



U.S. NUCLEAR REGULATORY COMMISSION
**ENVIRONMENTAL STANDARD
 REVIEW PLAN**

8.2.2 FACTORS AFFECTING GROWTH OF DEMAND

REVIEW RESPONSIBILITIES

Primary— Organization responsible for the review of need for power information

Secondary— None

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's analysis and evaluation of the factors affecting historic and projected electricity consumption and peakload demands in the relevant service and market areas. The scope of the review directed by this plan should include a detailed analysis and evaluation of the applicant's treatment of these factors in its projections and, where needed, an independent assessment of forecasts of growth in electricity consumption and peakload demand in the relevant utility service and market areas for comparison.

The need for power is a critical component of an EIS as it establishes a framework for evaluation of project benefits and for the geographic boundaries over which benefits and costs are distributed. ESRP 8.2.2 discusses factors that underlay demand growth, some of which may indicate the proposed plant is not needed as the applicant proposes. This review is critical as it provides assurance to the NRC and the public that issuing a license/permit for the plant is an appropriate action.

In performing this review, the reviewer may rely on the analysis in the applicant's environmental report (ER) and/or analysis performed by State or regional authorities, regional transmission operators (RTOs), or independent system operators (ISOs). The reviewer may also rely on relevant North American Electric Reliability Corporation (NERC) regional council analyses concerning the need for power and energy supply alternatives after ensuring that the analysis of the need for power and alternatives is reasonable and meets high quality standards.

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NUREG-1555

USNRC ENVIRONMENTAL STANDARD REVIEW PLAN

This Environmental Standard Review Plan has been prepared to establish guidance for the U.S. Nuclear Regulatory Commission staff responsible for environmental reviews for nuclear power plants. The Environmental Standard Review Plan is not a substitute for the NRC's regulations, and compliance with it is not required.

These documents are made available to the public as part of the Commission's policy to inform the nuclear industry and the general public of regulatory procedures and policies. Individual sections of NUREG-1555 will be revised periodically, as appropriate, to accommodate comments and to reflect new information and experience. Comments and suggestions for improvement will be considered and should be sent to the U.S. Nuclear Regulatory Commission, Office of New Reactors, Washington, D.C. 20555-0001.

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The primary benefit of a new nuclear plant is the large quantity of baseload power it can provide. Consequently, analyses of need should focus primarily on energy, rather than peak demand requirements. These requirements can be met by the proposed project, potential competing projects, and other alternatives. New power plants may be needed to meet growing loads and to replace plants that are retired. The need for new plants also has a geographic component, as power may be needed at specific locations on the interconnected power grid to ensure reliability of the entire power grid or of subsections of the grid. The geographic scope for the need for power may be defined in the application by a utility service area, but it also exists in a larger geographic context because power from outside a utility service area boundary may also serve the load. This larger boundary is primarily a function of the way the transmission system is planned and managed. This has both electrical and economic features, which requires further description to facilitate evaluation of materials submitted by the applicant and other materials staff may consult.

Wholesale power supply continues to be deregulated nationwide. Firms that do not serve retail customers may build and operate power plants. Power from any power plant may be sold to utilities and others using the regional transmission system. Management and operation of utility transmission is performed on a regional basis to support regional power exchanges through competitive power markets. Some parts of the country have formed RTOs or ISOs to provide regional transmission planning and management and to operate wholesale power markets. Where these exist, they define the relevant market area for a proposed project. In addition to RTOs/ISOs, the United States is divided into unique regional electricity reliability councils by NERC. Each NERC regional council has responsibility for managing system reliability within their respective region by monitoring the balance between customer demand and generation. As a result, the local NERC region may be the relevant market area where RTOs/ISOs do not exist. It should also be noted that high voltage transmission interties enable power exchanges between NERC regions and RTOs/ISOs, although these exchanges are primarily governed by sales contracts.

