



An Energy Efficiency Workshop & Exposition

Palm Springs, California

*Please be courteous to our speakers*



***Turn off all cell phones  
and  
Set pagers to vibrate***





An Energy Efficiency Workshop & Exposition

Palm Springs, California

## *Playing by the Numbers*

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## *The Value of Energy Information*

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- Identify billing and metering errors
- Helps track utilities to cost centers
- Identify building and system inefficiencies
- Allows for measurement and verification of energy retrofit cost avoidance
- Identify more economic rate schedules
- Prepares you for deregulation opportunities

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## *Utility Bill Analysis*

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***“You can’t manage what you can’t measure”***

- ❑ Collecting and Organizing Utility Data
- ❑ Calculating the Energy Use Index
- ❑ Creating Charts & Graphs
- ❑ Analyzing Consumption



## *Recording Energy Information*

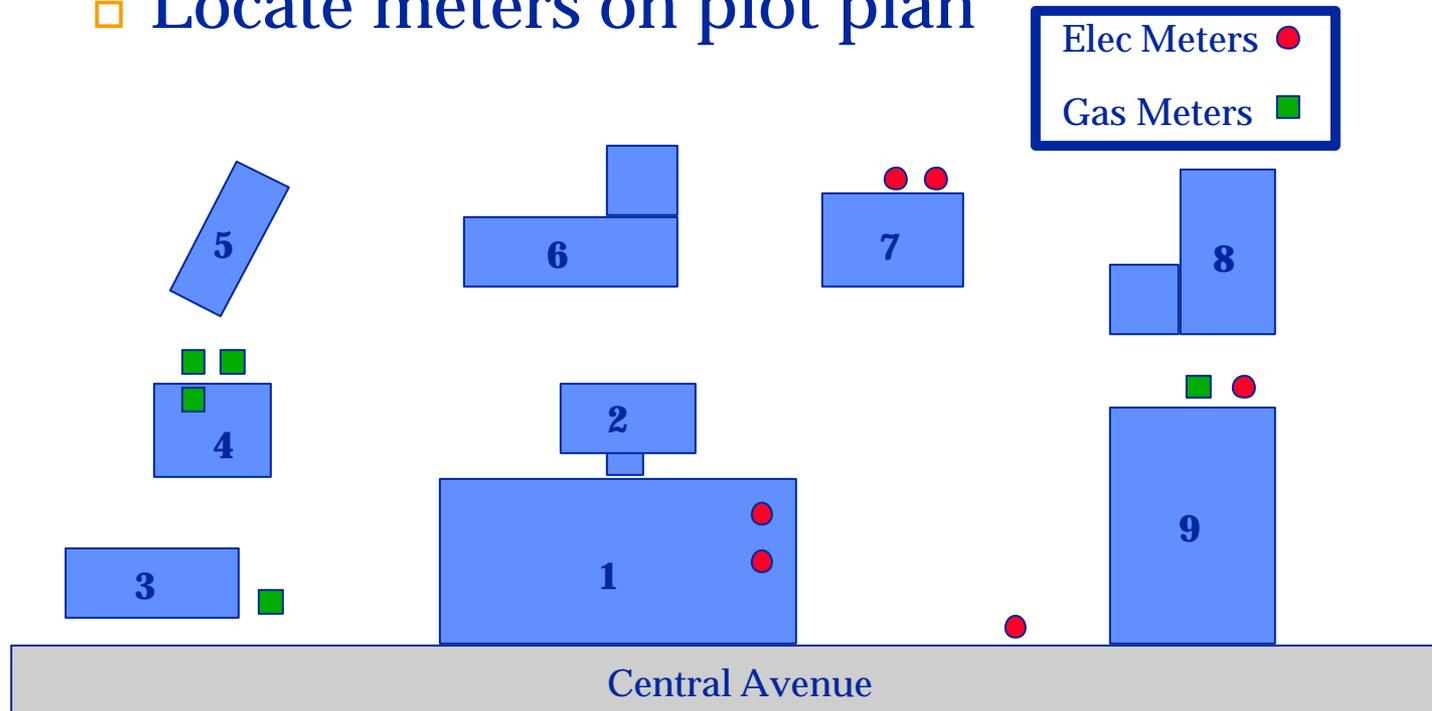
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- ❑ Start with 12 to 24 Months of Utility Data
- ❑ Establish Energy Accounting Year
- ❑ Establish Baseline Year
- ❑ Read Dates
- ❑ Days in Billing Period
- ❑ Fuel Consumption - kWh, Therms, Oil
- ❑ Electric Demand kW
- ❑ Fuel Costs & Rate Schedules



