THE TRANSFORMER PROBLEM

Little in the modern world is taken more for granted than electricity. We expect an endless supply, and usually we have it. At work and at home, we are dependent on the power grid, a fact that is easy to overlook until the lights suddenly go out – or the air conditioning stops – or the production equipment quietly comes to a halt.

For those in the utility business, that moment may be preceded by flash of light or an acrid burning odor, the result of a fault or short circuit in electrical equipment. It may be followed by a fire, causing even more disruption. For those not in the utility business, it's simpler: the lights go out. If we're lucky enough to have a transistor radio on hand so we can find out what happened, we start hearing about the links in the electrical power train: circuit breakers, wiring and transformers.

Transformers are an essential part of the system, allowing large loads to travel long distances and smaller loads to flow safely into our neighborhoods and homes. Like many utility assets in the post-deregulation era, however, transformers are aging and deteriorating. In many cases, utilities face "asset walls," which appear when various equipment installed during high-load-growth periods in previous decades simultaneously shows rapidly increasing failure rates. The capital required to replace this vital infrastructure represents a substantial financial burden. Failure to replace old equipment represents several risks, primarily accelerating maintenance costs and increasing loss claims.

Power transformers have long been a major underwriting concern. Failure of a single unit can result in widespread loss of service with considerable lost revenue as well as replacement and other collateral costs. As an object class, transformers have for decades been ranked in the top five by equipment insurers in terms of claims. One insurance company recently reported 25 transformer claims during one fiscal year. The largest transformer loss on record occurred at a power plant, leading to business interruption costs of more than $86 million. Had this event, which took place in 2000, occurred today, costs would have been much higher. Power companies aren't the only businesses at risk. Three of the top four transformer property damage claims reported were in industrial plants.

THE PROBLEM'S SOURCE

For U.S. utilities, the source of the transformer problem is clear. After deregulation in the 1980s, the longstanding practice of utilities paying for maintenance and improvements at will and passing along the costs to customers went away. Utilities were forced to operate like other businesses, struggling to keep expenses down and retain customers. Many electric utilities merged to form large international utilities, while others sold off their generating assets, in efforts to enhance revenue streams, reduce the incremental cost per MW or react to spot market opportunities.

Deregulation, however, did not mean utilities were free to do what they wished. Starting in the 1980s, utilities had to contend with mandates to utilize independent power producers to satisfy demand. This made planning for future load projections difficult. Rate setting remained under the aegis of local utility commissions, and rate increases were hard to justify in the newly open, competitive power market. Many utilities were forced to stop capital spending on infrastructure, including transmission and distribution assets. By the 1990s, capital spending on new and replacement transformers was at its lowest level in decades. Many of the major manufacturers exited the power transformer business. Many of the remaining transformer makers instituted cost-cutting measures and higher prices to survive.

At the same time, demand for electrical energy, or load growth, has slowly but steadily increased. The typical power transformer on the U.S. domestic grid today is 35 years old and facing the high end of its capacity. Electrical equipment of this age is generally considered to be approaching the end of its useful life.

North American utility managers are of course not unaware of the situation. For years, experts have published scholarly and technical articles, white papers, and engineering society presentations elucidating the problems and pointing to solutions. Loss control professionals have shown that unplanned failures are both predictable and preventable. The financial reality remains, however. Projections of capital required to maintain reliable service across the system are simply beyond the financial capacity of many of the relatively new transmission and distribution (T&D) companies.

INCREASING THE PRESSURE

Just as utilities aren't the only organizations facing the transformer problem, deregulation is not the sole cause of the looming crises today. Other factors include the growing shortage of skilled workers. As the baby boom retires, replacement workers who know this equipment are hard to find. The shortage in skilled workers presents a potentially serious increase in exposure to loss and liability.

Another significant factor is the cost of raw materials. The rise in the prices of copper and stainless steel, the main materials used in transformer fabrication, has been accelerated by high levels of military consumption and growing international demand. All copper commodity price indices increased in excess of 25% in 2007. Metal prices, rising rapidly for the past two years, are expecting to continue climbing.

The price of transformers has more than doubled in recent years. According to the Handy-Whitman Index, widely recognized as the leading authority on utility equipment replacement costs, transformer prices have experienced a 5.5% annualized rate of inflation for the past 10 years. At this rate, the cost doubles approximately every 12+ years. A large transformer that cost $500,000 in 1960 (there are many of this size and vintage still in use), now has a replacement cost of about $4,000,000.

Another roadblock to upgrading transformers is the lead time required to move from order to completed installation. Typical lead time is now 750 days – if the reinstallation is possible on the same settings as the replaced transformer. The shortage in skilled workers is a factor here. Another issue is yard crowding: new equipment often requires new settings and position due to changes in safety regulations.

The space problem will only grow worse as the size of the equipment expands to meet growing load demand. Current load growth of 2% is expected to continue, meaning that equipment installed now will have to be replaced at the end of its expected life (in 35 years) with equipment twice the size. The need to find additional land space can significantly expand installation lead time. Along with the growth in load and equipment comes an expansion in risk. The all-in costs of unexpected and unplanned failure are immense, far in excess of the $400,000,000 maximum capacity normally available for

monoline Equipment Breakdown protection coverage. Many underwriters, given the potential for fire following transformer failure, are now treating this exposure as Property risk, rather than Equipment Breakdown risk, in order to access the greater amounts of reinsurance thereby available.

POTENTIAL ANSWERS

Tools have been developed to reduce the risk of transformer failure. Diagnostic technologies such as online multiple gas dissolved gas analyzers and partial discharge monitoring can help provide health snapshots of transformers. Despite these advances –and despite the likelihood that a large transformer failure could easily cost a utility CEO his or her job – few transformer owners are willing to spend the investment dollars necessary. The economic forces described above, along with a culture of conservatism that dominates many of the companies in the field, prevent ready adoption of new technologies.

No simple solutions are available to solve the transformer problem. Cultural change is rarely fast, and an uncertain economy further delays major capital investments. The risk control technology is emerging, however, as are risk management answers in the insurance marketplace. Partnering with a risk control and risk management expert who knows these issues can be of vital assistance to the risk manager faced with unavoidable facts of extreme equipment aging, increased failure frequency and increased loss expectancy –in addition to the bewildering technical nomenclature, jargon and buzzwords of the transformer world. Willis Property Resource Consultants can assist in the discussion of the transformer problem and the diagnostic tools available to determine the condition of transformers in an effort to avoid cataclysmic failure and better prepare for the future.

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