MCerberus®
The HVAC Monitoring "WatchDOG" System

Ron Roth, Ph.D.

RT Automation

RT Automation: We make automation simple™

Central HVAC Operation and Status

- Homeowners do not know the operating state of their HVAC systems.

- Most individuals WAIT until their HVAC system has an issue before calling for service.

# MCerberus® HVAC Monitoring System

- Continuous monitoring of Central HVAC Units in Residential and Businesses

- Low Hardware and Installation Cost

- Determines real-time operational state of equipment via our Backoffice Software Solution

- Net Savings due to lower energy bills as well as minimizing repair costs

MCerberus® Summary

- The **PRODUCT HARDWARE** may be installed on any Central HVAC unit

- The **PRODUCT HARDWARE** Unit takes measurements every 60 seconds and transmits the data to our Cloud based MySQL database

- The **BACK END OFFICE SOFTWARE** analyzes the data and determines the current state of the equipment
  - The **SOFTWARE** is executed by the HVAC Contractor and/or Homeowner
  - The data is evaluated with respect to established "rules" which determine the **OPERATIONAL STATE State** of the HVAC unit
  - The **SOFTWARE** includes automated report capability allowing the HVAC Contractor to manage multiple installations

HVAC Monitoring Schematic

Current Probe

Return Air

Supply Air

Temperature Sensor
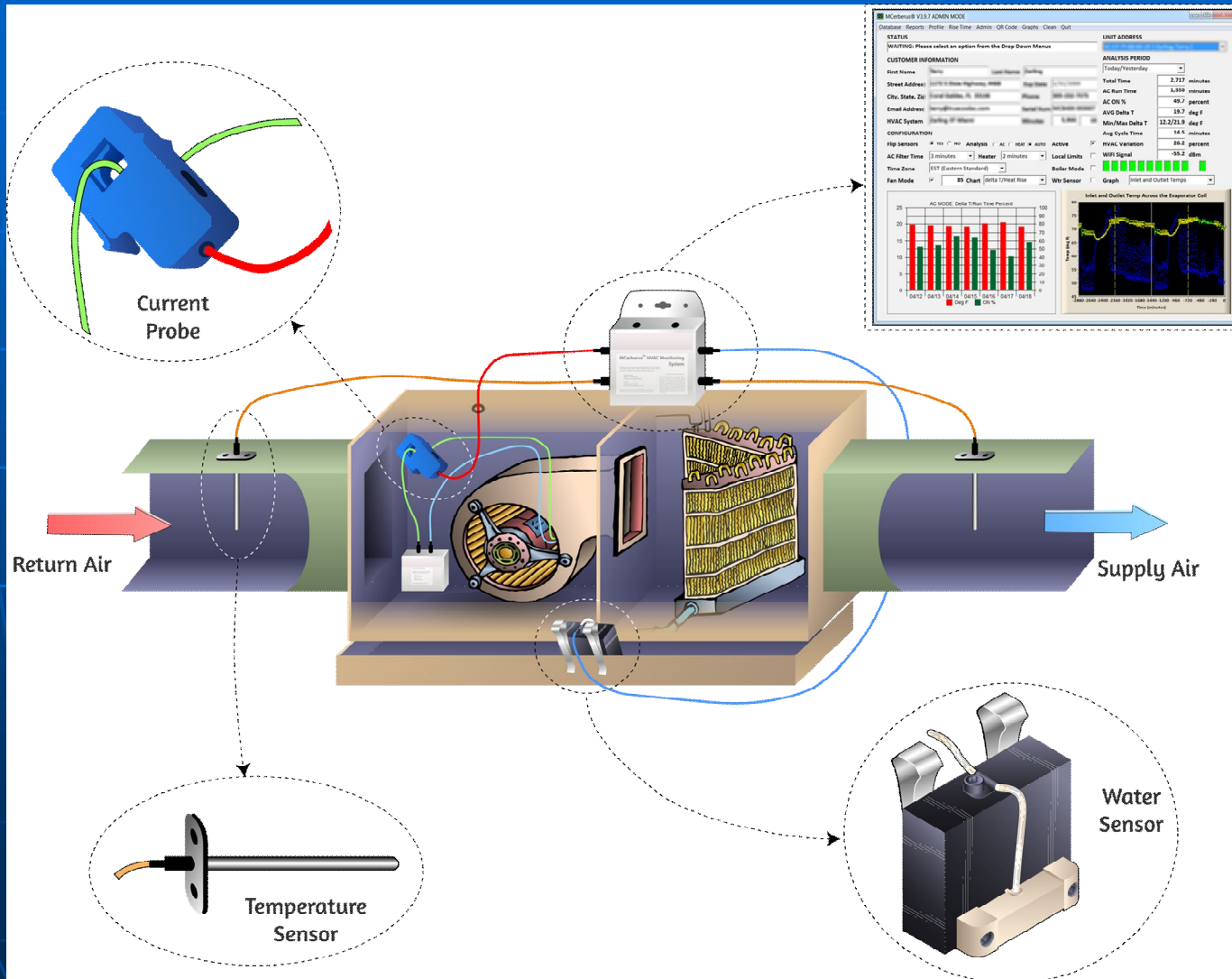
Water Sensor

HARDWARE INSTALLATION

- Configure WiFi

- Install Inlet and Outlet Temp Sensor

- Install Water Sensor

- Install Current Clamp on Air Handler Power

- Connect 120VAC Power (85 – 305VAC)

Backend Office Software Solution

- O/S: Windows and MAC Windows emulator mode
- AC and Heat Analysis Modes
- Computes delta T, Run Time, and ON/OFF Cycles over the Selected Analysis Period
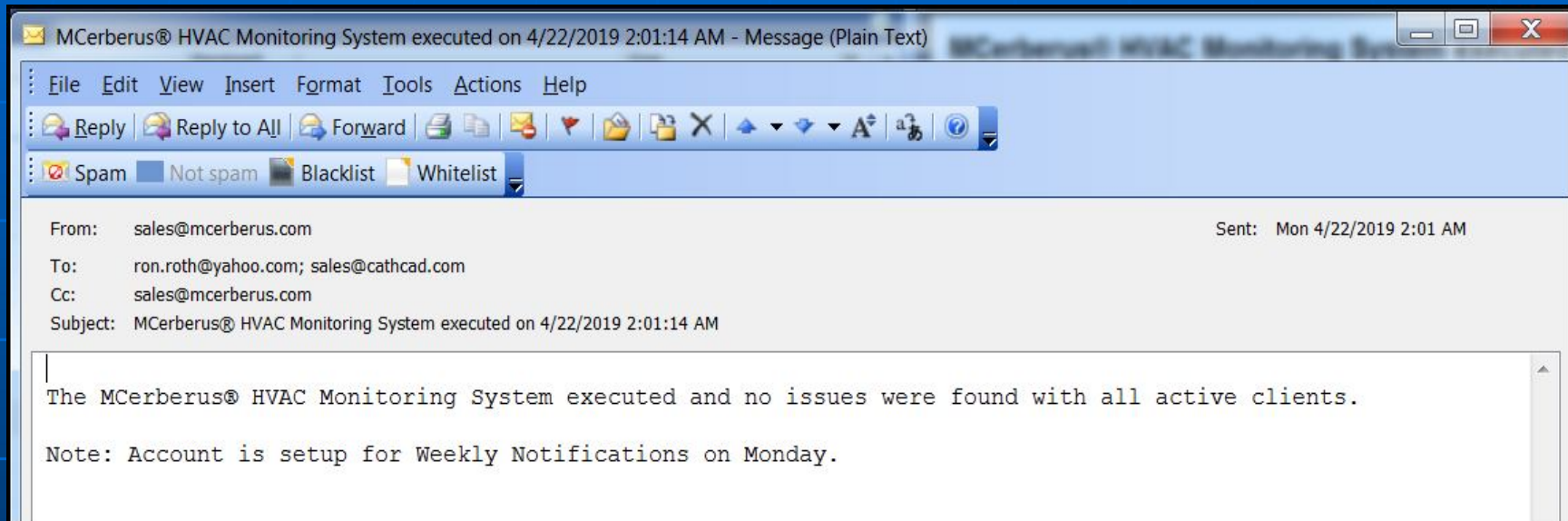- Monitoring Status Indicators
- Water Sensor detection
- Contractor Mode: Generates an Excel report that identifies units with issues
- Designed for the HVAC Contractor for managing 10, 100, or even 1,000+ units