## Meter Locations

- Locate meters on plot plan



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# Spreadsheet Setup

Energy Accounting Form															
Facility Name:															
Facility Type:															
Electric Utility:								Electric Meter #				Electric Rate Schedule:			
Gas Utility:								Gas Meter #				Gas Rate Schedule:			
Gross Square Footage:															
YEAR:	ELECTRICITY							NATURAL GAS				TOTALS		ENERGY USE INDEX	
MONTH	# Days	ELECTRIC	ELECTRIC	ELECTRIC	ELECTRIC	ELECTRIC	LOAD FACTOR	GAS	GAS	GAS	GAS	(A)	(B)	(C)	(D)
	In Billing	USAGE	DEMAND	COST	UNIT COST	MMBTU		USAGE	COST	UNIT COST	MMBTU	MMBTU	COST OF	EUI	COST
	Period	kWh	kW	\$	kWh/\$	kWh x .003413	$\frac{kWh}{kW \times Days \times 24}$	THERMS	\$	Therms/\$	Therms x .10	CONSUMED	ENERGY	Btu/Sq.Ft.	\$/Sq.Ft.
JAN															
FEB															
MAR															
APR															
MAY															
JUN															
JUL															
AUG															
SEP															
OCT															
NOV															
DEC															
Annual Totals															

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## *EUI Calculations*

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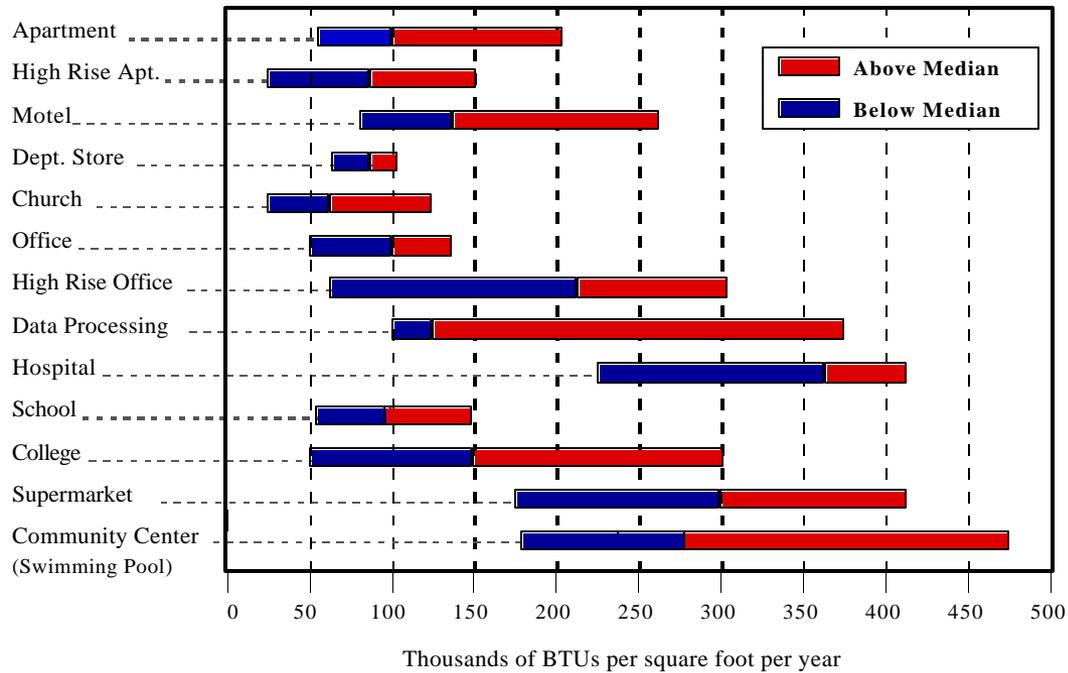
- Convert Fuel to Common Units - BTUs
- Add Annual Totals for Each Fuel
- Divide by Gross Conditioned Area

*Example: 25,000 Sq.Ft. Grocery Store*

- $2,000,000 \text{ kWh} \times .003413 = 6,826 \text{ mmbtu}$
- $17,000 \text{ Therms} \times .100000 = 1,700 \text{ mmbtu}$
- Total Annual Energy Use = 8,526 mmbtu
- $\text{EUI} = 8,526 / 25,000 \text{ Sq.Ft.} \times 1,000,000$
- $\text{EUI} = 341,040 \text{ BTU} / \text{Square Foot} / \text{Year}$



# Energy Use Index



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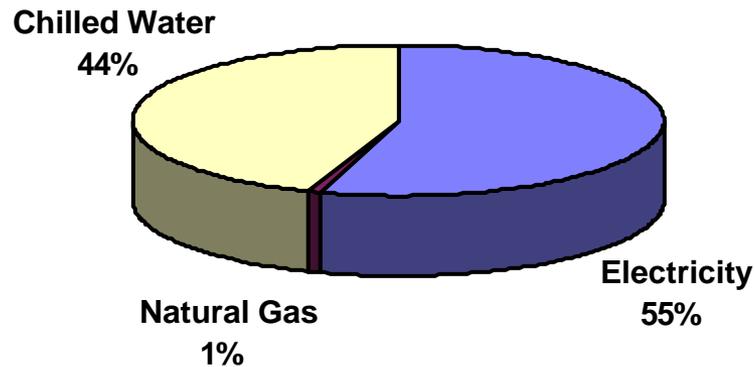


