

# Central Plant Energy Management At The University of Arizona

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Tucson, AZ



# ARIZONA WINTER STORM OF 2013



**WE WILL REBUILD**  
memegenerator.net





11 Million SF  
60,000 Students Faculty Staff

3 Interconnected Central Plants

37 MW Peak Electric  
26,000 Peak Tons  
200 klb/hr Peak Steam

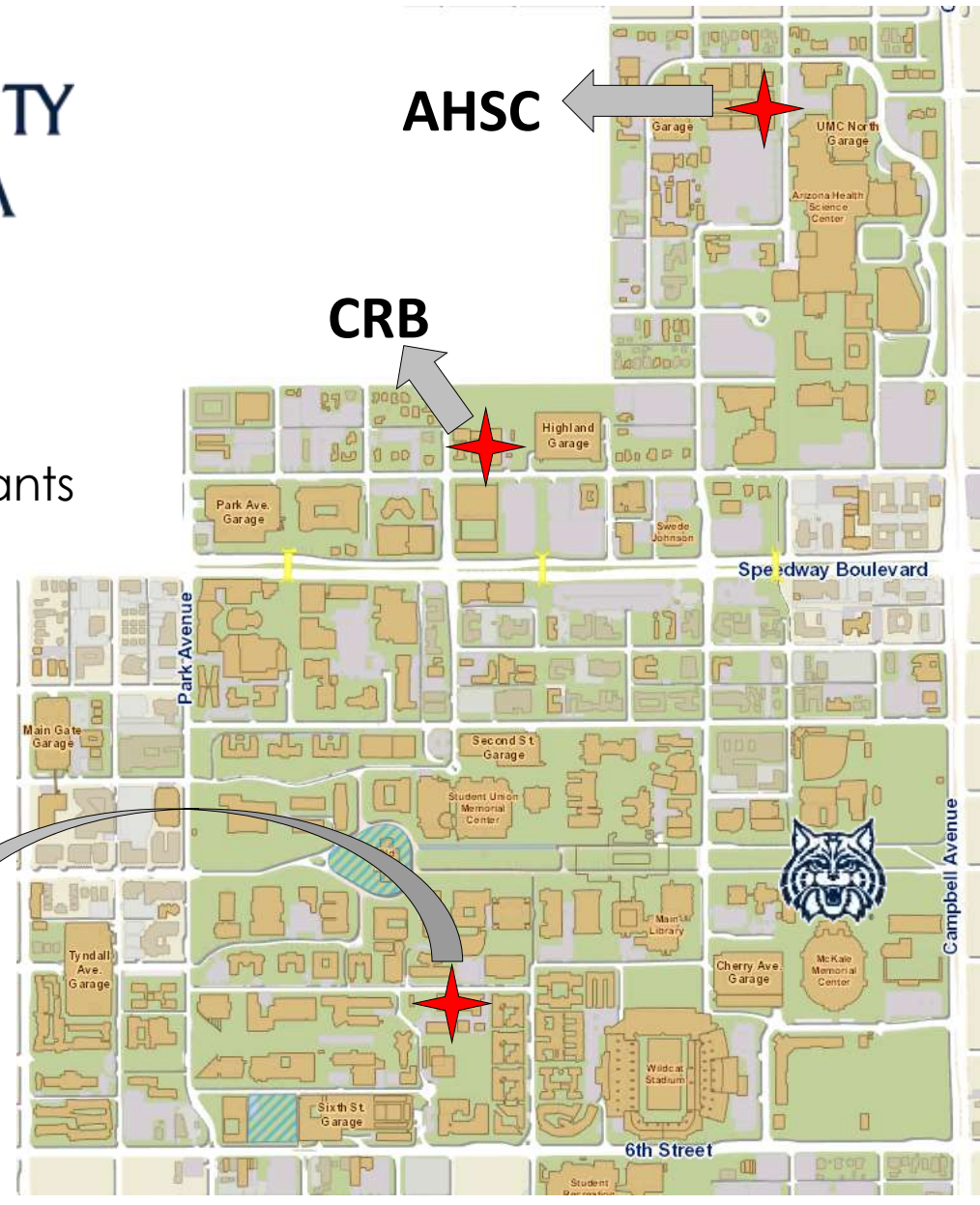
0.68 kW/Ton annual

Current Energy Spend  
\$14M Gas  
\$14M Electric

**CHRP**

**CRB**

**AHSC**





### **Central Heating and Refrigeration Plant**

- 12,000 Ton Cooling Tower
- 10,000 Water Chillers
- 800 Ton Glycol Chiller
- 6,400 Ton-hr Ice Storage
- 180,000 lb/hr Steam
- 7 MW GTG



