Energy Planning: Use Deregulation Also as a Tool

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ABSTRACT

In the 36 years since the oil embargo, a systemic approach to energy management and a comprehensive national program should have been very common features in our lives today. Unfortunately, efforts are still sporadic among most of the industry captains managing our energy resources. National programs mandated by executive orders are often met with resistance or a legally minimum level of compliance. For organizations with an effective program in managing their energy resources, it is mostly developed and practiced by isolated initiatives of individuals or groups within the organization. This article will try to make a case of how the overall culture needs to change, because if the 70s wake-up call in embargo is not properly heeded, deregulation may be a ruder second shock to many facility owners, energy planners, managers, and corporate suites. We have not seen the full impact that deregulation can have as yet; it will come as demand outpaces supply by a margin approaching about 5%. Deregulation will cause both positive and negative experiences, as has been seen in different parts of the country, and will evolve through these experiences as the market stabilizes. The driving theme of the article is that through these changing times, deregulation can pay good dividends to those who use the opportunities as tools in new market dynamics.

Success of deregulation lies in truly freeing the market dynamics, and it depends more on the forces from the demand side that we energy users can bring to bear on the market than it does from the supply side. The market is going to be more dynamic in the future, and for energy users to fully realize the positive results in this new setting, a new criterion of planning and management has to evolve. This author feels strongly that we owe it not only to our organizations' financial interests but also to the nation's goal of energy independence. It is imperative that we use deregulation as a force to harness in our favor and as an incentive to redefine our energy

performance profiles. Real case scenarios will be presented as appropriate to support the narrative logic.

INTRODUCTION

America's industrial progress through the last century and its ascension to global leadership came from the visions and hard work of industry pioneers like Ford, Edison, Firestone, and many others. Their efforts are widely known. It was also greatly helped by the abundance of natural resources in the country, allowing US production costs to be much lower than that of other countries during the post-World War growths. Little attention was paid to that detail, with the abundance and the low cost for industrial production perhaps being taken for granted, along with some complacency about any possible turn of the tide. This industrial progress could not have been possible without the means of harnessing energy into the right channels. History shows by milestones that, as energy was harnessed from early steam engines to electrical power generation, mass transportation, and other iconic features of the developed nations, industrial progress gained momentum. Natural gas and oil exploration came later and did not get to the production rates of recent times until the mid-1950's and 60's, after automobiles and road transportation became symbolic of the American lifestyle. Cost of energy was always a part of production costs, and with demand from domestic consumption on the rise, it started inching up. It still rose at a slower rate than the rest of the industrialized world because, once again, of the abundant resources in the US. Some political agreements further subsidized the oil costs, which kept the cost of energy at the point-of-use at an artificially low level relative to other nations. As a nation, we were lulled into treating energy cost as a small or insignificant component in our business and in our daily habits. At that level of cost burden, in those days there was neither any incentive nor any concern to even think of any future energy planning. Those were the happy days—with huge, heavy cars with long fins, a 400CID engine, and a 4-barrel carburetor. We always said, "Fill'er up," paid five dollars for a full tank, and got a free coffee mug. Our industry captains did not think much about an energy policy, either.

And then came the Arab oil embargo; it was October 1973. By October 20, all Arab countries had joined the embargo. [1] The thrust of the oil embargo was directed primarily at the US by OPEC (then OAPEC) by cutbacks in Arab oil production and choking the supply. Having nothing to do with technology, it was a retaliatory measure for the role the US played in a faraway war. As US dependence on foreign oil was already fairly high, this caused the oil price (and cost of energy) in the US to rise dramatically overnight, and it stayed high for almost a year, until OPEC relaxed it in 1974. The crude price quadrupled immediately, the market crashed in 1973-74, and it took almost a decade before regaining our balance from that shock.

It is relevant today to look back and examine what we have done as a nation from 1973 to today. US leadership among the industrialized nations with regard to high technology and an innovative and competitive spirit shows only in scanty fragments of progress in our energy initiatives in the 36 years since that embargo. To be clear, this article is not to decry the initiatives taken to date but as a reminder—perhaps an alert—that we have not done enough as a nation to overcome the threat the embargo has posed on us. As noted in the synopsis, deregulation will bring another shock wave to energy users unless we as consumers take charge in planning our futures, simply because there is no comprehensive and cohesive national plan on which we can rely. This article uses history as context to stress the need for energy planning from the demand side of the market. Let us look at what have we done since 1973, first at the national level then at the consumer level.