# Annual Energy Cost Breakdown

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## Year Ending 12/2001

Electricity	\$ 1,325,923
Natural Gas	\$ 16,922
<u>Chilled Water</u>	<u>\$ 1,074,929</u>
TOTAL	\$ 2,417,774

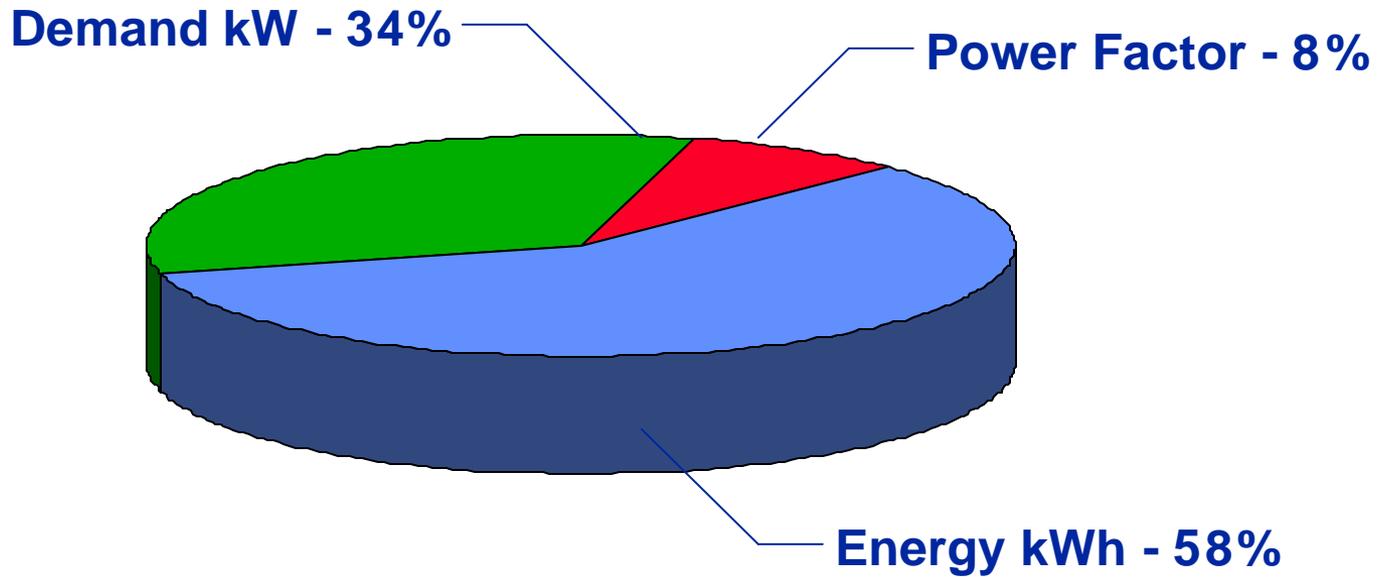


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## *Electricity Charges*

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## *Load Factor*

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- Relationship Between Consumption and Demand
- Indicator of Frequency of Peak Loads
- Average Demand/Peak Demand

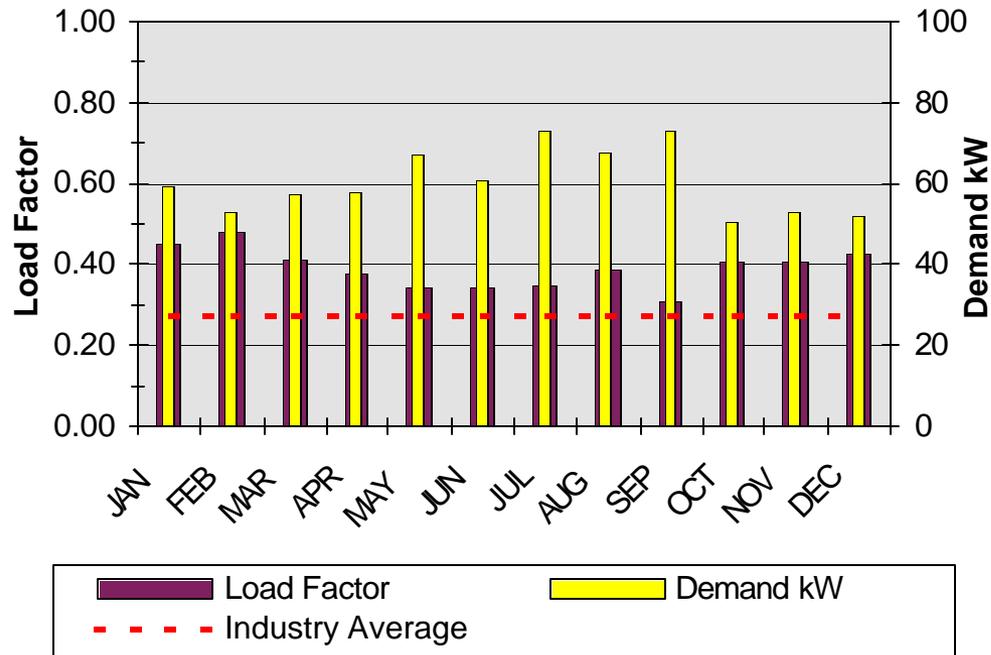
**kWh**

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**kW x # Hours in billing period**



