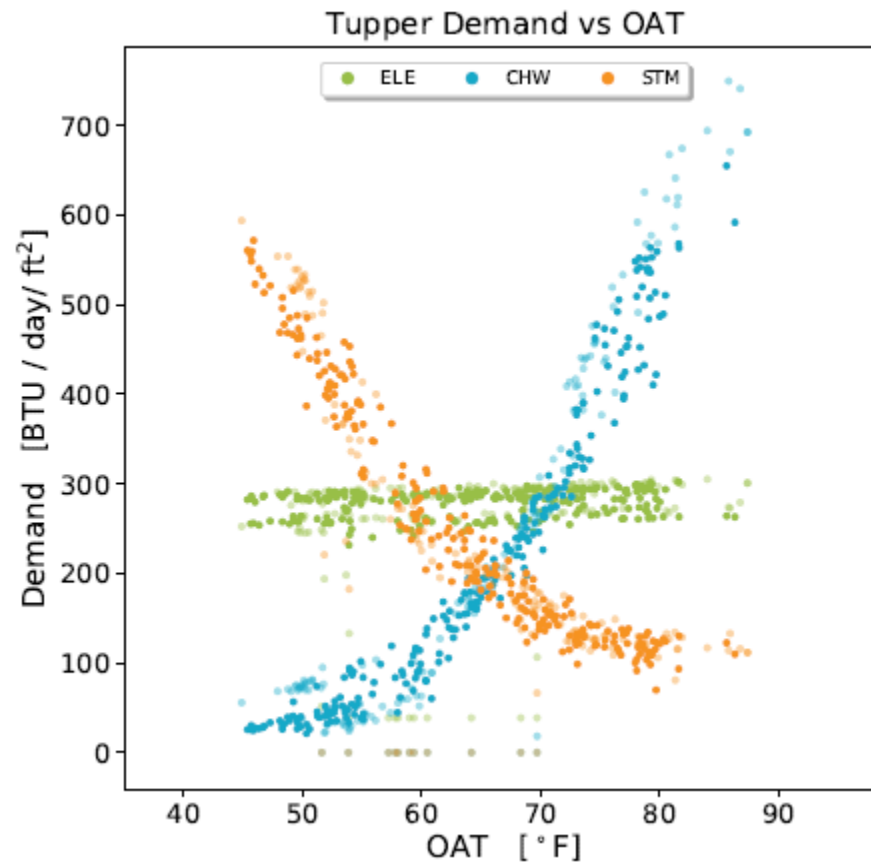
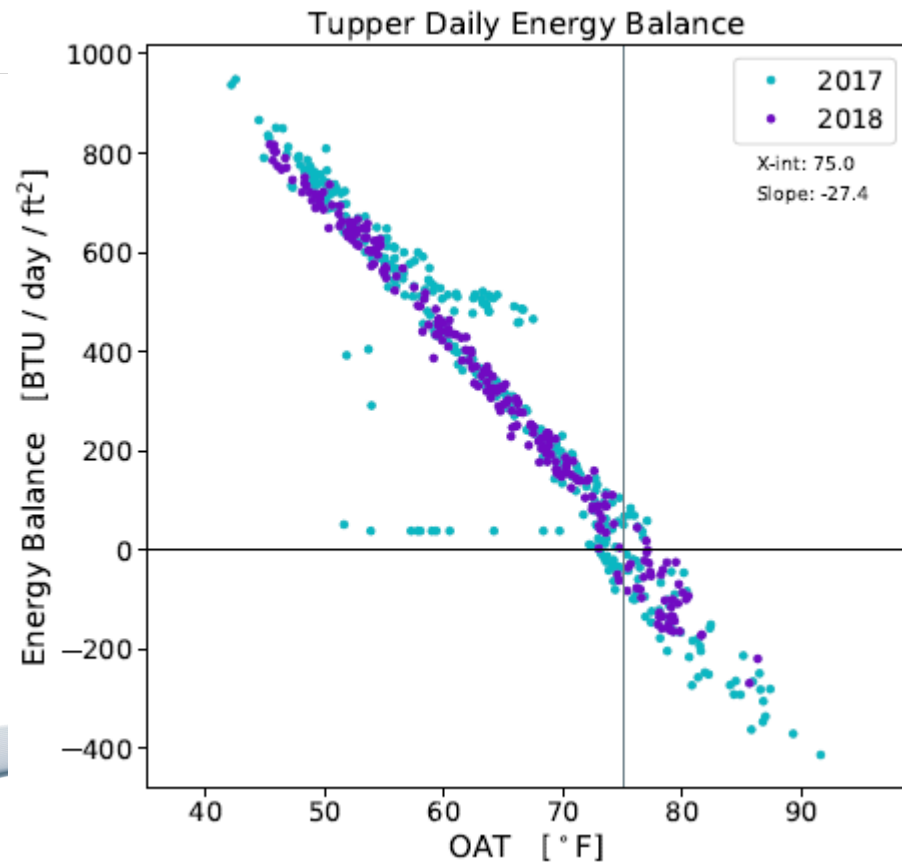
## Other meters in PI checked for Stale a Python