BACKGROUND

Just a month after the embargo, President Nixon announced "Project Independence,"[2] stating its main theme to: (1) achieve independence from foreign oil by 1980, (2) complete a Trans-Alaska pipeline, and (3) initiate conservation efforts. This was followed by Presidents Ford and Carter with lower highway speed limits, thermostat controls, etc. President Carter created the US Department of Energy. These could have been the seeds for a national energy policy for the US, but the initiatives fizzled shortly after OPEC eased the supply line in 1974.

We did not achieve oil independence in 1980, nor in the 30 years since, going instead in the opposite direction. Our share of energy imports has gone up, not down. US exploration has improved on natural gas but not on oil. As population has increased and the GDP expanded in the last few decades, demand for energy has steadily risen in all forms—crude oil, electricity, and natural gas, and in all sectors of consumption—industrial, commercial, and residential. We are looking at a very real threat of an energy shortage in all major industrial regions and population centers, which may implode within the next 10 years, perhaps sooner.

Starting from President Nixon, all US presidents made promises to achieve independence from foreign oil, but there is very little to show for any cohesive energy policy at the national level, or even significant milestones achieved towards that goal. Lacking a forceful central policy, the industry captains never undertook the challenge on their own. There has not been any significant or sustained commitment by the industry in exploration, innovation for alternates, or other avenues during the past four decades that could lead us toward the goal of independence. Programs such as Energy Star and Green Building Construction are definitely steps in the forward direction and have shown results. But they are voluntary programs, not national mandates or policies, and the results show that too. Executive orders have been issued by presidents over the years to force conservation and are effective to varying degrees; unfortunately, all were too limited in their scope to attain energy independence at a national level. Examples are EPA's mileage standards, lightweight alloys, ethanol, and other such measures; these are scattered efforts and are not part of any cohesive energy policy or any industry commitment for a sustained plan. Taking fleet fuel as just one example, industry captains created monstrous gas guzzlers in Hummers and SUVs during the same time that EPA's mileage measures were put into law. Such examples show that industries followed the orders only to minimal levels of effort, never trying to reach any attainable goal. This lapse has brought us to the point that energy is now a vital part of our national and economic security. How deregulation fits into energy management is an interesting piece in the mosaic of our current energy scenario.

Without any incentive or federal mandate, the free market did not rise to the task of achieving the goal of independence. Deregulation in the energy industry evolved partly as a result of this stalemate. In essence, deregulation changed the economic environment in the guise of lifting all barriers in order to open the commodities market to the broadest price competition possible. It should be recognized that the motivation was *commercial interest to contain the market price*, not a quest for the goal of energy independence.

The first act of deregulation in the energy industry was to deregulate gas exploration at the wellhead in 1978. It opened the entire nation to the market for exploration, and US production of natural gas improved, as all competing parties wanted to extend their markets beyond their existing boundaries. As the exploration expanded, the price dynamics improved and stabilized through open competition. After deregulation at the well-heads, the supply lines were deregulated in 1982, and finally the last leg, local delivery services, was deregulated in 1992. Deregulation of natural gas thus moved through a slow and careful process of "watch and learn," but deregulation of electricity has not followed the same path. Perhaps the success of deregulation on natural gas made the lawmakers feel somewhat eager to extend the principle to the electricity market at a faster pace. The results have not been as balanced and equitable to end-users with electricity as it has been for natural gas. The growing squeeze on the nation's generating capacity has wreaked havoc in many parts of the country. (The case of Enron may come to mind—how capacity was manipulated.)

The cost of electricity has gone up in almost every state since deregulation. The fundamental problem with this also goes back to the lack of a national energy policy. Growing demand for electric power was foreseen back in the 1960s. Eisenhower's "Atoms for Peace"[3] ushered in commercial nuclear power generation, and during the 70's to the early '80s about 60 nuclear plants were licensed for design and construction in the US. Had they been built, we would not be facing an energy crunch today but would be ahead of the game by a comfortable margin. Unfortunately, by the mid-80s most of these projects were cancelled by the utility companies. That is the central fact. The purpose here is not to look for the mix of reasons but to recognize that, lacking a central policy on energy, there was no concerted effort to mitigate the factors that evolved from these cancellations. Deregulation rules aimed to improve competition for the benefit of end-users, but it is impossible to do so when the commodity itself is in short supply.

