The electric generation, transmission and distribution systems in Ohio are satisfactory to meet current needs in the state, reliability problems are relatively few, and those that exist are being addressed by system improvements in equipment and management. However, mandates related to alternative energy and environmental protection may pose problems for Ohio’s electric utilities in the coming years. Electricity in Ohio is provided by several investor-owned utility companies, Rural Electric Cooperatives, and municipally-owned electric systems. The physical system is composed of generation, transmission, and distribution components.

Electricity usage in Ohio was relatively stable during the period from 1995-2005, which followed a 15-year period of significant growth in usage. Transmission and distribution outages have been cause for concern in Ohio due to weather-related disruptions of the transmission and distribution system. Recent experience may warrant review of design standards. In 2008, the Ohio legislature passed a bill that requires that 12.5% of energy be from alternative energy sources (including renewable, conservation and clean thermal) by 2024. Of this amount, half must be from renewable sources, such as wind, hydro, solid waste, and solar.

Background

Ohio is served by several electric utility systems that are interconnected and exchange and purchase electricity from each other in various ways. Major investor-owned utilities are: American Electric Power (AEP – Ohio Power and Columbus Southern) serving approximately 1.4 million of the state’s customers, mostly in central and southeast Ohio; First Energy (FE) in northern Ohio serving approximately 2.2 million customers; Duke Energy in southwest Ohio serving approximately 650,000 customers; and Dayton Power and Light (DPL) in the Dayton area serving approximately 500,000 customers. Some rural areas are served by Rural Electric Cooperatives under the statewide Buckeye Power Cooperative (BPC), and over 80 cities are served by municipally-owned electric systems. All of the investor-owned utilities have their own generation facilities, primarily coal-fired power plants. There are two nuclear plants in Ohio in the FE system, several smaller gas-fired generators, as well as one hydropower plant in the AEP system. Three of the systems, AEP, FE, and Duke, have major additional generation facilities outside of Ohio. The municipalities buy a substantial portion of supply from the investor-owned utilities in Ohio or from outside the state, but these municipal systems have recently increased their generation capacity through an association, American Municipal Power – Ohio (AMP-OH). This municipal-based system includes coal, gas and hydroelectric power plants that are owned in shared-ownership arrangements through AMP-OH. In addition, some 20 municipalities have their own generating facilities. The municipal and rural co-op system
rates are not regulated by the Public Utility Commission of Ohio (PUCO), but the state does have authority over their construction of new generation facilities. The rural co-ops and municipals each serve between 5 and 10% of the state’s total customers. Table 1 shows the total capacities of plants in Ohio owned by the various generating entities, with broad categories of generation technologies.\textsuperscript{1,2}

Table 1. Utility System Generating Capacity in Ohio - January, 2009

Table 2 shows the percentage in each type of generation for Ohio electric utilities.

Table 2. Utility System Generating Percentage by Type - January, 2009
Ohio Electricity Facts and Issues

The physical system is divided into generation, transmission, and distribution for regulatory and planning purposes. Ohio has gone through a process of revising its electric rate regulation system over the past several years, first establishing a program to go to an unregulated (or less-regulated) rate system in the 1990s, then, when Senate Bill 221 (SB 221) passed in 2008, moving to options for utilities to use either a regulated or a market approach in setting rates. Standards for reliability are separate from the rate regulation.

Ohio is involved with two Regional Transmission Organizations (RTOs); the Pennsylvania-New Jersey-Maryland (PJM) system, which includes AEP and DPL, and the Midwest Independent System Operator (ISO), which includes the other utilities in Ohio.

Electricity use in Ohio has been relatively stable in recent years, falling in the range of 150,000 to 165,000 million KWH per year, from 1995 to 2005. There was significant growth in usage from 1980 to 1995 (about 37% total growth over the 15 year period, or about 2.1% per year), but there is no indication of when or if such growth might resume in the future, given the decade of no-growth since the mid-90s. These data do not imply a near-term need for added generation capacity.

Usage by customer sector is fairly evenly divided, with 29% commercial, 37% industrial, and 34% residential. The industrial sector has been a lagging market due to reduced industrial production in Ohio in recent years.

Generation facilities are typically classified into two broad groupings: base load plants that run continuously and supply the majority of needs, and peaking plants that are operated only during periods of high demand. There have been no major additions to base load generation capacity in Ohio in the past 20 years, only gas-fired peaking plants and hydroelectric power plants have been built. The only base load facility planned at present is proposed by the municipal electric system, AMP-OH, which has proposed to build a 1000 megawatt (MW) coal-fired power plant. AEP is proposing a 550 MW gas-fired plant, and FE is planning a 544 MW gas-fired plant, both of which would primarily meet peak needs.

