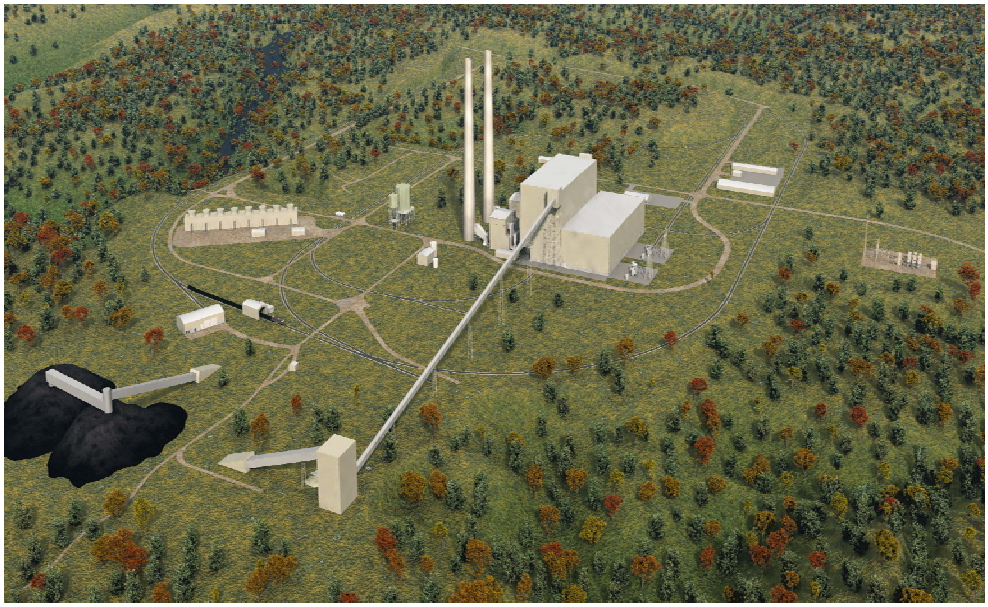
# Alternatives Evaluation and Site Selection Study for the Proposed J.K. Smith Circulating Fluidized Bed Generating Units, Clark County, Kentucky



## East Kentucky Power Cooperative, Inc.
**Winchester, Kentucky**

September 2006

Stanley Consultants INC.

A Stanley Group Company
Engineering, Environmental and Construction Services - Worldwide

# Executive Summary

The East Kentucky Power Cooperative, Inc., headquartered in Winchester, Kentucky, is a not-for-profit generation and transmission utility that provides wholesale energy and services to its 16 member cooperatives through power plants, peaking units, hydro power, and more than 2,759 circuit miles of transmission line. EKPC's mission is to generate and transmit energy to its member cooperatives who distribute it to approximately 375,000 retail customers at the lowest practical cost. To meet the growing energy demand of its member cooperatives and their customers, EKPC is proposing to construct and operate two 278 MW circulating fluidized bed boiler (CFB) generating units with the first unit expected to be in service by 2010 and the second unit to follow at a later date based on market conditions.

The EKPC has requested financial assistance from the Rural Utilities Service (RUS), an agency which administers the U.S. Department of Agriculture's Rural Development Utilities Programs, for the construction of the proposed CFB units. Stanley Consultants was hired by the EKPC to prepare the Alternatives Evaluation and Site Selection Study to meet the requirements of the RUS. This document would also support preparation of a future Supplemental Environmental Impact Statement required for the construction and operation of the two 278 MW generating units pursuant to 7 CFR Part 1794, Subpart G (new electric generating facilities of more than 50 MW (nameplate rating) other that fuel cell, combustion turbine, combined cycle or diesel generators).

The EKPC Integrated Resource Plan (2003), Load Forecast Report (2004), and other EKPC data were used to develop and evaluate alternatives for increasing power generation. The Environmental Impact Statement Related to the Proposed J.K. Smith Power Station Units 1 and 2 and Transmission Lines (1980 Rural Electrification Administration) and the EKPC 400 MW Combustion Turbine Project Alternatives Analysis/Siting Study (1991 Black & Veatch) were used to develop evaluation criteria for site alternatives and identification of the preferred site for the proposed two 278 MW CFB units.

Section 1 introduces the EKPC and the proposed action. The format of this document is also provided which follows the RUS outline (12/1/2003 DRAFT) for an Alternatives Evaluation and Site Selection Study for a new generation project.

Section 2 provides a brief history of the EKPC, identifies its member cooperatives and the total number and type of customers. In addition to the existing member cooperatives, the EKPC has a signed agreement with the Warren Rural Electric Cooperative Corporation to join its system in 2008.

Section 3 addresses the purpose and need for the two new 278 MW CFB generating units. EKPC currently owns and operates 1,657 MW of coal-fired capacity and has developed 12.8 MW of landfill gas capability. The existing EKPC purchase contracts in the region include a guaranteed 186,900 MWh/year from the Columbia Basin System of Projects and 36,400 MWh from the Laurel Dam facility. The EKPC Load Forecast Report (2004) is reviewed to identify the load demand forecasts (historic and projected) and factors considered in the economic model are discussed. The EKPC member cooperatives expect to add approximately 330,000 residential customers by 2024.

Section 4 includes a review of the existing and potential capacity alternatives. The impact of load management programs is presented including benefit/cost information. While load management and energy conservation programs are important, they do not substantially alter the need for new generation. Capacity alternatives including renewable energy sources, distributed and fossil fueled generation, repowering and/or uprating of existing facilities and new transmission capacity are discussed. Solar and geothermal power is not considered feasible for the area and/or the technology is not sufficiently developed. Pumped hydro power would be dependent on a partner to be feasible and would require an estimated ten years to develop at considerable risk. Fuel cells are being tested and evaluated by the EKPC Research and Development process and biomass and wind energy are being considered as part of the EKPC Green Power Program. Based on various analyses, EKPC does not plan to retire or repower any of its eight existing pulverized coal-fired units during the 20-year planning horizon (2002-2022). Based on the analysis of capacity alternatives, EKPC selected the proposed two 278 MW CFB units capable of burning coal, tire-derived fuels, petroleum and biomass as the preferred source for new generation.

Section 5 reviews the site selection criteria for the proposed CFB units within the EKPC region. The three phased approach to site selection includes the identification of potential siting areas, identification of candidate sites and site evaluation. The 400 MW combustion turbine study (1991 Black & Veatch) considered 22 potential sites, screened these to six candidate sites and identified one preferred site (CL-4/J.K. Smith, Clark County) and one alternate site (MA-2, Madison County). The 1980 Rural Electrification Administration (REA) study divided the region into four sections, identified five potential candidate sites based on screening criteria and selected site 5-A (J.K. Smith, Clark County) as the preferred site. Furthermore, REA committed to guarantee a loan to the EKPC in 1980 for two proposed 600 MW coal-fired steam electrical generating units at the J.K. Smith site, however, the project was never built. In 2002, the Department of Energy prepared an Environmental Impact Statement for a proposed 540 MW demonstration power station comprised of two synthesis gas-fired combined cycle units to be

located at the J.K. Smith site, however, the partners could not agree on project development cost-sharing and the project was never built.

Section 6 provides a description and location of the proposed and alternative sites for the two 278 MW CFB units. Based on information available from previous studies and the current location of existing combustion turbines on the site, the J.K. Smith Power Station is the preferred location for the two 278 MW CFB units. The John Sherman Cooper site and a 500-acre site near Irvine, Kentucky in Estill County, currently being planned for a 110 MW CFB unit, have been selected as alternative sites.

Section 7 describes the proposed action and component details of the 278 MW CFB units including a proposed site layout. Initial regulatory permitting of the project is underway. If permits can be obtained, construction of the first unit is expected to begin in June 2007. The project would require three years to complete construction and performance testing would be expected in mid-2010.

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# Section 1

# Introduction

## 1.1 General

Member cooperatives developed the East Kentucky Power Cooperative, Inc., (EKPC) as a not-for-profit generation and transmission utility with headquarters in Winchester, Kentucky. EKPC's purpose is to generate energy and transmit it to member cooperatives that distribute it to retail customers at the lowest practical price. Today, EKPC provides wholesale energy and services to 16 distribution cooperatives through power plants, peaking units, hydro power, and more than 2,759 circuit miles of transmission line.

To continue to meet the growing power needs of the member cooperatives, EKPC is proposing the construction and operation of two new 278 MW generating units each consisting of one circulating fluidized bed boiler (CFB), one turbine-generator, one flue gas desulfurization system, one SNCR $NO_x$ control system, one baghouse, one stack, and associated balance of plant (BOP) equipment. The proposed units would be built on a site currently owned by the utility in Clark County, Kentucky. Located on the north side of the Kentucky River west of SR 89 and east of Red River Road, the J.K. Smith Power Station, contains seven units operated by the utility consisting of three 110 MW combustion turbine (CT) units and four 70 MW CT units. The proposed CFB units would use a maximum of 3,000 gallons of water per minute and would be operated approximately 8,000 hours per year.

In addition to the two new CFB units, a separate EKPC proposal would be prepared to construct and operate five new CT units (8-12) that would be installed in line with the existing units. The proposed CFB units would be located to the east of the existing CT units on the site of the originally proposed Units 1 and 2 coal-fired electric 600 MW generating units at the J.K. Smith Power Station. The interconnection of the proposed CFB units with the CTs and the EKPC transmission system would require a new 345 kV switchyard and associated transmission lines be constructed on-site.

A 1981 Environmental Impact Statement (EIS) for proposed Units 1 and 2 at the J.K Smith Power Plant site was prepared, submitted to and approved by the Rural Utilities Service (RUS). The 600 MW generating units were never constructed and the proposed CFB units addressed in this document would be located at the same site. Early coordination between EKPC and RUS indicates a Supplemental Environmental Impact Statement (SEIS) would be required to address impacts associated with the proposed CFB units. The SEIS will be based on the November 2002 environmental document for the Kentucky Pioneer Project that was never constructed.

Four Environmental Assessments (EAs) were prepared for the existing CT facilities at J.K. Smith Power Plant. The proposed CTs (8-12) and interconnection with the proposed CFB units and EKPC system (i.e., switchyard and associated transmission facilities) would be addressed in a separate EA.

The format of this document follows the RUS outline (12/1/03 DRAFT) for an Alternatives Evaluation and Site Selection Study for a new generation project. The first part of this report addresses the purpose and need for the proposed units, examines existing generation resources, and reviews capacity alternatives. The second part of the report addresses the siting study, scope of analysis, approach, and findings. The project description and preferred site are discussed in some detail.

This document was prepared to support EKPC's request to the RUS for financial assistance for the proposed CFB units and replaces the study submitted in February 2006. This document would also support the preparation of a future SEIS required for the project pursuant to 7 CFR Part 1794, Subpart G (new electric generating facilities of more than 50 MW (nameplate rating) other than fuel cell, combustion turbine, combined cycle or diesel generators).

# Section 2

# Profile of Applicant

## 2.1 History

In 1941, thirteen rural cooperatives organized EKPC with an initial loan from the Rural Electrification Association (REA). EKPC was created to provide its members with an adequate supply of dependable electric power at the lower price consistent with sound business practices. This continues to be the mission of the cooperative today.

After its inception, planning and work on the EKPC system was voluntarily suspended during World War II. However, at the end of the war work was resumed with an ever-increasing demand for electricity in rural areas.

In 1949, four additional transmission cooperatives joined the system. These were joined by two more transmission cooperatives in 1951. Also in 1951, after years of litigation, EKPC was granted permission to construct a generation and transmission system.

The first unit of EKPC's initial generating facility, the William C. Dale Station, was completed in 1954. Three more generating units were added, with the fourth completed in 1960, making it at the time the nation's largest plant financed through REA with a total capacity of 172 MW.

To meet the growing needs of it system, EKPC added the John Sherman Cooper facility with a total capacity of 341 MW during the sixties, and the Hugh L. Spurlock Power Station in the late seventies with a total capacity of 850 MW.

