Customers in Mexico pay some of the highest electric utility rates in North America. With imported natural gas prices holding steady and new, gas-fueled technology offering up to 80 percent efficiency, on-site combined heat and power (CHP) or cogeneration plants offer numerous economic and operational benefits. However, careful planning is needed to minimize risk and maximize the benefits.
ESTABLISH YOUR BASE CASE

Currently for Comisión Federal de Electricidad (CFE), the state-owned utility in Mexico responsible for generating and distributing electric power, electricity rates are heavily influenced by the price of coal and fuel oil used in some of its power generation facilities. Many commercial and industrial customers with access to new sources of clean, inexpensive natural gas may look to some form of on-site power or cogeneration resources in place of CFE.

A simple base case analysis provides facility owners a comparison of what they currently pay for fuel to produce steam and to CFE for electricity, versus what they would pay for natural gas plus the expense of an on-site combined heat and power (CHP) or cogeneration plant.

The base case should examine not just the volume of use for each heat and power, but also the variability of use in daily operations. For example, aluminum smelters ramp up and down, requiring a surge of power from the grid when coming online. Any on-site power and heating solution must be able to meet this need to provide a full benefit.

UNDERSTANDING THE WHOLESALE MARKET

A primary driver for implementing an on-site power and heat solution is to insulate operations and costs from external pressures. However, many cogeneration owners and developers build and finance facilities that exceed internal needs in order to sell excess power into the wholesale market. It is important to remember that even if the wholesale market is favorable today, it might not remain a profitable option. Therefore, one must consider that although the grid might be a healthy option to sell excess power, economic and operational dependence on the wholesale market could be problematic.

Mexico’s aggressive renewable portfolio standards could have a dramatic impact on wholesale prices in the not-too-distant future. Lessons learned in Texas and California provide a cautionary tale. In both locations, the relatively recent build-out of renewable generation (wind in Texas and solar in California) has applied significant downward pressure on wholesale power prices. In Texas, wind power has driven wholesale market prices into negative values for periods of time, requiring generators to either pay to offload excess power or shut down. In California, wholesale prices also have been driven down during midday, when solar power is intense, only to skyrocket as solar generating capacity wanes during evening peak demand periods.

For industrial facility owners interested pursuing cogeneration, it is recommended that they build a facility that meets their power and thermal needs without relying on profits from the wholesale market. Cost-benefit analysis should focus on operational savings with the option for an opportunistic revenue stream.

FUEL RESOURCE AVAILABILITY

Wholesale power prices in the New England region of the U.S. usually skyrocket during extreme cold weather events as a result of power producers not having enough natural gas to operate their facilities. Power generators may not pay for fixed capacity on natural gas pipelines and, therefore, are not guaranteed delivery of natural gas on any given day. For most of the year, fuel supply is not an issue. However, as temperatures drop and natural gas utility customers consume more to heat their homes and businesses, less natural gas is available for power generators. These fuel scarcity periods are highly correlated with the times when sources of power generation are most needed.
For industrial facilities in Mexico located on or near a major natural gas pipeline or trunk line, fuel resource availability might not be a significant issue. However, for facilities located on smaller lines — particularly for those who are downstream from other large buyers of natural gas — fuel availability could be cause for concern. Assessing fuel availability scenarios and fallback options in the event of a loss of supply are critical steps to developing resilient operations. For example, many facilities with on-site cogeneration maintain agreements with CFE for backup power, while other facilities have planned shutdowns to accommodate fuel shortages.

**USE OF THIRD-PARTY DEVELOPERS**
Implementing a cogeneration facility is a capital-intensive project. In addition, operating and maintaining a cogeneration facility typically is not a function or skill set that industrial owners have conveniently on hand. Engaging a third-party developer to build, own and operate the cogeneration plant has the potential to provide economic and operational benefits at the cost of giving up some control.