# Data Validation - Energy Balance

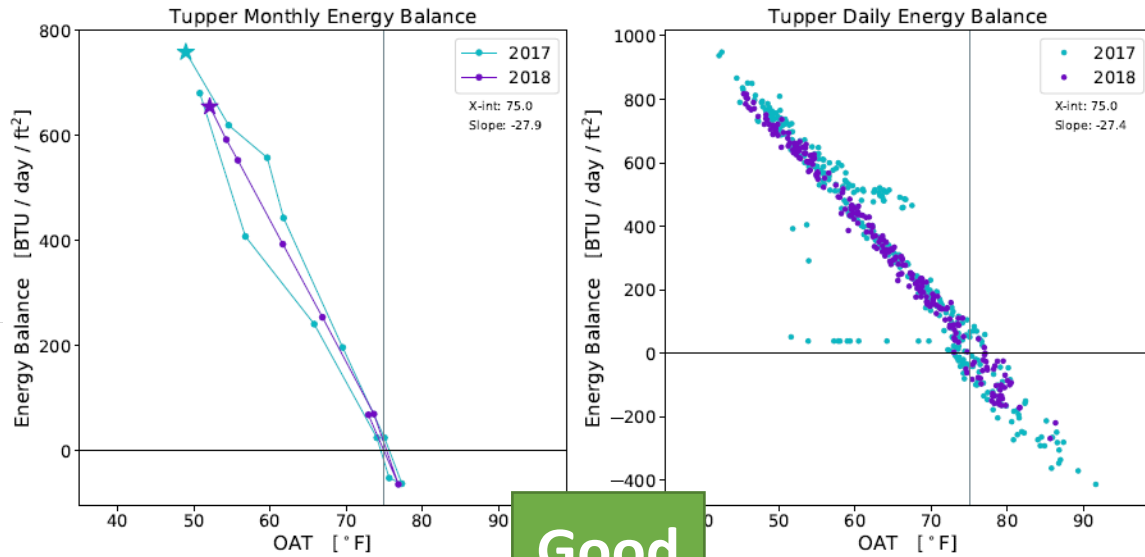
$$\text{Energy Balance} = \text{Steam} + \text{Electricity} - \text{Chilled Water}$$

The Energy Balance is a function of the outside air temperature (OAT)