MAIN DISCUSSION

So this is where we are today. As users we have open access to any supplier, but the supply is short of the demand. We have to redefine our energy portfolios to optimize our dollars in this conflicting market of supply and demand. This can be done by blending the essence of our energy efficiency and conservation measures while taking advantage of the market rules for deregulation. We can play this game and win.

It is important to note that using deregulation as leverage does not offset the need for energy efficiency and conservation programs in any way. Any large energy user must focus on improving operating efficiency and institute cohesive conservation efforts as core components of its energy program. Deregulation can offer an added layer by controlling the commodity costs. However, it does not replace the technical management efforts of an energy program that will try to contain the kW demand (both average and peak), shift the load from peak rate hours to off-peak hours for demand-side management (DSM), and pursue conservation efforts such as daylight harvesting, occupancy sensors, or other, similar measures to lower consumption (i.e., the kWh charges on the electric bill). For leveraging the deregulated market, users must have precise information on both cost components of the electric bill, the kW demand and the kWh energy. The next paragraphs suggest a path in preparing for natural gas and electricity purchases with this new opportunity in a deregulated market.

Electricity future trades in MWH units, for both on-peak and off-peak. The prices swing for both as the seasons change throughout the year. We can not predict future weather by months or years, yet the key to maximum savings is through tailoring the purchases as close as possible to the actual consumption for those future months and years. Analyzing that will be a study in economics and is deferred here, as this article focuses more on the technical process. The first step in the process is to have a usage profile for every month by on-peak and off-peak hours, culled from past years. This task may be daunting for large users, but it is attainable with preparation and a bit of diligent work. Through informal surveys or discussions on such a database, it appears that most large commercial and industrial users do not have precise datasets for their energy or demand profile through the hours of the day, or days of the year. Many use the total on-peak and off-peak data from their monthly bills as their energy profile, but that is not fully adequate to secure the best possible rate contracts in the futures market. This is usually a popular practice among ESCO providers who contract to manage energy accounts of large end-users and promise dollar savings. When such contracts result in savings, it is usually from judicious conservation steps, with no consideration at all given to futures pricing for the best energy rate. This does not diminish the value of ESCO services; it only emphasizes the subject of this article, to navigate the energy market for securing the best base contract rates for purchasing electricity and gas—above and beyond any energy management program the users may have in place. Large energy users need to blend the commercial aspects of energy costs with the technical management of all energy operations for a total package of cost and efficiency in energy usage.

Securing a lower cost rate is not the end in itself. Dollar savings from this tool should be used to improve operating efficiency for the facility through upgrade projects. In essentially all product areas, there has been significant development in new products and methods in last 5-10 years to enhance energy performance, i.e., high-efficiency lighting, boiler/chiller controls, motors, and belts. The technology is here, but many items such as LED floodlights, retro-commissioning, etc., require major investment or capital funding. A facility owner has to meet the immediate business demands first before tending to long-range options when the operating budgets get constricted, a very common reality in a competitive or depressed economy such as we have today. If the payback for the capital upgrades is more than 2-3 years, projects usually get lower funding priority. However, the energy manager can find funding for these types of upgrades through the savings realized from lower cost rates in securing energy services. This cycle of saving and upgrading should continue as part of the energy plan until the facility reaches a point of optimum performance on energy. *That is the mission*.

For cost analysis, it is necessary to dissect the energy bills into the main constituent components and manage each separately. Electricity is taken up first, as its cost burden is usually larger than natural gas or gasoline/diesel to most large energy users. [The few exceptions may be UPS, FedEx, airlines, and similar transportation-related owners.] Electric bills for most commercial and industrial users will have three major cost elements—demand kW, energy kWh, and fuel charge. All other charges in the bill (e.g., meter charge, tax, etc.) are inconsequential to these three and will not be addressed in this article. kW costs are for on-peak and off-peak hours, on-peak usually being several multiples of the off-peak rates. kWh charges for on-peak and off-peak will have the same pattern, but the ratio may not be as high as that for the kW charges. The fuel charge is a flat rate and applies to every kWh of energy used, on- or off-peak. Using the composite monthly summaries for energy planning is not adequate for best rate analysis with the market traders. The trade unit is MWH, but the kW demand profile should also be a guide to plan future MWH forecasts through the on- and off-peak cycles. Many large users may not have their metering set up for monitoring kW demands on a continuous basis for a database of kW to project future usage. It will serve well to have demand-monitoring instrumentation as a pulse indicator of the facility's energy usage profile, and for peak shaving or other conservation steps in the energy program. ESCO or other consultants do not typically project future usage based on kW; they advise only on kWh conservation in return for their savings guarantees. The first task for an end-user is to develop a database for both kWh and kW before proceeding to futures purchases.

