"Working their Tariff"

Rate-Responsive Building Operation at GSA's Philadelphia Custom House

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The Philadelphia Custom House

Under the Hood: Operations and Maintenance

CH Energy Biography

- **1934 570,000 sq. ft. art deco**
- **Fantastic track record:**
  - 67,000 Btu/ft^2 per year (office bldg. avg. ~ 100,000 Btu/ft^2)
  - 1999 ENERGY STAR score: 86/100
  - 1st ENERGY STAR building in PA
  - 1st historic ENERGY STAR bldg. in US
  - All despite: single pane windows, constant volume air supply, induction unit space conditioning
- **2003 ESPC: lighting, new EMCS**
  - So energy performance even better

Prospective Energy Project?

- **Nothing left? LBL asked GSA if it could take a closer look**
- **Result: GSA implemented project that saved $70K (~ 10% of electric bill) over past year**
  - Savings will likely be higher this year
- **Payback Period? Maybe two weeks**
  - Two solenoid valves + one visit from controls contractor

Key to Savings: Tariff

- **Energy Charge: < 3¢/kWh**
  - Less than 1/2 of comm./ind. average
- **Demand charge: $27/kW/mo.**
  - About 2-3 times C/I norm
- **Demand "ratchet":**
  - 80% of summer peak (single interval reading) becomes floor for next eight months' (Oct. – May) billed demand
  - EX: If CH reaches 2000 kW peak in July, 1600 kW is min. demand for Oct. – May

Tariff's Implications

GSA was paying $70K/yr. in ratchet chgs.

Month	Actual Peak (kW)	Billed Peak (kW)	Ratchet Penalty*
Summer, 2003	2,088	2,088	N/A – Summer
Oct-03	1,691	1,691	N/A – Actual > Ratcheted
Nov-03	1,520	1,670	$3,812
Dec-03	1,040	1,670	$16,008
Jan-04	1,069	1,670	$15,271
Feb-04	1,051	1,670	$15,729
Mar-04	1,112	1,670	$14,179
Apr-04	1,582	1,670	$2,236
May-04	1,955	1,955	N/A – Actual > Ratcheted
TOTAL			$97,235

* @$25.41/kW (current is $27.02/kW)

How GSA Cut CH's Demand

- **"Pre-Cooling"**
  - If OA temp. > 70° at 2 A.M., chiller comes on (normal start is 6 A.M.)
  - Induction units fail open (full cool) until 9 A.M., then tenants control
  - Result: Dehumidification and slight over-cooling
- **"Demand-limiting"**
  - Only one chiller runs throughout day
  - CHW temp. from 42° to 46° at 9 A.M. and up to 48° later, if necessary

GSA's Operations Team

Results

- **Demand peak was reduced ~ 15%**
- **Conservative savings est.: ~ $70K**

CH '05-'06 Savings w/ 1766 kW (vs. 2050 kW) Summer, '05 Peak					
MONTH	Expected Peak	Actual Peak	Billed Peak	Peak Cut	kW Value
June, '05	1900	1766	1766	134	$ 3,410
July, '05	2050	1692	1692	358	$ 9,109
August, '05	2050	1692	1697	353	$ 8,982
September, '05	1900	1711	1711	189	$ 4,809
October, '05	1640	1604	1604	36	$ 916
November, '05	1640	1448	1448	192	$ 4,885
December, '05	1640	1015	1413	227	$ 5,776
January, '06	1640	992	1413	227	$ 6,134
February, '06	1640	961	1413	227	$ 6,134
March, '06	1640	953	1413	227	$ 6,134
April, '06	1640	1393	1413	227	$ 6,134
May, '06	1850	1646	1646	204	$ 5,512

Results (cont.)

- **Expected energy (kWh) penalty didn't occur**
  - Regression of previous summers' usage against cooling degree days predicted 2% higher kWh usage in 2005 than actual
  - Why? Greater efficiency of higher-load chiller operation???
- **Thermal complaints went down**
  - Hot calls: dropped from 41 in summer 2004 to 26 in much hotter 2005
  - Cold calls: dropped from 10 in summer 2004 to 6 in 2005 – pleasant surprise

Moral of Story: Know Thy Tariff!

- **CH had model energy program**
- **Nonetheless, by studying elec. rate and designing operations around it, big savings were still possible with little investment**
- **Not only operations strategies but also conservation measures (e.g., lighting retrofits, chiller selection, etc.) should be planned with attention to rate structure**

Tariff Caveats!

- **Rates of "X cents/kWh" are rare for large facilities**
  - If consultants and ESCOs cite them beyond early stage, they probably don't get it
- **Demand charges (esp. with ratchet clauses) must be understood**
- **Time-of-use, block, and real-time rates all have great bearing on ECMs' savings**
- **Remember: <u>average</u> kWh aren't saved, <u>marginal</u> ones are**