
“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/ft² per year (office bldg. avg. ~ 100,000 Btu/ft²)
 - 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 | | | \$67,035 |

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

How GSA Cut CH's Demand

- **“Pre-Cooling”**
 - If OA temp. $> 70^{\circ}$ 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: average kWh aren't saved, marginal ones are**