For a steady pattern of business operation, kW demand should have a fairly steady pattern of high and low demands for the day, week, month, or year. Significant shifts in the weather will affect the kW demand and the kWh use, but it is not perceptible unless the shift involves several degrees in temperature and is prolonged. We can not predict the weather, but a median profile drawn from past usage patterns can be the basis for a futures contract in the open market. An actual profile is used below to get through the next steps. The commodity trade is by MWH by months (by 50 MWH units), and the profile is depicted the same way. If the chart (Table 1) is the basis of quantifying the purchase, all MWH figures would be rounded up to the next multiple of 50, then adjusted up or down by the energy manager based on the company's risk tolerance. Since the commodity traders will offer a price based on the MWH for each month for their spread, the modified MWH figures have to be identified by each month, not as a total for the year. Lastly, figures in the sample chart (Table 1) have been altered slightly to protect user identity, but they are representative of a facility's actual usage.

Table 1 shows a fairly stable pattern of demand kW, with higher levels during the summer cooling demands. This would be common in most states. The purpose of this example is to highlight the sudden rise in unit cost from July onwards. It was due to a rate adjustment by the utility affecting both $/MWH and $/day, although the monthly kW and MWH measures did not vary significantly between the two halves of the year. The example is for a bundled service at a "large commercial" rate. The change caused a jump of about 25% in the budget for electricity, and it disrupted the balance of priorities in the facility operations for the year. The relevance is that a deregulated market allows latitude to guard against such shocks in the operating costs for the organization. Besides the possibility of securing a low cost rate ($/MWH), buying futures contracts also ensures a stability in the business operations and cash flow. Details of this table and the increase follow.

It should be stated that, for this particular case, the service and costs with this utility are on a stable operating base. This is a well-established utility company serving a wide jurisdiction that is well-balanced in residential, commercial, and industrial customers. The utility is very well-managed,

Table 1. Sample usage and billing data for electricity

		Demand KW		Energy MWH				Unit Cost, **$ / MWH**		
	Days	On-peak	Off-peak	On-peak	Off-peak	Total	$ / day	Aggregate	Main	South
Dec	31	28060	27110	7593.7	9941.3	17535.0	36482	64.496	64.187	75.654
Nov	30	26772	26491	7505.4	8565.1	16070.3	35272	64.167	63.913	73.892
Oct	31	28229	26583	7224.1	9169.6	16393.7	35343	65.576	65.239	82.965
Sep	30	29294	29924	5963.4	11362.4	17326.4	37626	64.257	64.022	80.940
Aug	31	31565	30155	7121.5	11440.5	18561.5	39540	65.008	64.757	80.450
Jul	31	32276	31116	7411.6	11841.6	19253.6	38738	61.376	61.097	77.583
Jun	30	33157	32057	6792.7	10761.7	17553.7	29818	50.141	49.772	72.106
May	31	27400	26227	7571.6	8954.3	16525.9	26163	48.194	47.855	65.917
Apr	30	27656	25544	7350.2	8519.7	15869.7	26141	48.519	48.186	65.955
Mar	31	26332	27228	7758.4	8975.7	16733.7	26122	47.229	46.833	62.827
Feb	28	27640	28028	6862.7	9449.7	16312.3	27393	47.170	46.849	56.525
Jan	31	27892	27598	7719.8	9235.8	16955.7	27143	47.996	47.641	58.086

evident in the fact that its cost per MWH is lower than most others in the state for comparable service, with the state's aggregate average being in the lowest 25% in the nation. It is important to state this stability in the utility's management of services and costs, rather than draw speculations about the sudden 25% rate increase in mid-year. The reason for this increase was part of the deregulation process as the state introduced open access to all consumers.