In March 2005, EKPC began operating one of the nation's cleanest coal generating units. This unit, the E.A. Gilbert Unit, is located at the Spurlock Power Station. It features a clean coal technology, a CFB that has very low emissions and gives the unit the ability to burn alternative fuels such as tire-derived fuels and biomass. The two proposed CFB units at J.K. Smith would be

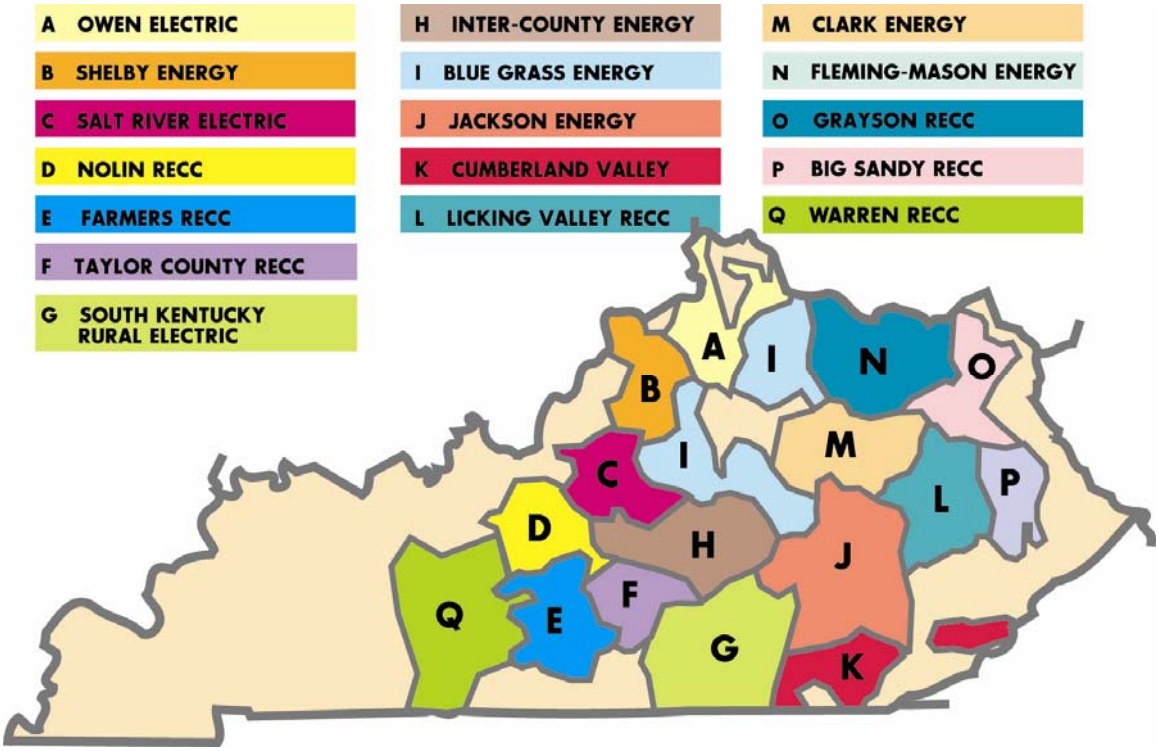
able to burn coal, tire-derived fuels, petroleum coke, and biomass similar to the existing E.A. Gilbert Unit.

## 2.2 Member Cooperatives

EKPC serves sixteen member distribution cooperatives that serve over 475,000 meters that represent approximately 375,000 retail customers. Member distribution cooperatives served by EKPC are listed below and their service territories shown on Figure 2-1:

| | |
|---|---|
| Big Sandy RECC | Jackson Energy Cooperative |
| Blue Grass Energy Coop. Corp. | Licking Valley RECC |
| Clark Energy Cooperative, Inc. | Nolin RECC |
| Cumberland Valley Electric | Owen Electric Cooperative |
| Farmers RECC | Salt River Electric Coop. Corp. |
| Fleming-Mason Energy Cooperative | Shelby Energy Cooperative, Inc. |
| Grayson RECC | South Kentucky RECC |
| Inter-County Energy Coop. Corp. | Taylor County RECC |

One additional cooperative, the Warren RECC ("Warren") is scheduled to join the EKPC system in 2008.




**EKPC Member Service Territories**
**Figure 2-1**

## 2.3 Customer Base

Within the EKPC service area, electricity is the primary method for water and home heating. Approximately 85 percent of all homes have electric water heating, and 59 percent have electric heat. In 2001, 58 percent of EKPC's member cooperative retail sales were to the residential class. Residential customer use averaged 1,143 kWh per month.

The economy of EKPC's member cooperatives service territories varies within and between the different areas. The areas around Lexington and Louisville have a relatively high amount of light manufacturing. The area around Cincinnati contains a growing number of retail trade and service jobs while the eastern and southeastern portions of EKPC's service areas are dominated by the mining industry. Tourism is an important aspect of EKPC's southern and southwestern service areas, with Lake Cumberland and Mammoth Cave National Park contributing to jobs in the service and retail trade industries. Textile and apparel manufacturing employ a significant number of workers throughout the service areas, particularly in the northeastern and southern portions.

# Section 3

# Purpose and Need for the Project

## 3.0 Purpose and Need

The power needs of the existing sixteen member distribution cooperatives that form the EKPC and the additional Warren RECC, a distribution cooperative with headquarters in Bowling Green, Kentucky, require the construction of the proposed CFB generating units at the J.K Smith Power Plant site. The additional CTs (8-12) addressed in a separate proposal are required to meet peaking needs and will not diminish the need for baseload units at the site. A 2003 Integrated Resource Plan (IRP) documents the need for approximately 500 MW (summer rating) of additional capacity to be added between 2004 and 2009. An additional baseload unit, Spurlock 4, similar to the Gilbert Unit is planned to be in service by the summer of 2009.

These additional capacity needs are based on the EKPC strategy of acquiring firm resources available all year to meet summer capacity needs and buying winter seasonal capacity to make up the additional resource demands to meet the winter peak. The long-term reserve margin target used by EKPC for acquiring resources is 12 percent. EKPC adds resources to meet a minimum of a 12 percent reserve margin for the summer peak while keeping any purchases needed to meet the winter peak to a level EKPC believes can be reliably imported.

## 3.1 Demand Forecast

EKPC's most recent demand load forecast (EKPC Load Forecast Report, September 2004, see Appendix E) projects that firm peak demand load will increase from 2,899 MW (actual 2004) to 4,922 MW in 2022, an annual average increase of 3.2 percent. Corresponding energy required to serve EKPC member cooperatives is projected to increase from 11,158 GWh (actual 2002) to 20,483 GWh during the same time period, an annual average increase of 3.1 percent.

Some of the significant factors that drive the September 2004 demand load forecast include:

1. EKPC's member distribution systems will add approximately 330,000 residential customers by 2024. This represents an increase of 2.7 percent per year and includes the Warren RECC beginning in April 2008.
2. EKPC uses an economic model to help develop its demand load forecast. The model uses data for 89 Kentucky counties in six geographic regions. The economy of these counties will experience modest growth over the next 20 years. The average unemployment rate is expected to fall from 6.9 percent in 2004 to 5.4 percent in 2020. Total employment levels will rise by over 400,000 jobs. Manufacturing employment will increase from 272,000 jobs in 2004 to 332,000 jobs in 2020. Regional population will grow from 3.5 million people in 2004 to 3.9 million people in 2020, an average growth of 0.8 percent per year.
3. From 2004 through 2024, approximately 70 percent of all new households will have electric heat. Eighty percent of all new households will have electric water heating. Nearly all new homes will have electric air conditioning, either central or room.
4. By 2024, naturally occurring appliance efficiency improvements will decrease retail sales nearly 400,000 MWh. Appliances particularly affected are refrigerators, freezers, and air conditioners.
5. Residential customer growth and local area economic activity will be the major determinants of small commercial growth.
6. Forecasted demand load growth is based on the assumption of normal weather, as defined by the National Oceanic and Atmospheric Administration, occurring over the next 20 years.

Table 3-1 lists EKPC annual peak demand load and compares resulting capacity requirements with existing and committed resources. The table shows that EKPC will need to provide approximately 1,750 MW of additional resources to serve projected loads by 2017. EKPC is continuing its negotiations with native demand load industrial customers concerning interruptible service. EKPC has also screened and designed a package of new demand side management (DSM) programs, which are presented in Section 4.

**Table 3-1 EKPC Projected Capacity Needs (MW)**

| | Projected Peaks | | 12% Reserves | | Total Requirements | | Total Resources | | Deficit | |
|---|---|---|---|---|---|---|---|---|---|---|
| | WIN | SUM | WIN | SUM | WIN | SUM | WIN | SUM | WIN | SUM |
| 2003 | 2,390 | 2,013 | 287 | 242 | 2,677 | 2,255 | 2,604 | 2,102 | 73 | 153 |
| 2004 | 2,488 | 2,112 | 299 | 253 | 2,787 | 2,365 | 2,364 | 2,112 | 423 | 253 |
| 2005 | 2,591 | 2,202 | 311 | 264 | 2,902 | 2,466 | 2,368 | 2,309 | 534 | 157 |
| 2006 | 2,684 | 2,283 | 322 | 274 | 3,006 | 2,557 | 2,497 | 2,320 | 509 | 237 |
| 2007 | 2,776 | 2,363 | 333 | 284 | 3,109 | 2,647 | 2,494 | 2,317 | 615 | 330 |
| 2008 | 2,863 | 2,437 | 344 | 292 | 3,207 | 2,729 | 2,499 | 2,322 | 708 | 407 |
| 2009 | 2,967 | 2,528 | 356 | 303 | 3,323 | 2,831 | 2,504 | 2,327 | 819 | 504 |
| 2010 | 3,068 | 2,616 | 368 | 314 | 3,436 | 2,930 | 2,499 | 2,322 | 937 | 608 |
| 2011 | 3,166 | 2,699 | 380 | 324 | 3,546 | 3,023 | 2,504 | 2,327 | 1,042 | 696 |
| 2012 | 3,256 | 2,775 | 391 | 333 | 3,647 | 3,108 | 2,504 | 2,327 | 1,143 | 781 |
| 2013 | 3,369 | 2,871 | 404 | 345 | 3,773 | 3,216 | 2,504 | 2,327 | 1,269 | 889 |
| 2014 | 3,477 | 2,961 | 417 | 355 | 3,894 | 3,316 | 2,504 | 2,327 | 1,390 | 989 |
| 2015 | 3,583 | 3,052 | 430 | 366 | 4,013 | 3,418 | 2,504 | 2,327 | 1,509 | 1,091 |
| 2016 | 3,682 | 3,137 | 442 | 376 | 4,124 | 3,513 | 2,504 | 2,327 | 1,620 | 1,186 |
| 2017 | 3,797 | 3,235 | 456 | 388 | 4,253 | 3,623 | 2,504 | 2,327 | 1,749 | 1,296 |

Source: EKPC

### 3.1.1 Summary of Latest (2004) Power Requirements Study

EKPC's demand load forecast is prepared every two years in accordance with a RUS approved Work Plan. The work plan details the methodology employed in preparing the projections. EKPC prepares the load forecast by working jointly with member cooperative systems to prepare their demand load forecasts. Member cooperative projections are then summed to determine EKPC's forecast for the 20-year period. Member cooperatives use their demand load forecasts in developing construction work plans, long-range work plans, and financial forecasts. EKPC uses the load forecast in such areas as marketing analysis, transmission planning, power supply planning, and financial forecasting.