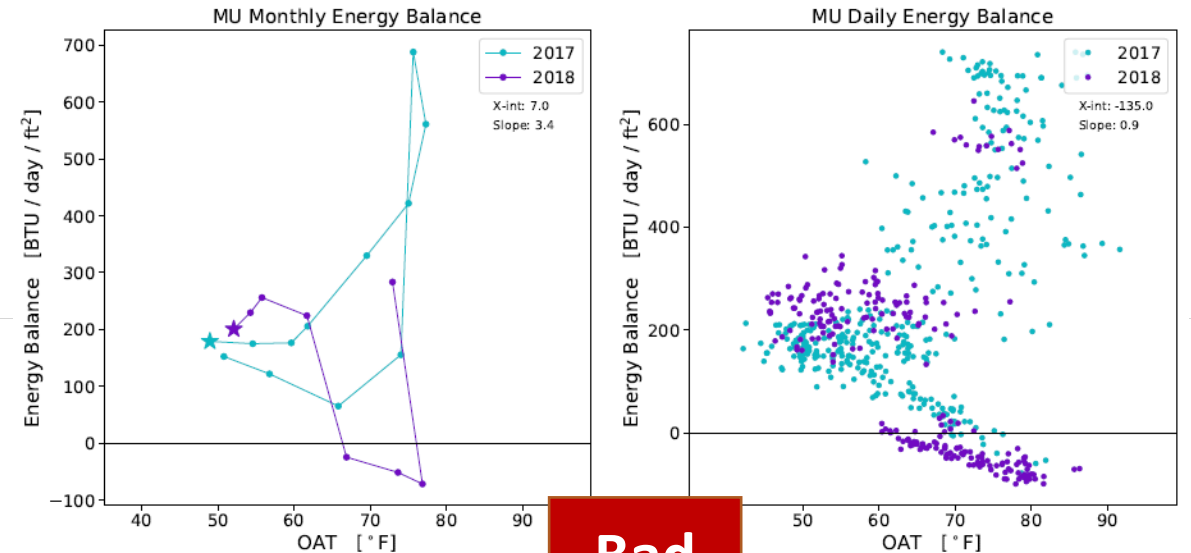
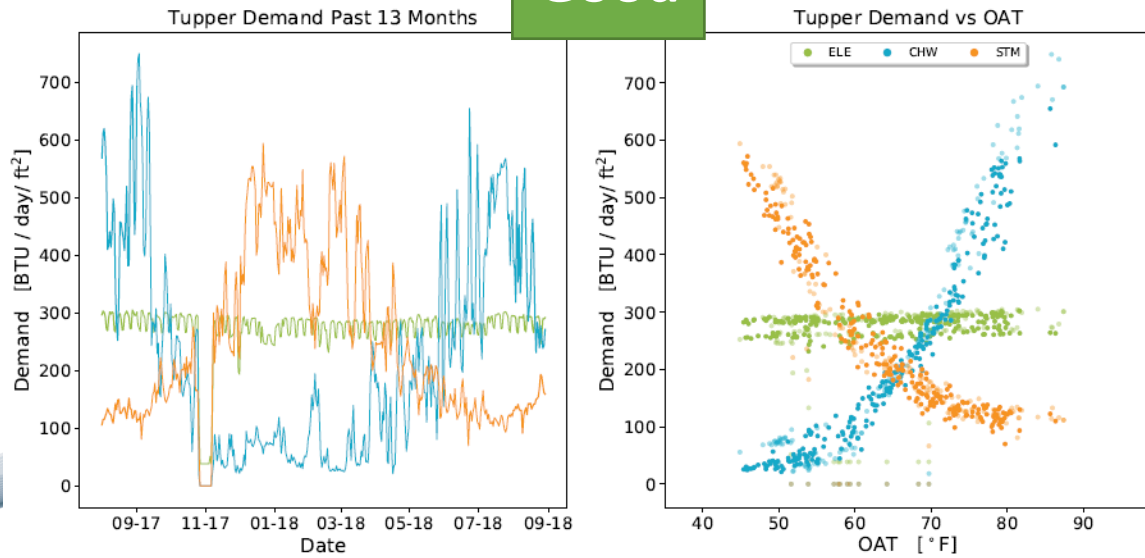