In enacting deregulation laws, states included provisions to safeguard all consumers against uncontrollable market runs driving the rates up. Lessons learned from the Enron case were diligently considered by state lawmakers of all states in the post-Enron years. One aspect of this was a "rate cap" in this state and similar features in others. The primary effect of the rate cap was to force cost stability while the deregulated service was opened up to all consumers, as well as to allow state regulators to evaluate the impact of this new dynamic from both the consumer side and the supplier side under "controlled" conditions. It allowed this provision in case some parts of the laws needed to be amended or supplemented once the impacts were assessed through the initial period. In net effect, the basic "cost of service" formula was modified to defer the utility's transient costs for providing the services during this period to a future date of recovery after the rate cap was lifted. The sudden jump in the sample table shows the effect on the cost rate after the rate cap was lifted. Stranded costs in this case became extremely high due to the effects of hurricanes Katrina and Rita on oil and natural gas prices, which nearly doubled and stayed there almost one whole year. This jump is part one of three for this utility, which decided to collect the stranded costs over three years. Allowed by state laws, its effect on the consumer was as shown in the chart. Neighboring states also had very similar results, where many residential customers saw their electric bills go up by as much as 70% after "reregulation" provisions were passed in state legislatures at the end of the deregulation cap. The point of this detail is that an artificial restraint was put into place at the start of deregulation, but with rate caps expired and supplementary legislations enacted, this artificial restraint (i.e., control) was removed, and the market now plays by the natural dynamics of cost and price. This is a judicious time for all large users to evaluate their needs, seek to secure the best contract terms from the entire market (regulated and deregulated) for the best possible rates, and form long-term business strategies with cost stability.

We can not control the crude prices, but we can control our purchase costs for electricity and gas, which are both influenced by the crude. The crude market is volatile to year 2025 per DOE projections. The energy manager needs to prepare for this with a strategy to contain purchase costs through a reliable and long-term process. It is essential that the emphasis be on both the attributes—reliable and long-term. The playing field is the commodities market, where variations are a daily and hourly occurrence. This article does not attempt any crystal ball technique, as there is no known method for gauging the price dynamics in that market in advance so as to hit the lowest price at all times for a purchase. Instead, the decision must have some cushion to absorb market movements, and the contract must be executed as far in advance and as precisely as possible for the future needs. The three elements—contract term, contract quantity, and advance planning—form the basic needs for defining a futures contract. Each of these elements is addressed in more detail, with some real case data, in the following paragraphs.

It is common in many circles to have a short contract term of a year or less. Short-term contracts will typically not draw as low a bid as a long-term contract would, because a longer term gives the trader a cushion of time over which to spread the high and low risks of future trades in bidding the price. By spreading the risk, the trader can offer a lower price to the buyer. A typical example is cited in Table 2, with exact market prices at the time the comparison was made.

The data are for a natural gas contract in the deregulated market. This sample dataset shows the difference between short-term and long-term contract prices. Market data for electricity will show the same pattern, jus-

Table 2. NYMEX data for Natural Gas (Henry Hub, $/DTH) [4]

NYMEX data for Natural Gas (Henry Hub, $/DTH) [4]

1-yr renewal	11.811	11.939	↓saving/yr	
2-yr renewal	11.285	11.296	$288,933	$353,485
5-yr renewal	10.607	10.545	$661,835	$766,645
10-yr renewal	10.568	10.630	$683,698	$719,510
Trade date	a/o 5/28	a/o 6/4	a/o 5/28	a/o 6/4

tifying the value of a long-term contract for stability in fiscal planning for the managers. As the data shows, a 10-year term would save $7.2 million dollars over the full term of the contract, as compared to multiple one-year terms. For some users, this saving may be more than a year's budget on natural gas, that is the 9th or 10th year of the contract can become zero-cost. Although the 5-year term showed a higher annual savings rate in this example, that in itself may not be the deciding factor in choosing a 5-year or a 10-year term. Two 5-year terms may have more total cost than one 10-year term in constant dollars. A long-term business plan envisioned by the company should have a place in the final consideration. Large corporations may use 5-year or 10-year budget planning as routine management tools in their strategic plans. Small and mid-size companies may not always have a 10-year strategic business plan. That is why the strategic business plan needs to be a factor in choosing the contract term. In general, it is necessary to go past a 2-year term to secure a level of stability in a business forecast and for a lower cost rate from the deregulated market. As some financial planners and advisors like to say, it is *time in* the market, not *timing* the market.

On that cue, timing is important in the sense that rigorous preparatory work is necessary for advanced planning before negotiating the final price. Electricity and natural gas demands are both seasonal, being cyclic through the seasons in a fairly consistent pattern. The preparation is to understand the need (demand) and the market (supply) reasonably enough to avoid buying a contract on the high end. Two samples of trade data from NYMEX floor are charted in Figure 1. The first is NYMEX trading for natural gas, showing the need for advance planning. This actual data shows how price for the same commodity for the same time of delivery moved in 6 months; the variance is nearly $4/MBTU. Large commercial users for natural gas use well above 100,000 MBTU per year, at which scale this price difference will turn into half a million dollars or more in an annual budget.