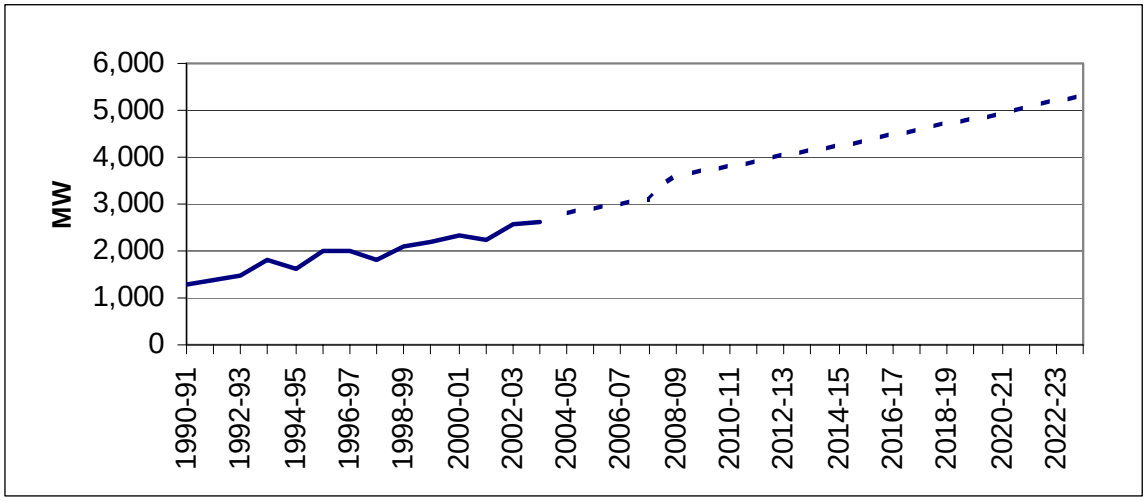
Historical and projected total energy requirements, seasonal peak and annual demand load for the EKPC system are presented in Tables 3-2, 3-3, and 3-4. The EKPC system is winter peaking with winter peaks more than 400 MW greater than summer. Internal demand load refers to EKPC's peak demand unadjusted for interruptible service, and net demand load refers to EKPC's firm peak demand, taking all adjustments into account. Both are based on coincident hourly-integrated demand load intervals. Demand load factor is calculated using net peak demand and energy requirements.

EKPC's 2004 demand load forecast indicates that total energy requirements are projected to increase by 3.6 percent per year during the 2006 through 2024 period. Net winter peak demand load will increase by approximately 2,400 MW and net summer peak demand load will increase by approximately 2,100 MW. Annual demand load factor projections are expected to remain steady at approximately 53 percent.

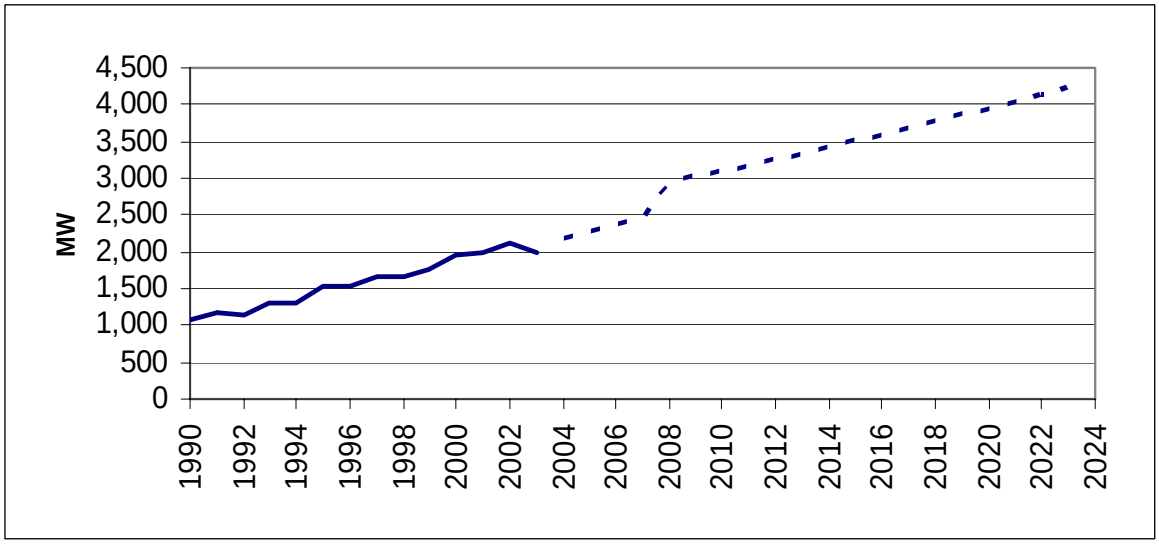
### 3.1.2 Historic Load Growth vs. Projected Load Growth

EKPC has experienced steady demand load growth from its inception. In the early years of the cooperative, growth was rapid due to expanding transmission and distribution systems reaching farther into rural areas. Growth of the demand load was also facilitated by the continually expanding uses of electricity. This steady growth is mirrored by the increase of EKPC's capacity to meet demand load.

The cooperative continues to meet the electric needs of the member cooperatives with a mix of purchased power, hydro, gas turbines, and landfill gas generators. However, coal remains the most cost effective, reliable source of capacity. Figure 3-1 shows the historic and projected winter demand load growth for EKPC until 2024. Figure 3-2 shows summer peak demand for the same period.




**EKPC Historic and Projected Summer Peak Demand in MW**
**Figure 3-1**




**EKPC Historic and Projected Winter Peak Demand in MW**
**Figure 3-2**

**Table 3-2 Historical and Projected Winter Peak Demand**

| | Season | Total Internal Peak Demand (MW) | Gallatin Steel Interruptible Demand (MW) | Other Interruptible (MW) | Net Peak Demand (MW) |
|---|---|---|---|---|---|
| Historical | 1981 - 82 | 1,087 | 0 | 0 | 1,087 |
| | 1982 - 83 | 845 | 0 | 0 | 845 |
| | 1983 - 84 | 1,151 | 0 | 0 | 1,151 |
| | 1984 - 85 | 1,125 | 0 | 0 | 1,125 |
| | 1985 - 86 | 1,039 | 0 | 0 | 1,039 |
| | 1986 - 87 | 983 | 0 | 0 | 983 |
| | 1987 - 88 | 1,104 | 0 | 0 | 1,104 |
| | 1988 - 89 | 1,114 | 0 | 0 | 1,114 |
| | 1989 - 90 | 1,449 | 0 | 0 | 1,449 |
| | 1990 - 91 | 1,306 | 0 | 0 | 1,306 |
| | 1991 - 92 | 1,383 | 0 | 0 | 1,383 |
| | 1992 - 93 | 1,473 | 0 | 0 | 1,473 |
| | 1993 - 94 | 1,788 | 0 | 0 | 1,788 |
| | 1994 - 95 | 1,621 | 0 | 0 | 1,621 |
| | 1995 - 96 | 1,990 | 75 | 0 | 1,915 |
| | 1996 - 97 | 2,004 | 51 | 0 | 1,953 |
| | 1997 - 98 | 1,789 | 93 | 14 | 1,682 |
| | 1998 - 99 | 2,096 | 108 | 17 | 1,971 |
| | 1999 - 00 | 2,169 | 12 | 17 | 2,140 |
| | 2000 - 01 | 2,322 | 27 | 17 | 2,278 |
| | 2001 - 02 | 2,238 | 129 | 17 | 2,092 |
| | 2002 - 03 | 2,568 | 109 | 24 | 2,435 |
| | 2003 - 04 | 2,612 | 97 | 26 | 2,489 |
| Projected | 2004 - 05 | 2,794 | 135 | 26 | 2,633 |
| | 2005 - 06 | 2,893 | 135 | 26 | 2,732 |
| | 2006 - 07 | 2,999 | 135 | 26 | 2,838 |
| | 2007 - 08 | 3,085 | 135 | 26 | 2,924 |
| | 2008 - 09 | 3,623 | 135 | 26 | 3,462 |
| | 2009 - 10 | 3,726 | 135 | 26 | 3,565 |
| | 2010 - 11 | 3,818 | 135 | 26 | 3,657 |
| | 2011 - 12 | 3,914 | 135 | 26 | 3,753 |
| | 2012 - 13 | 4,033 | 135 | 26 | 3,872 |
| | 2013 - 14 | 4,141 | 135 | 26 | 3,980 |
| | 2014 - 15 | 4,246 | 135 | 26 | 4,085 |
| | 2015- 16 | 4,341 | 135 | 26 | 4,180 |
| | 2016 - 17 | 4,466 | 135 | 26 | 4,305 |
| | 2017 - 18 | 4,584 | 135 | 26 | 4,423 |
| | 2018 - 19 | 4,709 | 135 | 26 | 4,548 |
| | 2019 - 20 | 4,823 | 135 | 26 | 4,662 |
| | 2020 - 21 | 4,959 | 135 | 26 | 4,798 |
| | 2021 - 22 | 5,083 | 135 | 26 | 4,922 |
| | 2022 - 23 | 5,208 | 135 | 26 | 5,047 |
| | 2023 - 24 | 5,319 | 135 | 26 | 5,158 |

Source: EKPC Load Forecast Report, September 2004

**Table 3-3 EKPC Historical and Projected Summer Peak Demand Load**

| | Season | Total Internal Peak Demand (MW) | Gallatin Steel Interruptible Demand (MW) | Other Interruptible (MW) | Net Peak Demand (MW) |
|---|---|---|---|---|---|
| Historical | 1982 | 694 | 0 | 0 | 694 |
| | 1983 | 789 | 0 | 0 | 789 |
| | 1984 | 722 | 0 | 0 | 722 |
| | 1985 | 776 | 0 | 0 | 776 |
| | 1986 | 857 | 0 | 0 | 857 |
| | 1987 | 906 | 0 | 0 | 906 |
| | 1988 | 1,055 | 0 | 0 | 1,055 |
| | 1989 | 1,010 | 0 | 0 | 1,010 |
| | 1990 | 1,079 | 0 | 0 | 1,079 |
| | 1991 | 1,164 | 0 | 0 | 1,164 |
| | 1992 | 1,131 | 0 | 0 | 1,131 |
| | 1993 | 1,309 | 0 | 0 | 1,309 |
| | 1994 | 1,314 | 0 | 0 | 1,314 |
| | 1995 | 1,518 | 52 | 0 | 1,466 |
| | 1996 | 1,540 | 88 | 0 | 1,452 |
| | 1997 | 1,650 | 101 | 0 | 1,549 |
| | 1998 | 1,675 | 4 | 17 | 1,654 |
| | 1999 | 1,754 | 4 | 12 | 1,738 |
| | 2000 | 1,941 | 86 | 23 | 1,832 |
| | 2001 | 1,980 | 116 | 23 | 1,841 |
| | 2002 | 2,120 | 119 | 23 | 1,978 |
| | 2003 | 1,996 | 125 | 26 | 1,845 |
| Projected | 2004 | 2,197 | 135 | 26 | 2,036 |
| | 2005 | 2,294 | 135 | 26 | 2,133 |
| | 2006 | 2,377 | 135 | 26 | 2,216 |
| | 2007 | 2,461 | 135 | 26 | 2,300 |
| | 2008 | 2,930 | 135 | 26 | 2,769 |
| | 2009 | 3,017 | 135 | 26 | 2,856 |
| | 2010 | 3,098 | 135 | 26 | 2,937 |
| | 2011 | 3,174 | 135 | 26 | 3,013 |
| | 2012 | 3,250 | 135 | 26 | 3,089 |
| | 2013 | 3,341 | 135 | 26 | 3,180 |
| | 2014 | 3,426 | 135 | 26 | 3,265 |
| | 2015 | 3,508 | 135 | 26 | 3,347 |
| | 2016 | 3,584 | 135 | 26 | 3,423 |
| | 2017 | 3,680 | 135 | 26 | 3,519 |
| | 2018 | 3,773 | 135 | 26 | 3,612 |
| | 2019 | 3,870 | 135 | 26 | 3,709 |
| | 2020 | 3,955 | 135 | 26 | 3,794 |
| | 2021 | 4,059 | 135 | 26 | 3,898 |
| | 2022 | 4,155 | 135 | 26 | 3,994 |
| | 2023 | 4,249 | 135 | 26 | 4,088 |
| | 2024 | 4,340 | 135 | 26 | 4,179 |