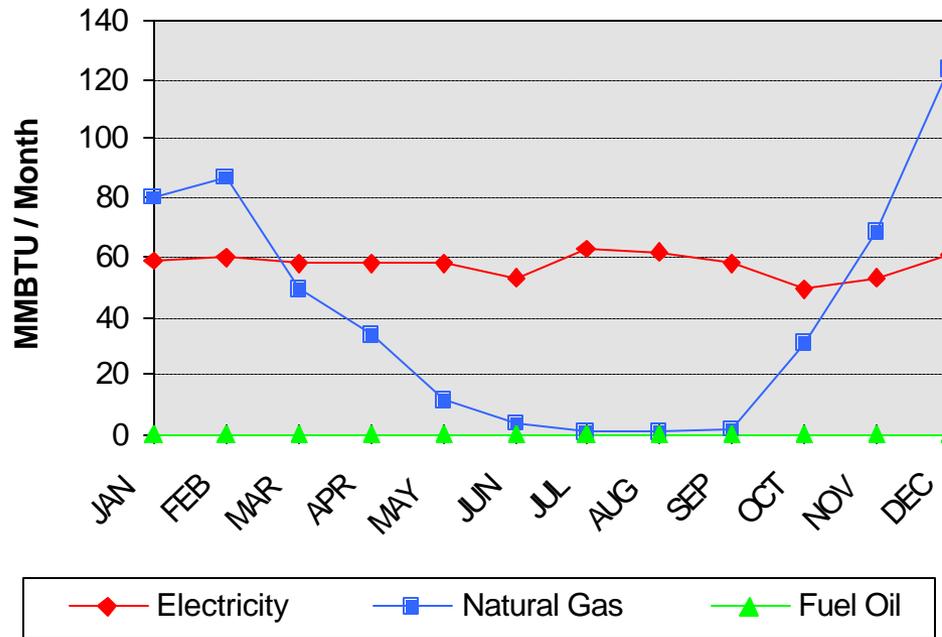
# Demand & Load Factor



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## Energy Use Profile

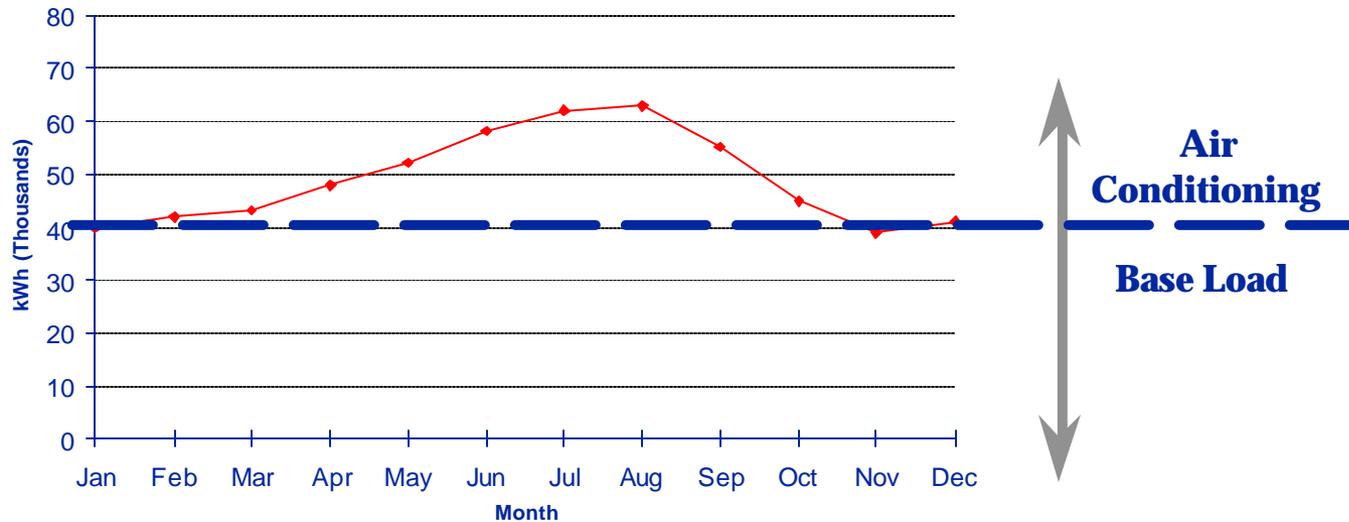


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## Base & Seasonal Loads

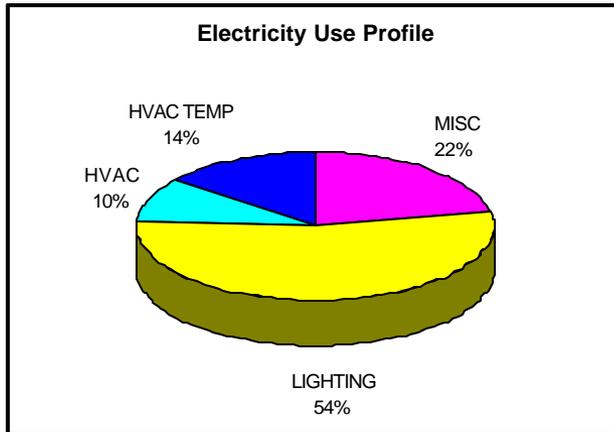
### Electricity Consumption



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# Office Building End Use



**HVAC Temp. – Varies by Outdoor Temp.**

**HVAC – Ventilation/Varies by # Occupants**

**Lighting – Interior/Exterior Lighting**

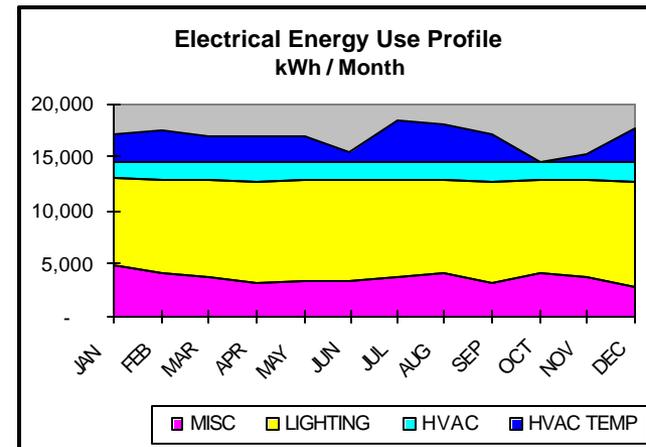
