"It's the Fuel, Stupid!"

"What is the impact of natural gas prices on Distributed Generation?"

This is a question that has been asked repeatedly since the rapid natural gas price run-up and subsequent market volatility. Although clearly a major factor in the current California Energy Crisis, the price of natural gas has been somewhat overshadowed by the generation capacity issue, but for the Distributed Generation (DG) advocates, it remains the key issue.

Most of us are familiar with economic dispatch curves, drawn to represent the capacity and ascending "levelized cost" of producing electricity for the various power plants in the region and their presumed order of their dispatch. Taken cumulatively and with margins applied, this represents the supply-side elasticity.

By arranging plants in their order of "levelized" cost, clustering tends to occur around fuel choice, plant efficiency and facility age, the three main components of levelized cost. But even here, there is an ordering of the dispatch mostly oriented around the fuel source. In general, hydroelectric plants are dispatched first, followed by the nuclear plants, both benefiting from the low cost fuel source and/or the operational requirement to remain base-loaded. Written-down, coal-fired plants burning $1.25/mmbtu fuel at 35% efficiency come next, followed by the 55% efficient CCGT's burning $4-5.00/mmbtu oil or gas, and then finally the GT-Peakers burning oil or gas.

The intersection of this ordered supply and hourly demand is what sets the "clearing price" or "spot price", plotted as we most often see it.

"Time of Day" rate structures are an attempt by the PUC's to translate these cost variations into a supply curve. These regulated rate structures are limited in their effectiveness however, as they tend to be static over relatively long periods of time and are still based more on allocation logic than driven by true cost.

The equipment reality is that most of the generating capacity must be operated around the clock and the off-peak clearing price has become the short-term marginal cost of operation. The off-peak capital coverage that was available in a regulated environment is no longer in place, and investors must now recover capital and earn a profit at the short end of the supply curve. This skews the supply-side curve accentuating the pricing peaks.

While there may be some opportunity for selected DG cogeneration applications to operate 8760 hours per year, it will be very difficult for a powergen only unit to compete with off-peak grid power. For the powergen only units, the reference electric price is that of the "Grid" for both the peak and mid-peak or shoulder hours of the day, which constitute approximately 3500 hours per year.

The issue that drives regional electric price volatility is the percent of the time that gas/oil are clearing on the margin. Regions with a high percentage of the electricity provided by these fuels will be far more likely to see volatility, and their spot electric prices will more nearly reflect gas price movements. There are differences in the conversion efficiency and purchasing leverage between the competing "grid-supplied" and "on-site" value chains so they track, but don't parallel one another.

PowerGen f.o.b., to an ESCO

Gas/Oil on the Margin		Fuel	Grid	$/kW Ex-works at HHV Electric Efficiency			
Hours	%	$/mmbtu	$/kWh	25%	30%	35%	40%
3504	40%	2.50	0.081	$910	$1,033	$1,122	$1,188
		5.00	0.097	$516	$763	$940	$1,072
		7.50	0.113	$122	$493	$758	$956
2628	30%	2.50	0.076	$601	$694	$760	$809
		5.00	0.088	$240	$426	$558	$657
		7.50	0.100	-$120	$158	$356	$505
1752	20%	2.50	0.072	$357	$419	$463	$496
		5.00	0.800	$73	$197	$285	$351
		7.50	0.088	-$211	-$25	$107	$206
876	10%	2.50	0.062	$124	$155	$177	$194
		5.00	0.065	-$45	$17	$61	$94
		7.50	0.069	-$209	-$116	-$50	$0

With gas on the margin 75 and 100% of the time, the DG powergen only scenario holds up reasonably well at efficiencies at 30% and above. In regions where coal is more likely to be on the margin, it is hard to make an economic case at $5.00 fuel.

The ability of a load aggregator to buy fuel at wholesale remains the key factor in obtaining an adequate return and minimizing exposure to fuel price risk, but the DG economics are regionally based.

Admittedly, the developers are having a difficult time meeting their original cost and efficiency projections, but this game is just beginning to unfold and it is simply too early to declare winners and losers.

My conclusion is that when the 3500 hours of peak and shoulder operation coincide with the gas on the margins 40% of the time, the economics for DG can still look very attractive.

Peter Baldwin
Contributing Editor
pete_baldwin@base-e.net

Turbomachinery International
September/October 2001
Vol. 42 No. 5