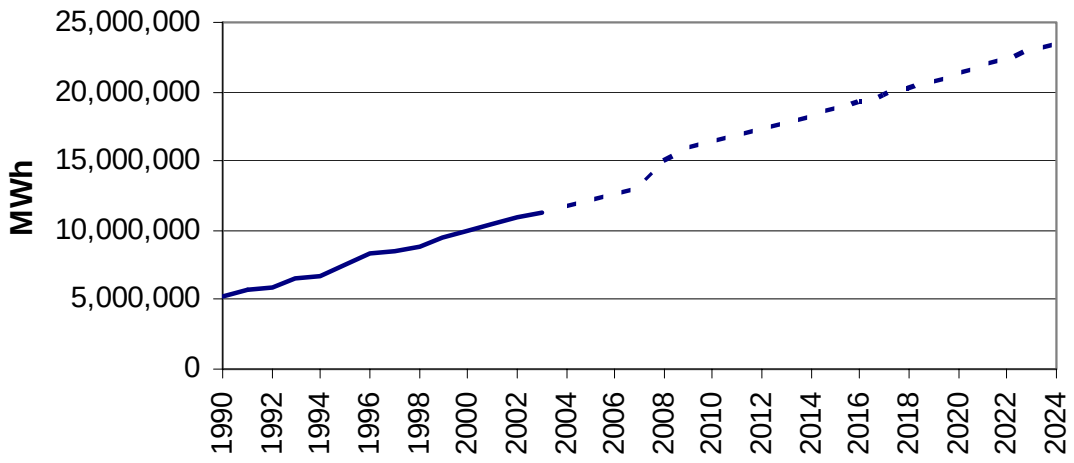
Source: EKPC Load Forecast Report, September 2004

## Table 3-4 EKPC Historical and Projected Energy Sales and Total Requirements

| | Year | Total Retail Sales (MWh) | Office Use (MWh) | % Loss | EKPC Sales to Members (MWh) | EKPC Office Use (MWh) | Transmission Loss (%) | Total Requirements (MWh) |
|---|---|---|---|---|---|---|---|---|
| HISTORICAL | 1990 | 4,986,373 | 5,087 | 5.7 | 5,295,459 | 6,287 | 3.5 | 5,489,092 |
| | 1991 | 5,385,059 | 5,333 | 6.3 | 5,775,588 | 6,798 | 3.4 | 5,928,422 |
| | 1992 | 5,528,366 | 5,242 | 6.3 | 5,903,268 | 7,559 | 3.2 | 6,099,308 |
| | 1993 | 6,209,917 | 5,552 | 6.0 | 6,612,687 | 8,026 | 3.6 | 6,860,902 |
| | 1994 | 6,357,502 | 5,614 | 5.4 | 6,727,959 | 8,541 | 2.7 | 6,917,414 |
| | 1995 | 7,122,797 | 5,711 | 5.7 | 7,558,452 | 9,197 | 2.6 | 7,761,980 |
| | 1996 | 7,876,243 | 6,167 | 5.0 | 8,301,379 | 8,856 | 2.4 | 8,505,621 |
| | 1997 | 8,112,659 | 6,349 | 5.1 | 8,559,022 | 8,505 | 3.3 | 8,850,394 |
| | 1998 | 8,419,790 | 6,121 | 4.5 | 8,821,630 | 7,236 | 2.8 | 9,073,950 |
| | 1999 | 9,010,267 | 6,040 | 4.8 | 9,472,955 | 8,157 | 3.6 | 9,825,866 |
| | 2000 | 9,575,197 | 6,605 | 4.4 | 10,021,053 | 7,862 | 4.9 | 10,521,400 |
| | 2001 | 10,006,107 | 6,752 | 4.0 | 10,426,995 | 8,205 | 3.0 | 10,750,900 |
| | 2002 | 10,376,541 | 6,912 | 4.9 | 10,913,425 | 8,246 | 4.9 | 11,456,830 |
| | 2003 | 10,717,762 | 6,911 | 4.8 | 11,260,295 | 8,287 | 2.7 | 11,568,314 |
| PROJECTED | 2004 | 11,125,647 | 8,382 | 4.7 | 11,685,899 | 8,329 | 3.0 | 12,055,905 |
| | 2005 | 11,539,497 | 8,382 | 4.7 | 12,122,725 | 8,370 | 3.0 | 12,506,284 |
| | 2006 | 11,970,119 | 8,382 | 4.8 | 12,577,021 | 8,412 | 3.0 | 12,974,673 |
| | 2007 | 12,420,150 | 8,382 | 4.8 | 13,051,486 | 8,454 | 3.0 | 13,463,856 |
| | 2008 | 14,272,210 | 8,382 | 5.0 | 15,035,668 | 8,497 | 3.0 | 15,509,448 |
| | 2009 | 15,224,774 | 8,382 | 5.0 | 16,037,649 | 8,539 | 3.0 | 16,542,462 |
| | 2010 | 15,651,597 | 8,382 | 5.0 | 16,488,495 | 8,582 | 3.0 | 17,007,296 |
| | 2011 | 16,042,894 | 8,382 | 5.0 | 16,902,113 | 8,625 | 3.0 | 17,433,751 |
| | 2012 | 16,485,982 | 8,382 | 5.0 | 17,370,355 | 8,668 | 3.0 | 17,916,519 |
| | 2013 | 16,933,848 | 8,382 | 5.1 | 17,843,670 | 8,711 | 3.0 | 18,404,516 |
| | 2014 | 17,385,477 | 8,382 | 5.1 | 18,320,843 | 8,755 | 3.0 | 18,896,493 |
| | 2015 | 17,823,172 | 8,382 | 5.1 | 18,783,024 | 8,798 | 3.0 | 19,373,012 |
| | 2016 | 18,271,927 | 8,382 | 5.1 | 19,256,935 | 8,842 | 3.0 | 19,861,626 |
| | 2017 | 18,735,857 | 8,382 | 5.1 | 19,747,033 | 8,887 | 3.0 | 20,366,928 |
| | 2018 | 19,225,508 | 8,382 | 5.1 | 20,264,674 | 8,931 | 3.0 | 20,900,624 |
| | 2019 | 19,738,557 | 8,382 | 5.1 | 20,806,890 | 8,976 | 3.0 | 21,459,656 |
| | 2020 | 20,256,022 | 8,382 | 5.1 | 21,353,969 | 9,021 | 3.0 | 22,023,701 |
| | 2021 | 20,754,203 | 8,382 | 5.1 | 21,880,610 | 9,066 | 3.0 | 22,566,676 |
| | 2022 | 21,266,497 | 8,382 | 5.1 | 22,422,310 | 9,111 | 3.0 | 23,125,176 |
| | 2023 | 21,780,314 | 8,382 | 5.1 | 22,965,474 | 9,157 | 3.0 | 23,685,187 |
| | 2024 | 22,332,048 | 8,382 | 5.1 | 23,548,897 | 9,202 | 3.0 | 24,286,700 |

Source: EKPC Load Forecast Report, September 2004

Figure 3-3 shows EKPC historic and projected annual energy consumption megawatt hours for 1990 to 2024.




**EKPC Historic and Projected Annual Energy Consumption in MWh**
**Figure 3-3**

Table 3-5 shows EKPC historic and projected peak demand loads and energy growth rates over five-year periods, 1982 to 2021.

**Table 3-5 Historic and Projected Peak Percentage Growth**

| Years | Historic Peak (MWh) | Forecast Peak (MWh) | Percentage Growth/Year |
|---|---|---|---|
| 1982-1986 | 5247 | | 2.56 |
| 1987-1991 | 5956 | | 4.36 |
| 1992-1996 | 8750 | | 6.38 |
| 1997-2001 | 10024 | | 2.54 |
| 2002-2006 | | 12381 | 3.81 |
| 2007-2011 | | 16446 | 4.94 |
| 2012-2016 | | 19870 | 3.45 |
| 2017-2021 | | 22736 | 2.40 |

Source: EKPC

Expected demand capacity deficits to 2017 are shown in Table 3-1. Without additional generation, EKPC will have a winter deficit of 1,749 MW and a summer deficit of 1,296 MW in eleven years.

## 3.2 Planning History

### 3.2.1

EKPC has a long history of resource planning with RUS dating back to the development of EKPC's first generating units that went into commercial operation in 1954. All of EKPC's

existing units and units in development have been or are expected to be financed through RUS. RUS has reviewed EKPC's load forecasts, resource plans, financial forecasts and other information for many years.

**3.2.2**

EKPC is currently not a member of a power pool engaged in regional joint dispatch of generating units. EKPC is a registered market participant with the Midwest ISO and a member of PJM for the purpose of making power transactions with those organizations, but not joint dispatch of units. EKPC has studied membership in those organizations and concluded the costs were not justified to fully participate.

As a regulated utility in Kentucky, EKPC's resource plans are reviewed by the Kentucky Public Service Commission (PSC). An integrated resource plan is required to be filed every three years with the PSC and is reviewed by commission staff or a consultant. A certificate of public need and a certificate of site compatibility are required and must be issued by the PSC before EKPC can begin construction of a new generating facility. The PSC reviews EKPC's resource plans, capacity needs, and the alternatives evaluated before issuing a decision on the certificates.

## 3.3 Existing Resources

### 3.3.1 Existing Generation Resources

EKPC currently owns and operates 1,657 MW of coal-fired capacity. This capacity is located at three separate sites with a total of nine generating units.

The first plant built by EKPC was the William C. Dale Power Station located on the Kentucky River in Ford, Clark County, Kentucky. The first two units have a net capacity of 23 MW each and began commercial operation on December 1, 1954. The third unit is capable of producing 75 MW and began operation on October 1, 1957. The fourth unit is also rated at 75 MW and began operation on August 9, 1960.

The second plant EKPC built was the John Sherman Cooper Power Station located on Lake Cumberland near Somerset, Kentucky. The station has one 116 MW unit that became operational on February 9, 1965, and one 225 MW unit that began operating commercially on October 28, 1969.

The most recent coal-fired plant constructed by EKPC is the Hugh L. Spurlock Power Station situated near Maysville on the Ohio River. The station consists of one 325 MW unit that began commercial operation on September 1, 1977, one 525 MW unit that began operating on March 2, 1981, and the E.A. Gilbert Unit 3, a 268 MW CFB that began operating on March 1, 2005.

EKPC also has three 110 MW CTs and four 70 MW CTs located on the Kentucky River at the J. K. Smith Power Plant in eastern Clark County, Kentucky.

Finally, EKPC has developed 12.8 MW of landfill gas capability that is marketed as green power. Additional landfill gas to electricity capacity is planned for the near future.

Existing generation sources are summarized in Table 3-6.

**Table 3-6 EKPC Existing Generation Resources**

| Facility | Size (MW) | Fuel Type | Capability |
|---|---|---|---|
| Dale Station | 196 | Coal | Base-Load |
| Cooper Station | 341 | Coal | Base-Load |
| Spurlock Station | 1,118 | Coal | Base-Load |
| Smith Station | 610 | Gas/Oil | Peaking |
| Landfills | 12.8 | Methane Gas | Base-Load |

Source: EKPC

### 3.3.2 Existing Purchase Contracts

EKPC contracts with the Southeastern Power Authority (SEPA) for two sources of peaking capacity. The first source provides for 100 MW of scheduled peaking power from the Cumberland Basin System of Projects. EKPC is guaranteed 186,900 MWh per year with a minimum monthly take of 6,000 MWh and maximum monthly take of 24,000 MWh. This energy is scheduled for delivery through the Tennessee Valley Authority distribution system.

The second source provides EKPC with 70 MW of peaking capacity from the Laurel Dam facility. EKPC is guaranteed 700 MWh per week or 36,400 MWh per year. EKPC receives all the energy produced from the Laurel Dam facility and can request the unit with as little as five minutes notification. EKPC is required to run the unit a minimum of 30 minutes every 48 hours and is requested not to lower the lake level more than six inches in a 24-hour period. EKPC dispatches the Laurel Dam hydro-generating unit within the EKPC control area.

EKPC renewed its SEPA contract for a 20-year period beginning in June 1998.

Table 3-7 Summarizes EKPC's SEPA contracts for peaking capacity.

**Table 3-7 EKPC's Purchase Power Contracts**

| Source | Size (MW) | Type | Capability |
|---|---|---|---|
| Columbia Basin System of Projects | 100 | Hydroelectric | Peaking |
| Laurel Dam | 70 | Hydroelectric | Peaking |

Source: EKPC

### 3.3.3 Existing Demand-Side Management

EKPC and its member cooperatives promote conservation programs and the cost effective use of electricity. Conservation programs are implemented and managed by the member distribution systems. EKPC conservation programs help reduce electricity consumption during all or significant portions of the year.