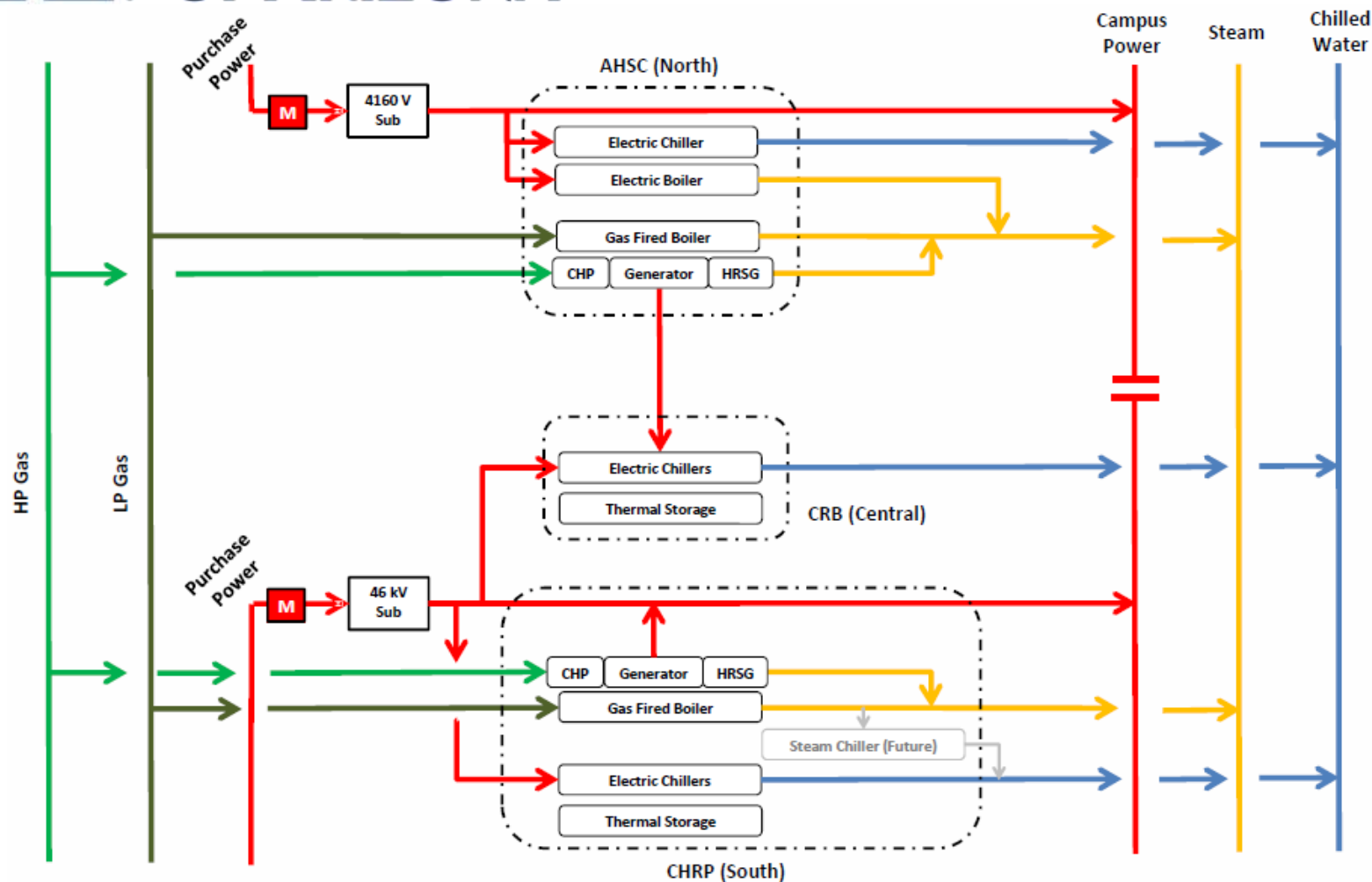
### **Arizona Health Sciences Central Plant**

- 8,000 Ton Cooling Tower
- 7,500 Water Chillers
- 155,000 lb/hr Steam
- 6 MW GTG

