The Value of Distributed Generation in a Deregulated Market

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ABSTRACT

Deregulation of energy markets and the establishment of a transparent market such as the PJM Interconnection, LLC have allowed companies that have generation assets located in that market, a means to cost effectively manage market risks over a significantly longer period than typical supply contracts. The value of on-site generation lies in its ability to dispatch based on market conditions, therefore acting as a market hedge for the purchase of electricity. This provides a collar on the price of electricity for the life of the generator, unlike financial hedges, which are limited in their term.

An analysis of the benefits of on-site generation as a hedge for the market purchase of electrical power will be discussed for a project located in the PJM market. A pro forma analysis demonstrates the behavior of the generation project in various market conditions and is based on actual data. The electric procurement strategy for the site includes market based dispatch, which is simply a make/buy decision. When the cost of power on the spot market is below the price to generate, then the consumer buys. When the price exceeds the cost to generate, the equipment is operated to supply the needs of the consumer. In this way, a cap is placed on the price of power and corresponding futures (fixed price) power contract premiums are avoided.

ELECTRIC MARKET

The current electric market is structured to provide a customer, with opportunities to employ strategies to its benefit in terms of its cost of power. With the onset of deregulation, industries have been able to purchase power in ways that match their use. No longer are they subject to rate structures from the utility that averages the cost of power, sometimes to their detriment. In the deregulated market, buyers pay for the power based on supply and demand, in a commodity market. If the buyer is a consumer during the heaviest use periods, such as mid-afternoon in the heat of the summer; the customer can expect to pay a premium for its power. Likewise, in the dead of night, power usage is so low that many times, the cost of power is zero as shown in Figure 1. While the new market more clearly reflects the economics of producing power and transmitting to where it is needed, volatility is also present. In the past, the utility took the risk of price fluctuations and priced a risk premium into its cost. Now the consumer is exposed directly to the market fluctuations; therefore, the consumer must employ strategies that can reduce its risk in the market.

Risk Management Strategies

In order to minimize the risk of the current market, a consumer can employ financial or physical hedges. Financial hedges employ techniques that allow the consumer to purchase power at a fixed rate over a specific period of time. This rate is set through the use of futures contracts and spot market purchases as shown in Figure 2. Purchasing on the spot market provides the greatest chance of cost savings (see Table 1), but it also exposes the consumer to the greatest amount of risk. The use of futures contracts can level that risk; but at the cost of a risk premium.

The physical hedge approach utilizes generation equipment to produce power or shift loads from high cost periods. Many customers are already successfully employing a physical hedge to control their power costs through minimizing operations such as chiller operations, thus avoiding the higher cost of power to run the chillers. This technique allows the consumers to shift load patterns away from the high cost periods. However, the balance of the power needs is often bought on the spot market. The cost savings from this technique would still contain an element of risk with the spot market purchase of the balance of the power needs.

The use of generation equipment can produce the ultimate collar on the price of power. Through the use of generation equipment, the consumer now has a make/buy decision. When the cost of power on the spot market is below the price to generate, then the consumer buys. When the price exceeds the cost to generate, the equipment is operated