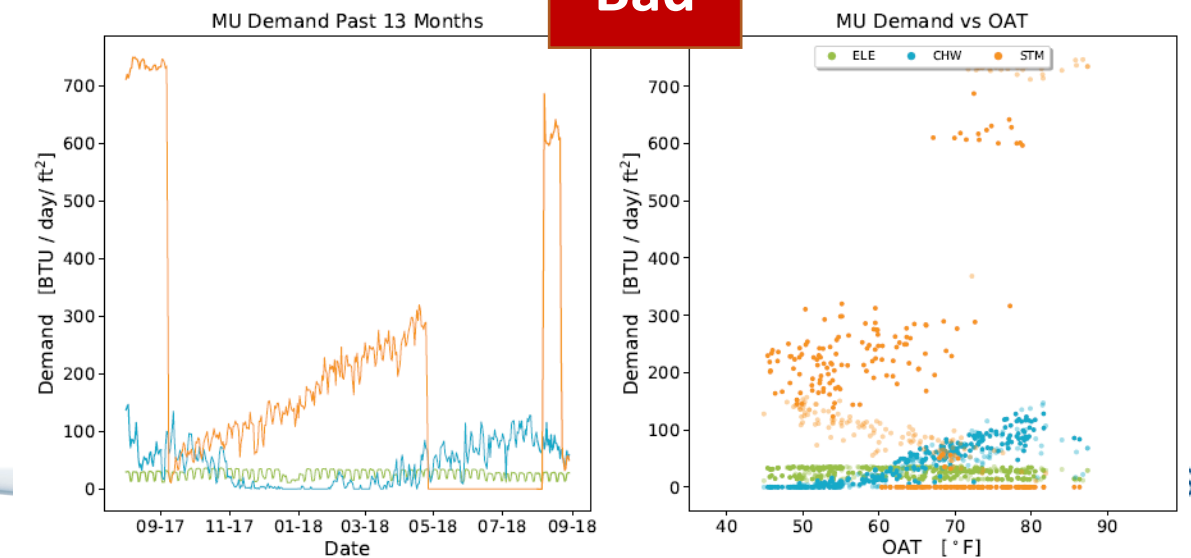
# Data Validation - Energy Balance



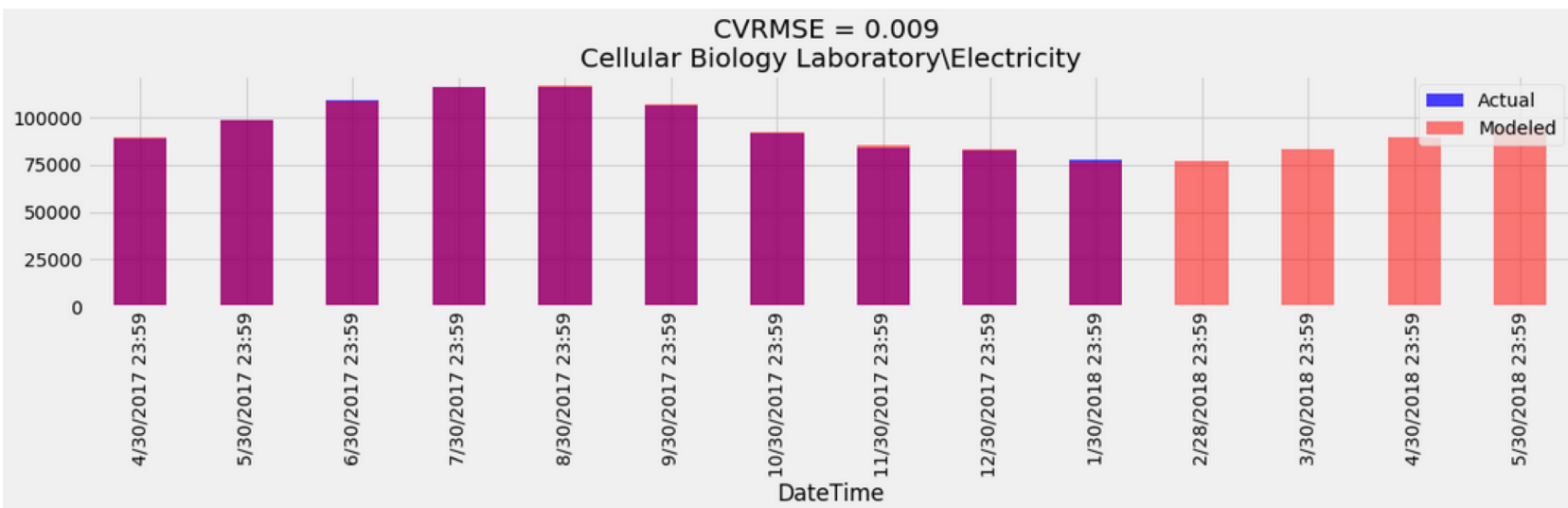
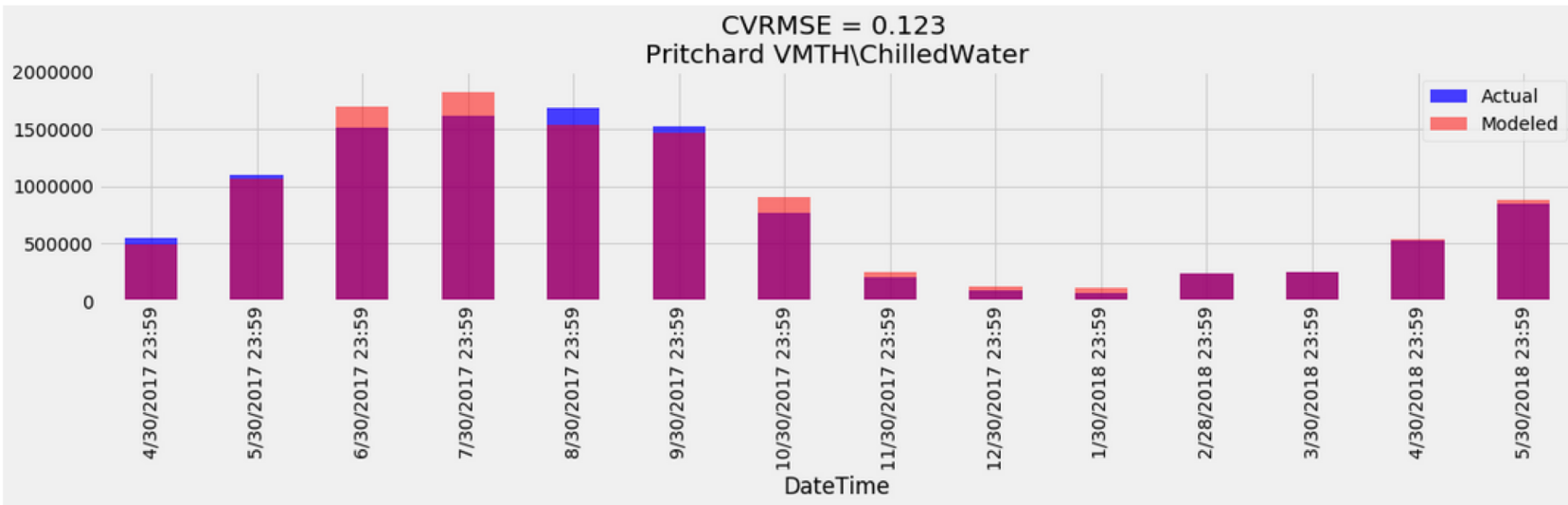
Good