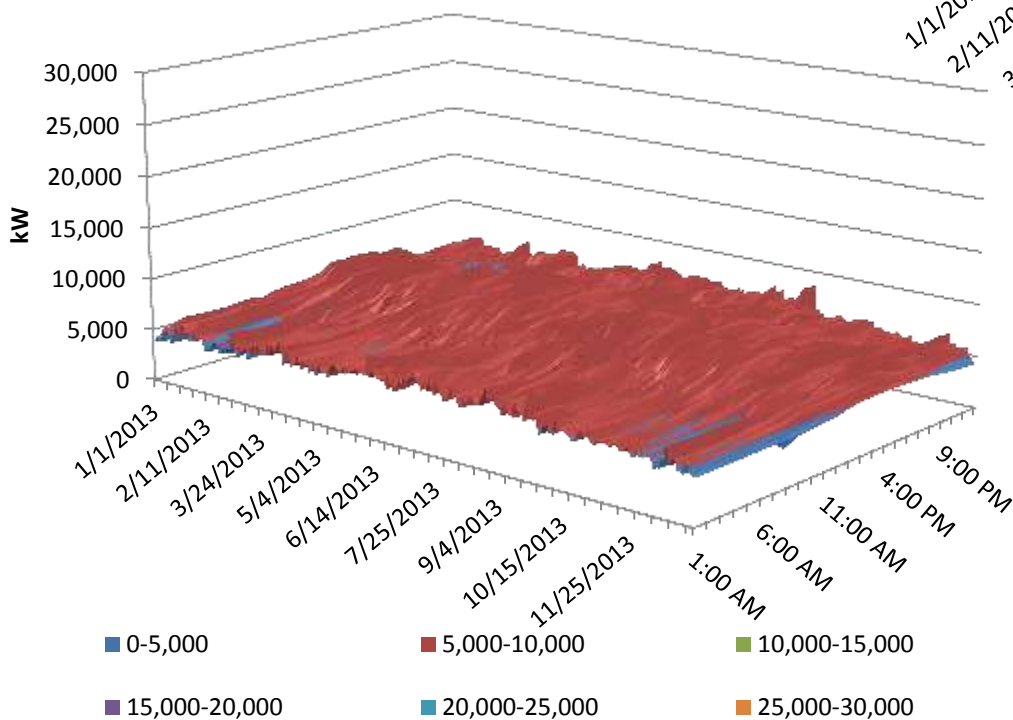


### **Central Refrigeration Building**

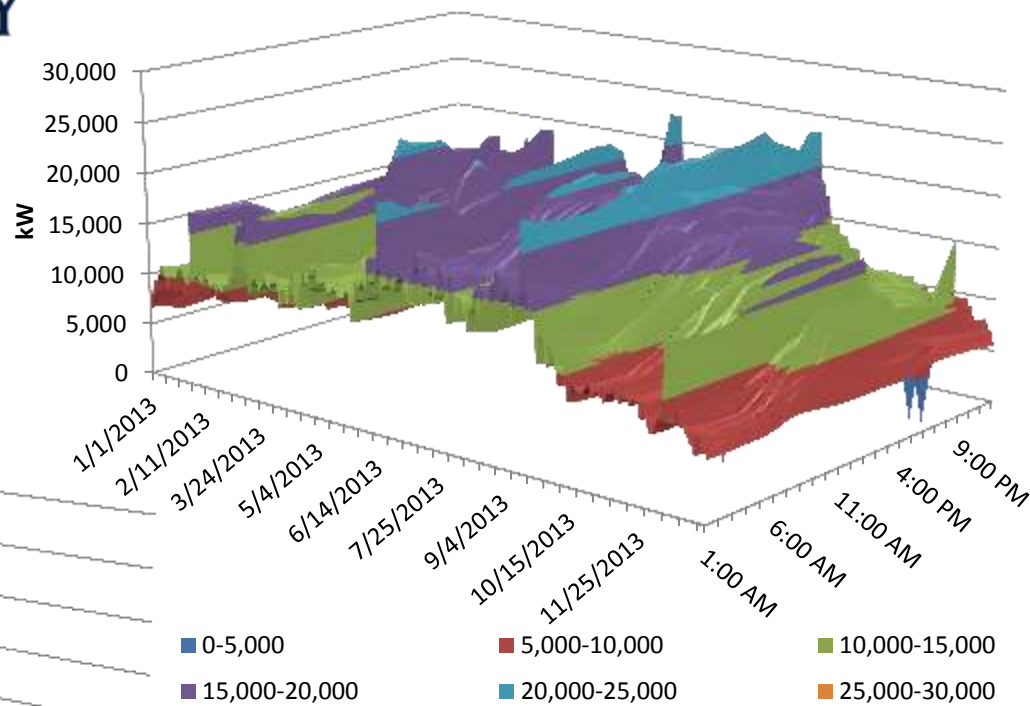
- 13,000 Ton Cooling Tower
- 12,000 Water Chillers
- 2,400 Ton Glycol Chiller
- 20,000 Ton-hr Ice Storage