**Misc. – Plug Loads/Non-HVAC Loads**

**HVAC Temp. – Above Min. Line**

**HVAC Vent. – 1 kWh/Sq.Ft./Year**

**Lighting – Watts/1,000 x Hours**

**Miscellaneous – Remaining kWh**



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## *Energy Using Systems*

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### Heating System

- Combustion Efficiency
- Distribution System
- Controls
- Hours of Operation
- Envelope

### Ventilation

- Amount of Outside Air
- Night & Warm-up Operation
- Exhaust System Interaction

### Lighting

- Operation Time
- Lamp Efficiency
- Light Levels

### Service Hot Water

- Temperatures
- Distribution System

### Pumps & Motors

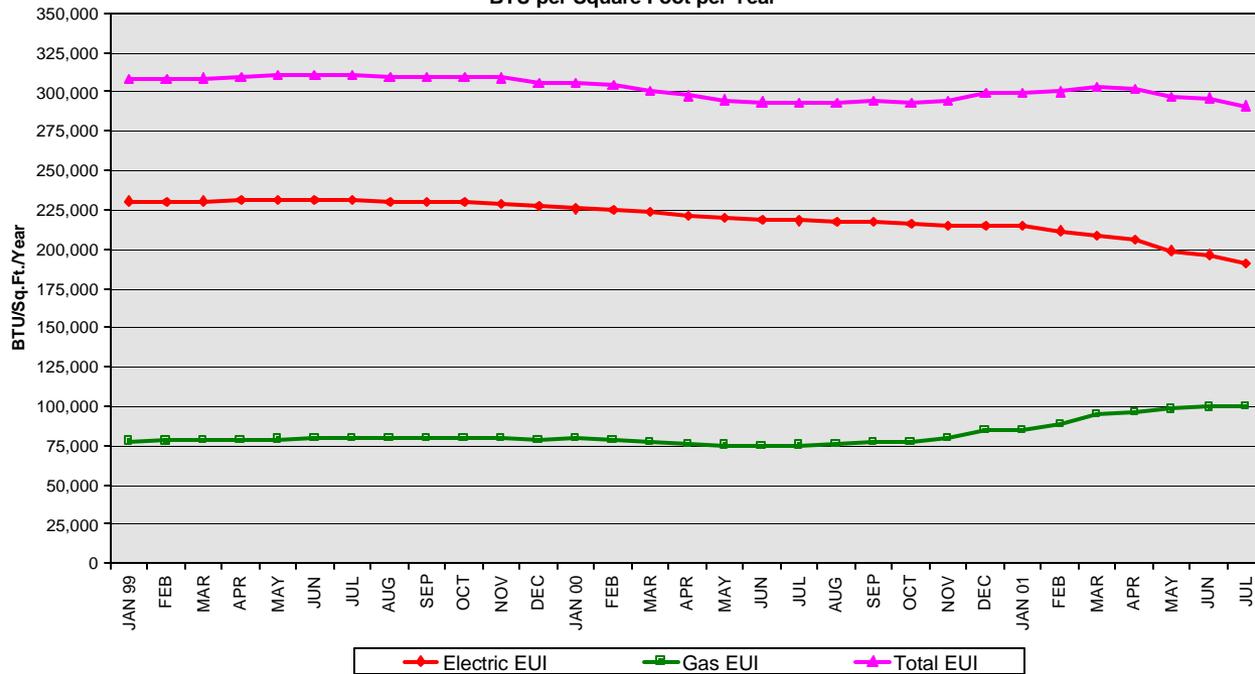
- Sizing
- Energy Efficient
- Maintenance