The determination of the need for new generation requires evaluation of both utility supplies compared to projected demand, and demand in the relevant utility service and market areas. The applicant may provide or NRC staff may seek information from sources that encompass different geographic areas. Therefore NRC staff must be specific about what area they are referencing, such as utility service area, State, RTO/ISO area or regional market, NERC region, or other area if appropriate.

In performing this review, the reviewer may rely on the analysis in the applicant's environmental report (ER) after ensuring it is consistent with all available State or regional authorities' or RTO/ISO analyses, including appropriate regional NERC councils.

Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to the reviewers for the following ESRPs, as indicated:

- ESRP 8.2.1. Obtain data on the power and energy requirements used to support the forecast analysis, including information on forecast methodology and assumptions. Provide data on power and energy alternatives and provide the historic and projected growth data that are considered

appropriate for the relevant area(s) to support the forecast analysis. This may or may not be the applicant's historical service area, even if the applicant is a traditional electric utility. For example, power production in excess of a traditional utility's needs can be readily sold to other utilities or retail power providers as a result of wholesale power market deregulation. Similarly, power from other projects can be purchased to satisfy the applicant's stated need. This makes the largest applicable regional power market a reasonable boundary for this review.

- ESRP 8.4. Provide information pertaining to baseload capacity planning to support the evaluation of the need for the plant.
- ESRPs 9.1, 9.2.1 and 9.2.2. Provide information pertaining to those factors affecting growth of electricity demand that could affect the need for or choice of alternative energy sources and systems.

Data and Information Needs

Affected States and/or regions, NERC reliability councils, and regional transmission organizations may prepare need-for-power evaluations for proposed generation and transmission facilities. The NRC will review applicable evaluations and determine if each is (1) systematic, (2) comprehensive, (3) subject to confirmation, and (4) responsive to forecasting uncertainty. Forecasts should include demand scenarios for midrange, high, low, 75th percentile, and 25th percentile conditions that incorporate consumer response to power cost changes as new power plants are integrated into the power system. Projections of power need are expressions of "wants" rather than of necessity. Customers will find substitutes if the projected quantities are not available or are too expensive. Available projections should be evaluated based on the ability of the project methodology to capture these effects. As the area covered by the project increases, there is a greater likelihood underlying drivers for the growth in demand will vary across the area. Accordingly, larger area projections should be evaluated to determine if underlying assumptions are realistic for an entire region. Projections that incorporate ranges of forecasts allow evaluation of situations where regional growth is uneven and are better than projections that do not cover a range of growth rates. If State/regional or other independent third-party need-for-power evaluations are found to be acceptable, no additional independent review by NRC is needed, and the alternative analysis (analyses) can be the basis for the review in ESRPs 8.2 through 8.4.

If an analysis prepared by or under the direction of one or more State or regional agencies meeting the preceding criteria is not available, data and information on the factors that affect demand growth should be obtained by NRC staff for review of the applicant's need-for-power analysis. Typically, demand growth is a function of population growth, increased wealth, fuel switching, industrial electricity use, and introduction of new or improved electricity using appliances, equipment, and other end uses. As a result, demand forecasts are very sensitive to assumptions about these factors. Accordingly, the following data or information should be obtained by NRC staff for review of the applicant's need-for-power analysis:

- historical and estimated growth for the relevant service area (or close geographic approximation) and ROI of the following variables: population, employment by major industries, number of households, per capita income, consumer price index, manufacturing output, gross regional product, saturation of major appliance, trends in size of household, and prices of alternative fuels and competitiveness of

on-site generating technologies including renewables and combined heat and power. Data should cover the 15 years preceding the date of application through the 3rd year of commercial operation of all proposed units.