TEP – Arizona Health Sciences Meter

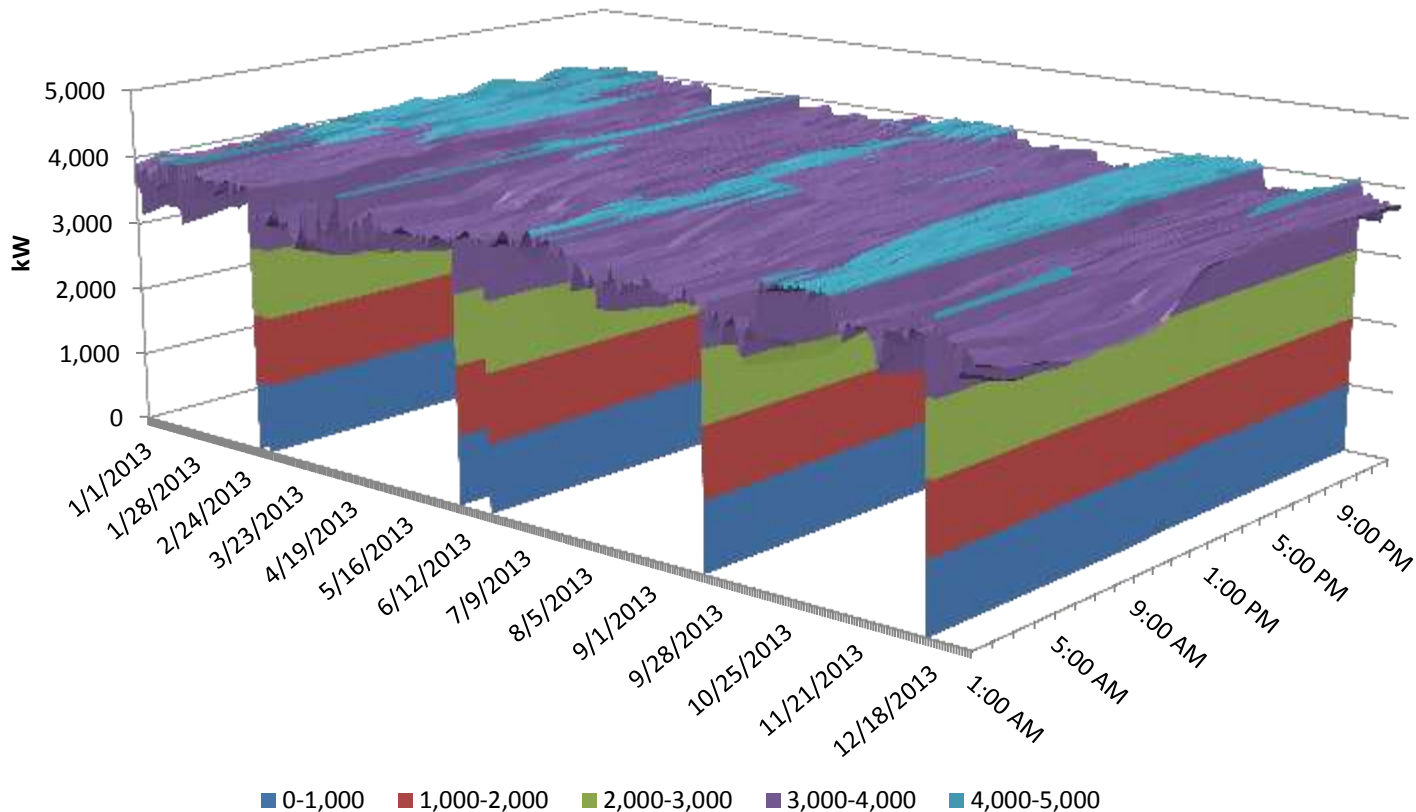


TEP - Main Campus Meter



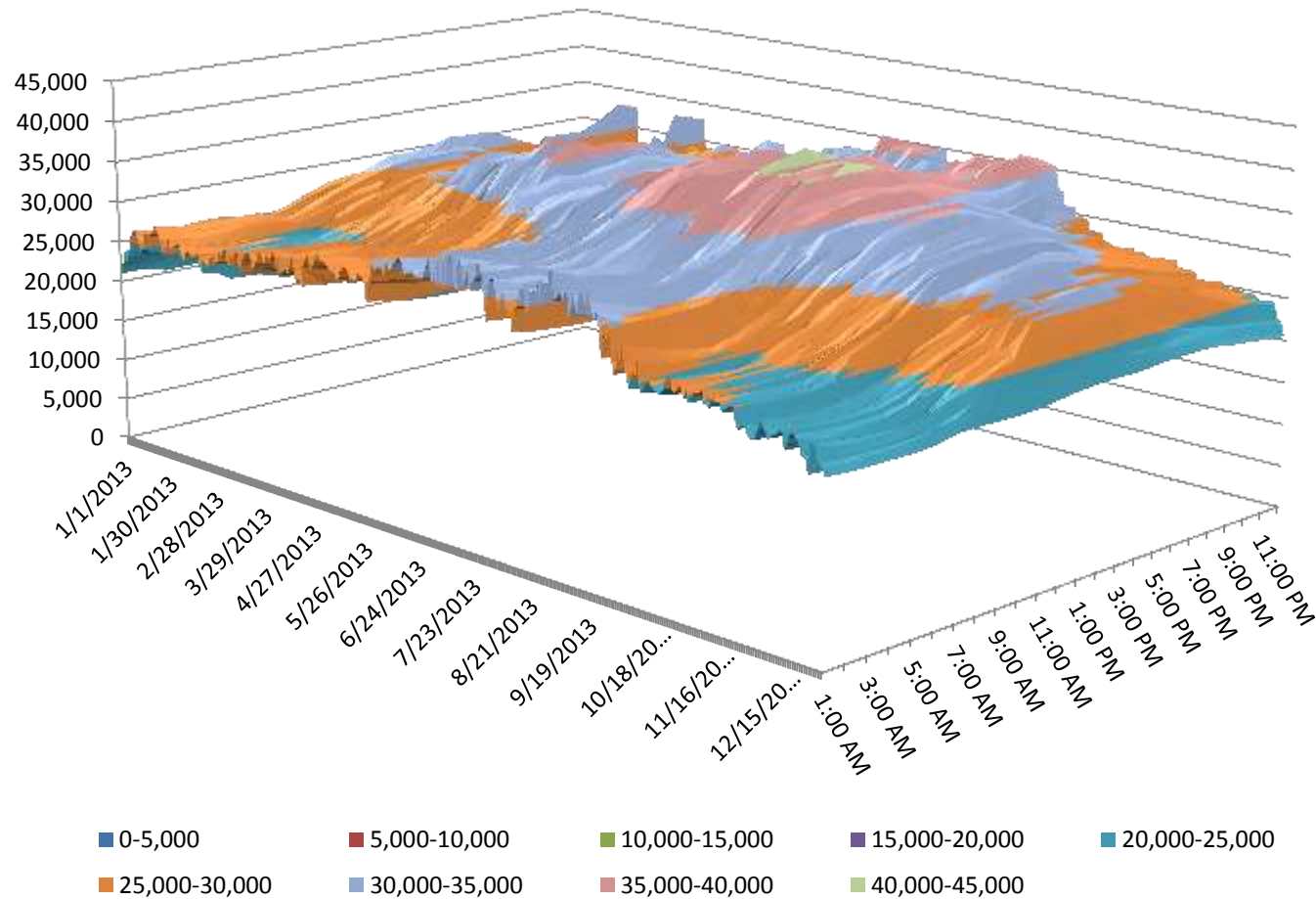


## Typical GTG: AHSC T60 Shown

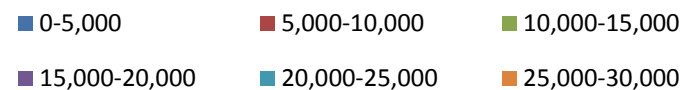
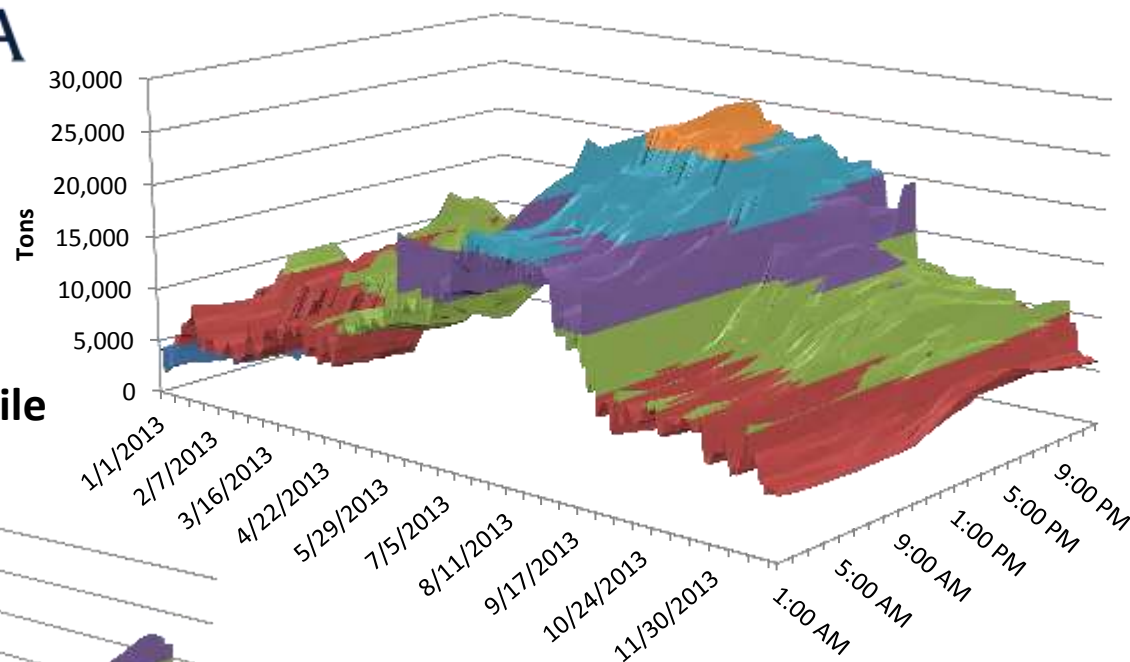