Bad



# Data Validation – Regression models



- Input

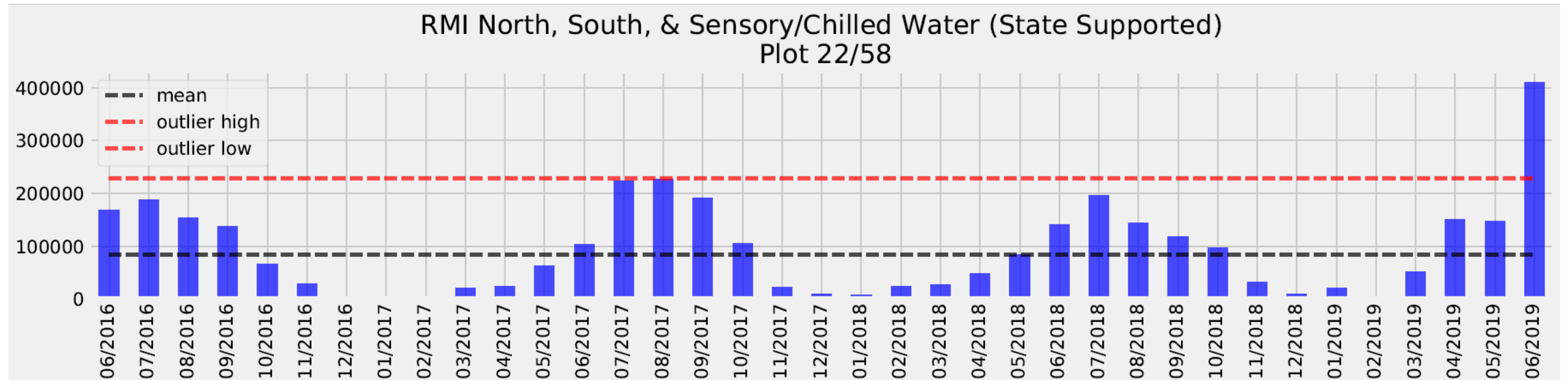
- Past 3 years demand data
- Outside Air Temperature
- Day of week
- Week of year

- Use Cases

- Only use for buildings with very high model “fit”
- Estimate for billing
- Identify meter issues

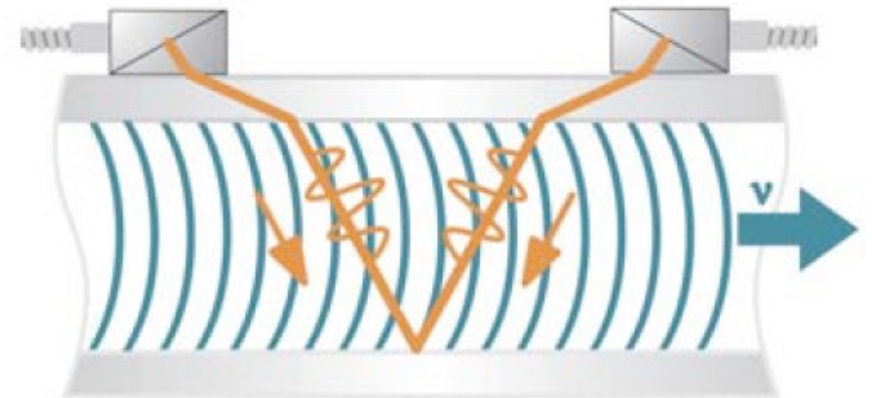
# Data Validation – Monthly Billing Review

- Billing for Campus Utility Recharge includes 559 meters
- Reviewed by Utility System Superintendents and Data & Engineering team