EKPC and its member cooperatives have interruptible rates that serve to reduce peak demand load.

EKPC has one member cooperative that participates in distributed generation.

The following tabulation shows the effects of demand-side management.

| Program | Demand Reductions (MW) |
|---|---|
| Conservation Programs | 95 |
| Distributed Generation | 4 |
| Interruptible Load Control | 161 |

### 3.3.4 Incremental Upgrades

Currently, EKPC has no upgrades in progress or any projected that would affect existing capacity ratings. In addition, EKPC currently has no planned or anticipated derating of generation resources below their existing capacity output.

### 3.3.5 Power Pool Member Resources

Currently, EKPC is not a member or participant in a power pool, but is considering becoming a pool member based on economic merit.

### 3.3.6 Transmission System Constraints

EKPC's transmission system covers all but the western third of Kentucky. It consists of approximately 2,759 circuit miles of line at voltages of 69, 138, 161, and 345 kV and 59 normally closed, free-flowing interconnections with neighboring utilities.

EKPC participates in joint planning efforts with neighboring utilities to ascertain the benefits of potential interconnections, which can include increased power transfer capability, local area system support, and outlet capability for new generation. It should be noted that transfer capabilities are unique to actual system conditions, as affected by generation dispatch, outage conditions, demand load level, third-party transfers, etc.

Within the next three years, EKPC plans to improve the efficiency of its transmission system primarily through transmission line capacity upgrades, transmission line reconductoring, and capacitor bank additions. These upgrades would enhance EKPC’s ability to obtain purchase power from outside the East Kentucky system.

Transmission expansion plans are developed and updated on an annual basis. Demand load flow analysis and reliability indices are used to predict problem areas on the transmission system. Various alternatives for mitigating these problems are then formulated and analyzed. The least cost alternatives, which ensure reliable transmission service to EKPC demand load centers are then added into the plan. Transmission planning, like all EKPC planning processes, is ongoing, and changing conditions may warrant changes to the transmission plan.

When evaluating alternative power supply resources, the cost of additional transmission associated with each resource needs to be included in the analysis. Some resource alternatives are site specific, and transmission plans can be developed for that project. Other resource alternatives are generic units, and no site has been specified for a unit. In that case, an average cost of transmission is used in the cost analysis. An average cost of $50 KW

(2002) is being used for the transmission facilities associated with future EKPC generating unit additions.

The transmission facilities associated with the proposed CFB units at the J. K. Smith Power Plant are currently under study. These studies are anticipated to be finalized in the near future, however, no additional transmission facilities other than those needed on-site (a substation and lines) to connect the unit to the system developed for the CTs are expected.

### 3.3.7 Characteristics of Energy Needs

EKPC has revised its power supply plan due to a significant change in the expected demand load requirements and an update of the demand load forecast. The current plan is documented in EKPC's 2003 IRP approved by the EKPC Board of Directors (Board) at the April 2003 Board meeting and filed as Case No. 2003-00051with the Kentucky Public Service Commission on April 21, 2003. The 2003 IRP documented the need for approximately 500 MW (summer rating) of peaking capacity to be added from 2004 to the summer of 2009 to meet summer peak demand load requirements. An additional baseload unit similar to the Gilbert Unit would be in service by the summer of 2009. The most important factor addressed in the revised power supply plan was the addition of a new member, Warren RECC, to the EKPC system. Warren RECC accepted an offer to become a member of EKPC beginning on April 1, 2008 and signed a 33-year wholesale power agreement on May 27, 2004. The addition of Warren RECC to the EKPC system would have a significant impact on EKPC's power supply plan.

The projected peak demand load in 2008 for the Warren RECC is approximately 433 MW in the winter and 400 MW in the summer. The Spurlock Power Station Unit 4 baseload unit would provide sufficient baseload capacity to meet Warren RECC baseload needs when it comes on-line in 2008. Two of the CT units are expected to provide sufficient capacity for Warren RECC peaking needs, including reserves, in 2008. Warren RECC Energy needs will be provided by an improved EKPC transmission system.

The EKPC Board approved the 2004 Load Forecast Report (2004 LFR) at the September 2004 Board meeting. This important update of EKPC's demand load requirements includes a forecast of Warren RECC load beginning on April 1, 2008. EKPC staff met with Warren RECC to develop their forecast using the same methodology as the existing member cooperatives. The Warren RECC forecast was then rolled into the forecast for the existing member cooperative systems. Another important change in the 2004 LFR is the summer peaks are lower than forecasted in the 2002 LFR by approximately 100 MW, and the winter peaks are slightly higher.

EKPC staff initiated a study in the spring of 2004 to re-evaluate the timing of the baseload addition scheduled for 2011 in response to the increase in natural gas prices. Since the development of the 2003 IRP, natural gas prices have risen substantially and are expected to remain at higher levels than previously thought. Coal prices have also risen and become more volatile. Assumptions on market prices, fuel prices, and capital costs were updated for the study. The study was initiated prior to Warren RECC committing to join the EKPC system and prior to completion of the 2004 LFR, and therefore, Warren RECC demand load

was not included. The results of the study indicated there was economic justification to advance the schedule for the baseload capacity addition scheduled in the IRP for 2011. With the addition of Warren RECC and completion of the 2004 LFR, the study was updated to re-affirm the results. Spurlock Power Station Unit 4 was assumed to come online April 1, 2008. A basecase production cost run was made with the next baseload unit coming on-line in April 1, 2009. Additional scenarios were evaluated to determine the cost to delay the unit for up to five years. A comparison of cases indicated a significant cost to delay the unit from 2009.

## 3.4 Needs Summary Conclusion

The demand load requirements of EKPC and its member cooperatives are growing and are expected to continue to grow for the foreseeable future. EKPC would continue to meet the need for this additional capacity through a combination of purchased power, baseload, CTs, landfill gas turbines, and demand side management. CFB boilers, such as the two units proposed at the J. K. Smith Power Plant, meet the need for economical and environmentally acceptable baseload capacity.

# Section 4

# Capacity Alternatives

## 4.1 Load Management

EKPC and its member cooperatives have long promoted conservation and cost effective use of electricity. This section describes existing demand load management marketing programs. Please note that these programs are implemented and managed by member distribution systems, not EKPC. While EKPC supports member cooperatives with analysis, promotional material, and other information, and EKPC views these programs as part of its overall power supply portfolio, the programs impact EKPC indirectly through implementation by its member cooperatives.

Existing marketing programs are listed below.

- Tune-Up HVAC Maintenance Program.
- Geothermal Heating & Cooling Incentive Program.
- Electric Thermal Storage Incentive Program.
- Electric Water Heater Incentive Program.
- Air-Source Heat Pump Incentive Program.
- Button-Up Weatherization Program.
- Manufactured Home Program.

The total reduction in system load is shown in Table 4-1.

**Table 4-1**
**Demand Load Impacts of all Existing Marketing Programs Implemented by EKPC Member Cooperatives**

| Year | Impact On Total Requirements* (MWh) | Impact On Winter Peak (MW) | Impact On Summer Peak (MW) |
|---|---|---|---|
| 1995 | 619 | -29 | -8 |
| 1996 | 2,102 | -38 | -10 |
| 1997 | 1,586 | -46 | -13 |
| 1998 | 1,770 | -52 | -14 |
| 1999 | 1,644 | -55 | -16 |
| 2000 | 2,317 | -58 | -17 |
| 2001 | 1,330 | -60 | -19 |
| 2002 | -514 | -62 | -21 |
| 2003 | -1,788 | -65 | -22 |
| 2004 | -3,271 | -67 | -24 |
| 2005 | -5,426 | -70 | -25 |
| 2006 | -7,413 | -73 | -27 |
| 2007 | -8,476 | -75 | -29 |
| 2008 | -9,456 | -77 | -30 |
| 2009 | -10,435 | -79 | -32 |
| 2010 | -11,414 | -81 | -33 |
| 2011 | -12,393 | -84 | -35 |
| 2012 | -13,372 | -86 | -36 |
| 2013 | -14,352 | -88 | -38 |
| 2014 | -15,343 | -90 | -39 |
| 2015 | -16,346 | -92 | -41 |
| 2016 | -17,360 | -94 | -42 |
| 2017 | -18,387 | -97 | -44 |

* as compared to target market.

Source: EKPC

While demand load management and energy conservation management programs are important, they do not substantially alter the need for new generation. For example, existing marketing programs are expected to reduce 2017 winter capacity needs by 97 MW from 1749 MW to 1652 MW. Summer peaks may be reduced by 44 MW to 1,252 (see Tables 3-1 and 4-1).

### 4.1.1 Benefit/Cost Analysis

EKPC utilized a computer program called DSMANAGER that was created by the Electric Power Research Institute (EPRI) in order to calculate the relative benefits of existing marketing programs. DSMANAGER is relatively well known and has been used by utilities

for years to compute a matrix of benefit/cost ratios. Table 4-2 below reports two important ratios the participant test and the total resource cost test.

**Table 4-2 Benefit/Cost Ratio Summary**

| Program | Participant Test | TRC Test |
|---|---|---|
| Air Source Heat Pump Program Into New Homes | 1.64 | 1.39 |
| Air Source Heat Pump Program Into Existing Homes | 1.71 | 0.59 |
| Efficient Water Heaters Into New Homes | 2.23 | 0.76 |
| Efficient Water Heaters Into Existing Homes | 0.77 | 1.01 |
| Tune Up | 2.78 | 1.82 |
| Button Up | 2.46 | 2.84 |
| Geothermal, New Homes, Non-ASCH | 1.34 | 1.42 |
| Geothermal, New Homes, ASCH | 1.00 | 1.56 |
| ETS Replacing Electric Furnace | 1.35 | 0.86 |
| ETS Replacing Propane | 1.14 | 1.62 |
| Total Program Effects | 1.32 | 1.23 |

Source: EPRI/EKPC

### 4.1.2 New Marketing Programs

In addition to reviewing existing marketing programs, EKPC analyzed the following new demand load programs considered for future implementation by member cooperatives:

- Commercial Lighting.
- Compact Fluorescent Light Bulbs.
- Demand Response Program.
- Direct Load Control.

EKPC and its member cooperatives are currently addressing the above four programs in the following manner.

**4.1.2.1 Commercial Lighting.** Member cooperatives can offer large commercial and industrial customers a commercial lighting option through Envision.

**4.1.2.2 Compact Fluorescent Light Bulbs.** Distribution cooperatives are promoting the use of these light bulbs by handing them out at annual meetings.

**4.1.2.3 Demand Response Program.** Member cooperatives can utilize existing rate structures with EKPC to approximate the most recognized demand response programs.

**4.1.2.4 Direct Load Control.** This type of demand load management has been continuously reviewed by EKPC since 1994. In the past, the benefit/cost ratios were much less than one. EKPC would continue to maintain the relative merits of Direct System Management (DSM) load control. Implementation, however, requires both EKPC and its member cooperatives to be in complete acceptance and agreement. Because of the high fixed costs involved in this type of DSM there has to be a commitment by all parties.

### 4.1.3 Marketing Support of DSM Programs

DSM programs are supported by a wide variety of training programs, trade ally conferences, special events, and advertising support materials. Programs are offered to all member cooperatives, with each choosing the combination of materials and participation that best meets their individual service area needs. EKPC also provides technical support for marketing programs.

## 4.2 Renewable Energy Sources

### 4.2.1 General

Renewable energy includes any source that is regenerative or virtually inexhaustible. The Energy Information Administration (EIA) classifies wind, solar, geothermal, hydropower, and biomass as renewable energy sources. According to the EIA Renewable Energy Annual (2000), renewable energy consumption increased 3 percent between 1998 and 1999 to more than 7 quadrillion Btu, accounting for almost 8 percent of total U. S. energy consumption. This 8 percent renewable is broken down as 1 percent solar, 5 percent geothermal, 44 percent biomass, 1 percent wind, and 49 percent hydroelectric.

