

Submetering Technologies – Results from field demonstrations

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Rocky Mountain Utility Exchange – 2018
Aspen, Colorado

Anatomy of Circuit-Level Submetering



- **User interface** – provides data access and insights/rules/alerts/etc.



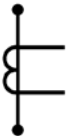
- **Cloud hosted data storage** – Remote data store. Often can be accessed programmatically



- **Communications bridge/Local data logger** – Collects meter data and transmits data to cloud



- **Meter** – Collects data and processes



- **Current transformers** – Measures current flow

Technologies Tested

Enertiv

- Captures power consumption from up to 42 distinct circuits
- CTs and voltage tap to capture electrical measurements
- Proprietary board/data acquisition system
- Data is transferred to cloud and presented in custom dashboard

Panoramic Power

- Captures electrical current (and voltage for PAN-42) and calculates power consumption of individual circuits
- Self powered sensors
- Wireless transmission of data from sensors to bridge
- Data is transferred to cloud-based servers and presented in custom dashboard with analytics

Lab Testing

Single Test

Appliance	Voltage	Dryer On	Water Heater On	Range On
Refrigerator	120			
Dishwasher	120			
Washer	120			
Lighting (All)	120			
Lighting (240V)	240			
Dryer	240	X		
Water Heater	240		X	
TV/DVD	120			
Range	240			X

Interference Test

Dryer	240	X		
Dryer	240	X	X	
Dryer	240	X		X
Dryer	240	X	X	X
Lighting (All)	120			
Lighting (All)	120	X		
Lighting (All)	120			X
Lighting (All)	120	X		X