- historic and estimated growth of employment and wages by two digit standard industrial classification (SIC) code and personal income for the relevant utility and regional market areas for the preceding 15 years and projected through the 3rd year of commercial operation of the proposed plants.
- historical temperature adjusted energy and peakload data for the 10-year period preceding the application submittal date for the relevant service and market areas.
- to review fuel switching assumptions, data for the 5 years preceding the date of application including the percentage of residences in the relevant service area relying on oil and the percentage relying on gas for space conditioning, water heating, and operating major appliances; similarly, for industries in the relevant service area, the percentages of total energy requirements being met by oil and gas over this same time period, trends in fuel switching, and promotion of fuel switching.
- from the date of application to 3 years after initial commercial operation of the first proposed unit, the generally known availability of oil and gas to ultimate customers in the relevant service area (e.g., gas curtailments and status of gas hookups to new customers).
- for the 15 years preceding the date of application through the 3rd year of commercial operation of all proposed units, the historic and projected growth for the relevant areas of the real price of electricity and substitute fuels by major customer class.
- historic and projected saturation rates of major electricity using equipment and appliances and average electricity use per each for the relevant utility and regional market areas for the preceding 15 years and projected through the 3rd year of commercial operation of the proposed plants.
- the current and projected rate structures (at time of first-unit startup) for major customer classes.
- the relevant region's efforts to conserve and promote customer conservation of electrical energy and changes in underlying building, appliance, and equipment efficiency codes and standards.
- alternative assumptions used to conduct sensitivity studies, and associated results for each study. This should include variations on: employment and income growth rates, customer growth rates, and electricity using equipment and appliance saturation rates including customer installation of power generating equipment such as photovoltaic and wind generators.

If the proposed project will replace an existing generating plant, all of this information may not be needed, however sufficient data and information should be provided to verify the output of the plant being replaced. Staff should verify that the plant will, in fact, be retired through such means as plant retirement filings and announcements and evidence in filings of retirement plans to regional reliability

councils and regional transmission organizations showing zero output from the plant. Staff should also verify that demand will not decline below a level that requires the output from the proposed project using the data and information listed above. If the plant is being proposed to replace plants outside the scope (further in the future) of alternative forecasts and resource plans, staff should attempt to verify general growth trends for the appropriate period and compare these to planned power plants, operating power plants, and license expiration dates for plants that may need to be replaced. Applicants may be required to provide current information to state and local authorities later when construction is imminent.

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of the factors affecting growth of demand are based on the relevant requirements of the following:

- 10 CFR 51, Appendix A(4), with respect to discussion of the no-action alternative in NRC environmental impact statements (EISs)
- 10 CFR 51.71(d) with respect to analysis of alternatives and to weighing the costs and benefits of the proposed action and reasonable alternatives
- 10 CFR 51.75(b) and (c) with respect to applications for early site permits and combined licenses, respectively.

Regulatory positions and specific criteria necessary to meet the regulations identified above are as follows:

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), with respect to electrical demand and projections.

Technical Rationale

The technical rationale for application of these acceptance criteria is discussed in the following paragraphs:

NRC's regulations implementing the National Environmental Policy Act (NEPA) in 10 CFR Part 51, Appendix A, contain the format for presentation of material in EISs. Section 4 of Appendix A specifically requires that the no-action alternative be discussed in an NRC EIS. ESRP 8.2.2 will aid this analysis by providing information to enable an analysis to be made of the need for power from the proposed power plant.

NRC's regulations implementing NEPA also include 10 CFR 51.71, which specifies the content requirements for draft EISs. It is stated in 10 CFR 51.71(d) that a draft EIS is to include "a preliminary analysis that considers and balances the environmental and other effects of the proposed action and the alternatives available for reducing or avoiding adverse environmental and other effects." In addition to providing input for analysis of the no-action alternative, the review under ESRP 8.2.2 will aid this

analysis by providing, as input to the reviewer of ESRP 9.2, information pertaining to those factors affecting the growth of electricity demand that could affect the choice of alternative energy sources and systems.

It is stated in 10 CFR 51.71(e) that a draft EIS is to include a preliminary recommendation respecting the proposed action “reached after weighing the costs and benefits of the proposed action and considering reasonable alternatives.” The review conducted under ESRP 8.2.2 will aid this determination by providing input that can be used to evaluate the need for power and the potential benefits of the proposed action and the alternatives.