U.S. renewable electricity generation rose 1 percent between 1998 and 1999. This reflects a decline in hydroelectric generation balanced against growth in electricity generated from other renewable sources. Biomass had the largest absolute increase in generation, but wind power expanded 50 percent in 1 year, while geothermal increased 14 percent. The five leading states for renewable generation in 1999 were Washington, California, Oregon, New York, and Idaho. As in the past, the majority of renewable generation recorded in Kentucky was from conventional hydroelectric sources.

### 4.2.2 EKPC's Renewable Program

EKPC and its member cooperatives have become the pioneers in Kentucky in developing least cost renewable generation. EKPC's cooperatives offer renewable power under the service market of ***Enviro Watts*** at a premium of $2.75 per month for a 100 kWh block. Consumers have the option of choosing from one block to 100 percent of their electrical needs from renewable power. For the calendar years 2002 and 2003, EKPC purchased renewable energy from a cooperative in a neighboring state to supply renewable power to its member cooperatives. During this time, EKPC has also been working to develop its own renewable power program. During the past year, EKPC and its consultant, SCS Engineers,

have visited and evaluated over 15 landfill sites for potential development. Several have potential and may be developed if agreements can be reached on electricity pricing.

Currently, EKPC has four landfill gas to electric projects, totaling almost 12.8 MW of renewable capacity for EKPC's current and future needs. A fifth unit is under construction in Pendleton County, Kentucky. EKPC continues to explore potential landfill gas to energy projects. EKPC received an exemption from the requirements of a Certificate of Public Convenience and Necessity from the Kentucky Public Service Commission for the first of these projects on December 18, 2002.

As of November 2002, the following five member cooperatives have renewable energy tariffs:

- Owen RECC
- Blue Grass Energy
- Salt River Energy
- Clark Energy
- Inter-County RECC

Other member cooperatives are expected to begin offering renewable power in the future.

### 4.2.3 Tennessee Valley Authority Green Power Switch Program

The Tennessee Valley Authority (TVA) and local public power companies, working with input from the environmental community, have created a program called Green Power Switch to produce electricity from cleaner, greener sources and add it to the TVA power mix. Green Power Switch began on Earth Day 2000 and is expanding to consumers throughout the Tennessee Valley as more resources for generating renewable power become available. TVA offers their green pricing product to customers in 150-kWh blocks for a premium of $4 per month or about 2.67 cents/kWh. An average customer using 1,200 kWh per month would pay an extra $32 per month to receive all of their power from renewable energy. Currently, TVA has the following renewable power options:

- A wind powered generating site on Buffalo Mountain near Oak Ridge, Tennessee, that generates about 2 MW of capacity.
- Thirteen solar systems totaling 326 kW of capacity.
- A landfill gas program in the start-up stage.

An update of participation from Summer 2002 shows TVA has the following participation:

- 43 TVA utilities offer the program.
- 258 business customers subscribing.
- 5,614 residential customers subscribing.

EKPC member cooperatives have not enrolled in the TVA program because EKPC's ***Enviro Watts*** program is more economical for customers.

### 4.2.4 Hydroelectric Power

Hydroelectric power has a relatively high capital cost but has no fuel-related costs. During operation these facilities have minimal environmental impacts. They create little or no emissions and can be designed to minimize their effects on fish and wildlife. However, the impoundments often associated with hydroelectric projects can impact large land areas and associated ecosystems. Hydro plants are classified as storage, run-of-river, or diversion projects.

In EKPC's April 2000 IRP, two specific hydro projects were analyzed. The timing, cost, and operating data for these projects were provided by a developer, and EKPC hired a consultant for independent review. Both projects considered were 80 MW run-of-river plants, which could supply approximately 352 and 366 GWh's of energy annually. EKPC was unable to negotiate a contract for power purchase and rights to the project were acquired by others.

EKPC would evaluate any future project involving hydroelectric power on an individual basis for feasibility and economic merit.

### 4.2.5 Biomass

Bioenergy is energy contained in biomass such as plant matter and animal waste. These replenishable resources can provide energy in the form of electricity, heat, steam, and fuels.

Overall, biomass plants have higher capital costs and operating and maintenance costs than fossil fuel plants. With their lower output efficiencies (an average of 20 percent nationally), their fuel costs are higher than those of more efficient fossil fuel plants. The costs of power from conventional biomass combustion can range from $0.06—$0.12/kWh. Co-firing biomass with coal is much cheaper and can hover from almost nothing to $0.04/kWh from a project where biomass is 10—15 percent of the total fuel input of the power plant. The cost of power from landfill gas can range from $0.035—$0.079/kWh, depending on the size of the landfill, financing available, and distance from the grid.

As mentioned in Section 4.2.2, EKPC has constructed four landfill gas to electric generation projects. These units provide 12 MW of renewable capacity for EKPC members. A fifth landfill gas unit is currently under construction in Pendleton County, Kentucky that will provide an additional 3.2 MW.

EKPC has also completed a test burn cofiring kiln-dried wood byproducts at its Cooper Power Station and is modifying the stations permit to cofire up to ten percent of this material. EKPC's Dale Station is also obtaining the necessary approvals to perform a test burn on a kiln-dried byproduct, and if successful will also modify its permit to continue cofiring this product. The emissions from the test burn at Cooper Station indicated the kiln dried wood product could be successfully cofired with coal at the station lowering emissions of carbon, sulfur, and NOX.

Currently, EKPC is evaluating the possibility of using some saw dust or closed loop biomass (fescue) for potential use at its E. A. Gilbert Unit No. 3 at Spurlock Power Station near Maysville, Kentucky. The proposed CFB units at Smith Station would also have the capabilities to cofire biomass with coal.

EKPC will evaluate any project involving biomass on an individual basis for feasibility, economic merit and environmental benefits.

### 4.2.6 Wind Power Production

Wind turbines are most efficient at supplying centralized electric power. Electricity from wind farms, large clusters of interconnected wind turbines, is fed into the local distribution grid and sold to local utility companies. The levelized cost of wind energy, which is the cost of capital and operating and maintenance expenses associated with the plant over its lifetime, divided by the estimated output in kWh over the lifetime of the plant ranges from $0.03—$0.06/kWh (2001, not including the federal Production Credit Tax).

According to the Wind Energy Resource Atlas of the U.S. prepared for the U.S. Department of Energy (USDOE) by Pacific Northwest National Laboratory, areas that are potentially suitable for wind energy applications (wind power class 3 and above) in Kentucky are the exposed mountains and ridges of the Appalachians (rated 3) in extreme southeastern Kentucky.

In 2002 EKPC commissioned a study to determine whether the mountains in southeastern Kentucky offered a viable source of wind power that could become a cost effective alternative to be included in EKPC's renewable portfolio. Based on the relative success that TVA has experienced at their nearby Buffalo Mountain wind turbine site, the possibilities looked encouraging.

The study identified 15 potential sites. They were reduced to 10 after contacts with land owners. Following conversations with landowners seeking permission to test their sites, EKPC selected two initial test sites with a potential of two more if landowner issues can be resolved. In December 2002, 50-meter test towers with anemometers were erected on these sites. Readings were taken from the sites for six to 12 months and compared with data already collected at Buffalo Mountain to see if the sites are feasible for wind energy development. When this study is completed, it could provide EKPC with cost effective wind power alternatives to add to its renewable portfolio.

Although wind power is a renewable resource creating no greenhouse gases or other emissions, it does have inherent environmental concerns. It appears that suitable wind sites in Kentucky occur on sites that may be environmentally sensitive such as major flyways and could prevent development of this resource.

### 4.2.7 Solar Power

Solar energy systems use either solar cells or some form of solar collector to generate electricity and heat homes. EKPC has developed net metering tariffs which would enable small-scale applications of solar energy generation. EKPC, Salt River Electric Cooperative

Corporation, and the Bernheim Forest are currently planning a solar installation at the forest's new visitor center near Beardstown, Kentucky. Several schools within EKPC's service area have installed solar panels.

Solar power has potential as a pollution free source of electricity. On small-scale projects it is an effective supplement to centralized generation. However, there are economic and environmental considerations that, at present, prevent it from being an alternative to large fossil fuel plants. Economically it has a high installation and maintenance costs. Environmentally, centralized solar projects would require huge investments in land and transmission resources.

### 4.2.8 Fuel Cells

Fuel cells rely on a fairly simple chemical reaction to generate energy.

According to the Center for Renewable Energy and Sustainable Technology, fuel cells are attractive as energy generators because:

- They are cleaner and non-combustive. Fuel cells emit no particulate matter and almost no $NO_x$ and $SO_2$. While fuel cells still have some substantive $CO_2$ emissions, they are only 45 percent of coal generation and 47 percent the amount emitted from the production of energy using fossil fuels.
- They have high efficiencies when compared to combustion driven generators. Fuel cells alone are about 50-65 percent efficient, and with cogeneration technologies, their efficiency can be boosted as high as 90 percent.
- They are extremely reliable. A fuel cell within an integrated power system can deliver 99.0 percent reliability.

Research shows that the price of fuel cells is variable. Depending on the technology and application, the cost of a fuel cell can vary from $50/kW—$10,000/kW (2000). These costs reflect the threshold of commercial viability for each application. On average, the current fuel cell commercial cost is $4,000—$5,000/kW.

Currently, EKPC is following fuel cell research and development with the hope that in the future fuel cells can be a viable source of energy for its member cooperatives.

### 4.2.9 Cogeneration

Prospective Qualifying Facilities (QFs) may request EKPC's avoided capacity and energy costs to evaluate the financial feasibility of either locating within the EKPC system or adding a QF at their existing site within EKPC's service area. Qualifying facilities are cogeneration facilities that sequentially produce electricity and another form of useful thermal energy such as heat or steam used for industrial, commercial, or institutional purposes. A QF must meet several other conditions. These rates and the methodology used to develop them are on file with the Kentucky PSC. The Cox Interior Cogeneration Project is the first QF facility on the EKPC system. Cox Interior is a wood molding manufacturing facility located in Campbellsville, Kentucky, that burns wood waste and generates electricity to supply its own needs and sells excess power to EKPC. Cox Interior was a large power customer of Taylor

County RECC with a load of slightly less than one megawatt. The QF is able to provide between one and one-half to three megawatts of capacity beyond that needed by the Cox Interior facility to the EKPC system. EKPC would continue to provide updated rates for QFs and will incorporate their impacts into the planning process as needed.

## 4.3 Distributed Generation

EKPC has no pending or proposed distributed generation projects in development. EKPC is not aware of any firm plans by any of its members to develop any new distributed generation projects in the near future. EKPC has evaluated small scale peaking projects in recent RFPs but due to the large quantity of capacity needed, those projects were not considered economically advantageous enough to pursue. The concept was to install approximately 20 MW peaking projects utilizing gas-fired internal combustion engines near existing substations to minimize transmission related cost. This concept could be used to provide black start capability to another generating plant, provide quick start peaking capacity, or help provide relief for certain transmission issues. While micro-turbines have been proposed to EKPC in the past for small peaking applications, these units have generally been higher cost than internal combustion engines. EKPC expects to evaluate these projects in the future based on the need, economics, and the specific application. As mentioned earlier in Section 4, EKPC has four landfill gas generation plants operating and one under construction. These plants range in capacity from approximately 2 to 5 MW and are generally located in rural locations.

## 4.4 Fossil Fuel Generation

### 4.4.1 Natural Gas

EKPC has seven gas-fired simple cycle peaking CTs in operation at the Smith Power Station. Five more CTs are proposed to be installed at the site. These five units, 100 MW each, are expected to be in operation in 2008. State and federal approval is pending. These units will be capable of operating on fuel oil.

### 4.4.2 Coal

Currently EKPC owns and operates 1,657 MW of coal-fired base load capacity. Additional capacity appears feasible at the Cooper Facility and at Spurlock Power Facility. EKPC has recently installed the E.A. Gilbert Unit 3, a 268 MW CFB, at the Spurlock Power Station near Maysville, Kentucky. The proposed 278 MW units at Smith are also CFB. EKPC is committed to the environmentally friendly and flexible fuel burning in its new baseload plants and has selected CFB technology over pulverized coal.

