ENERGY EFFICIENCY REDUCTIONS METHODOLOGY

The emission reduction estimates for the proposed Dallas Fort Worth SIP includes reductions within the nine non-attainment counties (Denton, Collin, Dallas, Tarrant, Johnson, Ellis, Kaufman, Parker, and Rockwall). The EPA's Office of Atmospheric Programs, in coordination with the Texas Commission on Environmental Quality (TCEQ), Electric Reliability Council of Texas (ERCOT) and Energy Systems Laboratory (ESL), developed a methodology for quantifying NOx emission reductions resulting from the energy savings due to energy efficiency measures. The methodology considered the amount of energy savings (kWh) in different areas of the State above original SIP baseline assumptions, and included the reductions to natural gas use from the elimination of pilot lights in furnaces. The result was an estimate of the emission reductions at each power plant within the ERCOT region, and the reductions of natural gas within each county. The reductions for each power plant and for natural gas were then summed for each county.

A major source of the data used was contained in the EPA's Emissions and Generation Resource Integrated Database (eGRID). eGRID is a comprehensive data base of information on the environmental attributes of the U.S. electric power system, and provides emissions and resource mix data for every power plant, electric generating company, State, and region of the U.S. power grid. At each of these levels, eGRID reports data on emissions of sulfur dioxide, nitrogen oxide, mercury, and carbon dioxide, as well as power plant operating data such as heat input, generating capacity, and net generation. The data base is assembled from a variety of data collected by the EPA, the Energy Information Administration (EIA), and Federal Energy Regulatory Commission (FERC). Major electronic data sources include EPA's Emissions Tracking System/Continuous Emissions Monitoring (ETS/CEM), National Air Pollutant Emission Trends (NET) fossil fuel steam component, EPA Electric Utility Steam Generating Units Hazardous Air Pollutant Emission Study: 1999 Mercury Information Collection Effort Data Base, EIA Forms EIA-759, -767, -860A, -860B, and -861, and FERC Forms FERC-423 and -714.

One basic assumption included in the analysis was that no electricity is imported into or exported out of the ERCOT region, although, in reality, some electricity is imported into or exported out of the ERCOT North America Electric Reliability Council (NERC) region. However, the amount that is exchanged is relatively small. For example, in 1998, 1,193,479 MWh was imported from the Southwest Power Pool (SPP) and 1,004,568 MWh was exported into SPP, resulting in a net interchange of 188,911 MWh. In comparison, 296,042,502 MWh was generated within the ERCOT region in the same year. Therefore, the amount of electricity imported into and exported out of the ERCOT region is less than one-half of a percent of the electricity generated within the ERCOT region.

The first step in the analysis estimated how much electricity generation would be curtailed in each service territory for a given amount of electricity demand savings occurring in a particular service territory. Within the ERCOT region there are several power control areas. These power control areas are related to the service territories mentioned above and electricity flows between these power control areas. The amount of electricity generated in each of these power control areas varies greatly, as do the fuel sources and emission characteristics of electricity generated. The eGRID database contains information about how much electricity was exchanged between each power control area within the ERCOT region in 1998. This information, along with the amount of electricity generated within each power control area, was used to determine where the electricity originates. For cases where two adjacent power control areas reported different quantities of exchanged electricity, the method relied on the average of the two values. The method also presumed that the proportions of electricity originating

from each power control area in 1998 will remain the same in 2007. The annual generation and the annual interchange of electricity was configured into simultaneous equations, even though the electricity is not exchanged simultaneously.

The next step in the analysis was to estimate the location of electricity generation reductions to the power plant level within each particular power control area. eGRID power plant level data for all of the generators in the ERCOT region was used in this step. Electric generating units that are expected to be retired by 2007 were removed from the calculation. New generating units and expected operating characteristics (annual generation, capacity factor, and emission rates) were added to the eGRID power plant level data.

Next, how much of each power plant's generation could potentially be affected by energy efficiency measures was estimated. Instead of using dispatch modeling, these values were determined by using the power plant's fuel type and capacity factor. First, the generation from nuclear and hydroelectric power plants are assumed to not be affected by energy efficiency measures. Nuclear units are normally baseloaded units (among the first units to be dispatched to accommodate electricity demand) and hydroelectric power plants usually generate electricity whenever adequate water supplies are available. Capacity factor is a measure of a power plant's generation relative to its maximum capacity over a given period of time and is generally a value between 0 and 1. eGRID lists power plant specific capacity factors on an annual basis. In the analysis, power plants that have a capacity factor of 0.8 or greater are considered to be base loaded units and none of their generation would be affected by energy efficiency measures. Power plants that have a capacity factor of 0.2 or less are considered to be "peaking" units and all of their generation could be affected by energy efficiency measures. Power plants with capacity factors between 0.2 and 0.8 are considered to have a portion of their generation possibly affected by energy efficiency measure.