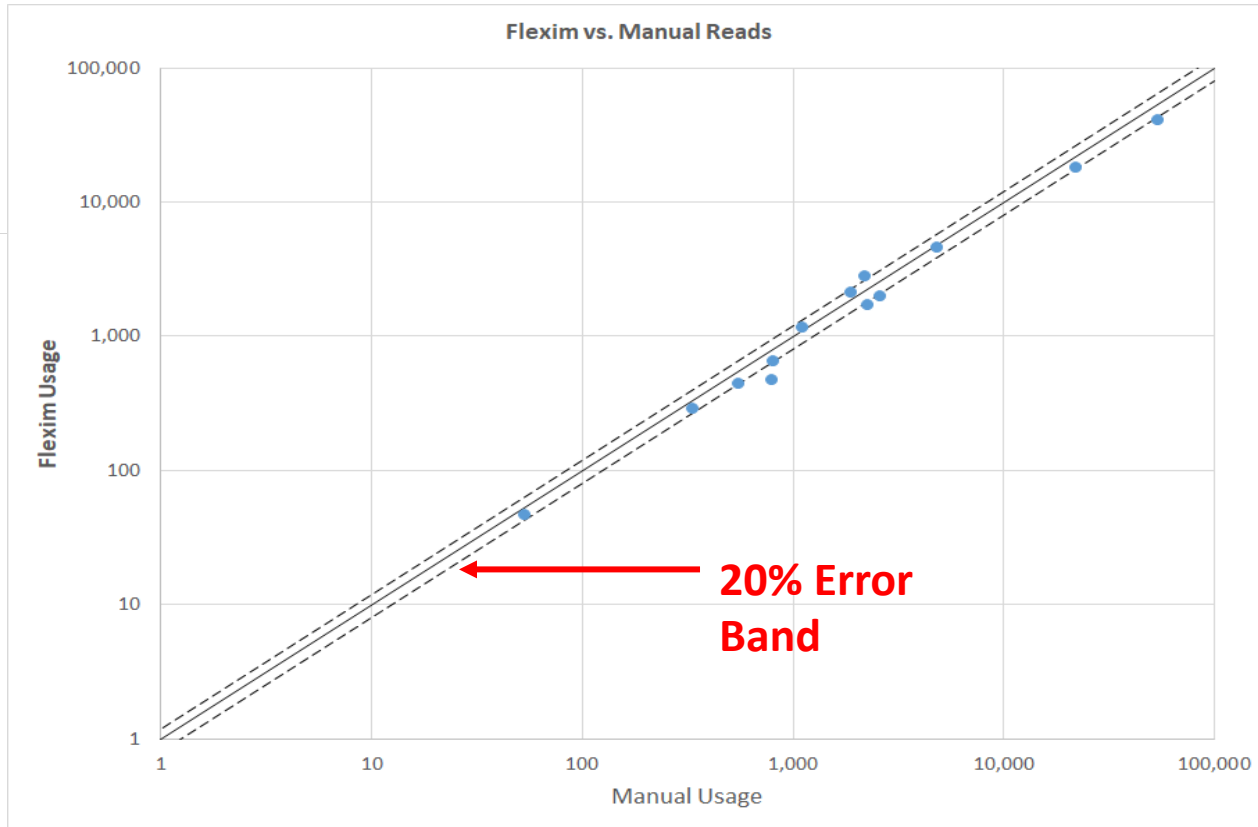


# Meter Verification

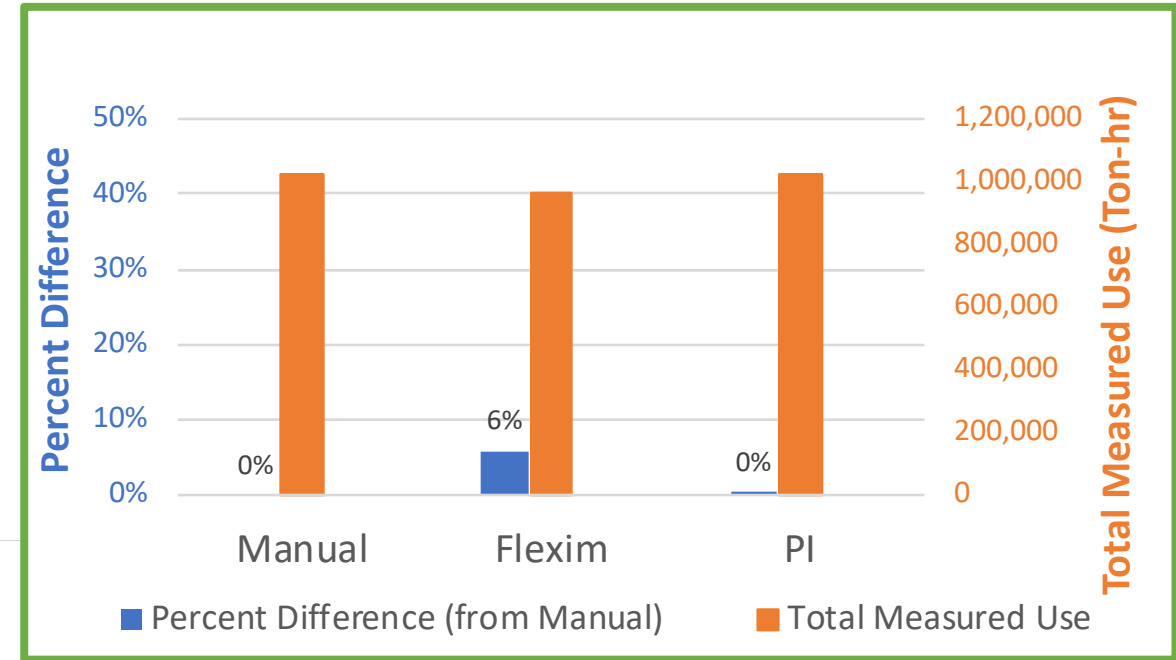
- Validation Steps
  - Physical meter performance
  - Accuracy of Inventory Data
  - Historian set-up
  - Historical data quality check