## 4.5 Repowering

As units age and become less reliable and economic, or it becomes apparent that a boiler would have to be replaced, repowering with different fuels and/or technologies could prove to be economical. Repowering units could also be a feasible alternative for compliance with emission restrictions. EKPC evaluated its units to see if any appeared to be likely candidates for repowering.

The Dale Power Station is the oldest of EKPC's generating facilities and would be the most likely candidate for repowering. Currently, there is no apparent need to replace the boiler at any of the

Dale units. Repowering was considered for Units 3 and 4 as a compliance option in the "Clean Air Act Compliance Study", an attachment to the 1993 IRP. Both units were evaluated with an atmospheric fluidized bed option and a CT/combined cycle option. Natural gas pipelines are located in the vicinity of the Dale Power Station, making it a viable fuel alternative. Repowering these units with either option would provide relatively high reduction in $SO_2$ emissions when viewed on a percent removal basis. However, due to the small size of these units, the relative $SO_2$ removal cost is significantly higher for the repowering option than for fuel switching to Central Appalachia low-sulfur coal. There is limited space at the Dale plant site and no adjacent property is available for reasonable expansion possibilities. Repowering the units would require significantly more space than is available at the site. For these reasons, repowering was not considered a feasible alternative for Dale.

Cooper Power Station is EKPC's second oldest power generating station, over 30 years old, with Unit 1 becoming available for commercial operation on February 9, 1965, and Unit 2 on October 28, 1969. These units have been reliable and very economical, and currently there is no apparent need for boiler replacement. There have been no operating problems to indicate that EKPC should consider retirement or repowering based solely on previous operations. Both Cooper units were affected by Phase I of the Clean Air Act Amendments of 1990 and have had to operate under a reduced emissions limitation along with Spurlock Power Station Unit 1. Therefore, repowering these units was considered as a compliance option. The units currently emit approximately 2.2 pounds of $SO_2$ for each MBtu of Central Appalachia medium sulfur coal that is burned. Repowering could effectively reduce that emission rate to almost zero. There are no natural gas lines in the Cooper Power Station vicinity, and a significant investment would have to be made to make CTs or combined cycle units feasible alternatives. The cost was prohibitive for these options and they were discarded as repowering options. An atmospheric fluidized bed option could be feasible, but economic evaluation indicated that a lower cost compliance alternative would be to leave Cooper Power Station “as is” and install $SO_2$ scrubbers on Units 1 and 2 at the Spurlock Power Station. The installation of an SCR unit and $SO_2$ scrubber has been considered and appears to be feasible at Cooper Power Station.

Spurlock Power Station Units 1 and 2 are now over 20 years old. Neither unit is anywhere near retirement or needing boiler replacement, so repowering would only be a compliance option. Fuel switching is an economic alternative for Spurlock Power Station Unit 1. The old Unit 2 scrubber was uneconomical to restore and return to service. New scrubbers are being installed on Units 1 and 2. Therefore, the capital-intensive cost of repowering for compliance is not a feasible alternative at the Spurlock Power Station.

Based on various analyses, EKPC does not plan to retire or repower any of its eight existing pulverized coal-fired units during the 20-year planning horizon, through 2022. Therefore, no comparative evaluation of benefits expected from the proposed CFB units at the J.K. Smith Power Plant with those of repowering and/or uprating existing generating units can be established.

## 4.6 Generation Partnerships

EKPC is currently not participating in another company’s generation project. However, EKPC is currently involved in a generation partnership or alliance with seven other generation and

transmission (G & T) cooperatives called C-Gen. The purpose of the alliance is to seek economically attractive capacity alternatives that are feasible for the group but may be difficult for an individual G & T cooperative to realize on its own. It is unknown if any generation partnership will be formed to generate power at a cost less than what is expected from the proposed project.

## 4.7 Purchased Power

Considering that Warren RECC would likely become a new member cooperative in 2008, and the study on future baseload capacity that involved the timing of the baseload unit scheduled for 2011, EKPC issued RFP No. 2004-01 (2004 RFP) on April 2, 2004, to meet the needs of its member cooperatives including the addition of the Warren RECC load. EKPC hired EnerVision, Inc., (EnerVision) an energy services consultant, to help evaluate proposals from the 2004 RFP based on economics, transmission reliability, creditworthiness, environmental compatibility, and performance guarantees. The 2004 RFP was advertised in *The Wall Street Journal*, *USA Today*, and on the Energy Central website. A copy of the 2004 RFP was emailed to a distribution list of approximately 70 contacts made up of those responding to previous RFPs, independent power producers, surrounding utilities, and other interested parties. The 2004 RFP was also sent to over 60 media contacts and was available on EKPC's website.

The 2004 RFP requested proposals for baseload and peaking capacity resources. EKPC's peaking capacity needs as requested in the 2004 RFP were:

| Date Requested | By Capacity Amount |
|---|---|
| June 1, 2005 | up to 50 MW (DG Projects) |
| June 1, 2006 | up to 200 MW |
| June 1, 2007 | up to 200 MW (additional) |
| June 1, 2008 | up to 200 MW (additional) |

EKPC's baseload capacity needs as requested in the 2004 RFP were:

| Date Requested By | Capacity Amount |
|---|---|
| April 2008 | 275 MW |
| December 2008 | 275 MW (additional) |

### 4.7.1 Baseload Results

The alternatives considered for supplying the capacity needs requested in the 2004 RFP to meet EKPC's capacity needs are discussed in Exhibit 4, "RFP No. 2004-01 Proposal Evaluation Process." A total of 38 proposals were received including demand-side management and distributed generation. As discussed in Exhibit 4, EKPC's proposal for Spurlock Power Station Unit 4 was the best evaluated baseload bid to provide for the capacity needs of Warren RECC according to EnerVision's analysis. In the table entitled "RFP 2004-01 Summary of Results," included in Exhibit 4, EKPC is bidder No. 15 and Spurlock Power

Station Unit 4 is the proposal ranked number one based solely on economics. The second ranked proposal is for Spurlock Power Station Units 4 and 5. The proposal for J. K. Smith CFB Unit 1 was the proposal ranked third. Evaluation criteria included pricing, timing, commercial terms, and performance security measures. Purchased power is not the solution to EKPC's long-term energy needs.

## 4.8 New Transmission Capacity

There are physical transmission constraints that prevent EKPC from receiving adequate generation capacity from outside sources. Through the RFP process, EKPC has determined the most economical alternative for their customers is self-build generation rather than build transmission to obtain power from outside sources.

## 4.9 Capacity Alternatives Summary

Of the alternatives discussed, solar power is not being considered for further evaluation because of insufficient existing technologies to be cost competitive in the near future. The pumped hydro project would have required a partner to be feasible, would take ten years, and would involve a considerable amount of risk. It was not included for further evaluation, however, EKPC is interested in any hydroelectric project proposed that is feasible and has economic merit.

Fuel cell projects are being tested and evaluated by the Research & Development Process at EKPC. Biomass (which includes landfill gas to electric) and wind energy are currently being evaluated and considered as part of EKPC's Green Power Program. The remaining capacity options evaluated to determine the best combination of resources to supply EKPC's future needs were:

- Combustion Turbines
- Combined Cycles
- Fluidized Bed Boiler Unit
- Distributed Generation
- Integrated Gasification Combined Cycle (IGCC)

The IGCC gasification process "cleans" heavy fuels and converts them into high value fuel for gas turbines. IGCC technology can satisfy a wide range of output requirements from 10 MW to more than 1 GW, and can be applied in almost any new or re-powering project where solid fuels are available. This method of generation utilizes a variety of fuels, such as coal, pet coke, oil, or biomass producing fewer emissions than conventional coal generation alternatives, however it has a considerably higher cost.

IGCC technology was evaluated by EKPC as an option for baseload generation at Smith Station. EKPC determined the technology, while promising, did not provide the availability required for its baseload needs. It was also determined that IGCC would be much more expensive to build and maintain than the selected option. EKPC will continue to evaluate this technology for future baseload needs.

CFB technology has emerged as an environmentally acceptable technology for burning a wide range of solid fuels to generate steam and electricity power. CFB, although less than 20 years old, is a mature technology with more than 400 CFB boilers in operation worldwide, ranging from 5 MW to 250 MW. Electric utilities must evaluate different technologies that will utilize a wide range of low-cost solid fuels, reduce emissions, reduce life cycle costs, and provide reliable steam generation for electric power generation. Therefore, CFB is often the preferred technology. Even though pulverized coal (PC) fired boilers continue to play a major role worldwide, they have inherent issues such as fuel inflexibility, environmental concerns and higher maintenance costs. EKPC has chosen CFB technology for the two new Smith units to take advantage of its low emissions, reliability, and fuel flexibility.

EKPC selected two 278 MW circulating fluidized bed boiler units capable of burning coal, tire-derived fuels, petroleum coke, and biomass at the J.K Smith site. The J. K. Smith units feature clean coal technology patterned after EKPC's E. A. Gilbert Unit at the Spurlock Power Station, one of the nation's cleanest coal generating units.

# Section 5

# Siting Alternatives

## 5.1 Scope of Siting Study

EKPC is proposing to build two 278 MW CFB units in or near its service area. Unit 1 is expected to go on-line in 2010, with a second unit following at a later date. The unit is considered a "clean-coal" facility with minimal air emissions. The unit would also be able to utilize petroleum coke, tire-derived fuel, and biomass alternative fuel sources.

Critical support facilities for the proposed CFB units include:

- Transmission
- Waste Disposal
- Water Supply
- Transportation

This siting analysis addresses the proposed 278 MW CFB units only and any other generation projects such as additional CT units at the J. K. Smith Plant are discussed in separate documents.

## 5.2 Study Approach

Over the past several years EKPC has conducted several site selection studies for new generation facilities and supporting transmission lines. These studies generally follow the three phase approach suggested by the RUS "Guide for Preparing the Alternatives Evaluation and Site Selection Study for New Generation Projects." Two studies in particular would be used as a basis for the selection of a preferred and alternate site for the two proposed 278 MW CFB units. These studies are:

- "Environmental Impact Statement Related to the Proposed J.K. Smith Power Station Units 1 and 2 and Associated Transmission Lines," Rural Electrification Administration, 1980. The 1980 EIS is found in Appendix A of this report.

- "East Kentucky Power Cooperative, Inc. 400 MW Combustion Turbine Project Alternatives Analysis/Siting Study," Black & Veatch 1991. The Black & Veatch report is found in Appendix B.

The 1980 EIS used a two phase process in identifying sites. Phase 1 included the following:

- Development of objectives and site requirements
- Identification of regions of interest
- Identification of candidate siting areas
- Evaluation and selection of siting area
- Identification and evaluation of potential sites
- Conclusions and recommendations

Phase 2 of the study used the following steps:

- Scoping meeting with regulatory agencies
- Identification of alternative sites
- Evaluation and selection of proposed site and favorable alternatives
- Conclusions and recommendations

The 1991 study used the three stage approach in selecting a preferred and alternate site.