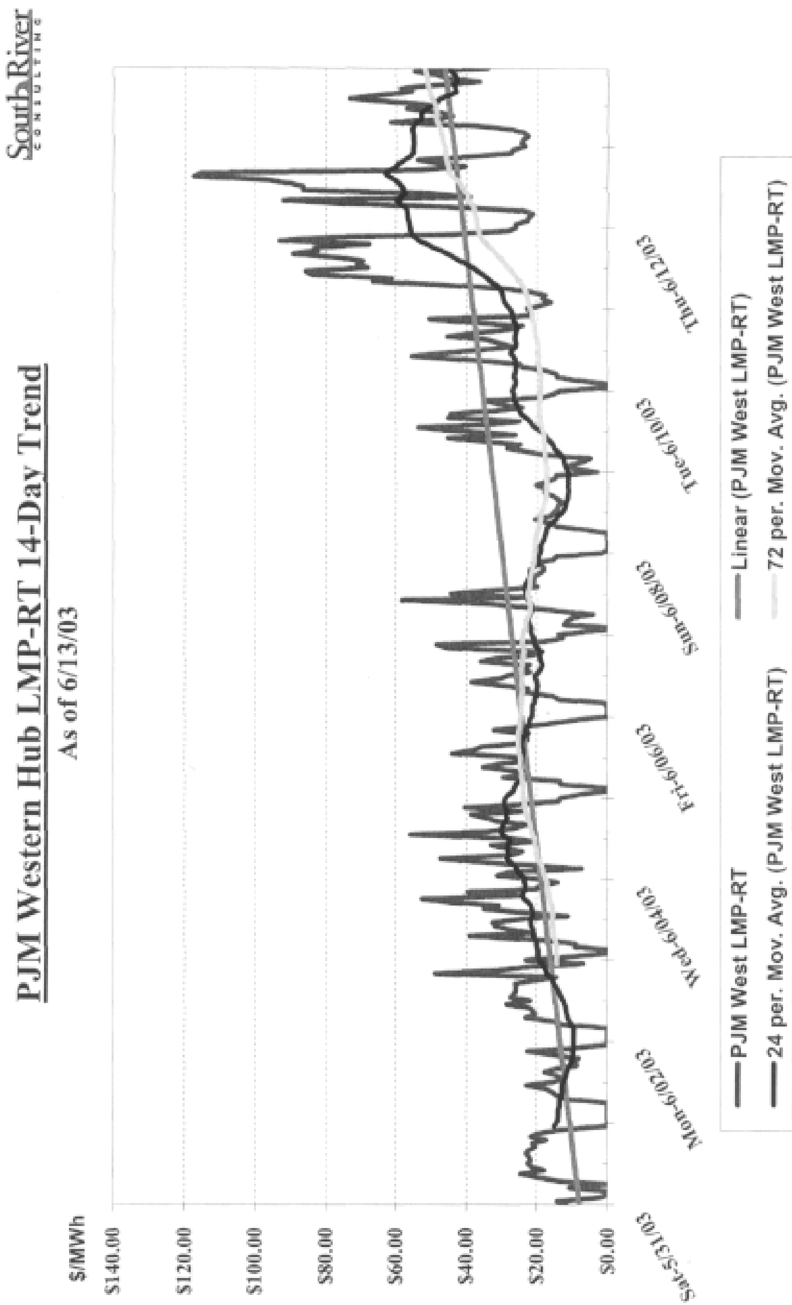

Figure 1. PJM Hourly Pricing

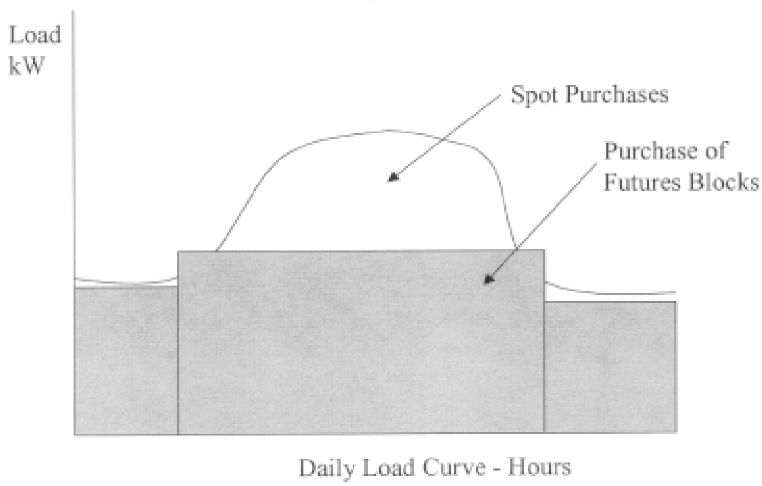

Figure 2. Load Purchase Strategy

Table 1. Spot versus Future Costs

	Range	*Average*
Actual Spot (98 - 02)	$28 - $39	$35
Projected Spot (03 - 07)	$32 - $40	$37
Front Years (futures) As of 7/21/03	$29 - $61	$45

to supply the needs of the consumer. In this way, a cap is placed on the price of power.

PJM GENERATION PROJECT

An analysis of the benefits of on-site generation as a hedge for the market purchase of electrical power was performed based on the current usage profile of the example PJM facility. Figure 3 shows the hourly load. This particular client desired complete back-up of its load and therefore the installation of 5.5 MW of generation was modeled. The model took into account the dispatch of the generation based on historical market data (futures contracts as well as spot markets) and the sale of excess generation. The output of the modeling determined if the project could provide savings on future electric purchases and return sufficient revenues to justify the installation of the equipment.