Daily Server Agent Notification

Automatic Report Generation

The SOFTWARE provides the capability to the HVAC Contractor to generate and export a Summary report in Microsoft Excel.

Mobile Application (iOS and Android)

PRODUCT CASE STUDY: GOOD HVAC SYSTEM

Compressor Freeze-over Event

System detected compressor issues eleven days before compressor freeze-over event occurred

PRODUCT CASE STUDY: Refrigerant Leak Detected

- SOFTWARE identified Refrigerant Leak within one week of its occurrence
- Homeowner did not notice issue until three weeks
- Our SOFTWARE moved the detection date FORWARD by two weeks
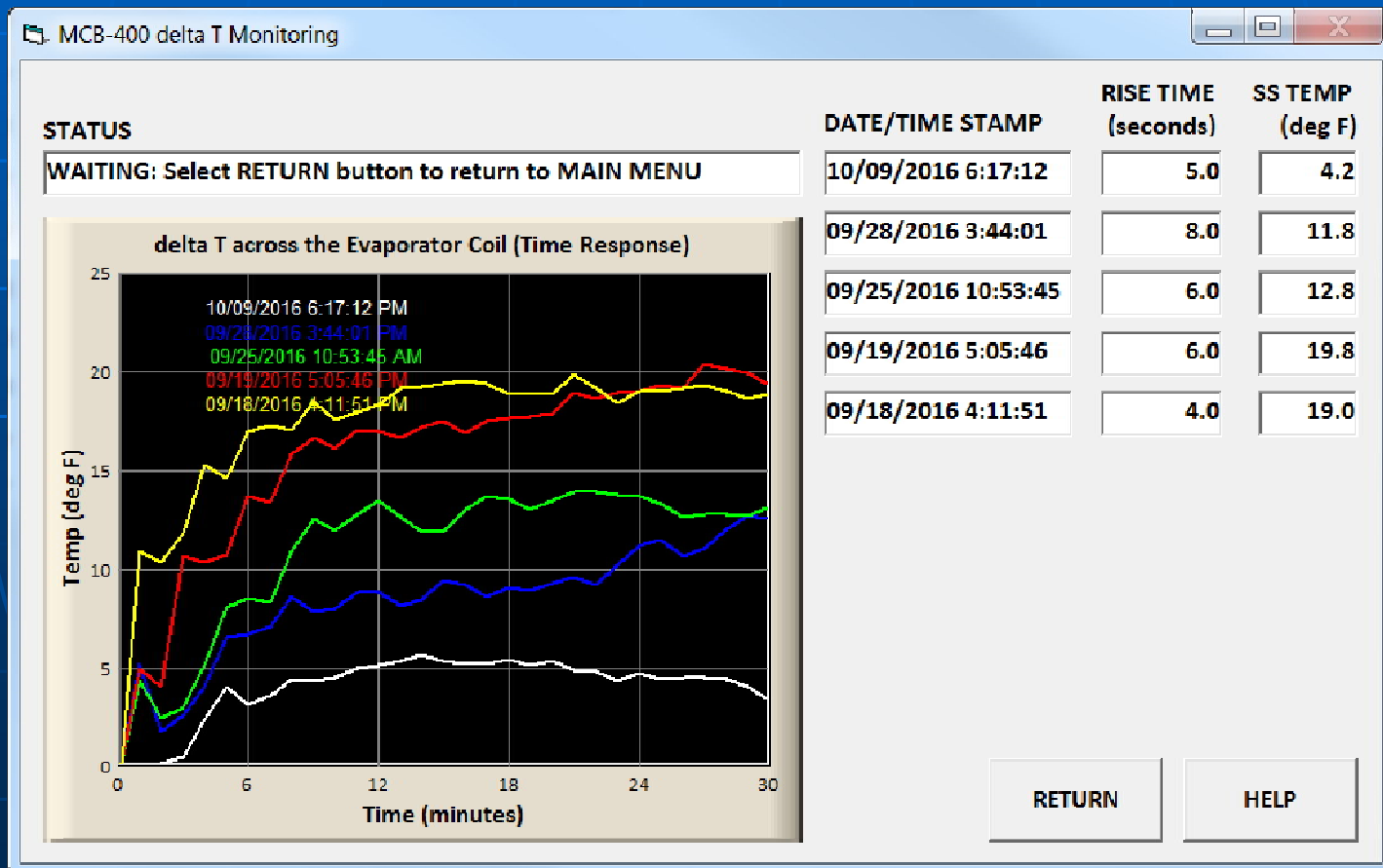