Field Testing

Salt Lake City Courthouse, Utah



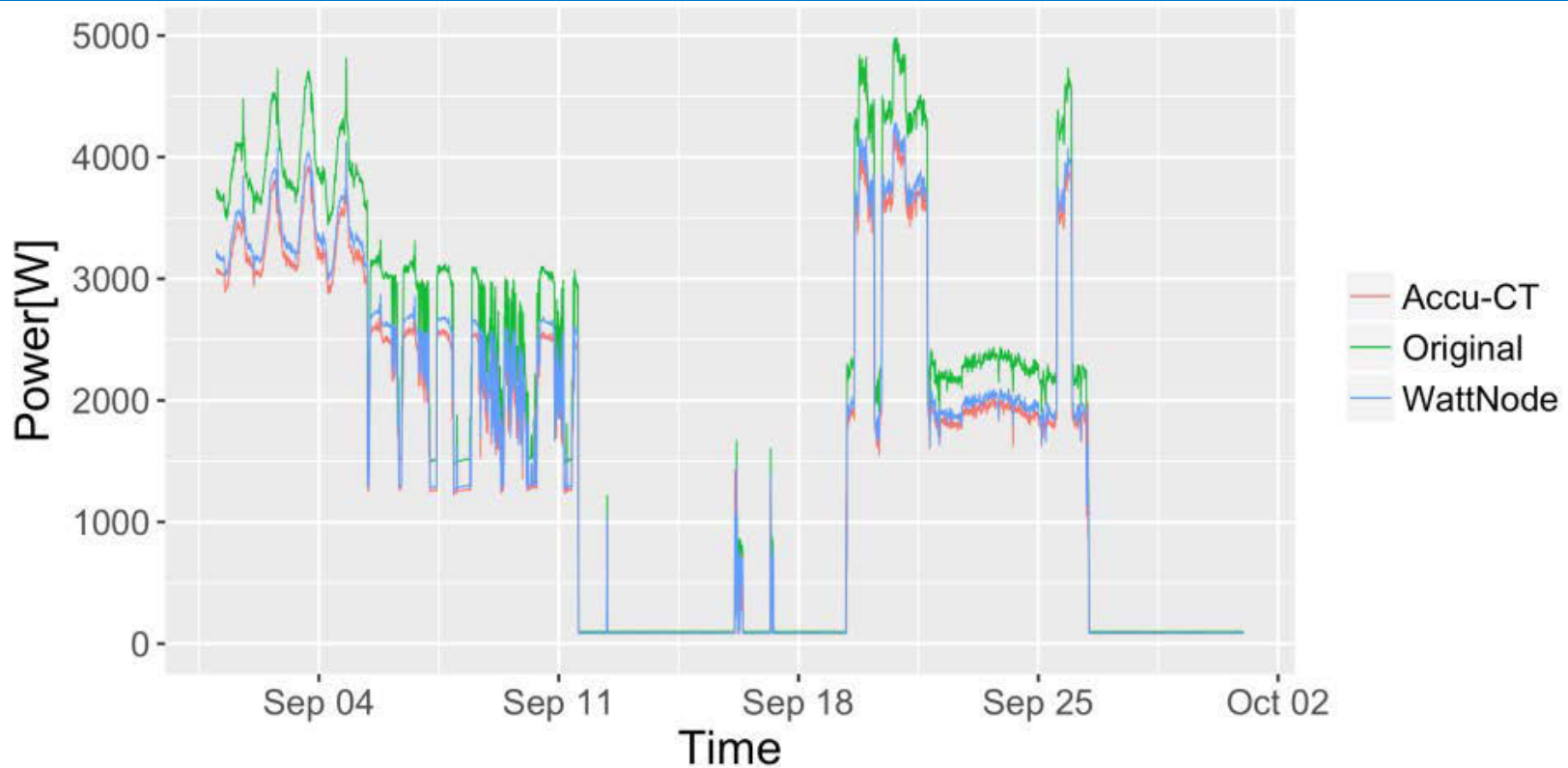
Reference Metering



Cesar Chavez, Denver



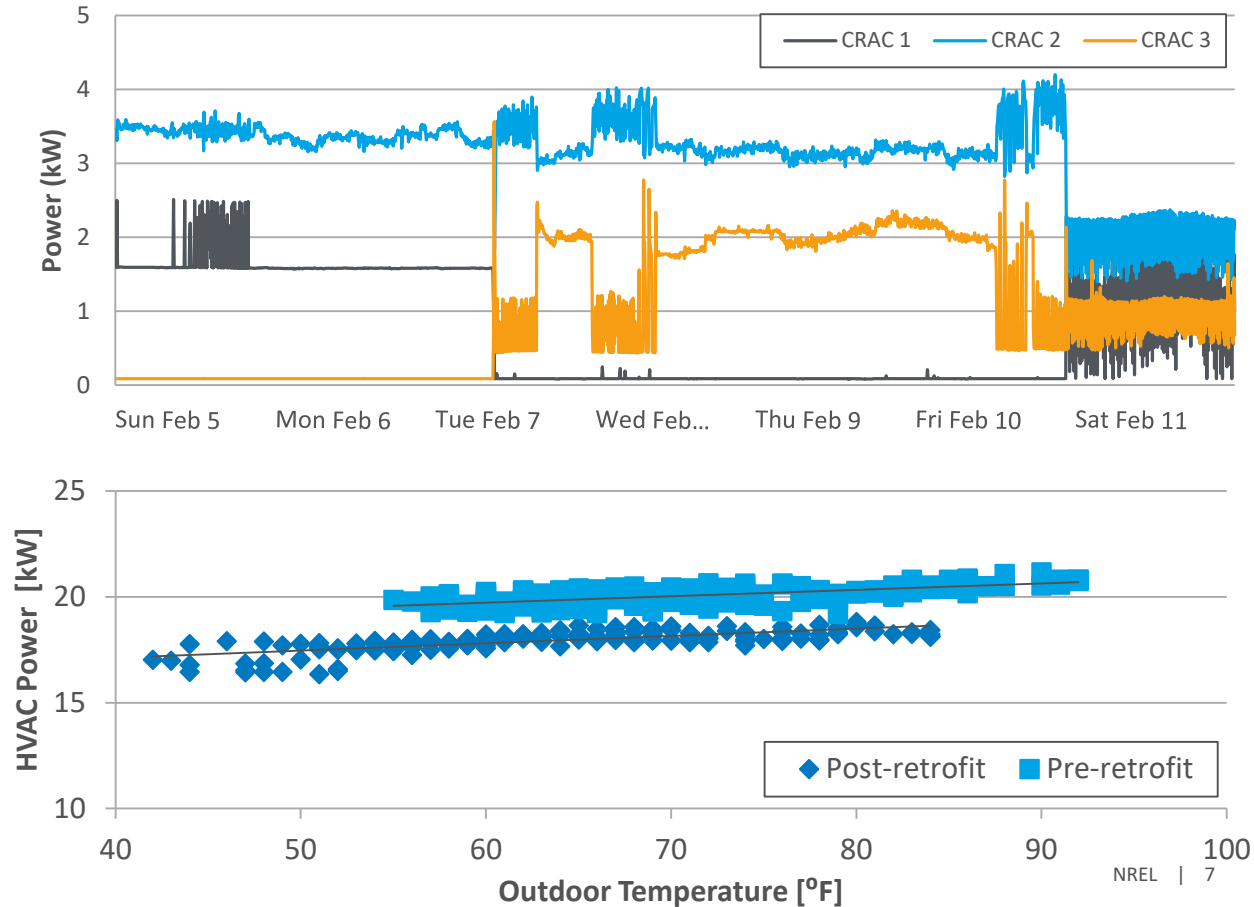