The next chart (Figure 2) is for electricity on NYMEX for the PJM western hub. Flatness in the future prices beyond 2011 is showing that electricity futures usually trade to 24-30 months, whereas NYMEX on gas would trade to much longer contracts. The slight upward movement from year 2012 forward is indicative of the anticipated labor index and is not reflecting any significant trading activity.

The charts show general dynamics of a deregulated energy market. This is by no means an exhaustive study of the market to find a uniform formula for all energy managers to find the best price for their commodity purchase. There is no crystal ball, as said before, but an understanding of the general nature of the market is essential in using the market trends for the best possible decision. This is the supply side.

On the demand side, the energy mangers have more control in deciding the needs, the premise stated at the start of this article as the potential for benefitting from open market in containing energy costs. Every facility has a datum reference for minimum energy needs, based on local parameters (weather) and its business mission. For example, a steel mill will have a

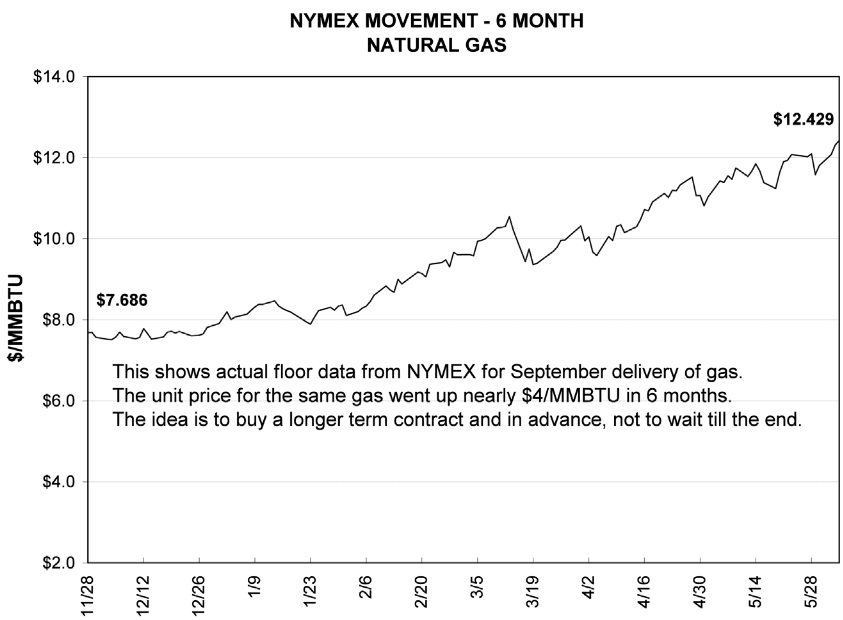

Figure 1.

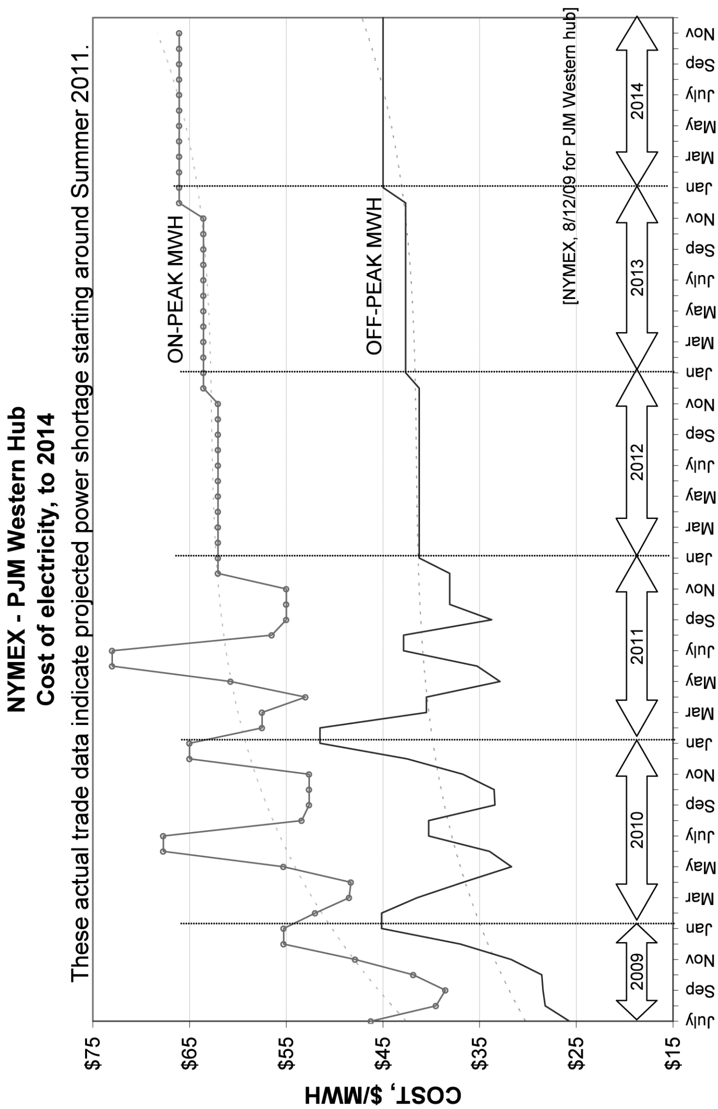
NYMEX - PJM Western Hub
Cost of electricity, to 2014
These actual trade data indicate projected power shortage starting around Summer 2011.
ON-PEAK MWH
OFF-PEAK MWH
[NYMEX, 8/12/09 for PJM Western hub]
COST, $/MWH
$75
$65
$55
$45
$35
$25
$15
July
Sep
Nov
Jan
Mar
May
2009
2010
2011
2012
2013
2014