Model Components

The model was constructed to purchase blocks of power on the futures market and obtain the balance of the power on the spot market. The generation system would be utilized anytime the spot market exceeded the cost of generation. The project utilized three 1.8 MW oil-fired reciprocating engines with a 9,500 Btu/kWh heat rate and a cost of $0.01/kWh for operations and maintenance. The hours of operation for the generation system are dependent on the type of market and range from 300-800 hours annually. This level of operation keeps emission levels from being a concern. Since the generators may not match the load of the facility, the model also established an opportunity to sell the excess power generated into the PJM market at LMP (locational marginal price - spot pricing).

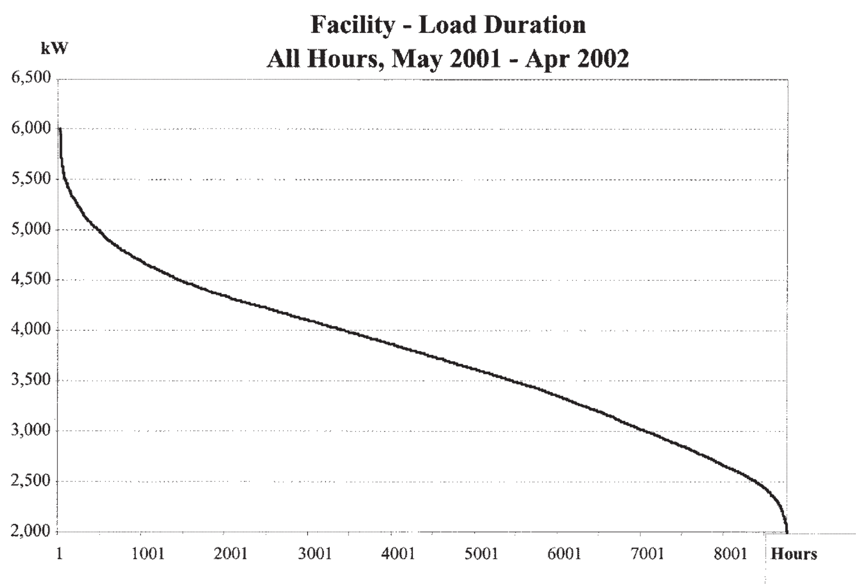

Figure 3. PJM Project—Load Duration Curve

The analysis was run for various market conditions. Historical data for a low and a high market were used to establish the bounds of the potential savings. Project revenues are generated by operating the on-site system whenever the market conditions indicate that it is more cost effective to do so than purchase power on the open market and from the additional revenues earned by the sale of excess power into the market. The generation system is sized slightly less than the current peak consumption of the facility. Whenever the system comes on-line, a portion of the output may be sold back into the market due to the fact that the generators operate most efficiently at full output, which may not correspond to the power needs of the port at the time of operation. Project expenses include the cost of fuel, operations and maintenance. When the system is not operational, the facility will purchase its power from the market through a retail supply agreement. The results of the analysis can be viewed graphically in Figure 4. The bar charts compare the cost of purchasing power entirely from the market versus purchasing power in combination with the use of generation and finally the purchase of power in combination with generation and export of excess power from the generation system.

The cost of electricity utilizing generation compared to purchasing on the market yields savings that can be applied to capital. Assuming a ten-year lease structure, the capital required for this project is $328,000 annually. The savings per year after capital for different market conditions are presented in the Table 2.