Salt Lake City Results



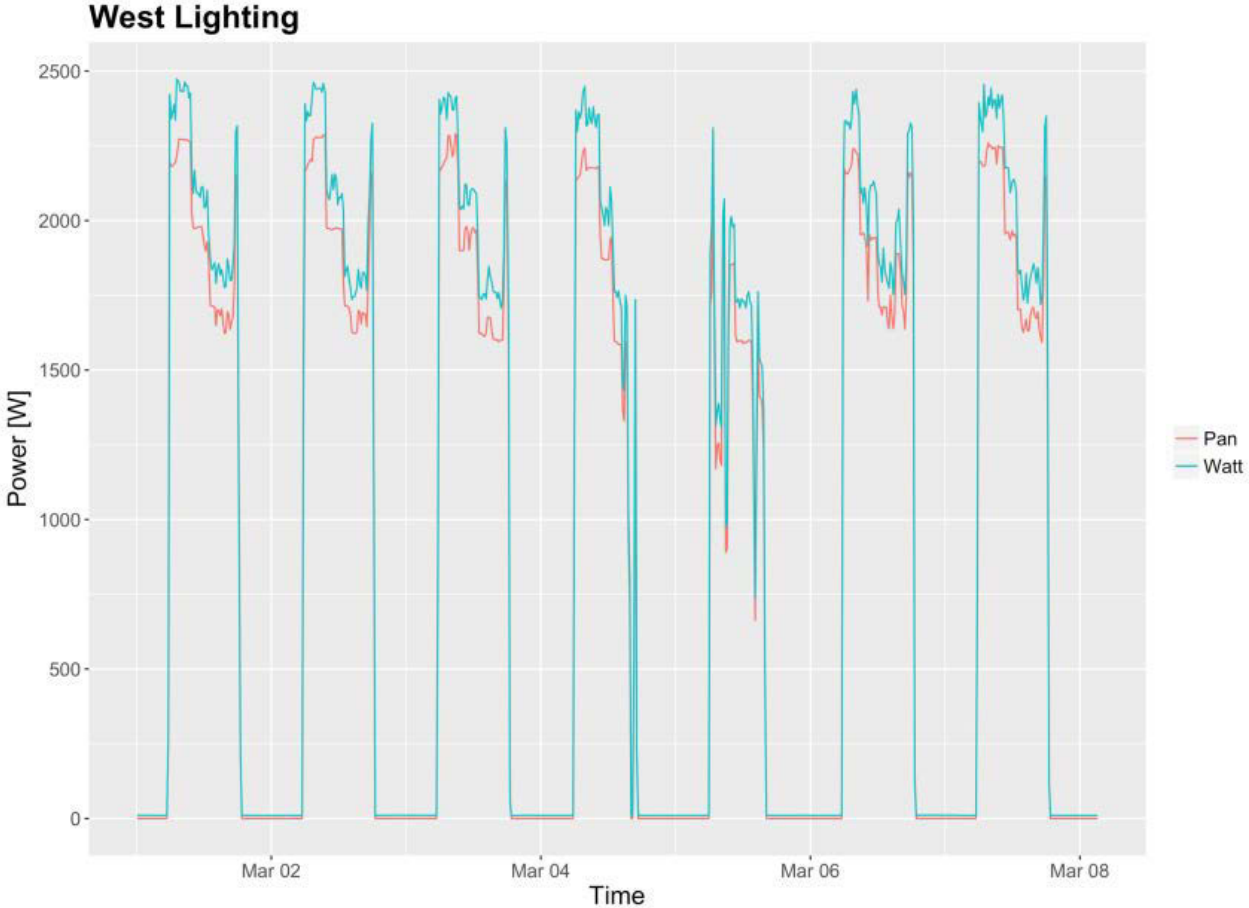
➤ With high-accuracy CTs this system met accuracy goals of <5% energy error, <1% RMSPE