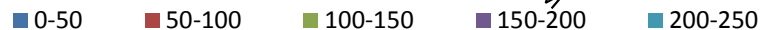
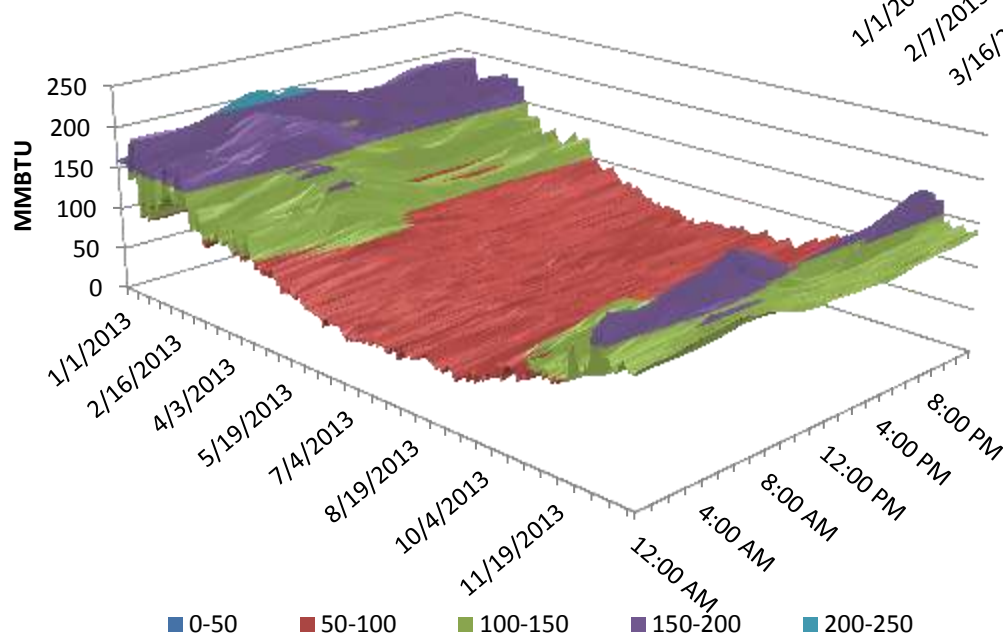
## Total Campus: TEP + GTG