Based on the previous steps, one can then distribute the amount of energy efficiency to each of the control areas and to each of the power plants within the power control areas. Within each power control area, all of the generation that could be affected by energy efficiency measures is summed. Each power plant's potential reduction in generation is then divided by this total amount, expressing the figures as a percent of the power control area total. This procedure presumes that there are no transmission constraints within each power control area. The information from the previous steps are combined so that the generation reductions for each power plant within ERCOT is determined for a given amount of electricity demand savings that is implemented in a particular service territory.

Each power plant's emission factor for NOx is applied to the generation reduction to determine the emission reduction, with eGRID the primary source of data for this step. The final step is to add up the power plant level estimated emission reduction data into countywide totals.

SIP APPROVABLE MEASURES

Quantifiable - The emission reductions were quantified by the use of a calculator developed in conjunction with EPA and ESL. The Laboratory calculated the electricity and natural gas savings from the implementation of the International Residential Code (IRC) and the International Energy Conservation Code (IECC) for residential, commercial and industrial buildings. The methods used to calculate and verify savings used several different sources of information, including:

• The calculation of electricity savings and peak-day electric demand reductions from the implementation of the IECC/IRC in new residences, ASHRAE 90.1-1999 in commercial buildings, and ASHRAE 90.1-2001 in Texas State Agencies in non-attainment and affected counties as compared

against 1999 building characteristics using code-traceable, hourly, building energy simulation.

- The cross-check of electricity savings using a utility bill analysis method.
- The cross-check of pre-code and post-code construction data using on-site visits.

The Laboratory worked closely with the TCEQ and EPA to develop procedures for calculating NOx reductions from electricity savings using the EPA's Emissions and Generation Resource Integrated Database (eGRID). This procedure calculates annual and peak-day, county-wide NOx reductions from electricity savings from Energy Efficiency and Renewable Energy projects implemented in each Power Control Area (PCA) in the ERCOT region.

Surplus - The emission reductions are surplus since they are not relied upon to meet air quality attainment requirements in the DFW SIP. The emission reductions are from the implementation of the new construction code, and they are only accounted for in the DFW energy efficiency measures.

Enforceable - The reductions are enforceable because the measures are part of the new construction code requirements. To achieve energy savings in new construction, Senate Bill 5 mandates statewide adoption of the International Residential Code (IRC) and the International Energy Conservation Code (IECC) for residential, commercial and industrial buildings. The Energy Systems Laboratory (Laboratory) at the Texas Engineering Experiment Station of the Texas A&M University System is responsible for determining the energy savings from energy code adoption and to report annually to the TCEQ.

Permanent - The reductions are permanent because the measures are part of the new construction code requirements. To achieve energy savings in new construction, Senate Bill 5 mandates statewide adoption of the International Residential Code (IRC) and the International Energy Conservation Code (IECC) for residential, commercial and industrial buildings. The Energy Systems Laboratory (Laboratory) at the Texas Engineering Experiment Station of the Texas A&M University System is responsible for determining the energy savings from energy code adoption and to report annually to the TCEQ.

PROJECTED 2007 AND 2012 CALCULATED REDUCTIONS

The calculations begin with the 2007, 2012 estimations, where the kWh/house annual and kWh/house peak day from the Laboratory's 2003 report were extracted for each county. Similarly, the therms/house annual and therms/house peak day from the Laboratory's 2003 report were also extracted for each county. This procedure was then repeated for multifamily residences in each county. The Laboratory's 2003 report was calculated using the energy efficiency calculation methodology described above.

Next, the housing permits from the U.S. Census were assembled for each county for 2001, 2002, and 2003, and projected for 2004 through 2012, using a constant value locked at the 2003 housing permit rate. The cumulative housing permits were then calculated for each county, and then multiplied by the kWh/house and therms/house savings from the Laboratory's 2003 report. The values are then inflated by 7% to represent the losses from transmission and distribution, and reported for both annual MWh/county and MWh/peak-day.

Next, the savings for each county is rolled-up into the appropriate Power Control Authority (PCA), using the values from the 2003 report. These summed PCA values are then taken forward into eGRID and calculated as annual NOx and annual NOx 20% in the following way. The annual NOx values are

calculated for each PCA by county using the original 100% 1998 eGRID values. The annual Nox 20% values are reported as 20% of the 1998 eGRID values. This procedure is the repeated for peak day calculations. The 2007 and 2012 plant emission rates are estimated to be the 1998 x 20% calculation.

The projected 2007 NOx reductions for the DFW area from energy-code compliant new residential construction in the nine non-attainment counties are calculated to be 229 tons. On a peak summer day in 2007, the NOx emissions are projected to be 0.72 tons.

REFERENCES

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