Fault Detection and M&V of ECM

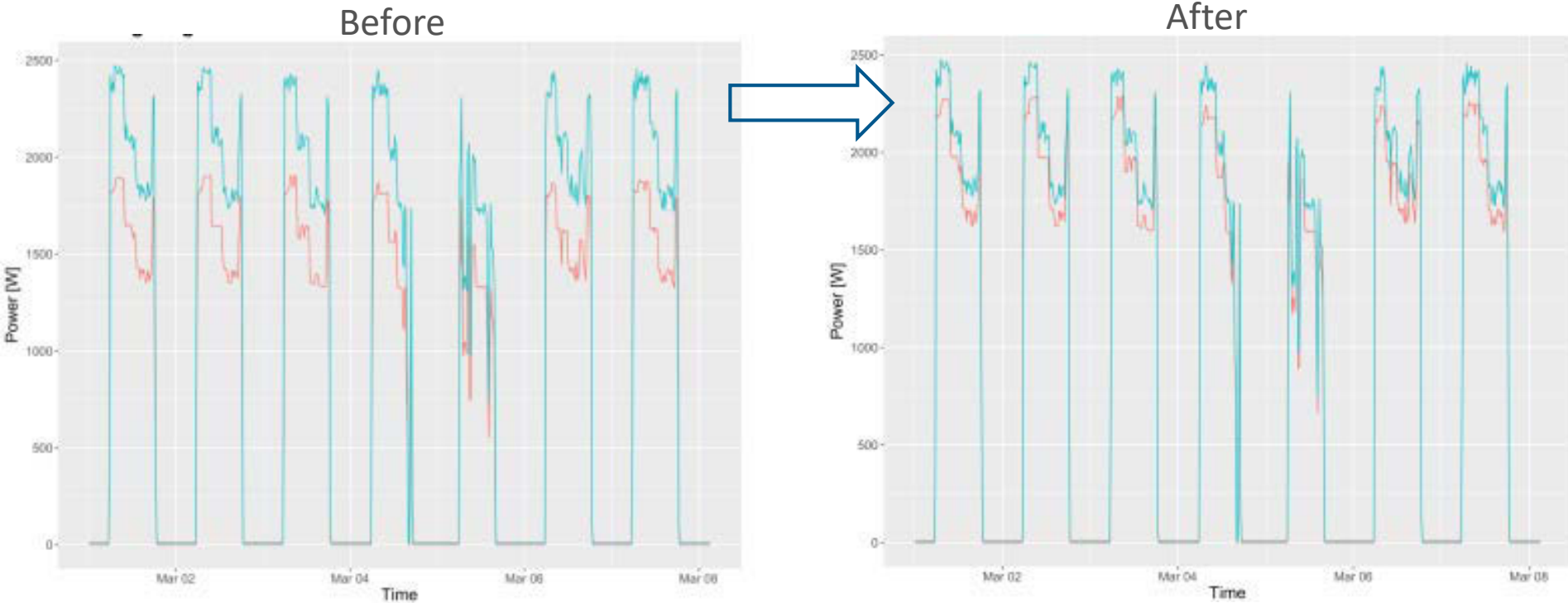
- High PUE calculated for server room (2.8)
- CRAC Units identified as fighting
- Reprogrammed by local technician
- Resulted in ~11% HVAC savings for server room