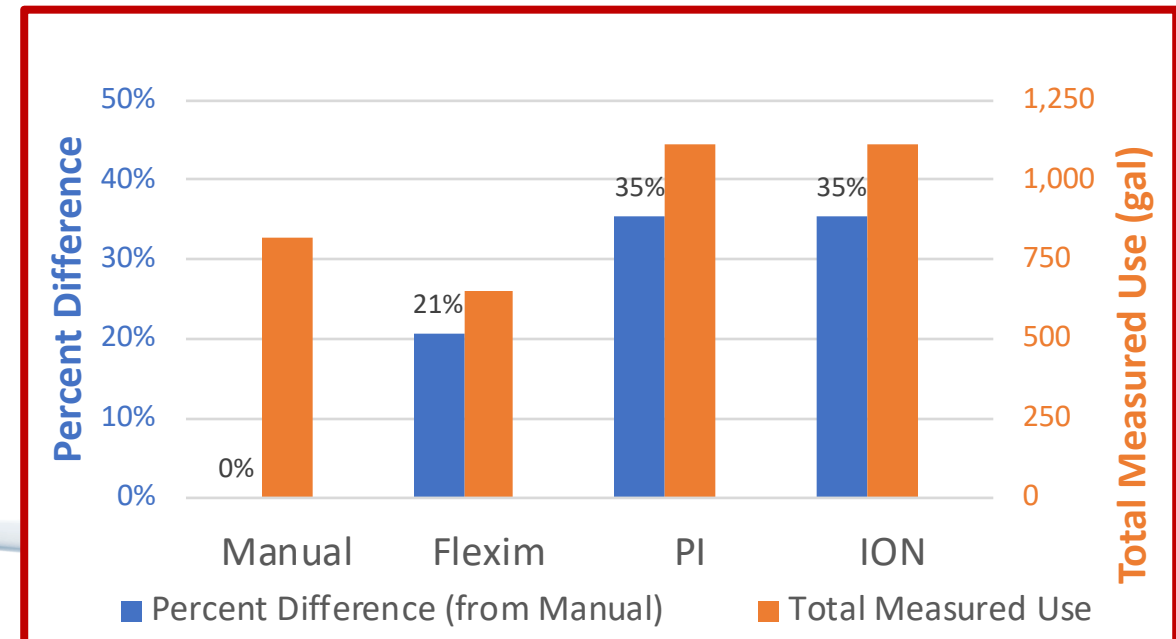
# Meter Verification



**GOOD**

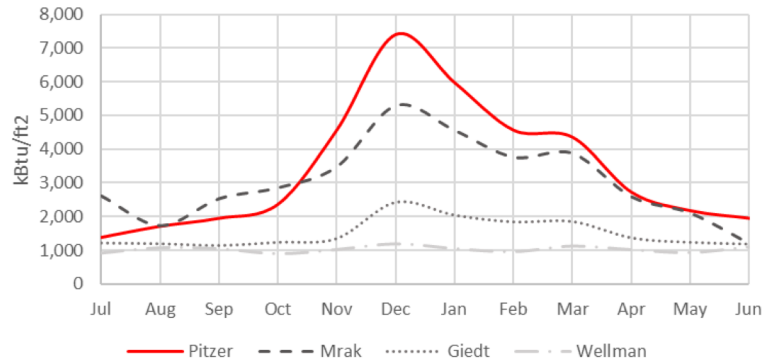


**BAD**

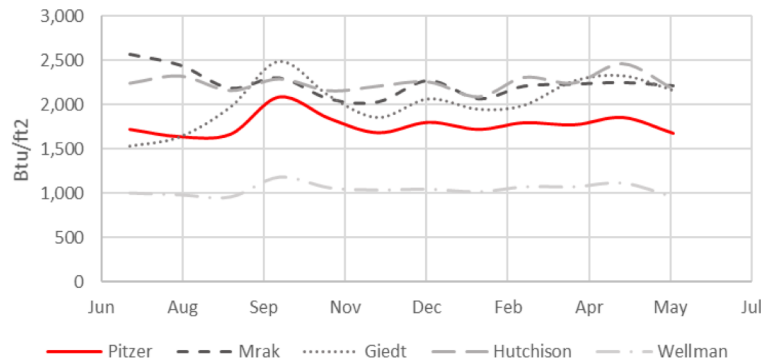


# Meter Verification

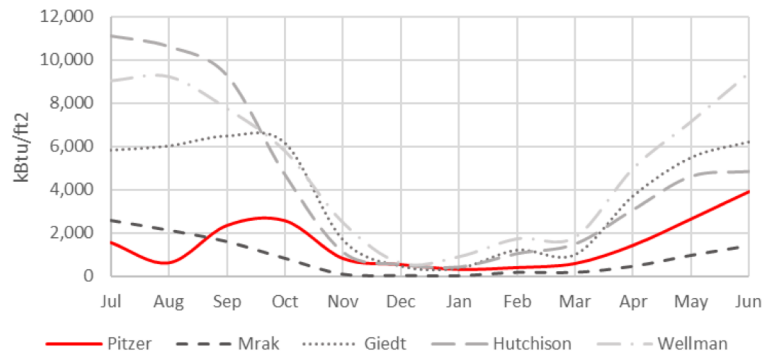
Steam & Condensate



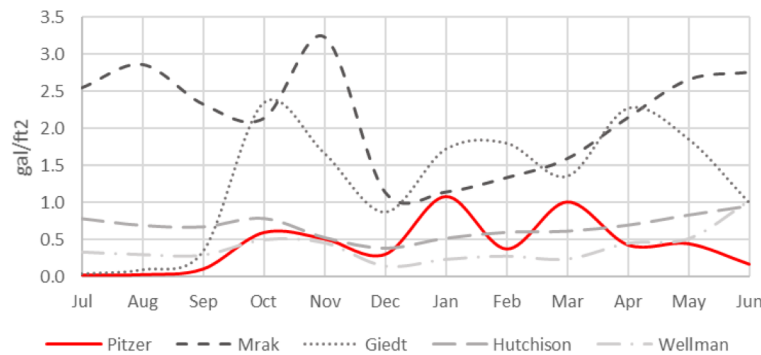
Electricity



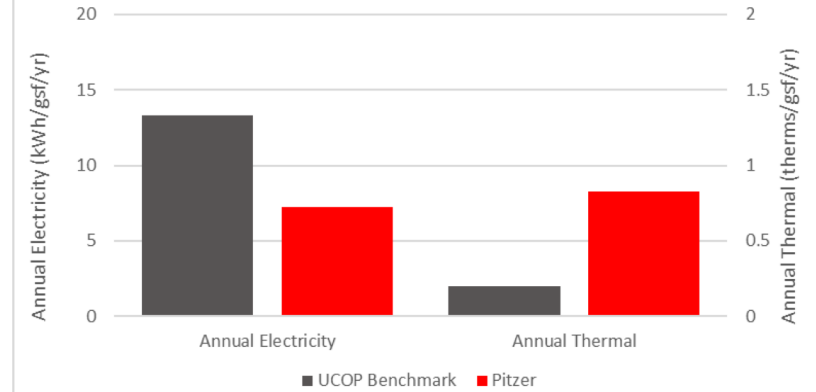
Chilled Water



Domestic Water



Comparison to UCOP Benchmark



# Functional Performance Test

- Test meters at new buildings (*data should be correct from the start!*)
- Test includes:
  - Verify Design and Installation
  - Verify Pulse and Units
  - Verify Purpose
  - Document PI tags
  - Manual reads to verify accuracy
  - 11-month follow-up for warranty walk



# Thank you!

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