III. REVIEW PROCEDURES

If an independent review of need for power is needed by NRC staff in lieu of using a review prepared by affected States and/or regions, the procedures discussed below should be followed. These procedures also may be used by the reviewer as an aid in evaluating forecasts prepared by others. The procedures assume a traditional utility. Industry best practice may evolve as a result of deregulation of the utility industry. The reviewer should be aware of, and use, industry best practice where possible. **In this context, industry best practice is defined by methods used by leading consultants in the field, the Energy Information Administration (EIA), federal power marketing administrations such as the Bonneville Power Administration and including the Tennessee Valley Authority, and leading state and regional power planning organizations, such as in California, New York, and Wisconsin and the Northwest Power and Conservation Council.**

Economic and Demographic Trends

- (1) Analyze the applicant’s estimates of the effects of economic, employment, and demographic trends on the applicant’s projected growth of electricity demand in the relevant service area. Growth in demand typically follows patterns of growth in population, employment, and income.
- (2) Obtain or prepare independent forecasts for the economic and demographic variables identified by the applicant as affecting the rate of growth of electricity demand within the relevant service area.
- (3) Consider additional variables when it appears that they could affect electricity demand growth. **In particular, consider trends in manufacturing employment, out-sourcing, and growth in service industries in relation to energy intensive manufacturing.**

Forecasts prepared for service areas other than those to be served by the applicant may be used when in the reviewer’s judgment they are sufficiently similar to provide a meaningful comparison.

- (4) For each variable used by the applicant,
 - (a) Compare the applicant’s projected growth rates with growth rates developed or obtained by the reviewer.

- (b) Identify differences.
 - (c) Analyze significant differentials as they contribute either positive or negative effects to the applicant's forecasted growth rate of electricity demand.
- (5) Compare the historic growth of these variables with the forecasted growth rates, and identify differences as positive or negative influences on projected electricity demand growth.

Energy Efficiency and Substitution^(a)

- (1) Estimate the importance of energy efficiency and substitution in the relevant service area by preparing an estimate of the effect of these factors on projected kilowatt-hour (kWh) sales and peak demand in the relevant service area for the proposed initial year of plant operation (first unit). Consider power production from renewables by customers (including thermal uses such as the use of ground source heat pumps in place of conventional air conditioners, passive solar designs for heating and cooling, and building integrated solar and wind power) and combined heat and power.
- (a) Contrast this estimate with that of the applicant.
 - (b) Note any significant differences between the two estimates.
 - (c) Calculate the annual compound growth rate in kWh sales and peakload for the last 15 years and compute the increase or decrease in growth rates during the period. Consider historic and projected future electricity growth rates in conjunction with comparable trends and forecasts for retail electricity prices.
- (2) Identify those elements that could have contributed to diminished growth during the historic period and in the forecast period. The list should include the following
- increases in energy efficiency including changes in building and appliance codes
 - higher prices of electricity and tariffs that encourage conservation and demand reduction
 - economic recession
 - milder than usual weather.
- (3) Estimate the relative effects of energy efficiency, price, recession, and weather on diminished growth using the following analyses:
- (a) Compare the real rate of change in the average price of a kWh of electricity in the service area in the last 15 years and contrast with the real rate of change nationally.

(a) For this ESRP, substitution is defined as the substitution of electricity for other fuels and vice versa.