Figure 2.

different demand profile than that of a warehouse facility, mall, or hotel. The energy manager needs to articulate that from past history and future business plans. The sample consumption chart in Table 1 may serve in developing a model to plan for the purchase of electricity. The manager has to refine the past data for future projections through an energy program which will include conservation measures and peak shaving, shifting demands from one part of the day to another when feasible without affecting the business objectives. A key aspect is to disperse concurrent demands to suppress the peak monthly demands. As an example, one facility known by this author had high chiller loads and a huge postal warehouse sorting operation on the same campus. Postal sorting operation used to start at 3 p.m. during the time when summer cooling demands required several chillers to be on line. This routinely pushed up the concurrent demand kW at the meter during summer months, with higher average cost/kWh in summer than in all the other months. The postal operation was asked if it was possible to shift the sorting operation to any other hour of the day outside a noon to 5 p.m. block, and it was. This change lowered the summer kW charges significantly and saved on monthly electric bills, benefiting both sides. This example is cited to illustrate the need for measuring kW at all major load centers, as mentioned earlier. It is a basic tool for the energy manager to know the demand profile of all major load centers by hour of the day and by season, aggregated to the monthly projection for future planning.

Natural gas bills do not typically have as many cost components as a typical electric bill. Drawing a profile and projecting future consumption is thus a bit simpler for the natural gas accounts. The consumption history should be normalized for weather variations when drawing an average monthly consumption profile. All facilities will have a base minimum load through all the months for gas, and that should be recognized. Although there is no direct cost billed as a demand charge for the LDC's service, the rate structure is usually a basis that is keyed to the demand. The charge is typically a tiered structure based on the monthly total consumption that is in addition to the commodity cost for the gas purchased in the open market. With knowledge of the base demand and the tiers in the rate structure, the energy manager can make reasonable projections for future total costs for the contract term, inclusive of the gas supply (commodity purchase cost) and the delivery (LDC cost). Other items in the bill are taxes, meter charge, etc., and are very minor compared to the gas cost and the delivery cost; thus they are not discussed here.

To summarize, the relative weights of kW demand, kWh energy, and fuel charges have been enumerated. Of the three, the fuel charge costs are pass-through costs from the utility company and are outside the direct control of the energy manager. It is a subordinate cost, however, to the kWh consumption, which can be controlled through the energy program under the manager's control. The kW demand is also under the manager's control through the means discussed. The energy manager can model future projections built on the kW and kWh, tuned to the needs of the facility. The variance of weather is a factor in the total consumption, but statistical data will show that an usual level of variance does not affect the total performance on the contract if measured on an annual basis; that is, the total variance in degree-days does not vary significantly over the years unless there is a prolonged duration of several degrees. For the term of the contract, these variances usually play out fairly evenly over time, and past data can thus serve as a fairly reliable basis for future projections in most cases.