2019 Polar Vortex (Iowa Installation)
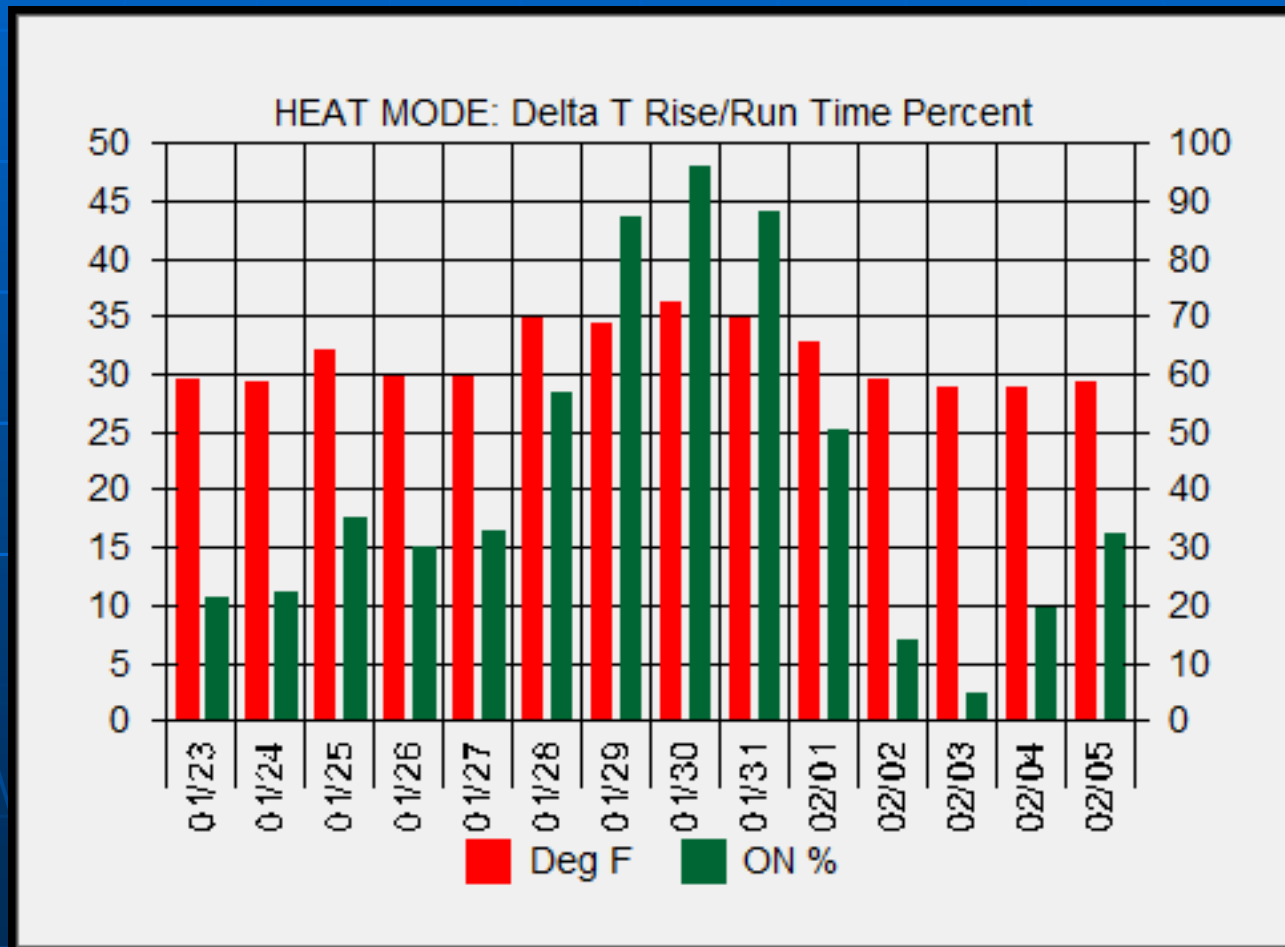
PRODUCT CASE STUDY: Bad Motor Starter Capacitor
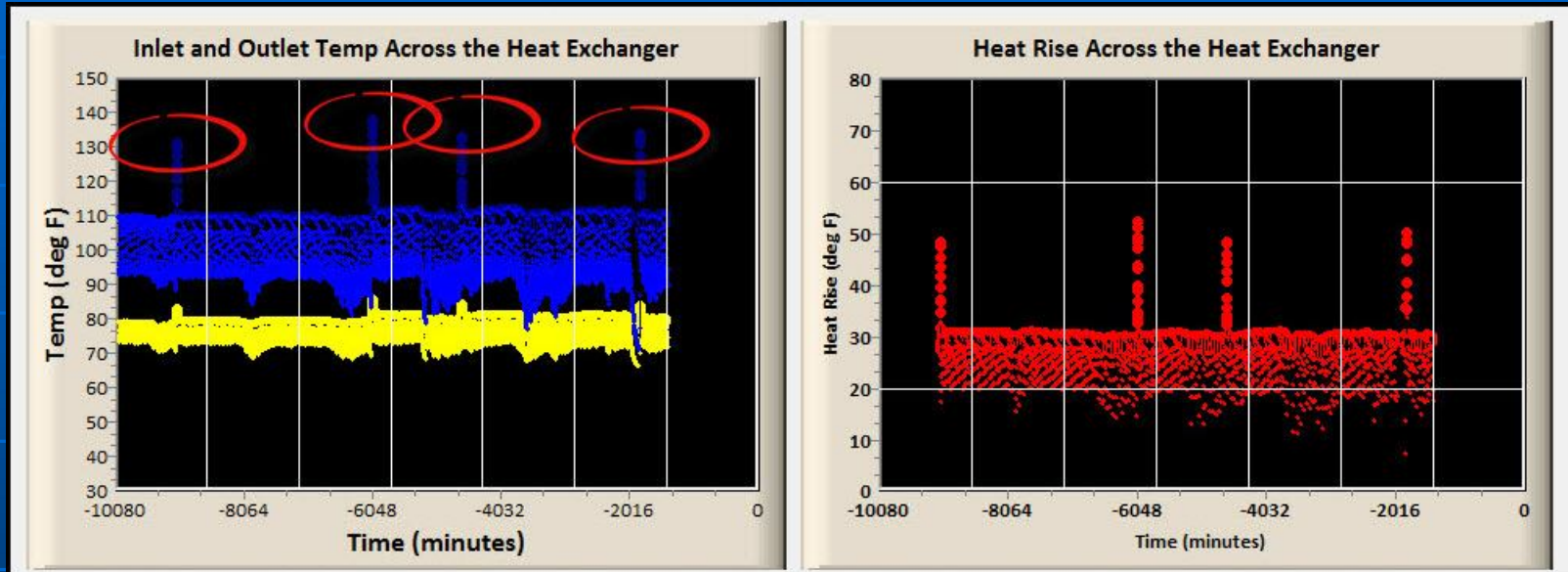
- Residential Installation of PRODUCT in Iowa (Furnace)
- PRODUCT identified where the FAN would not turn on
- Bad motor starter capacitor identified and replaced