- (b) Compute the real rate of change in the gross regional product for the relevant service area (or geographic approximation) in the last 15 years with the real rate of increase in gross national product.
 - (c) Review peakload growth in the last 15 years (adjusted for temperature) and discuss positive or negative effects on observed growth rate.
- (4) Consider the effect of substitution on growth using the following analyses:
- (a) Review the importance of oil and gas in the relevant service area relative to their availability. Consider any curtailments or denials to new customers (residential, industrial, and commercial) if they exist. Determine the relevant service area's dependence on fossil fuels and the ratio between demand and available supply.
 - (b) Identify trends in new homes (all-electric versus other), purchases of new appliances (electric versus other), and shifts in industrial energy and commercial energy requirements. Determine if electricity is capturing or losing an increasing share of the new and replacement market, and the reasons for the increasing or decreasing share.
- (5) Determine the extent to which the future substitution between electrical energy and fuels such as oil and natural gas may tend to increase or decrease the demand for electric power and thus offset or reinforce the impacts of energy efficiency measures.
- (6) Consider any estimates developed by the applicant with respect to the impact of substitution on realized growth rate and determine any adjustments to growth forecasts that may have been made to reflect the substitution.
- (7) Consider the following factors as they contribute to electricity demand growth:
- (a) the extent to which technological breakthroughs, government legislation and subsidies, and large energy efficiency investments may provide greater energy efficiency savings than have been experienced in the past paying particular attention to building, appliance, and equipment energy efficiency codes and standards including voluntary programs such as Energy Star and Leadership in Energy and Environmental Design (LEED).
 - (b) the extent to which energy sources (e.g., synthetic natural gas, hydrogen) or energy conversion systems (e.g., renewable power systems and geothermal and solar space heating and cooling systems) currently under development may reasonably be expected to compete with or significantly reduce the use of electricity. Consult with the reviewer of ESRP 9.2 to complete this portion of the review.
 - (c) the possibility that long-term savings may not be particularly significant if new electricity uses are introduced (e.g., increased availability of plug-in hybrid vehicles).

- (d) similarly, the possibility that improvements in energy efficiency would result in offsetting electricity savings and thus, decreased use of electric power.
- (e) the possibility of “double counting” energy savings (e.g., energy efficiency is an economic response and some conservation will be included in price factors, although specific conservation programs, including building codes and standards, will be additive).

Price and Rate Structure

- (1) Determine how and to what extent the applicant has considered price response in demand forecasts.
 - (a) Where the applicant has developed and/or used an econometric model, identify the applicant’s price elasticities, forecasted growth rates for the price of electricity, and treatment of price competition.
 - (b) Obtain independent forecasts of growth in the real price of electricity.
 - (c) Compare these forecasts with the treatment of price in the applicant’s analysis.
- (2) Consider the effects of price competition and alternative rate structures that would moderate load growth or reshape load curves.
 - (a) Consider alternative rate structures such as peakload pricing, inverted rates, marginal cost pricing, and flattened rates. Also consider rate and utility programs that promote use of renewable power, such as green power tariffs that either substitute power from renewable sources for conventional supplies or aggregate supplemental payments by consumers to invest in new renewable power resources.
 - (b) Analyze the relevant region’s present attempts and future plans to improve the system load factor via rate restructuring (e.g., higher tail rate during peak periods and demand charges that are based on maximum demand) or valley filling from new electricity uses, such as off-peak charging of vehicle batteries.
 - (c) Estimate anticipated effects on annual electricity consumption and peakload demand.
- (3) Determine to what extent economic, employment, and demographic trends, energy efficiency and substitution, open competition, and price and rate structure are likely to affect the rate of growth of electrical demand. This determination should be based on the following information:
 - the effect of economic and demographic variables on the expected growth of electricity demand with particular emphasis in the aging of existing residents and in-migration of new ones

- the effect of energy efficiency improvements and substitution on projected kWh sales and peak demand, especially the impacts from building, appliance, and equipment energy efficiency codes and standards
 - the effect of price competition with other fuels and on-site generating options and the growth in the real price of electricity on the expected growth of electricity demand
 - the capability of present and proposed rate structures to promote load management, customer site generation via net metering, and substitution of renewable power for conventional generation.
- (4) Ensure that the data and analyses submitted by the applicant are accurate and in sufficient detail to allow one to conclude that the forecast submitted by the applicant properly reflects the factors listed above.
- (a) If the reviewer concludes that the applicant has taken reasonable account of these factors in its forecast, the reviewer can endorse the applicant's forecast.
- (b) If the reviewer determines by analysis that adequate consideration has not been given to the factors listed above, however the forecast demand is consistent with independent forecasts (see ESRP 8.2.1) that do include these factors, the reviewer can endorse the applicant's forecast.

