Facility Savings Opportunities Possible Through Utility Cost Reduction Strategies

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Many savings opportunities exist in the reduction of utility costs. The key to a firm's ability to identify and assess specific opportunities is knowledge—utility cost reduction knowledge. It is necessary to have a well planned and executed utility cost reduction strategy in order to trim down expenditures and risks without the need for major capital outlays. Choosing to ignore utility costs will only cause preventable cost and usage risks to continue

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FIRST STEPS IN ANALYZING UTILITY COSTS

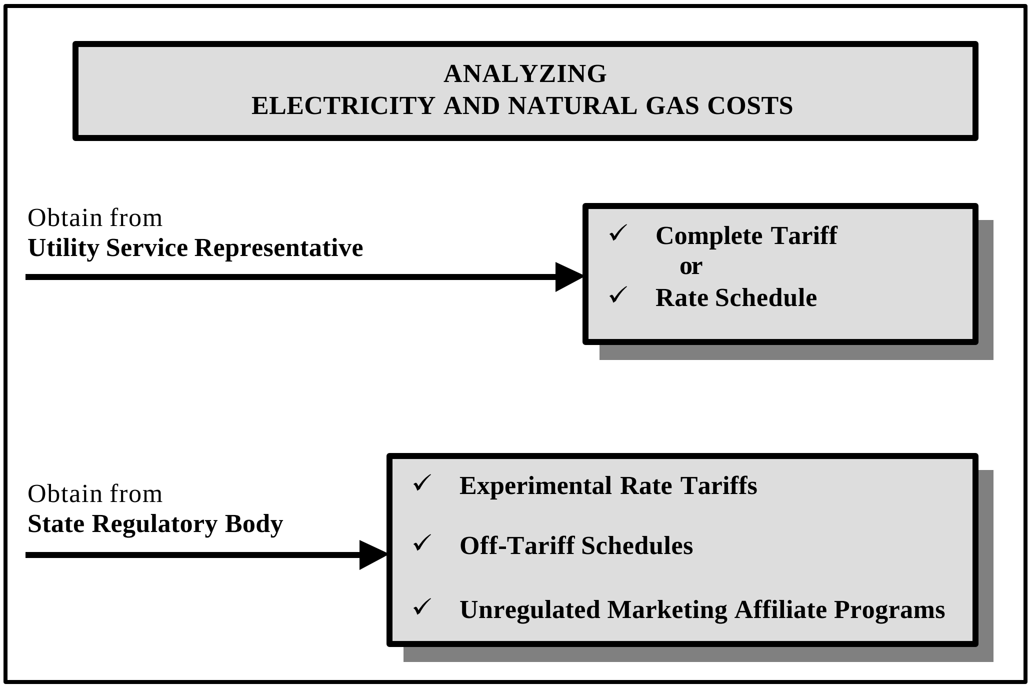

Figure 1: Items Needed to Analyze Utility Costs

THE FUNDAMENTALS OF ELECTRICITY COSTS

Components of Electricity

1. Voltage level
2. Demand level (kW)
3. Usage (kWh)
4. Power factor percent
5. Load factor percent

Voltage Level¾ Its Impact on Electricity Costs

Many small and medium size companies are taking over a service once provided solely by the electric utility. That service is the conversion of high voltage power, which runs through a utility's transmission lines (128,000, 69,000, 4,100 volts, etc.), to the low voltage (440, 220, 110 volts) used by most customers. These companies are accomplishing this as a result of purchasing or leasing transformer installations. When a customer switches to a so-called *primary or high voltage rate* from a *secondary or low voltage rate*, the electric utility costs are then reduced.

In utility tariff/rate schedules, where voltage level is a specific billing component, typical savings can range from 2%–8% of the total electrical costs when comparing primary to secondary voltage delivery levels. The cost to convert to primary from secondary service varies greatly but the cost can be minimized when transformers can be purchased/leased at the depreciated value from the serving utility company.

WHAT UTILITY PROCEDURES TO PERFORM THAT IDENTIFY SPECIFIC VOLTAGE LEVEL COST DIFFERENTIALS

1. Have the utility company calculate the potential for annual savings by switching from secondary to primary voltage levels, if this is an option available. (There should be no charge by the utility for doing this analysis.)

2. Have the utility company provide the depreciated value of the transformation equipment necessary to convert to primary voltage. Utilities generally depreciate uniformly over 30 to 40 years.