# Consumption Trends

## Energy Use Index

BTU per Square Foot per Year



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## *Measurement & Verification*

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- A. Partially Measured Retrofit Isolation
  - Measurement & Stipulations
- B. Retrofit Isolation
  - Field Measurement at System Level
- C. Whole Facility
  - Monitor at Utility Meter Level
  - Simple Comparison or Regression Analysis
- D. Calibrated Simulation
  - Computer Simulation of Energy Performance
  - Calibrated with Utility Meter Data if Possible



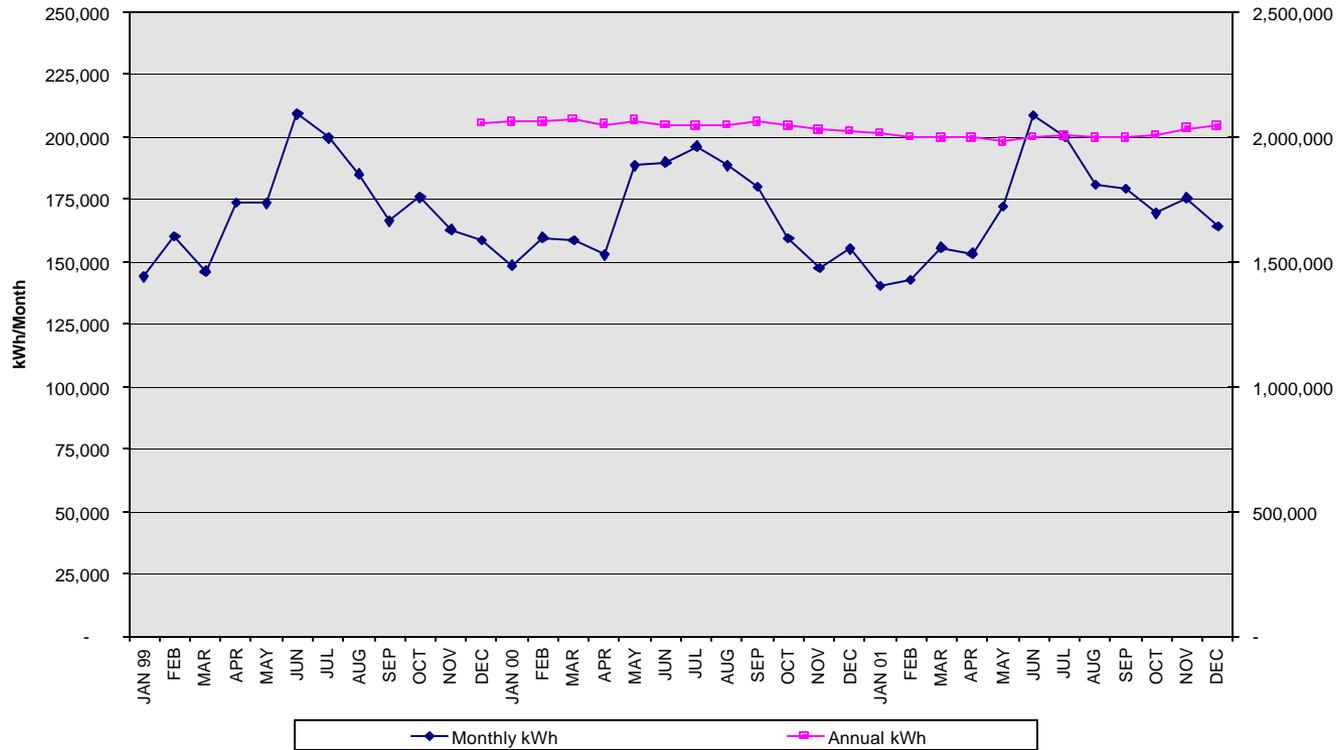
## *Option C – Whole Facility*

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- Calculate Avoided Cost
- Compare to Base Year Consumption
- Determine Energy Savings
- Convert Energy Savings to Dollars
- Weather Correct if Necessary