Denver Results



Denver Results



➤ Power factor/voltage estimates critical, did not meet accuracy requirements

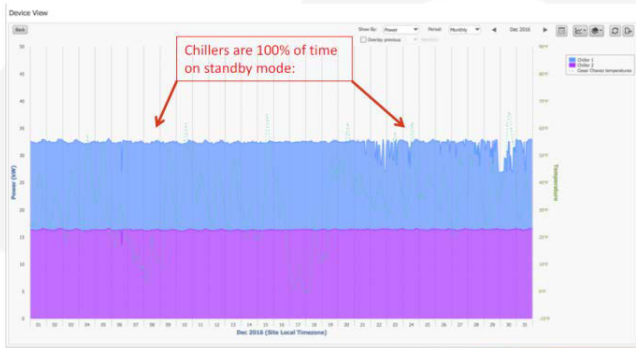
Fault Detection and Data integration

GSA

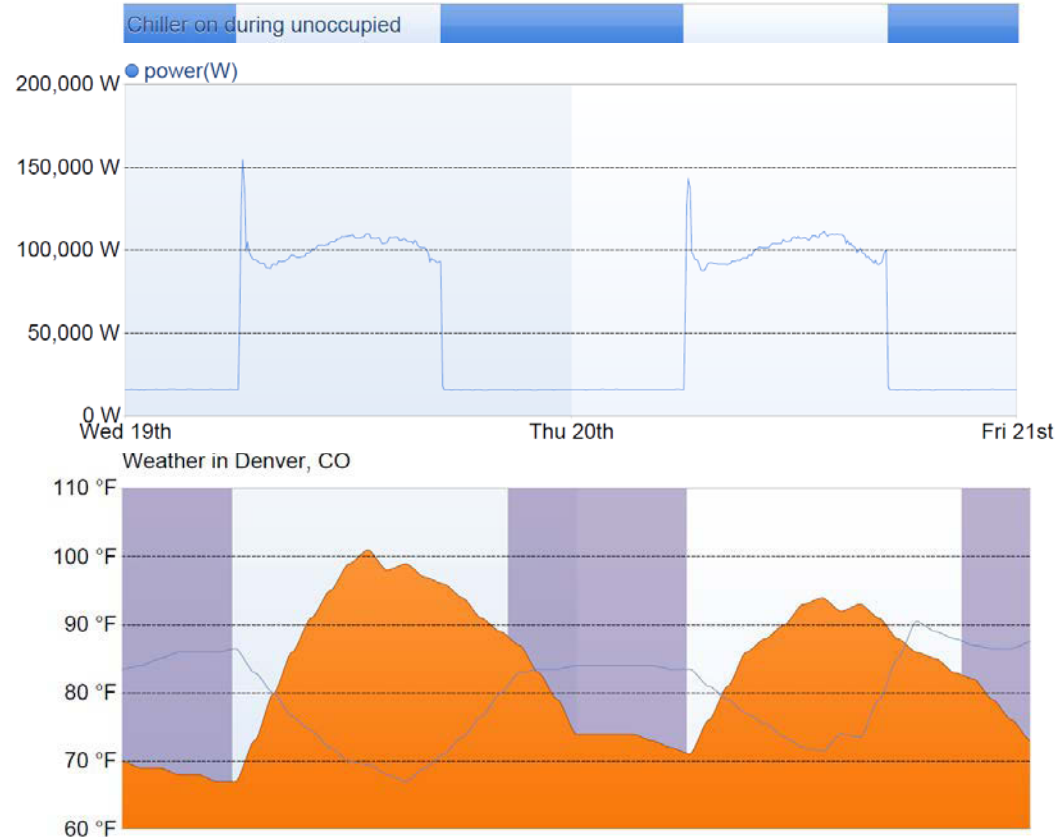
Report: Energy & Operational Efficiency – Initial 30 Days Report
Report Date: Q2 | June 2017 | Facility: Cesar Chavez - Denver, CO

OBSERVATION 3 of 5

Chillers running on standby in non-cooling seasons.



- Annual savings of 1.3% would pay off system, action on chiller ECM would save 1.1%



Use Cases vs. Technology Types

		Tenant or Equipment Billing	Fault Detection & Diagnostics	Energy Visibility or Benchmarking	M&V of ECMs	Tenant Engagement
Panel Meter – Wired CT's and voltage tap	Revenue	✓	✓	✓	✓	
	Standard		✓	✓		✓
Single Circuit – Wired CT's and voltage tap	Revenue	✓			✓	
	Standard					✓
	Wireless CTs		✓	✓		✓
	AMI Meters	✓			✓	
	Electromagnetic field sensors		✓	✓		✓

Conclusions

- Multiple different technology types, configurations
 - With varying capital, installation, and recurring costs
- Map well to different use cases
- Determine what your goals are for the submetering before selecting technology and circuits

Thank you!

Questions?

www.nrel.gov

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