3. Determine the most economical method to convert to primary voltage as follows:

   (a) Purchase transformation equipment from serving utility at depreciated value.

   (b) Lease transformation equipment from the serving utility or third party non-utility provider, if allowable by the tariff schedule.

Demand¾ Its Impact on Electricity Costs

Demand (kW)—as it applies to an electrical system is defined as, *the rate at which electric energy is delivered to or by a system, part of a system, or a piece of equipment expressed in kilowatts (kW), kilovoltamperes (kVA), or other suitable units as a given instant or average over a designated period of time.* The primary source of demand is the power consuming equipment of a consumer.

Peak or maximum demand charges are applied to the maximum demand for energy required by a system in a given period. Utilities generally charge a monthly fee based upon the maximum quantity of power (generally expressed as kilowatts) averaged in a given period of time, generally either a 15- or 30-minute interval.

The peak or maximum demand charge can vary from less than $2.00 to over $30.00 per kilowatt per month. The reduction of these peaks can result in sizeable savings. Many times a revision in how and when equipment is turned on or off can be all that is needed to reduce the monthly demand charges. In other instances, a computer controlled energy management system can be installed which will anticipate and adjust varying energy usages to reduce peak demands.

What To Do?

1. Determine current peak demand and the monthly charges related to it. (This information can generally be obtained from the monthly utility bill.)

2. Contact the utility and request that a strip chart recorder be installed in the system for at least a one-month period. The purpose of this recorder is to document, in strip chart form by day and time-of-day, the variations in the electrical demand of the system being analyzed.

   When the recorder chart strip is received, it will look very similar to an electrocardiogram in that it will show the peaks and valleys caused by changing demands. When the chart strip is analyzed, try to determine if there are widely variable peak patterns from demand integration period to demand integration period.

   If there are widely variable patterns, determine what is happening at those times that cause the peaks to occur. Example: start of a work shift, employee break or lunch times, equipment testing, etc. Once the information is received on the peak periods, a determination should be able to be made as to what corrective action can be taken.

Usage (kWh) ¾ Its Impact on Electricity Costs

The definition for usage is—*a function of connected load, times hours of usage; one kWh = 1000 Watts sustained for a one hour period.*

For example:

- (10) 100-watt incandescent lamp bulbs operated for one hour would result in the use of one kWh of electrical energy and one kW of demand.
- (1) 1,000-watt piece of equipment operated for a one-hour period would result in the use of one kWh of electrical energy usage and one kW of demand.

What To Do?

1. Reducing usage (kWh) of electricity requires the utilization of more energy-efficient equipment or a reduction of the quantity and/or time of operation of individual pieces of electricity-utilizing equipment.

2. Each individual analysis for usage (kWh) reduction will be different based upon the peculiarities of a given situation. But in general, there will be common items of investigation that will be utilized in all such analysis.

3. The following is a list of 10 basic items of frequently considered strategies for reducing electricity usage (kWh).

REDUCING ELECTRICITY USAGE

Items to Consider in Reducing Electricity Usage (kWh)

1. Chiller selection
2. Efficient exit signs
3. Electronic ballasts
4. Heating system options
5. Heat recovery
6. High-efficiency motors
7. Occupancy sensors
8. Part-load efficiency
9. Project design criteria
10. Variable-speed drives

Power Factor (Efficiency) ¾ Its Impact on Electricity Costs

Technically stated, power factor is: *the ratio of real power ¾ kilowatts (kW), to apparent power ¾ kilovoltamperes (kVA) for any given load and time; and, generally is expressed as a percentage ratio.* Simply stated, *power factor is the efficiency at which electricity is consumed.*

Example:

Utility-delivered real power	750 kVA
Customer peak demand	600 kW
PF – 600 kW ÷ 750 kVA = .80	(80% PF)

Power factor corrections (improvements) do not change customer peak demand (kW) levels. The correction relates to utility-delivered real power (kVA) levels in relation to customer peak demand levels (kW).

Since utility companies provide electrical energy in units of kilovoltamperes (kVA), and a customer's usage is generally measured in kilowatts (kW). Power factor, or relative efficiency, of the customer's usage may be charged for based upon some utility predetermined minimum factor (typically 80–90%). If this is the case, a customer can be paying for demand (kW) not actually utilized.

What To Do?