## Campus Cooling Demand Profile

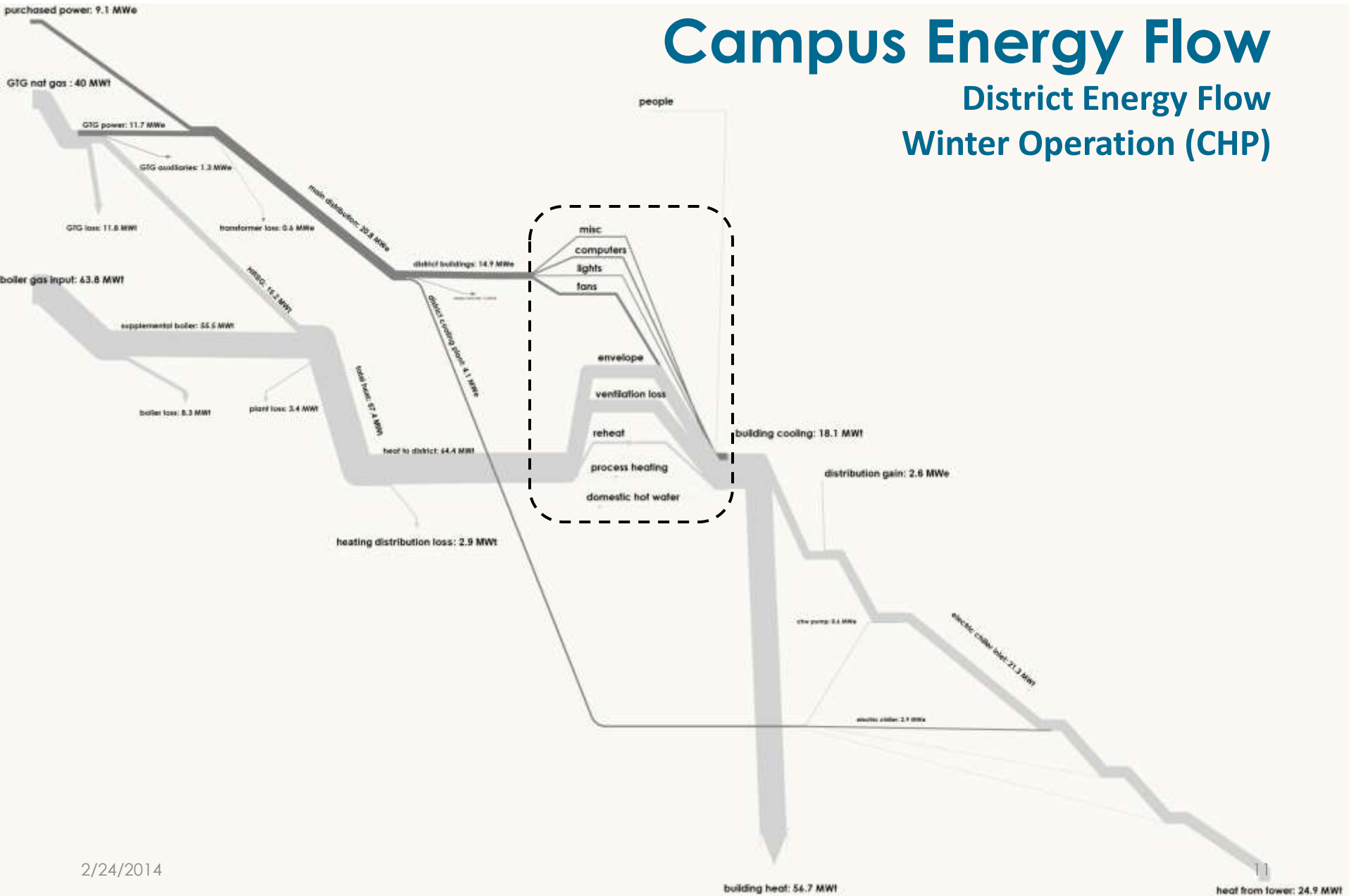


## Campus Heating Demand Profile



# Campus Energy Flow

## District Energy Flow Winter Operation (CHP)



## District Energy Flow Summer Operation (CHP)







- Electric Service Provider: **Tucson Electric Power**
- Rate Schedule: **Large Light and Power Time of Use Program (LLP-90)**
- Format: On/Off Peak **Consumption, kWh** (Energy) + **Demand, kW** (Power)

	<u>On</u> Peak Consumption	<u>Off</u> Peak Consumption	Demand
Jan	14%	36%	49%
Feb	13%	37%	50%
Mar	13%	40%	47%
Apr	13%	36%	50%
May	17%	32%	52%
Jun	15%	34%	51%
Jul	17%	34%	49%
Aug	16%	33%	51%
Sep	16%	33%	51%
Oct	16%	38%	46%
Nov	14%	37%	49%
Dec	14%	36%	50%
	<b>15%</b>	<b>35%</b>	<b>50%</b>