Because the sources of electricity for Ohio include not only the in-state generating facilities noted in Table 1, but also imports from other states, it is very difficult to judge the adequacy of the systems serving Ohio alone. This is compounded by Ohio’s involvement in two different RTOs, and the lack of available data on generation for competitive reasons.

Electric utilities in Ohio are transitioning from the deregulated system into the optional regulated system defined by SB 221. Under the deregulated approach, there has not been a mandate for electric utilities to construct generating facilities. It is the responsibility of the distribution companies to get adequate supply for their customers, from either system-owned plants or from open market purchases. For utilities that elect to return to a regulated approach in Ohio, their need for added generation in Ohio will be subject to PUCO review and approval of rates for cost recovery. The Ohio Power Siting Commission, a part of PUCO, has review and approval authority over proposed power plants in Ohio that exceed 50 MW in terms of the regional impact of the added generation, and in terms of environmental effects and mitigation requirements. At present, it appears that the generating companies in the two RTOs are planning for adequate generation in the areas of both RTOs, and that Ohio’s current and near term electricity needs
can be met by the combination of generating facilities in the state and ability to exchange with other systems in the region.\textsuperscript{5}

There are moves to expand interstate transmission capacity, especially to the Northeast states, which could lead Ohio utilities to expand sales out of the state. It is unclear how this might affect availability of low cost power for Ohio customers, but heavy commitments to out-of-state wholesale customers could result in less reserve capacity available for Ohio customers in the future.

In terms of system reliability, transmission and distribution systems (lines, transformers, switchgear) are very important. Since the Midwest/Northeast power outage of 2003, which originated in Northeast Ohio, transmission system regulation has been largely preempted by the federal government. Standards have been imposed that are generally considered adequate for Ohio, and all Ohio utilities have passed the federal reviews. The 2008 report by PUCO on 2007 transmission performance indicated that the number and duration of outages were generally declining over the five-year period ending in 2007.\textsuperscript{5} Distribution lines are being moved to road right-of-ways (ROW) for easier access than in wooded areas. Some undergrounding of lines is being considered, but the cost, typically more than triple the cost of aerial lines, is a barrier to this solution in most places. Preventive maintenance is being increased, and asset management programs are being applied in some systems. Rules now require annual inspection of transmission lines, five-year inspection of distribution lines, and monthly inspection of substations. Also, the federal agencies have added authority to help utilities acquire ROW for power lines in certain designated corridors, to help build new lines and strengthen the grid.

Distribution remains largely under the authority of the state through the PUCO. Problem areas are closely monitored by the PUCO, and the utility companies are required to show progress in these areas. Transmission and distribution outages have been cause for concern in Ohio due to weather-based disruptions of the transmission and distribution system. While the trend of outages has been down in recent years, there were extensive and prolonged outages in Ohio due to the strong winds associated with the passage of the remnants of Hurricane Ike in autumn, 2008. These were not considered to be a result of inadequacies on the part of the utilities, as the wind speeds were substantially above the design standards adopted by the utilities with PUCO agreement. The outages were most severe in distribution systems in areas with the best past performance, an indication of the severity of this particular event. The greatest problem is trees near power lines, especially those not in the utility ROW where the utilities have no right to trim. PUCO is pressing the utilities to attempt to get voluntary trimming authority from adjacent landowners. Also, there have been several major outages in recent years due to heavy ice loading, especially in southern Ohio. The design standards for Ohio include lighter ice loading in the south half of the state than in the north, a standard established in 1949. Recent experience indicates that the earlier standards may no longer be applicable in parts of the state.

A major question for electric power systems looking ahead is the “Smart Grid” concept, where automated sensors and control devices would help manage the grid, sense developing problems, and, where appropriate, react automatically. Smart grid studies and initial plans for action within the next year or two are under way at several utilities in Ohio. Other aspects of this initiative, which seems likely to receive much stronger support from the new federal administration, include smart metering (for peak demand reduction), and added transmission capacity where that would improve system integration of renewable power sources, especially from sources in the Plains and the West. There is concern that Ohio may be pressed to help
fund these long distance transmission facilities with no economic benefit to Ohio customers, an approach that PUCO is opposing. If there are going to be federal mandates for importing renewable power, and smart grid and smart metering programs, there may be a need for significant improvements to transmission and distribution for Ohio’s utility systems in the coming years. The need to generate funds from rates to meet these added costs, on top of ongoing normal upkeep and improvements, may lead to large rate increases, consumer opposition, and economic damage to the state’s economy.