1. Determine whether the utility company utilizes "power factor" in calculating their total electricity billing.

2. If below minimum power factor surcharges are imposed, determine how much they are. Discussions with the utility service representatives can help to determine what these charges are if they are not apparent from the monthly utility billing.

3. In conjunction with the utility company, determine the amount of power factor capacitance correction that is required for the specific system. Generally, the utility

company will install the required capacitors if they can be installed at the main electrical distribution point. There is generally a charge for this but it may be best to have a utility company do the installation since they will be familiar with the process. Also, capacitors can be purchased or leased from third-party suppliers.

4. Calculate the payback by comparing the monthly below minimum power factor surcharge with the cost of installing the correction capacitors. In many cases, payback will be less than one year.

Load Factor Level¾ Its Impact On Electricity Costs

Load factor is usually defined as—*the ratio of peak demand (kW) to total usage (kWh) during a measured period.* Load factor's typical calculation period is per month; however, it can be calculated per day (24 hours), per week (168 hours), per month (720 hours), or per year (8,760 hours). To calculate load factor, the total usage (kWh) during the period is divided by the peak demand (kW) calculation factor.

Example:

Load factor period	Monthly (720 hrs)
Total usage (kWh) during the period	300,000 kWh
Peak demand (kW) during the period	500 kW

Calculation:

300,000 kWh ÷ 360,000	(500 kW × 720 hrs)
300,000 ÷ 360,000 = .83	(83% Load Factor)

- The higher the load factor the more efficient is the usage of electricity
- Load factor has no relationship to power factor

What To Do?

1. Reduce demand (kW) in relation to usage (kWh).
2. Shift demand (kW) to off-peak (non-registration / billing period).
3. Determine whether Real Time Pricing is available from the electric utility. Real Time Pricing generally has no incrementally specified / billed demand (kW) component.

THE FUNDAMENTALS OF NATURAL GAS COSTS
Units of Measurement

THERMAL (HEAT) VALUE	
THERM (Therm)	100,000 Btu
DTH (Dekatherm) (10 Therms)	1,000,000 Btu
MMBtu* (One thousand, thousand Btu) (10 Therms)	1,000,000 Btu
VOLUMETRIC (At 14.70 psi at 60º Fahrenheit)	
CCF (100 cu ft)	Approximately 100,000 Btu (approx. 1 Therm)
MCF (1,000 cu ft)	Approximately 1,000,000 Btu (approx. 1 Dekatherm)

Figure 2:Thermal and Volumetric Units of Measurement

1. Generally, (1) Mcf of natural gas contains 3% more Btu than does (1) Dth/MMBtu of natural gas. (1 Mcf = 1,030,000 Btu) (1 Dth/MMBtu = 1,000,000 Btu)

2. Since natural gas heat content varies greatly depending upon many factors, the 3% differential is only a guideline.

3. Generally, Dth/MMBtu and Mcf can be used interchangeably in most cost estimating procedures, but when determining monthly billing volumes, actual Btu's delivered must be calculated.

British Thermal Unit (Btu)

The quantity of heat necessary to raise the temperature of one pound of water one degree Fahrenheit from 58.5 to 59.5 degrees Fahrenheit under standard pressure of 30 inches of mercury at or near its point of maximum density. One Btu equals 252 calories, (gram), 778 foot-pounds, 1,055 joules or 0.293 watthours.

USAGE VARIABLES
Characteristics of Usage Variables

1. Yearly
2. Monthly
3. Daily
4. Hourly

Usage Variables¾ Its Impact on Natural Gas Costs

Usage is the way a customer consumes natural gas and can have a drastic effect on their costs. Natural gas does not have as many distinct variables as electricity, but this does not mean that natural gas has any fewer cost reduction opportunities than the more easily categorized specifics in electricity.

Yearly Variables

Yearly variables include those variables that tend to be seasonal (Spring, Summer, Fall, Winter, etc.). In some instances, it may be difficult to completely manage/control these variables. This does not mean that these variable/cost relationships should not be thoroughly investigated for potential savings opportunities.

Monthly Variables

Monthly variables may include seasonal changes but more often are related to internal usage changes. Typically, these types of variables will not be consistent in their frequency or magnitude since they typically occur due to changes in operational characteristics of the facility involved.

Daily Variables

Daily variables can be very large, actually over 100% in some instances. These variables sometimes are unavoidable but may include seasonal changes; however, more often are related to internal usage changes.

