COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

AN ASSESSMENT OF KENTUCKY'S ELECTRIC GENERATION, TRANSMISSION, AND DISTRIBUTION NEEDS	)))	ADMINISTRATIVE CASE NO. 2005-00090

Submitted
TESTIMONY

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I appreciate this opportunity to provide testimony to the Commission regarding important issues relating to Kentucky's electrical power industry.

As background, I have been involved in many phases of the energy industry since I worked with KY's rural electric cooperatives during my engineering undergraduate work some 35 years ago. I received my doctorate from Purdue University working on a solar energy project and have been involved in energy related research, teaching and extension activities at the University of Kentucky for the last 26 years. I am a registered Professional Engineer in the Commonwealth. I recently completed a term as President of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) – a professional engineering organization with over 55,000 members in 128 countries. While President of that group I organized and am currently serving as Chairman of the Steering Committee of the Advanced Energy Design Guides. This is a consortium of four professional organizations: ASHRAE, the American Institute of Architects, the Illuminating Engineering Society of North America, and the US Green Buildings Council. This consortium is working to produce documents to guide the 145,000 designers and professional members of these organizations on producing energy efficient buildings which are 30%-, 50%- and 70%- of the way toward net zero-energy buildings. However, I should indicate that my statements today represent my own professional opinion and should not be construed as an official opinion of my employer nor these organizations.

It is well known that Kentucky is fortunate in having the least expensive electrical energy prices. In 2003 the Commonwealth's sector composite electric price was 51 percent below the national average[1]; however, it ranks 3rd highest in energy intensity[1] which leads to relatively high energy bills. My purpose today is not to analyze why this dichotomy exists; but rather to: a) present to you where much of this energy is being used, and b) describe some items which could resolve this dichotomy and provide for other ways to reduce the need for additional production and/or provide less expensive alternatives to adding generation and distribution capacity. My discussion highlights opportunities before Kentucky to enjoy not only the lowest electric prices in the nation but also the lowest electric bills in the nation.

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Where the Energy Is Being Used

Energy use in buildings accounts for over 60% of the electricity used in the US and almost 40% of the natural gas[2]. Most of the buildings in Kentucky are residences or small office, retail, school or service buildings. The typical distribution of energy use in a small commercial (office) building for our climatic conditions[3] is: lighting 31%, heating 22%, plug load (120V outlets) 19%, air-distribution and duct fans 13%, cooling 12% and service hot water 3%.

The typical distribution of energy in a modern 1800 sq ft central KY residence[4] is: heating 43%, major appliances 25%, water heating 14%, cooling 8%, plug loads 5%, and lighting 5%. On a typical year this home will use about 25,500 kWh. In many parts of the world statements about energy usage are followed by the amount of CO_2 produced. This 25,500 kWh from the typical 1800 sq ft home in Kentucky represents 20 tons of CO_2 produced per year[4].

Reduced consumption through energy efficiency and conservation measures can be thought of as an alternative to building additional generation capacity and demand control. Based upon the significant amount of energy used by buildings in the Commonwealth, building energy efficiency and management options should play an import role in the electrical policies of the state.

According to a recent Energy Foundation report, saving energy through building energy efficiency improvements costs much less than supplying energy from new power plants and associated transmission and distribution facilities[5]. For example, in addition to the decrease in pollution, saving electricity typically costs 2 to 3 cents per kWh saved; which is two to three times less than the delivered cost of electricity from new power plants[6]. Eight examples of energy efficiency and management programs with costs less than 2.5¢ per kWh were recently presented in Georgia[7]. Five examples were below 2¢ per kWh and even some of these programs had costs less than 1¢ per kWh.

Resolving the Dichotomy

Building energy efficiency improvements can be made in two major ways: a) implementation of energy building codes for new construction, and b) utilization of replacement programs for existing buildings.

a) The adoption and enforcement of building codes is a key element in saving energy usage in buildings. Kentucky has traditionally just gotten by with the least amount of requirements for energy efficient buildings and the enforcement of these requirements is severely lacking. It has been found that state-of-the-art building energy codes reduce electricity use, peak electrical demand, and natural gas in new homes and commercial buildings by 15-30 percent on average[8]. Kentucky is to be commended in its recent adoption of the latest version of the International Energy Conservation Code (IECC). However there is a significant need to ensure that:

1) architects, engineers and builders understand how to comply with codes in a cost-effective manner, and, perhaps more importantly,
2) the energy codes in effect be utilized and enforced.