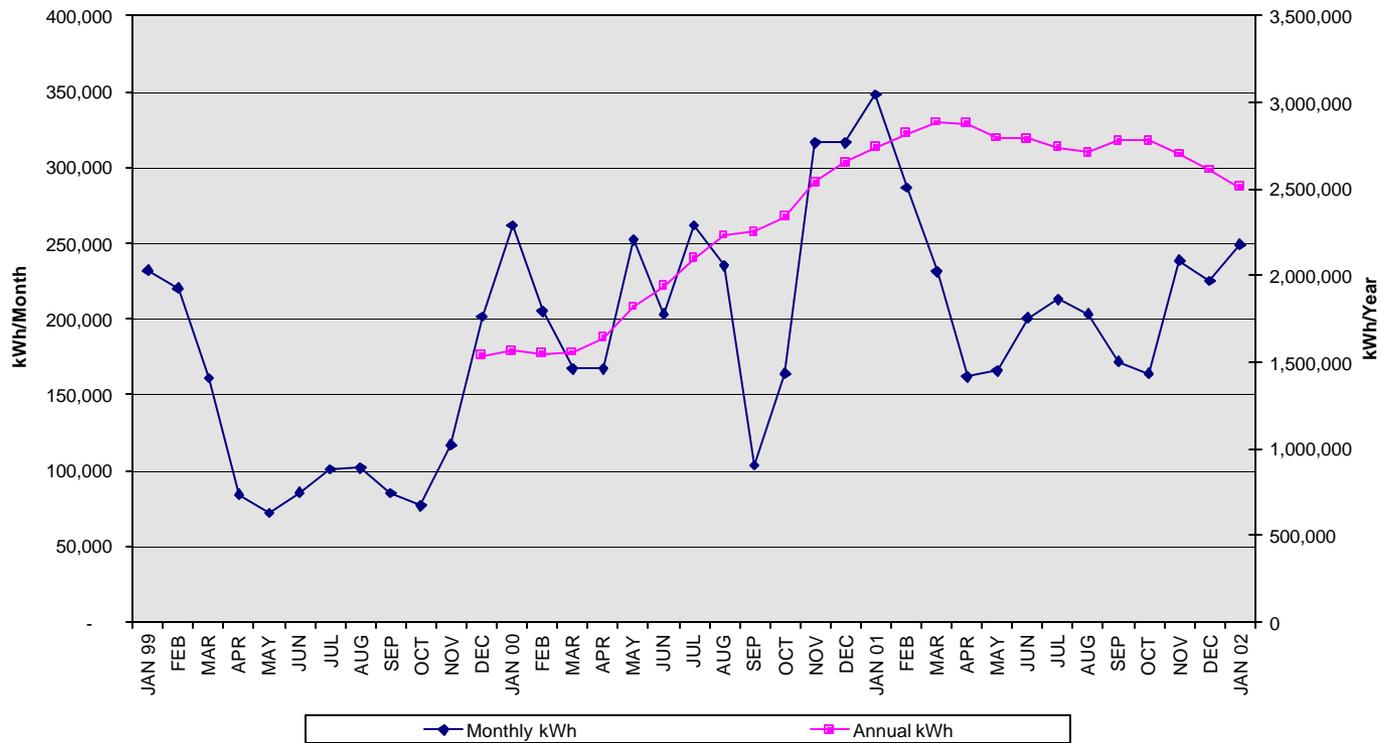
# #1 Facility Electricity Use



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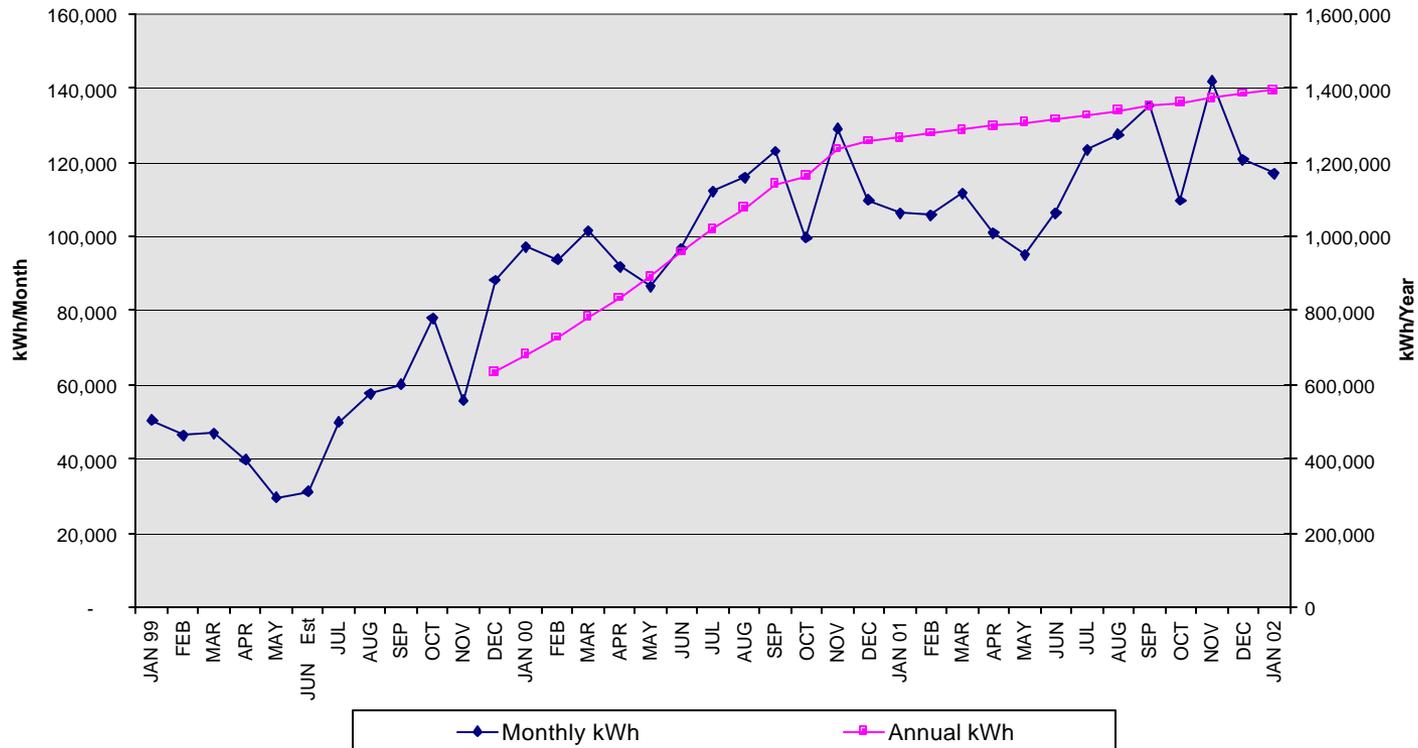
## #2 Facility Electricity Use