Hourly Variables

Hourly variables strange as it may seem, hourly variables may be causing as many or more cost penalties than do daily, monthly, or yearly variables. The reason for this is that some natural gas local distribution companies (LCD's) and/or marketers calculate at least part of their charges based upon the maximum hourly natural gas demand or throughput in a given billing period. This type of cost is similar to the demand billing (kW) utilized in electricity.

What To Do?

Analyze and evaluate overall natural gas usage patterns on an hourly, daily, monthly, and yearly basis. To be able to do this, the previous 12-month billing history that includes incremental usage data must be available and be analyzed. This process should identify whether large variables are present on a historical basis.

While this information is of value, ongoing ability to access this type of information is almost a "must." This will require digital interval recording meters that are generally available from the serving LCD on a free or rental basis.

REQUIRED SERVICES

Types of Services

1. Firm
2. Interruptible

Choosing the Correct Service ¾ Its Impact on Natural Gas Costs

The type of natural gas service required—*firm/interruptible*—has a large impact on total natural gas costs. An understanding of what the term "firm" as opposed to "interruptible" service represents is critical in being able to make a knowledgeable evaluation of which service to utilize.

Firm/Interruptible Service In No Way Impacts ¾

1. Natural gas quality
2. Origination point
3. Delivery process/routing

Firm Service and Possible Interruptions

1. Force Majeure conditions can interrupt natural gas flow.
2. Customer class can cause interruption in natural gas flow.
3. No *firm* service is 100% firm or non-interruptible.

Interruptible Service and Possible Interruptions

1. Understand what is the basis for interruption:
   (a) Gas producer
   (b) Interstate pipeline
   (c) Intrastate distribution, etc.
2. Know the history of actual interruption occurrences—
   (a) How many per year (past 10 years)
   (b) How long were interruption periods (past 10 years)
   (c) When interruptions occurred (past 10 years)
   (d) Future projections for whatever causes interruptions to occur
   (e) Remember that some interruptible service is more interruptible than others are.

WHERE TO START TO DETERMINE ELECTRICITY/NATURAL GAS SAVINGS OPPORTUNITIES

Basic Electricity/Natural Gas Data

Basic data required for accurately evaluating electricity/natural gas savings opportunities:

1. Complete utility billing copies
2. Complete serving utility tariff/rate schedules
3. Complete serving utility deregulated commodity delivery tariff rate schedules, if applicable
4. Listing of qualified, approved, service-area active, etc. marketers of deregulated electricity/natural gas commodities
5. <u>Analyze savings opportunities</u>

Where to Obtain Required Tariff/Rate Data

Utility regulated rate and deregulated commodity delivery tariff/rate schedules and listings of qualified, approved, service-area active, etc. marketers can be obtained at one of the following locations.

1. Serving utility website
2. Serving utility service representative
3. State Utility Regulatory Agency

ELECTRICITY/NATURAL GAS DEREGULATION

What is Electricity/Natural Gas Deregulation?

Deregulation

Deregulation as it applies to electricity/natural gas is—*the removal of the commodity cost portion of the utility billing from the serving utility retail rate so that the retail customer can arrange for commodity purchase through an independent third-party.*

Third-party providers can competitively price the deregulated-commodity portion of the retail rate. Normal regulatory implications in the remainder of the retail rate are not affected/changed by deregulation.

What Does Deregulation Affect?

1. Electricity—the commodity cost portion of the serving utility retail electricity rate is typically 20%–50% of the total electricity cost.
2. Natural Gas—the commodity portion of the serving utility retail natural gas rate is typically 50–70% of the total natural gas cost.
3. Deregulation affects the commodity portion of the serving utility retail rate ONLY.