Having a code on the books is not effective unless there are sufficiently staffed and well trained energy code enforcement agencies with the authority to assure that the intention of energy efficient buildings are being met. It is estimated that if builders controlled the quality of their buildings and code officials rigorously enforced state-of-the-art building energy codes, overall electricity and natural gas usage in the Southwest U.S. region could be reduced by 4-8% by 2020[9].

Building energy codes however only establish a bare minimum on energy efficiency; they do not "push the envelope" nor utilize all the commonly available strategies or materials to save energy. Good architects and engineers recognize that the greatest value to the owner usually means going beyond the minimum. However their design fees rarely allow them the luxury to do any energy design optimization. It is possible to reduce energy consumption by 30-50% relative to code requirements and to do so cost effectively by combining efficiency measures through an integrated design approach specific to building and location[10,11].

Although energy efficient building practices may have higher first costs, their impact over the life of the building must be considered. Based upon a 40-yr life cycle cost, the first cost (i.e. construction cost) is only 11% of the total life cycle cost of the building[12]. This illustrates that the additional cost of energy efficient options is quite small compared to the operational costs and salary of the personnel within the building. Nevertheless since affordability is the primary driver for building equipment purchase decisions, it is essential to develop lower first-cost options which might include utility incentives for energy efficient products.

b) New construction accounts for only about 2% replacement of Kentucky's buildings each year. Although opportunities to impact energy use in existing buildings are more limited than for new buildings, the existing building sector is so large that efficient replacement products and operational strategies are very important. The potential for savings due to energy retrofits in existing buildings can be 4 to 5 times the cost of installation. For commercial buildings large energy savings can be achieved through:

1. Replacing HVAC equipment with more efficient units,
2. Replacement of windows and utilization of more daylighting strategies,
3. Refurbishment of the thermal envelope with additional insulation and infiltration reduction,
4. Installing more efficient lighting systems,
5. Testing and sealing air distribution ducts,
6. Replacing electrical motors with more efficient or variable speed drives,
7. Use of automated energy management systems for demand limiting and load shifting, and
8. Replacing inefficient office equipment with more energy-efficient Energy Star products.

For residences the major savings are in the areas of adding insulation and replacing windows, reducing infiltration, replacing inefficient HVAC, lighting, and water heating systems and using Energy Star appliances.

Additional savings can be gained in both types of buildings with the use of renewable energy sources. The contribution of non-hydro renewable energy production to Kentucky's consumption was less than 1% of the total consumed. This places it 50th in the state rankings[13].

Building better buildings also have a significant non-energy benefit to occupants that live and work in these facilities. There are numerous studies that correlate building occupant performance, productivity, safety, comfort and heath to the design and operation of a facility. Quite simply - people perform better in well designed and constructed buildings that are operated efficiently.

Recommendations

Based upon this information, in order for Kentucky to continue to grow its economy and utilize our resources in a more sustainable manner, we need to:

1. Recognize energy efficiency standards and codes as an important component in the Commonwealth's energy policy and also recognize their ability to meet aggressive goals to reduce energy consumption and demand,
2. Adopt state-of-the-art building energy codes and standards,
3. Mandate that new state facilities and state-funded facilities have high-performance, energy efficient designs which use at least 30% less energy than current building code,
4. Initiate utility savings, energy efficiency and equipment maintenance programs in state and state-funded facilities,
5. Invest in improving building codes and standards to conditions unique to this region,
6. Establish an extensive training program for engineers, architects, and builders on compliance with codes in a cost effective manner,
7. Establish training for independent building commissioning or quality assurance agents and utilize their services,
8. Utilize demand side management and rebate programs for energy efficiency design optimization and initial and/or replacement of energy efficient equipment or renewable energy sources, and
9. Establish a Public Benefits Trust or utility energy surcharge program to provide for independent research and public educational activities to deal with end-use energy conservation and addressing the substantial energy impacts of key non-energy considerations such as health, safety and productivity decisions which are critical to improving energy efficiency in buildings.

In closing, energy usage in buildings plays an important part in the Commonwealth's electric generation, transmission and distribution needs. A commitment to energy efficiency and demand management in buildings produces jobs because of the labor required to manufacture, sell and install energy efficient measures; it utilizes our resources in a sustainable manner, and, it protects our environmental quality. All three of these are key components in having a more prosperous and more beautiful Kentucky.

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