Product Pricing/Availability

- Hardware Pricing
  - Single Units: $295/each
  - 100X: $250/each

- No charge for hosting/storage of data for the first five years
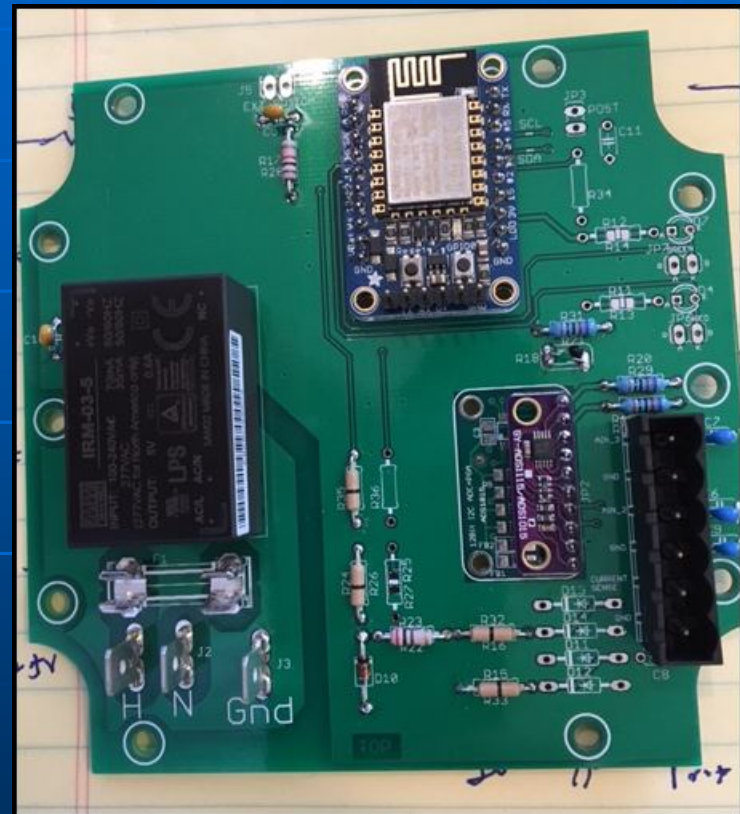
Smart Thermostats w/ Diagnostics Capabilities

Comparison	RT Automation	Company XYZ
Product	MCerberus® HVAC Monitoring System	Company XYZ HVAC Monitoring Service
Pricing	Current - $299 Hardware Only	Not provided
Service Fee	None	Not provided but website infers that monthly service fee applies
Availability	No Limit Installation on any Central HVAC	Limited to Channel Partners
Installation	Installs directly on/next to HVAC System (Invisible to Consumer)	Replacement of Thermostat
Measurement Method	Direct: Heat Exchanger Temp In, Heat Exchanger Temp Out, and Current	Measured Room Temp, ON/OFF Signal, thermostat setpoint Inferred signals via Internet
Communication	WiFi	WiFi
Analysis	Backoffice program provided to HVAC Contractor and Consumer at no additional charge	Backoffice analysis completed by Company XYZ on a weekly basis. Results emailed to Channel Partners
Time required to determine fault from time of installation	< 24 hours for min/max delta T 72 hours for statistical variations	Days to weeks since algorithms require "learning" with regards to the installation
"Reliability"	99+ percent goal	94 percent (**)