MAY - SEPT  
**SUMMER**  
3672 HOURS TOTAL  
  
DEMAND \$/KW  
ENERGY \$/KWH

# TEP ELECTRIC RATE

LLP-90

## ON PEAK

WEEKDAYS  
HOURS: 2PM - 8PM

\$20.50  
\$0.053



654 ON-PEAK HOURS

## OFF PEAK

ALL NON-PEAK HOURS PLUS  
WEEKENDS & HOLIDAYS

\$0.031



3018 OFF PEAK HOURS

OCT - APR  
**WINTER**  
5088 HOURS TOTAL  
  
DEMAND \$/KW  
ENERGY \$/KWH

## ON PEAK

WEEKDAYS  
HOURS: 6AM - 10AM  
5PM - 9PM

\$15.50  
\$0.037



1216 ON-PEAK HOURS

## OFF PEAK

ALL NON-PEAK HOURS PLUS  
WEEKENDS & HOLIDAYS

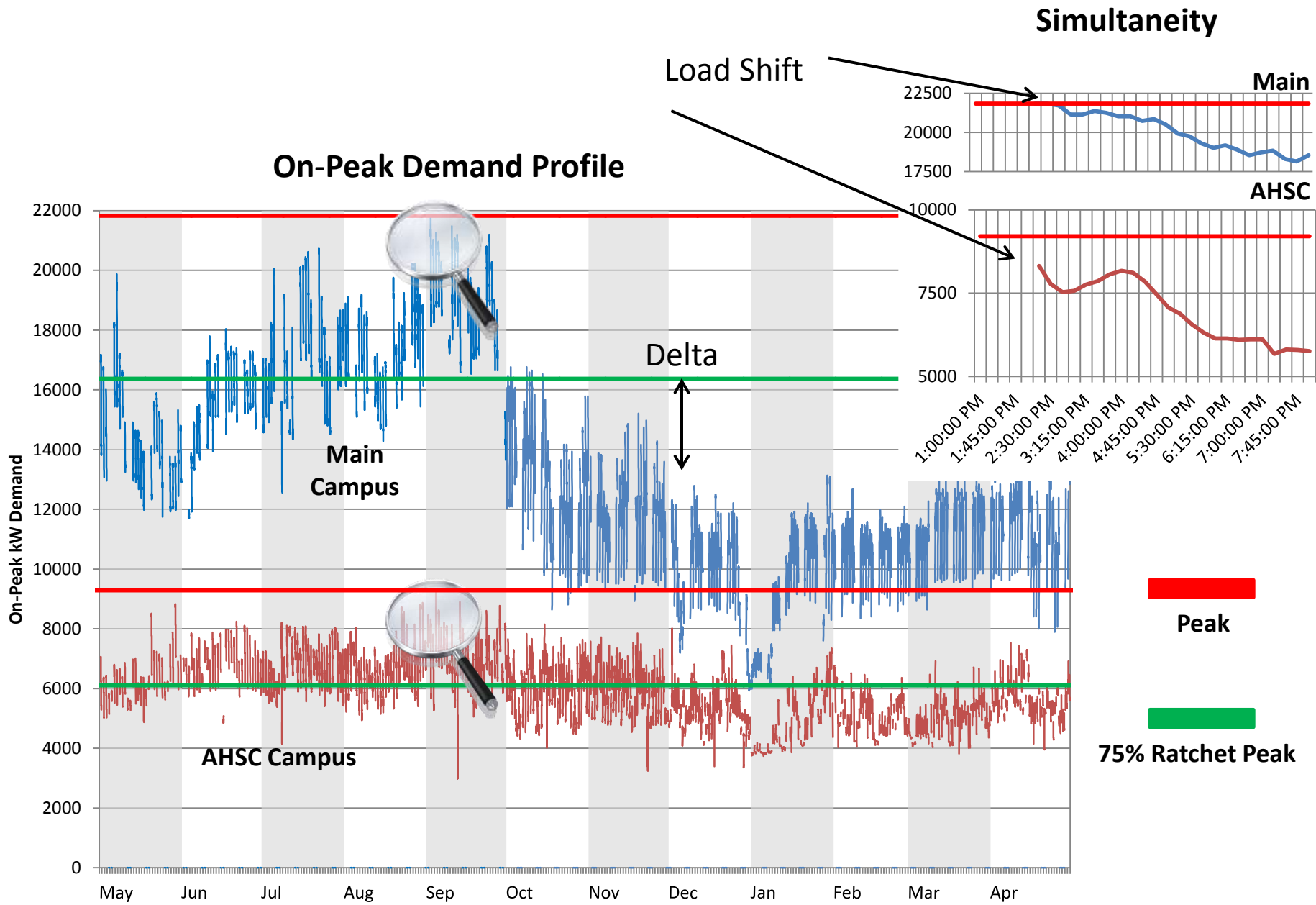
\$0.031



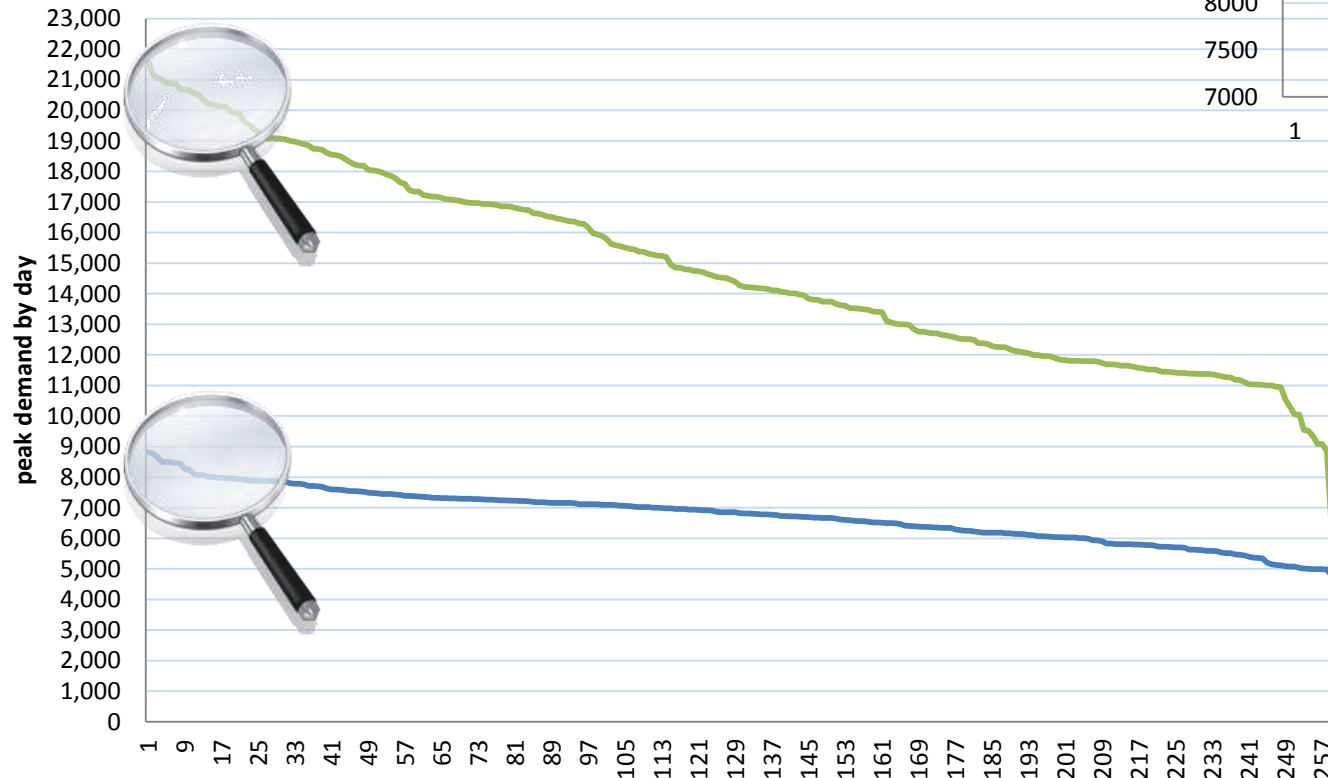
3872 OFF PEAK HOURS

### Ratchet Cost:

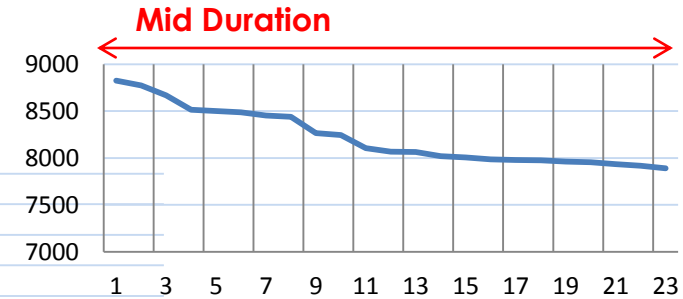
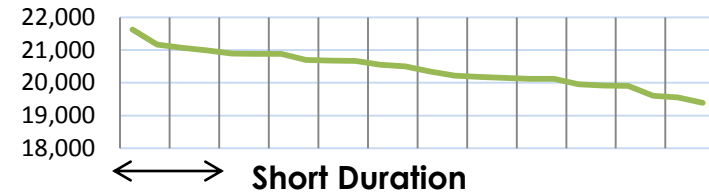
- “75% of the maximum on-peak period billing demand used for billing purposes in the preceding 11 months”