IV. EVALUATION FINDINGS

If a need-for-power analysis prepared by or under the direction of affected States or other reputable, independent third-party is determined to be unavailable or unsatisfactory and an analysis is conducted by NRC staff, the ESRP 8.2.2 analysis will normally be divided into three subsections consisting of a discussion of the applicant's treatment of economic and demographic trends, energy efficiency improvements and substitution, and price and rate structure. The following information should be included in each of these subsections.

Economic and Demographic Trends

This section should include a comparison of the applicant's estimates of the effect of economic and demographic trends on electricity-demand growth with independent analyses of those effects by State and regional authorities or NRC staff. Any significant differences should be noted, and the reviewer should indicate what appears to be the most appropriate estimate.

The reviewer should provide a concluding statement in the EIS similar to the following:

The staff reviewed the data and analyses submitted by the applicant and determined that they are reasonable and in sufficient detail to conclude that the forecast submitted by the applicant properly reflects the effect of economic and demographic variables on the expected growth of electricity demand.

Energy Efficiency and Substitution

The reviewer should provide a qualitative assessment as to the effectiveness of energy efficiency improvements in the last several years given industry restructuring, price changes, business cycles, and weather. Successful efforts undertaken within the relevant region to promote energy efficiency on the part of customers and with respect to internal use of power transmission and distribution efficiency and demand side management should be included.

The reviewer should present any other significant factors that could affect the growth of electricity demand in the service area paying particular attention to changes in building, appliance, and equipment energy efficiency codes and standards and economics of self-generation using renewables, use of ground source heat pumps and other renewable resources for thermal end uses such as for heating and cooling, and use of combined heat and power systems.

The reviewer should provide a concluding statement in the EIS similar to the following:

The staff reviewed the data and analyses submitted by the applicant and other data and determined that they are reasonable and in sufficient detail to conclude that the forecast submitted by the applicant properly reflects the effect of energy efficiency and substitution on projected kWh sales and peak demand.

Price and Rate Structure

The reviewer should describe present and proposed price and rate structures and discuss how price competition and utility price and rate structure may affect the growth of electricity demand.

The reviewer should provide a concluding statement in the EIS similar to the following:

The staff reviewed the data and analyses submitted by the applicant and determined that they are reasonable and in sufficient detail to conclude that the forecast submitted by the applicant properly reflects the effect of the growth in the real price of electricity on the expected growth of electricity demand, and the capability of present and proposed rate structures to promote load management.

If a need-for-power analysis prepared by or under the direction of affected States or regions is available, the ESRP 8.2.2 analysis may be divided into three subsections as above, or it may consist of a single section summarizing the relevant aspects of the region's need for power.

V. IMPLEMENTATION

The method described in this ESRP should be used by the staff in evaluating conformance with NRC requirements, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the requirements.

VI. REFERENCES

10 CFR 51, Appendix A(4), “Purpose and need for action.”

10 CFR 51.71, “Draft environmental impact statement—contents.”

10 CFR 51.75, “Draft environmental impact statement—construction permit, early site permit, or combined license.”

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D.C.

PAPERWORK REDUCTION ACT STATEMENT

The information collections contained in the Environmental Standard Review Plan are covered by the requirements of 10 CFR Part 51, and were approved by the Office of Management and Budget, approval number 3150-0021.

PUBLIC PROTECTION NOTIFICATION

The NRC may not conduct or sponsor, and a person is not required to respond to, a request for information or an information collection requirement unless the requesting document displays a currently valid OMB control number.