ELECTRICITY DEREGULATION

DEREGULATED

1. **Electricity Supply** ← **<u>PRICE POINT NO. 1</u>** (Commodity cost)

2. **Agent Charge**

REGULATED - FEDERAL

3. **Interstate Transmission Grid**
   - Usage Charge
   - Line Loss Charge
   - Fees and Taxes
   - Miscellaneous Access Charges

4. **Serving Utility Receipt Meter Point** ← **PRICE POINT NO. 2** (Total Costs for Items #1, 2, & 3)

REGULATED - STATE

5. **Serving Utility Intrastate Distribution Grid**
   - Demand Charge
   - Intrastate Distribution Costs
   - Distribution Line Loss
   - Transformation Costs
   - Customer Meter Costs
   - Stranded Investment Recovery Costs
   - Miscellaneous Fees/Costs

6. **Customer Meter Use Point Charge** ← **<u>PRICE POINT NO. 3</u>** (Total Costs for Items #1, 2, 3, 4 & 5)

Figure 3: Deregulated Electricity Flow Chart

STATUS OF ELECTRICITY DEREGULATION IN THE UNITED STATES

DEREGULATION LEGISLATION ENACTED¾ (24)			
Arizona	Maine	New Hampshire	Oregon
Arkansas	Maryland	New Jersey	Pennsylvania
Connecticut	Massachusetts	New Mexico	Rhode Island
Delaware	Michigan	New York	Texas
District of Columbia	Montana	Ohio	Virginia
Illinois	Nevada	Oklahoma	West Virginia

Note: Deregulation legislation enactment in a state does not necessarily mean that all utilities in that state are fully deregulated at this time.

DERGULATION INVESTIGATION ONGOING¾ (18)		
Alaska	Louisiana	South Carolina
Colorado	Minnesota	Utah
Florida	Mississippi	Vermont
Indiana	Missouri	Washington
Iowa	North Carolina	Wisconsin
Kentucky	North Dakota	Wyoming

DEREGULATION NOT INSTITUTED FOR ANY USER¾ (8)	
Alabama	Kansas
Georgia	Nebraska
Hawaii	South Dakota
Idaho	Tennessee

DEREGULATION/RE-REGULATION¾ (1)
California

Figure 4: Electricity Deregulation in the United States

NATURAL GAS DEREGULATION

DEREGULATE

1. **Natural Gas Supply** ← **PRICE POINT NO. 1** (Commodity Cost)

2. **Agent Charge**

REGULATED - FEDERAL

3. **Interstate Pipeline System**
   - Usage Charge
   - Pipeline Loss Charge
   - Fees and Taxes
   - Miscellaneous Access Charges

4. **City Gate Receipt Meter Point** ← **PRICE POINT NO. 2** (Total Costs for Items #1, 2, & 3)

REGULATED - STATE

5. **Serving LDC Intrastate Pipeline System**
   - Intrastate Distribution Costs
   - Pipeline Loss Costs
   - Customer Meter Costs
   - Miscellaneous Fees/Costs

6. **Customer Burner Tip Meter Point Charge** ← **PRICE POINT NO. 3** (Total Cost for Items #1, 2, 3, 4, & 5)

Figure 5: Deregulated Natural Gas Flow Chart

STATUS OF NATURAL GAS DEREGULATION IN THE UNITED STATES

DEREGULATION LEGISLATION ENACTED ¾ (5)	
New Jersey	Ohio
New Mexico	West Virginia
New York	

Note: Deregulation legislation enactment in a state does not necessarily mean that all utilities in that state are fully deregulated at this time.

DERGULATION INVESTIGATION ONGOING¾ (2)	
Maine	Oklahoma

*DEREGULATION FOR SMALL USERS NOT INSTITUTED **DEREGULATION FOR LARGE USERS INSTITUTED ¾ (18)		
Arizona	Minnesota	North Dakota
Connecticut	Mississippi	Rhode Island
Florida	Missouri	Tennessee
Indiana	Nevada	Texas
Iowa	New Hampshire	Utah
Kansas	North Carolina	Washington

*DEREGULATION FOR SMALL USERS PARTIALLY INSTITUTED **DEREGULATION FOR LARGE USERS INSTITUTED ¾ (10)				
California	Kentucky	Massachusetts	Montana	South Dakota
Delaware	Maryland	Michigan	Pennsylvania	Vermont

DEREGULATION FOR ALL USERS PARTIALLY INSTITUTED ¾ (8)			
Colorado	Georgia	Nebraska	Wisconsin
District of Columbia	Illinois	Virginia	Wyoming

DEREGULATION NO INSTITUTED FOR ANY USER ¾ (8)			
Alabama	Arkansas	Idaho	Oregon
Alaska	Hawaii	Louisiana	South Carolina

*Small user, typically residential/small commercial customers
**Large users, typically medium/large commercial/industrial customers

Figure 6: Natural Gas Deregulation in the United States

WHAT TO DO NOW TO CONTROL AND REDUCE ELECTRICITY / NATURAL GAS COSTS

BECOME PROACTIVE!