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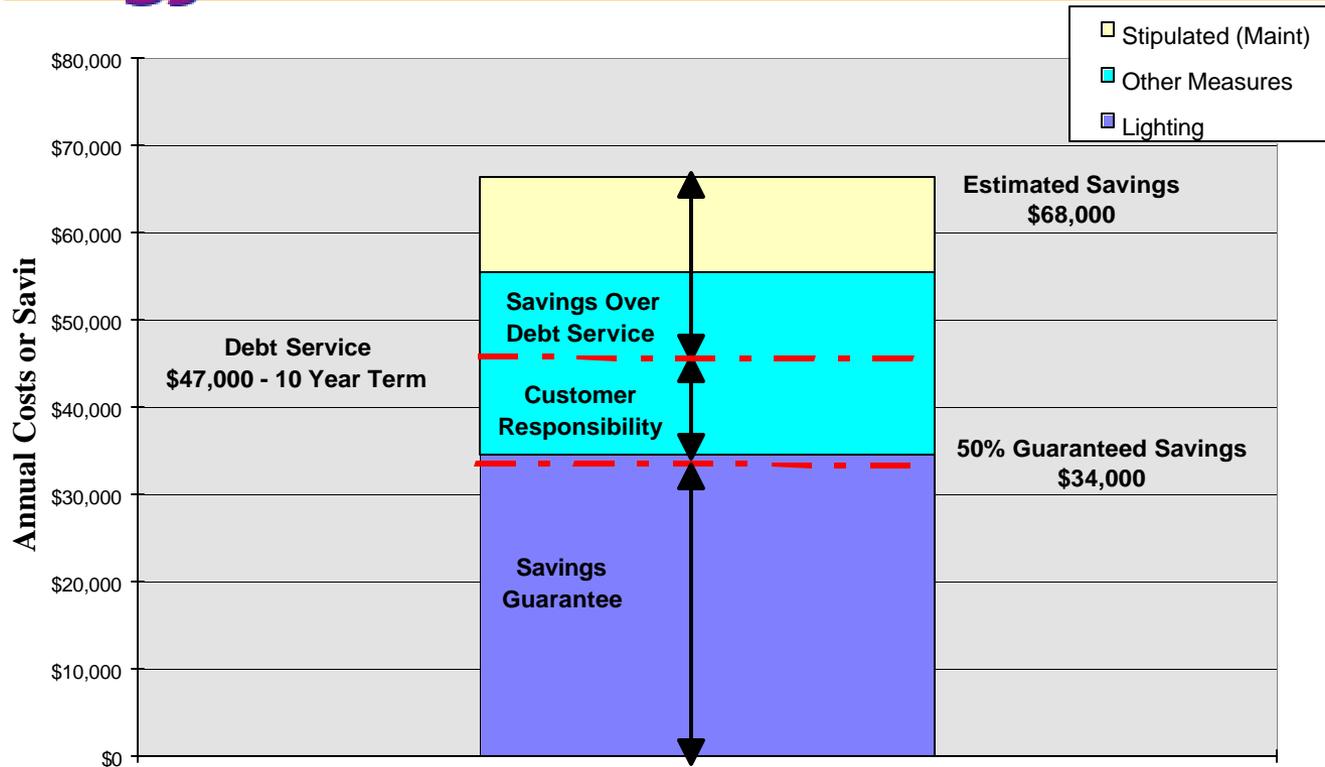
## #3 Facility Electricity Use



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# Estimated Savings & Guarantee



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## *Successful Energy Management*

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