Table 2. Risk Assessment

Risk Assessment			
	Market Conditions		
	Low	*High*	*Normal*
No Generation Minus LDC	$1,506,685	$2,007,175	$1,633,047
Generation	$1,506,685	$2,007,175	$1,633,047
Export	$1,506,685	$2,007,175	$1,633,047
Savings excl. capital	466,335	990,888	600,397
Capital	328,500	328,500	328,500
Savings/yr.	137,835	662,388	271,897

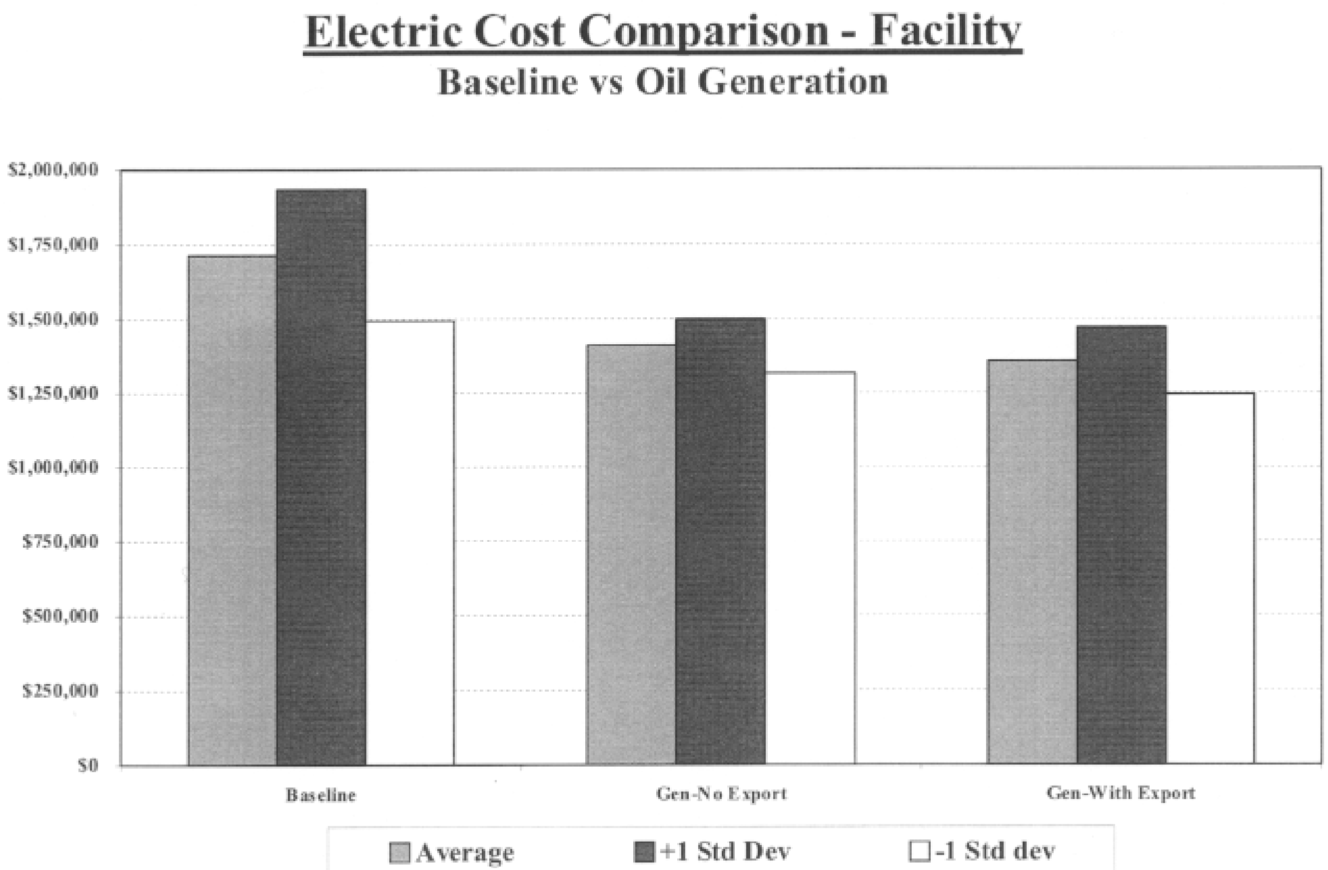

Figure 4. Electric Cost Comparison: Baseline vs. Oil Generation

In addition to the risk management and cost savings associated with the Project, the system will provide redundancy for the Utility supply. For facilities that have thermal storage, reduced insurance rates for spoilage of warehoused product due to a loss of power can also be realized.

CONCLUSION

The use of generation as a market hedge for the purchase of electricity provides a collar on the price of electricity. Unlike financial hedges, which have limited terms; the generation project provides a hedge for years to come and protects the facility from the volatility of the spot market.