Doing nothing **will increase** your electricity/natural gas costs and risks.

What You Must Have, Understand, and Manage to Control and Reduce Utility Costs

1. Have and understand cost/usage data
2. Understand current status of utility deregulation
3. Understand individual facility utility usage characteristics
4. Manage commodity cost/usage

What You Need to Understand, Develop, and Consider Internally to Control and Reduce Utility Costs

1. Understand commodity and energy service contracts and their long-term implications
2. Develop and energy strategy
3. Consider internal facility organizational factors

What To Do Now?

Begin by ¾ Developing a Utility Cost Control / Reduction Strategy

1. Knowing your current utility costs
2. Assessing your savings potentials
3. Utilizing internal/external expertise to reduce utility costs

AREAS TO REDUCE COSTS

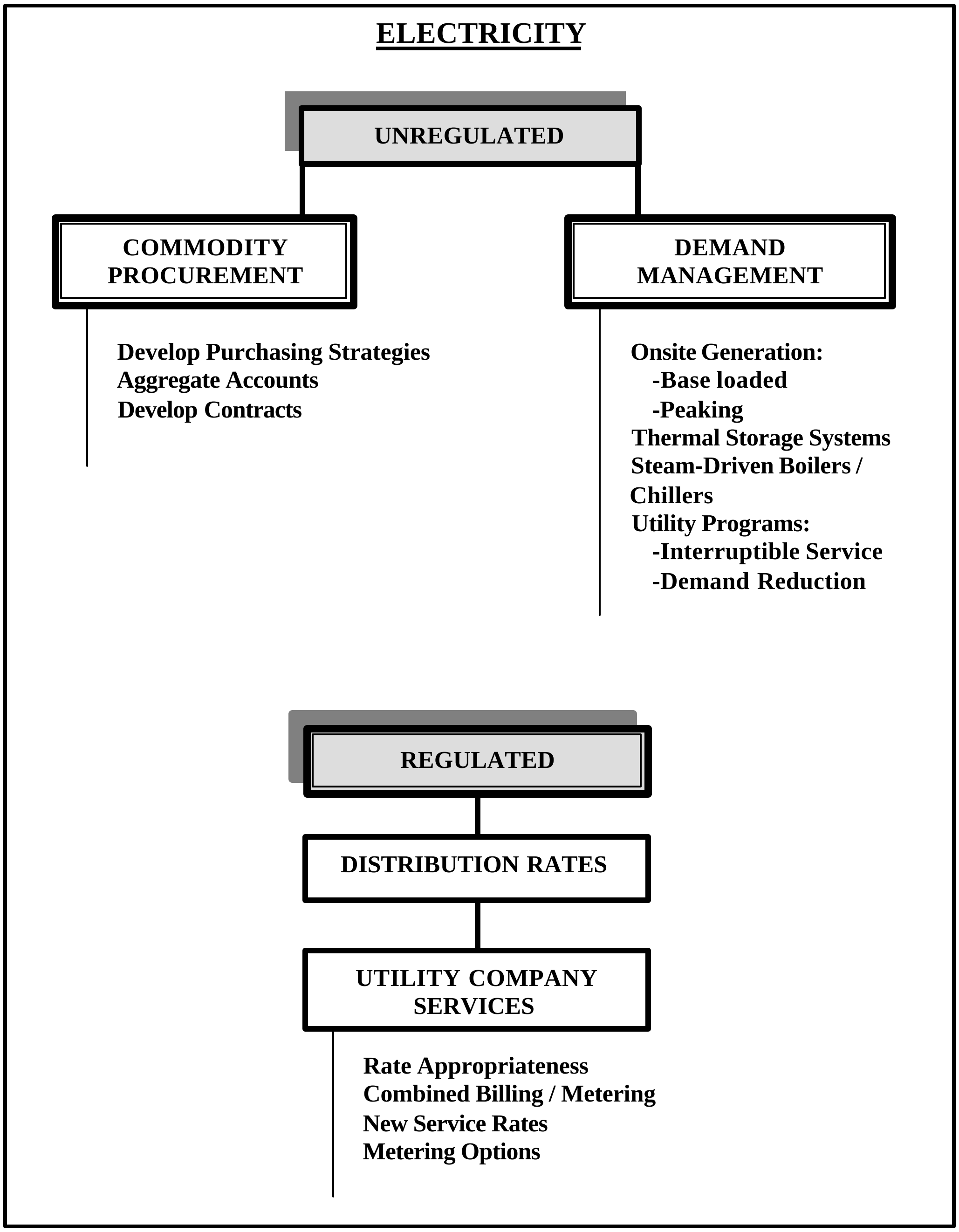

Figure 7: Areas to Reduce Electricity Costs

AREAS TO REDUCE COSTS

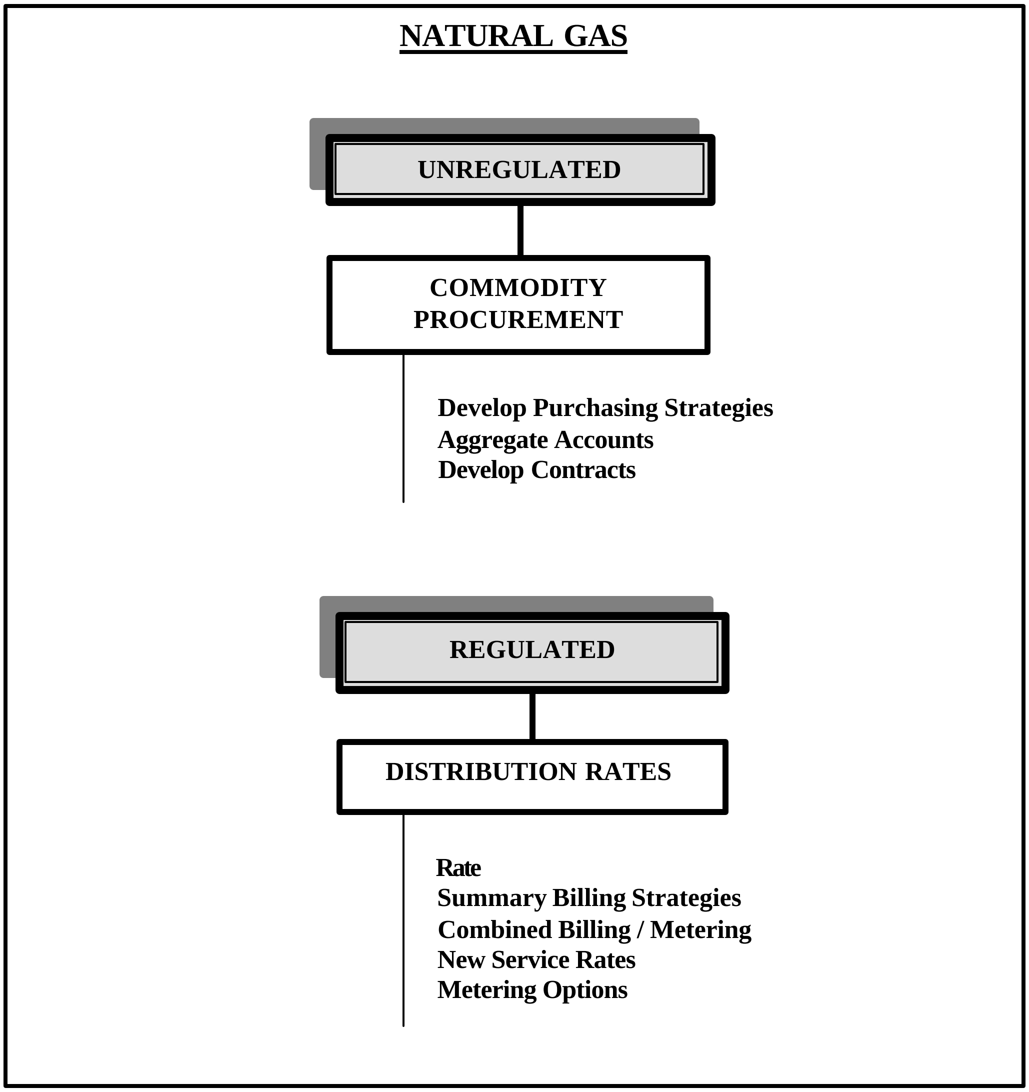

Figure 8: Areas to Reduce Natural Gas Costs

ACTUAL UTILITY COST REDUCTION EXAMPLES

1. Major State University
2. Manufacturing Organization
3. Nationwide Financial Institution

Major State University Campus Example

Overview:

A state University campus with a single utility, natural gas account to serve all campuses' primary heating requirements with annual natural gas costs of over $1.25 MM. This is a typical heating customer with primary natural gas usage during winter months.