Economic benefits of third-party ownership derive from a typically lower cost of capital in the power space, as well as economies of scale from producers with a robust home office support operation. Independent power producers often are willing to accept sub-10 percent leveraged, after-tax rates of return on investments, with creditworthy off-takers offering long-term contracts. In addition, the developer gains access to proven professionals to manage, operate and maintain the plant and run it in a manner that maximizes efficiency.

However, relinquishing control to a third-party operator can bring potential risk if the commercial agreements are not well thought-out and constructed to benefit both parties. For example, if the industrial owner does not secure rights to the power and steam product, the cogeneration plant owner and operator could cut the local supply in order to take advantage of more lucrative market opportunities.

Pricing formulas for power and cogeneration commodities should represent true costs rather than market theory. Straightforward and fair pricing formulas that contemplate the true price of fuel, the efficiency of the plant, and accurate fixed and variable costs to operate the plant with a profit component result in contracts that are fair, reduce the potential for conflict between the parties, and should stand the test of time.

It is recommended that industrial owners also gain “consent rights” within the commercial agreement for a third-party, on-site cogeneration facility. Consent rights allow the industrial owners to approve or disapprove of changes in operational staff or the sale of the cogeneration plant. Consent rights also can enable the industrial owner to maintain tight control over any cogeneration plant operations that deviate from the primary purpose of servicing the industrial facility with power and steam. For example, owners of an industrial facility that requires 100 percent reliability likely would not want the third-party owner/operator diverting its power to the wholesale market in pursuit of high price signals, as opposed to servicing its contract. Occasionally, price signals can be significant enough to cover liquidated damages for nonperformance in a power purchase agreement, which can drive bad behavior if a contract does not explicitly discourage these scenarios.

**HEDGE AGAINST FUTURE CHANGES**
The energy market in Mexico is in the midst of significant change and uncertainty. In times of uncertainty, energy self-sufficiency can provide a buffer against the fluctuating power prices and policy that are common in developing nations. With on-site cogeneration or CHP, the fuel stream is no longer tied to CFE’s (or its successors’) ability to produce power efficiently and reliably.

Operational resilience is also a significant benefit for facilities that could experience serious safety and economic hardship as a result of an unexpected loss of power from the grid. In large industrial facilities, an uncontrolled loss of process can result in a catastrophic loss of equipment, safety incidents and restart costs, as well as significant lost sales opportunities due to decremental production.
CONCLUSION
Commercial and industrial hosts and independent power producers have a major opportunity to take advantage of the new availability of natural gas and power market reforms. They can reduce the operational costs of facilities in Mexico, enhance resilience, and gain a hedge against market uncertainties through the development of on-site CHP or cogeneration facilities. CHP and cogeneration provide the benefit of self-sufficiency in a rapidly changing energy market, but maximizing the benefit requires close examination of current and future needs against current and anticipated costs; an understanding of the wholesale market; and, if opting to have a third party develop and operate the plant, careful consideration of commercial terms.

BIographies

EDUARDO ANDRADE is the director of country operations for Mexico at Burns & McDonnell. He has three decades of experience in a variety of executive roles for large companies in Mexico with significant operations in the energy sector. He is a past president of the World Energy Council, Mexico Chapter, and currently serves on the Mexico Energy Regulatory Commission’s External Advisory Board for electricity. He holds a civil engineering degree, with concentration in project management, from Universidad de Mexico and a graduate degree in corporate finance from ITESM (Instituto Tecnológico de Estudios Superiores de Monterrey).

DAVID P. DALEY is a regional practice manager for power generation at Burns & McDonnell. He has more than 20 years of experience developing and managing contracted and merchant utility-scale power and cogeneration natural gas combined-cycle facilities, as well as negotiating energy supply and off-take agreements with utilities and large power and steam users. David currently leads efforts to support utilities, industrial customers and private power developers and owners with a full scope of technical services, ranging from project conceptualization and permitting through engineering design, procurement and construction services for new generation and existing plant retrofit projects. He earned a Bachelor of Science in mechanical engineering and his MBA from the University of Houston.