**Only a few hours  
where demand is  
above 20,000 kW**



## Peak Daily Demand Duration

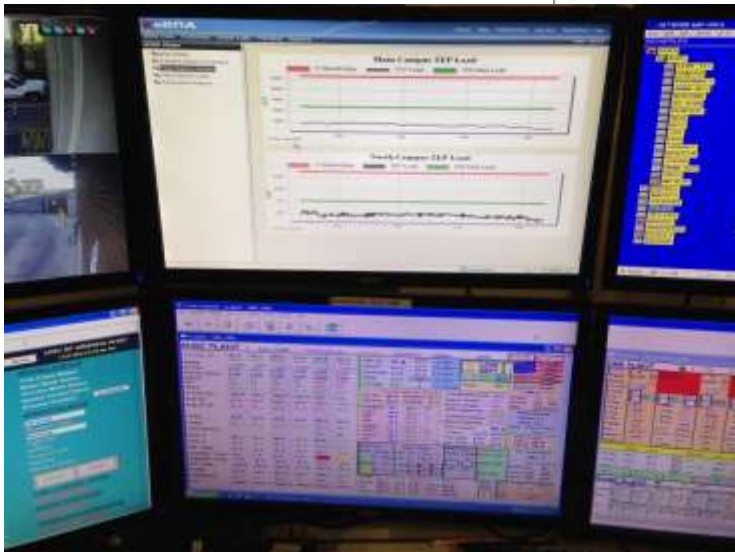
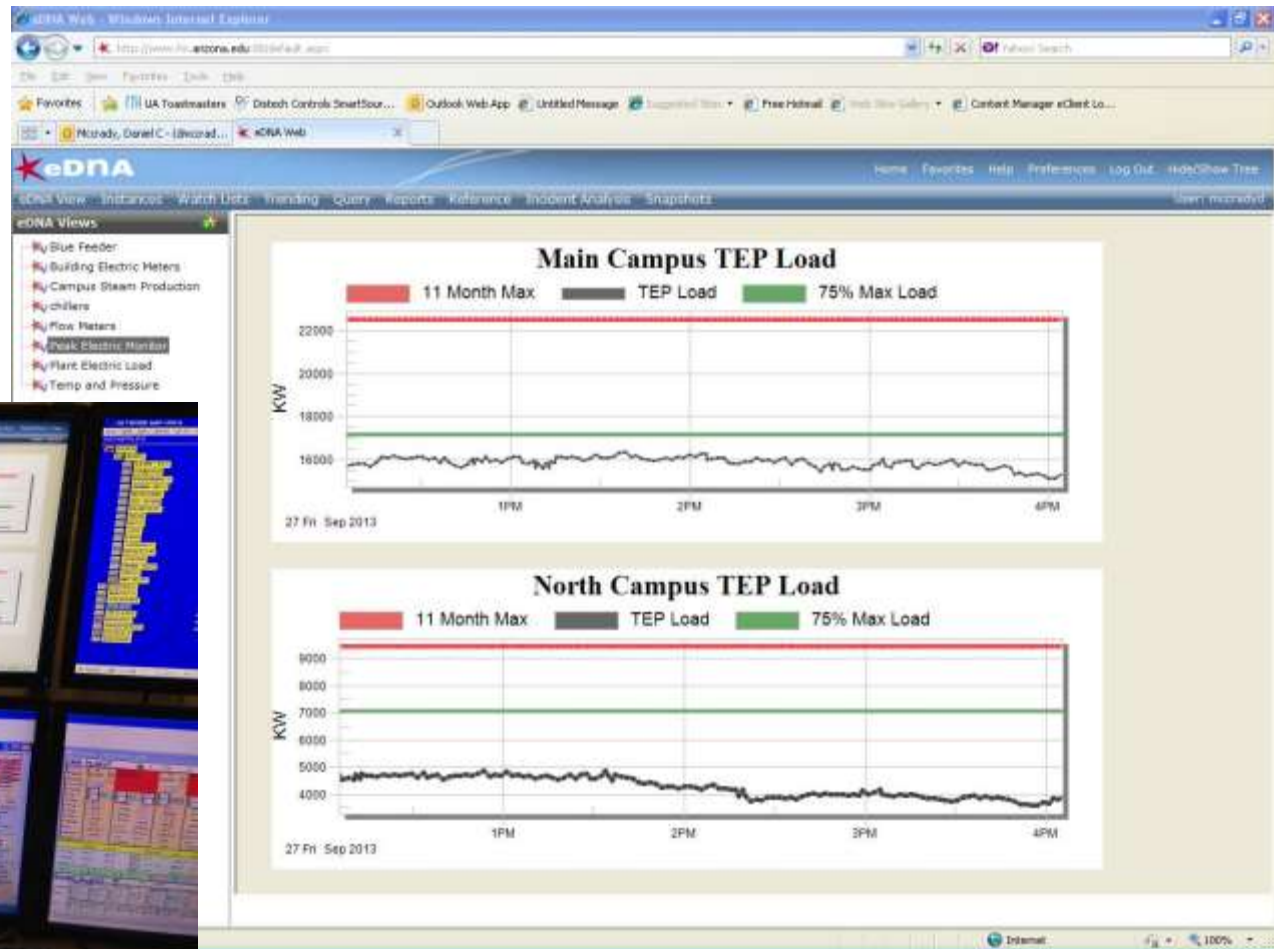


- Operate plants in close parallel
- Ride out short duration peaks
- Activate standby gensets through mid duration peaks
- Enhance TES Operation



## eDNA

- Operate to **Red Line**  
11 Month Max
- 75% Max Load



# Take Away

## **“You Can Not Control What You Can Not Measure”**

- Completeness and Granularity of Electric Demand Data
- Reliable Data Requires Ongoing Meter calibration, Validation, Energy
- Operator Training Scrutiny
- Managing Loads
- Clear Visualization