Vehicle fuel should also be a part of an energy plan, but it has not been included in this article. The reason is that the nascent state of alternatives at present, such as hybrids, solar-charged and all-electric cars, makes it a local factor based on local tax incentives and the electricity rates in each locality. For example, the cost of energy for the commercial sector varied from 5.72¢/kWh to 32.29¢/kWh in the 50 states in 2008, the last year EIA compiled the annual average cost rates. [The 2009 data will be available about January 2011.] The vehicle technology and electricity market segments are not yet developed to a level where some general discussion may be of common interest to all.

CONCLUSION

The mission of an energy manager today is threefold:

1) Manage both demand and consumption as technical aspects of an energy plan.

2) Use market price dynamics for the most competitive prices and savings.

3) Invest the savings on system upgrades to further lower the demand and consumption in future years.

The manager must repeat this cycle to reach the optimum energy efficiency in both technical performance and operating cost that the facility can attain.

A vision was expressed at the outset that we end-users can influence the direction of our energy future if we take over the reins of control, since there is no central policy or direction from industry or government to shape the future of our energy independence. I repeat here that I do believe it is possible to realize that vision if we collectively redefine our roles as energy managers and not wait any longer for others to help us. While fine tuning of specific facilities are best left to the facility owners and managers, the sequence of preparation is a progression through these suggested steps:

— Develop a statistical model of consumption by kW and kWh, for both on-peak and off-peak hours. It is recommended that the dataset span at least three years.
— Develop the trend for unit costs through the period. In most cases, it will be fairly linear. For sudden or unusual changes, search the cause and correct the trend line as may appropriately reflect the facility operation, but isolate the external causes. An example of an unusual change is depicted in the discussion earlier through the sample electrical consumption in Table 1. The 25% jump in that example is not a recurrent event, and the trend line should be corrected to treat that as such.
— Look for significantly unusual traits in the past data, not minor variations. Examples of significant variance are the increased cost of gas and fuel oil for almost a year after hurricanes Katrina and Rita. Adjust the trend lines to correct for non-recurring events.
— Develop a profile of heating and cooling demands by major load centers and the facility as a whole, by degree days and energy delivered (MBtu/DDH and MBtu/DDC). As HVAC load may constitute up to 40% of the total electrical burden in a large or mixed complex, this information can provide helpful hints for the facility's energy program and conservation measures.
— Review business plans and projections to at least the next 3 years in the future; for example, account for facility growths, increased orders, building efficiency improvement projects, etc., then adjust the energy model to reflect these changes for the future years. This will be the basis of the contract.
— Track the market data for the commodity to be purchased. The two commodities—gas and electricity—typically follow different

patterns through the year. (Crude oil price is an outside force on these and is still relatively unstable; however, oil influences the gas and electricity prices in a short-term outlook more than for a long-term outlook. A long-term contract in gas or electricity will typically not be influenced too much by spot price for crude oil, and the longer the contract, the lesser the effect.)

— Prepare bid documents in a way to allow latitude in negotiating a price through a two- or three-stage process, such as pre-qualification, an initial offer, and a final offer; or a mix of pre-set strike prices; or a target high/low on the floor. Prepare for a 3-year contract term or longer, with a base year and optional extensions as the company's risk tolerance may allow.

My wife has a tapestry at home which says, "No amount of planning can replace dumb luck." Well perhaps it's true, but let's not make luck the centerpiece of a corporate energy plan or our energy future!

Notes

Embargo: On October 16, 1973, OPEC raised the crude price 70%. On October 17th, Arab Oil Ministers started the embargo, cutting back production. Saudi Arabia and other gulf states joined the embargo on October 20, 2973.

Project Independence: President Richard Nixon announced Project Independence on November 7, 1973 as an initiative to attain US independence from foreign oil by 1980.

Atoms for Peace: Title of a speech delivered by President Eisenhower at the U.N. General Assembly on December 8, 1953, for peaceful development of nuclear energy. The first commercial nuclear power generating plant in the US was conceived from there; it went on line on December 2, 1957.

NYMEX (CME), New York Mercantile Exchange. Trading data can be viewed live, or as historical data, at cmegroup.com/trading/energy/natural gas, or/electricity, or/other commodities. Figures reflect snapshots at different times during the preparation of this article.

Bibliography

US Department of Energy: various databases. [www.energy.gov/pricestrends/index.htm]

Energy Information Administration: STEO tables, AEO reports. [www.eia.doe.gov]

US Department of Labor, BLS: Producer Price Index databases. [www.bls.gov/ppi/#tables]

NYMEX, CME: Energy market data. [www.cmegroup.com/trading/energy] December 2009, (Rev. Feb 2010)

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