Goals:

(1) To reduce annual natural gas costs
(2) To ensure the same reliability of commodity and delivery as currently available through the serving LDC (local distribution company)

Issues:

(1) Program for customer transportation of natural gas not in place (both natural gas and distribution services purchased through LDC)
(2) How to remain competitive in natural gas costs

Solutions:

(1) Determined natural gas requirements including volume and type of service (Firm or Interruptible); and, determined tolerance for interruptions in supply
(2) Reviewed utility rate options:
  a) Interviewed local natural gas utility for optional services
  b) Solicited qualified supplier proposals
  c) Negotiated reduced cost of natural gas through the local natural gas utility without the need to change any services requirements
(3) Contracted fixed price of natural gas through the winter heating season, eliminating the exposure to typically higher winter prices

Overall Natural Gas Cost Reductions:

10%
or
$125,000 per year

Figure 9: Actual Savings for Major State University

Manufacturing Organization Example

Overview:

Diversified components manufacturer with annual utility costs of approximately $8MM in over 20 locations nationally.

Goal:

(1) To reduce utility costs
(2) Complete the procurement of electricity without subjecting operations to any new risks

Issues:

(1) Higher cost of electricity than competitors in other regions of USA
(2) Zero tolerance for interruptions in productions schedules
(3) Multiple plants with varying degree of historical information
(4) No historical record of electricity supplier's abilities to fulfill electricity commodity contract obligations
(5) Significant deterioration of electricity service due to mergers of utility companies serving the client [this affected the level of service (constantly changing Reps) and the client's utility accounts numbers]

Solutions:

(1) Performance commodity contract with marketer to provide electricity ($6MM total), where separate client accounts were aggregated for greater delivery volume tolerances, thereby significantly reducing the potential to pay peak hourly electricity commodity costs in summer.
(2) Negotiated electricity commodity supply price based on actual generation costs <u>not</u> based on historical rates paid.
(3) Rate opportunities:
    a) Changed one facility to Primary for a 6% annual savings
    b) Requested another rate change that reduced annual account cost 6%
(4) Looking at onsite generation opportunities since many sites are on adjacent properties where client could serve more than one plant's needs through one generator.

Overall Electricity Cost Reductions:

5 - 7%
or
$400,000 / $560,000 per year

Figure 10: Actual Savings for a Manufacturing Organization

Nationwide Financial Institution

Overview:

One of the top 25 largest financial institution in the USA with annual utility costs of over $18MM

Goal:

(1) To take control of utility and energy costs and reduce corporate facility operating costs and risks

Issues:

(1) Many small commercial accounts (1200 branches and 1600 ATMs)
(2) 25 large commercial accounts (offices, computer centers, credit card processing, etc.)
(3) Managing late payments on utility bills required significant internal resources
(4) Combination of facilities that are—direct ownership, leased, and/or leased with utility bill payment responsibility
(5) Combination of different facilities brought together through years of acquisitions
(6) Lack of in-house energy expertise
(7) No dedicated resources for solving energy issues
(8) No internal data other than through Accounts Payable
(9) Strong facility management organization interested in reducing utility costs

Solutions:

(1) 'Bundled' solution for—utility bill payment, commodity and rate savings efforts, and/or energy projects (guaranteed savings offers from vendors between $2.2MM and $2.5MM over five years)
(2) Data needed to quickly turn raw data into useful, ongoing information - the prime use of a Utility Bill Payment System fulfilled their need
(3) Commodity:
   a) Needed utility information to do commodity procurement
   b) Did an arrangement with marketer (will save over 5% on commodity costs)
(4) Energy Projects:
   a) Implemented corporate-wide energy efficiency program (guaranteed cost not to exceed $3MM, with guaranteed savings of $2MM per yr)
(5) Contractually-assured guaranteed savings and acceptable method to calculate savings:
   a) Reduced the exposure to typical high price of natural gas in winter for all facilities
   b) Reduced risk of electricity commodity price spikes for typical air conditioning requirements in summer periods

Overall Energy / Utility Cost Reductions

13% or
$2,370,000 per year

Figure 11, Actual Savings for a Nationwide Financial Institution