Smart Thermostat Diagnostics Algorithm Leads to False Failures
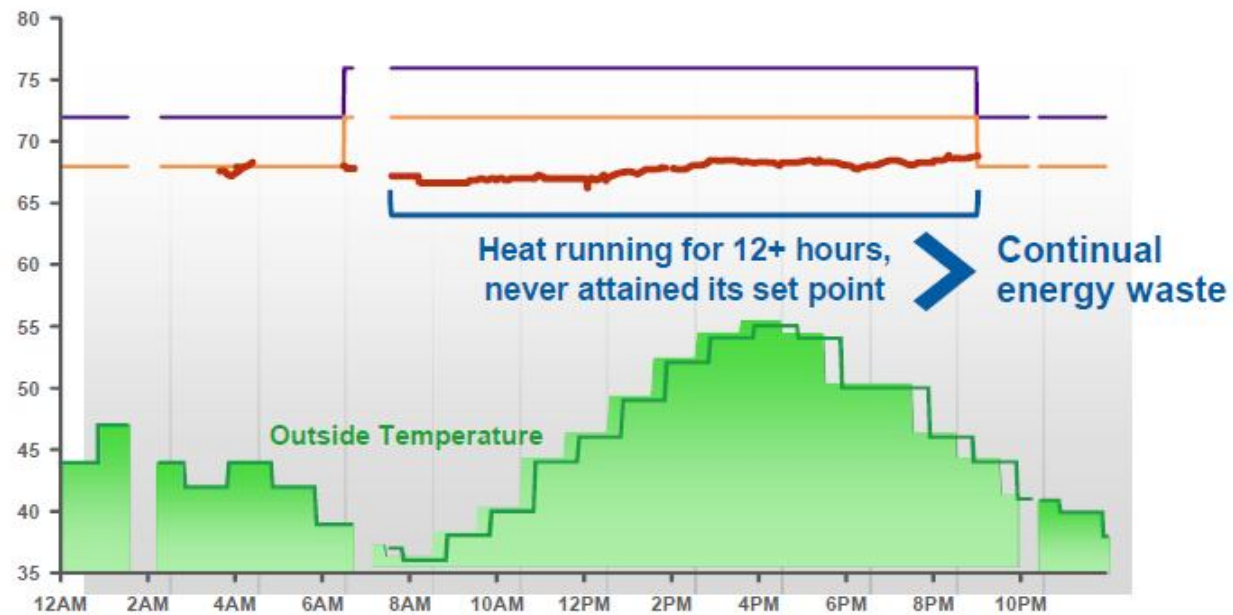
MCerberus® Target Market

- Nationwide
  - Air Conditioning in 100M US Homes (www.eia.gov – 2011 Survey)
  - 62% of these systems have Central HVAC installed (62M units)
  - Target Market is 0.1 percent of these installation (620K units)

- San Antonio
  - 1.47M population as of July, 2015 (www.suburbanstats.org)
  - Number of occupied homes = 479K
  - Using www.eia.gov statistics, number of Central HVAC installations = 270K single family homes
  - Target market in SA is 1 percent * 270K = 2,700 units

Excess Power Generation Calculation

Excess Power Generation (Peak) is 98MW estimated for CPS Energy to support derated/non-optimal HVAC Operation assuming 10 percent of single family homes in SA have derated systems

Item	Units	Value
Number of Single Family Homes in SA with Central HVAC	unity	270,000
Assume 10% of the Single Family Homes in SA have derated AC Systems	unity	27,000
Excess KWH required due to derated/non-optimum operation of HVAC	KWH	678
At the CPS Level -- Total excess power generation required (one month)	MWH	18,310
Excess Power Generation Required (avg over the month @ 6 hours/day)	**MW**	**98**
CPS Peak Demand on August, 2016 (http://www.sanantonioedf.com/regional/utilities/)	MW	5,017
Net reduction	%	1.96%

Capital Cost Equivalents to generate 98MW

Item	Conv Comb Turbine	Wind	Photovoltaic	mCerberus®
Capital Cost ($/MW)	$ 672,000	$ 1,686,000	$ 2,277,000	$ 548,265
Required (MW)	98	98	98	98
Total	$65,856,000	$165,228,000	$223,146,000	$53,730,000

Source: Cost and Performance Characteristics of New Generating Technology, 2017 US Energy Department

RT AUTOMATION

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Ron Roth, Ph.D.
RT AUTOMATION
Website: www.mHVACmonitor.com
Email: sales@rtautomation.org