The Ohio Legislature included mandates in SB 221 that require an increase in the proportion of alternative or advanced energy sources in the state’s power mix. SB 221 requires that 12.5% of energy be from alternative energy sources (including renewable, conservation, and clean thermal) by 2024. Of this amount, half must be from renewable sources such as wind, hydro, solid waste, and solar. However, the bill includes a cap on excess cost of 3%, which will likely limit the need to add alternative energy unless it is significantly subsidized by other financial sources. The provisions of SB 221, as now in force, do not appear to pose any threat to the future adequacy of Ohio’s electric supply, transmission, and distribution system, provided that they are not superseded by more stringent state or federal requirements.

Because coal currently provides approximately two thirds of Ohio’s electric generating capacity, its elimination, or a major reduction in the use of coal over a short period of time, would likely have a serious adverse effect on the effectiveness and economic viability of the system. There is a strong possibility that coal-fired generation will be required to drastically reduce CO2 emissions in the future. Ongoing research in clean coal technology and carbon sequestration offer the potential for continued use of coal in an environmentally responsible manner, but the resulting costs are as yet unknown. The costs of such coal generation upgrades could impose large financial burdens on the systems. Large expenditures to meet more stringent requirements may strain the utilities’ financial capacity, making it difficult for them to construct adequate facilities to meet any future load growth that may occur, unless appropriate funding methods are put in place.

The future means of providing adequate and reliable electric power to the residents and businesses of Ohio will likely be subject to mandates to meet reduced greenhouse gas emissions, and to utilize a wider range of sources, including locally generated and imported renewable electricity. All of these sources will involve the application of new engineering, design, construction, and operation methods. If these new approaches are to be efficient, reliable, long lasting and economical, they must be selected based on rational decision making processes, including experience, research, pilot applications, and fact-based economic analysis. Throughout this process of decision making and implementation, the input and talents of registered professional engineers will be essential if Ohio is to have a future electric system that meets its needs. These new approaches offer the potential for new industries in Ohio, and for new applications of the expertise of Ohio’s engineers. However, as with all new approaches, they will encounter resistance, well or ill founded, based on local preferences, aesthetics, cost, and other yet to be identified factors.

Overall, it appears that the electric generation, transmission, and distribution systems in Ohio are satisfactory to meet current needs in the state, reliability problems are relatively few, and those that exist are being addressed by system improvements in equipment and management. There is, however, some cause for concern that the existing system may not meet future requirements in support of economic growth, renewable energy transmission, and smart metering in the state.
Statewide grading for Ohio may be somewhat misleading as the different utility firms have different levels of adequacy, possibly ranging from C to A. Also, while existing utility systems may meet current standards, the standards may change in the future. Possible changes include emission controls for CO$_2$ at coal-fired plants, revised weather-based design standards, smart transmission systems, smart metering equipment, and transmission improvements to allow greater inter-system transfers, and to allow long distance transmission from potential renewable energy sources to load centers. Based on this information, the assigned electric system grade is C+, although changes in system standards at a local, state, or national level might warrant a different grade in the future.

**Specific ASCE Ohio Council Recommendations**

- To be prepared for the future, Ohio should anticipate changes in standards and have plans in place to meet new standards rather than face sudden changes that may strain technical and financial capabilities of Ohio’s electric utilities.

- Efforts to implement Smart Grid elements should be pursued where economically sound, and utility financing approaches should be in place to assure healthy electric utilities that can afford to meet both higher environmental standards, as well as any additions to meet increased demand.

- Ohio should seek a reasonable level of regulation in terms of using renewable power sources and encourage development of those with the best return on the charges to rate payers. Any additional requirements to meet pollution standards, such as controls on carbon emissions, should be met using the most cost effective technology (i.e. carbon sequestration, nuclear power, and renewable sources should be rated based on effectiveness and sound engineering and economic evaluations).

- Where long term climatologic data and operating experience indicate that current design or operating standards may be outdated (such as the estimated effect of ice on wires, or problems in vegetation control), new standards should be established to improve system reliability.

- For those system improvements that must be funded by customer rates, implementation should be phased to avoid excessive rate shock. Maintaining an economical electric utility climate in Ohio is essential for the citizens in general, for the state’s businesses and, ultimately, for the viability of Ohio’s economy.

**Sources**

1. Utility company websites and literature provided general statistics on utility customer counts, loads, and capacities

2. Commercial Electric Generating Plants Operating in Ohio as of January 1, 2009

3. Ohio Legislature, 127th session, Senate Bill 221


5. Midwest ISO and PJM ISO websites and literature


Electricity Fact Sheet - Page 6
2009 Ohio Infrastructure Report Card