- In Stage 1 available siting areas were determined.
- Stage 2 identified tentative site locations then potential sites within the available siting areas.
- Stage 3 consisted of selecting a preferred and an alternate site

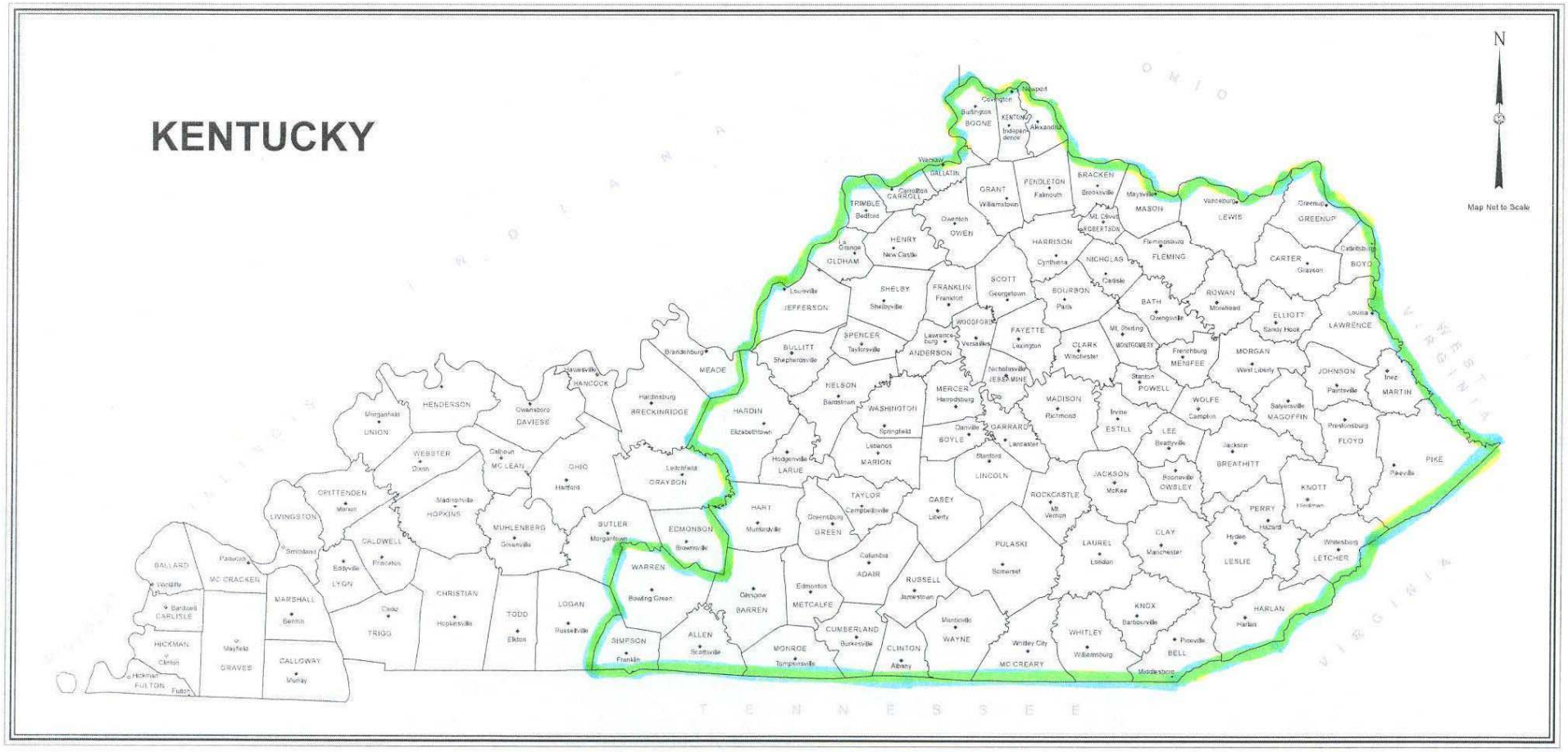
Even though the two studies differ slightly, one for a gas-fired unit and one for a coal-fired facility, the siting requirements are much the same. Both require water supply, transmission access, proximity to transportation facilities, favorable topography, and similar elements including a flood-free site. Therefore these previous studies form the basis of the site selection study for the proposed two 278 MW CFB units are summarized below. Additional information regarding siting methodology and process may be found in Appendices A and B of this report.

## 5.3 Phase 1 Identification of Potential Siting Area

### 5.3.1 Study Area Definition

The area investigated for siting these proposed units is defined as the area within or near the EKPC service area. Figure 5-1 shows the study area. The area contains abundant resources for CFB units including fuel, railroads, and alternative sources of water. Based on these considerations, previous siting studies, and the expectation that suitable sites exist within the siting region, investigating a larger area was not considered.

Stanley Consultants INC.




**Study Area**
**Figure 5-1**

### 5.3.2 Siting Area Evaluation Criteria

Evaluation criteria used in the two previous studies (1980 and 1991) are found in Table 5-1.

### 5.3.3 Identification of Potential Siting Areas

Table 5-2 shows potential siting areas from the two studies. The 1980 study identified areas while the 1991 report showed tentative site locations.

## 5.4 Phase II – Identification of Candidates Sites

### 5.4.1 Approach

Candidate areas or sites were screened by persons experienced in siting studies. Potential locations in the B&V study were reduced from 22 to 8. Five locations emerged for further study in the 1980 EIS (Table 5-3).

Sites were evaluated using criteria found in Table 5-4. The 1991 study reduced the number of sites to four following evaluation.

**Table 5-1 Siting Area Evaluation Criteria**

1980 EIS

- Fuel Sources - Areas within approximately 80 kilometers (50 miles) of primary coal producing areas.
- Proximity to Demand Load Centers - Areas in the eastern sector of the EKPC service area based on distribution of power demand within the system, location of existing generation capacity, and when considered jointly with fuel supply.
- Water Supply - Land within 16 kilometers (10 miles) of river segments with reservoirs or average flows of at least 500 cfs.
- Proximity to Railroads – Areas should be within 16 kilometers (10 miles) of railroads.
- Exclusion of National Parks and Forests.

1991 B&V Study

- Natural Gas Pipelines - Pipelines with a minimum diameter of 56 centimeters (22”); areas within 16 kilometers (10 miles) on each side of the pipeline.
- Transmission Lines - A 32 kilometer (20-mile) wide corridor along an EKPC 69 kV transmission line or larger; transmission line corridor must be within the gas pipeline corridor.
- Water Resources - Surface water with a 7-day low-flow, 10-year frequency discharge of 0.56 cubic meters (20 cubic feet) per second or greater; a 32 kilometer (20 mile) wide corridor along the water source must fall within the combined pipeline and transmission corridors.
- Geological Factors - Areas of high Karst/sinkhole potential within the combined gas pipeline, transmission line, and water resource corridor were excluded from consideration.

Source: REA, 1980; B&V 1991

## Table 5-2 Potential Siting Areas

1980 EIS

### Identification of Siting Areas

Proximity of Fuel Sources - Areas should be within approximately 80 kilometers (50 miles) of primary coal producing areas based on the potential advantages of truck delivery of coal to a site from mines in eastern Kentucky.

Proximity to Load Centers - Areas should be in the eastern sector of the EKPC service area based on the distribution of power demand within the system, location of existing generating capacity, and when considered jointly with fuel supply.

Proximity to Water Supply - Areas should be within 16 kilometers (10 miles) of river segments with reservoirs or with annual average flows of at least 500 cfs.

Proximity to Railroads - Areas should be within 16 kilometers (10 miles) of railroads.

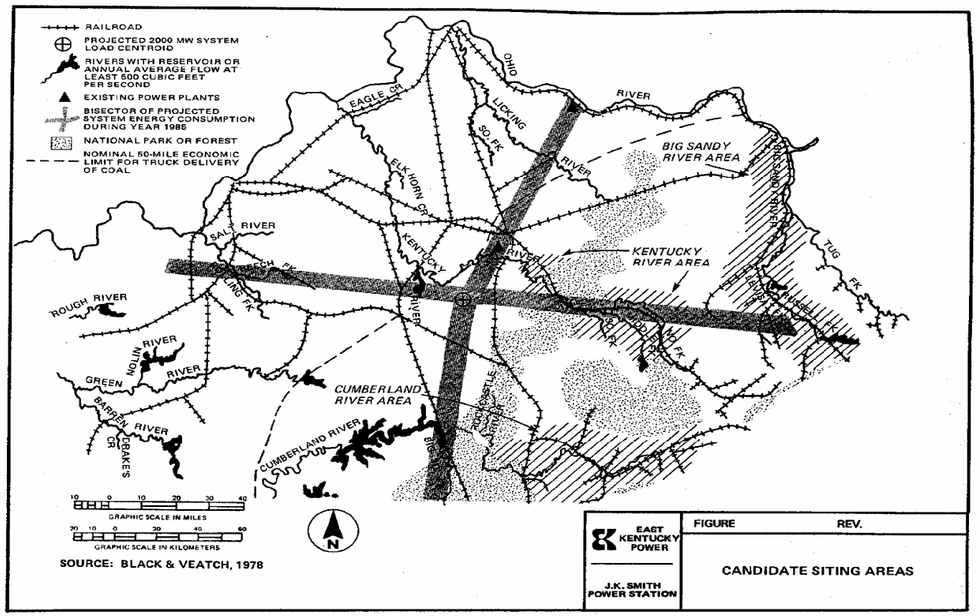
Exclusion of National Parks and Forests

Site Area and Availability - The site should have at least 20-40 hectares (50-100 acres) for each 600-MW unit and allowances for construction lay-down, parking and buffer. The site should also be available for scheduled station development.

Fuel Supply - Proximity to fuel sources, accessible to railroads; navigable waterways, or major highways for fuel delivery, site should accommodate 60-90 day supply of coal.

Water Supply - Site should have sufficient water to meet peak demand of 15 cfs and annual average demand of 10 cfs for each 600-MW unit, water quality should be suitable for plant use, site should be proximate to water source, site should meet water supply related regulations.

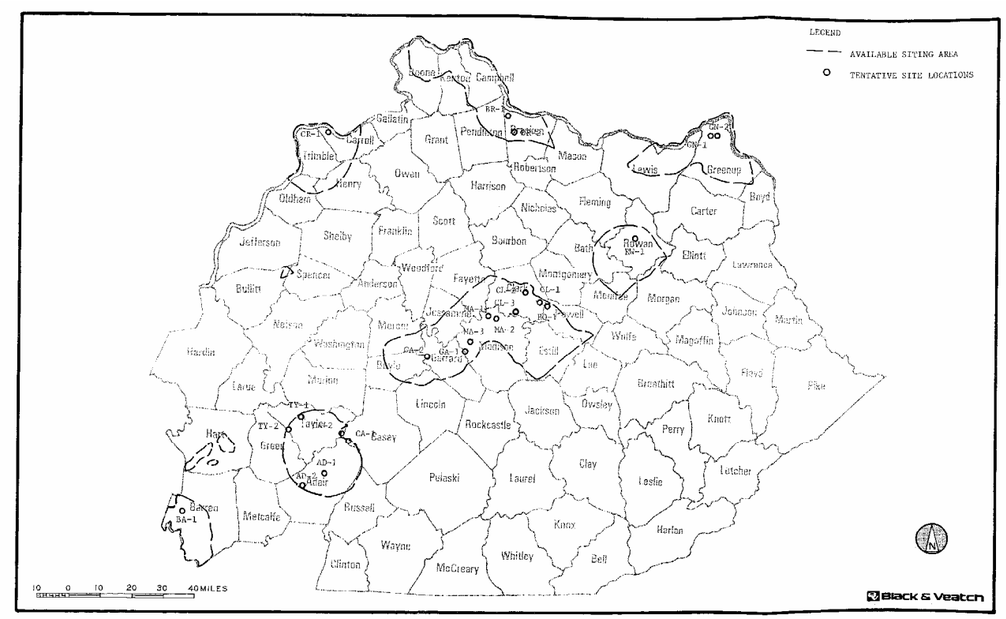
Transportation Access - Site should be near heavy duty roads, railroads, barge access is advantageous.




1991 B&V Study

### Site Locations 400 MW Combustion Turbine Project

| County | Number of Site Locations |
|---|---|
| Barren | 1 |
| Adair | 2 |
| Taylor | 2 |
| Casey | 2 |
| Garrard | 2 |
| Madison | 3 |
| Clark | 3 |
| Powell | 1 |
| Rowan | 1 |
| Greenup | 2 |
| Bracken | 2 |
| Carroll | 1 |
| Total | 22 |




Source: REA 1980; B&V 1991

## Table 5-3 Tentative Siting Areas

1980 EIS

### Evaluation of Siting Areas

Water Supply - A potentially suitable area must have an adequate water supply.

Accessibility - A siting area should contain a railroad and highways capable of carrying heavy loads. Proximity to a waterway navigable by barge is considered advantageous.

Fuel Supply - Siting area proximity to major coal producing counties is considered advantageous.

Proximity to Load Centers - Siting area proximity to projected load centers of EKPC member cooperatives is considered favorable.

Environmental Compatibility - A siting area should be environmentally accessible, particularly with respect to air quality, land use and water use. National and State parks, forests, and other designated use areas are excluded from siting consideration.

Transmission - Site should be near load centers, existing transmission facilities and free of transmission interference.

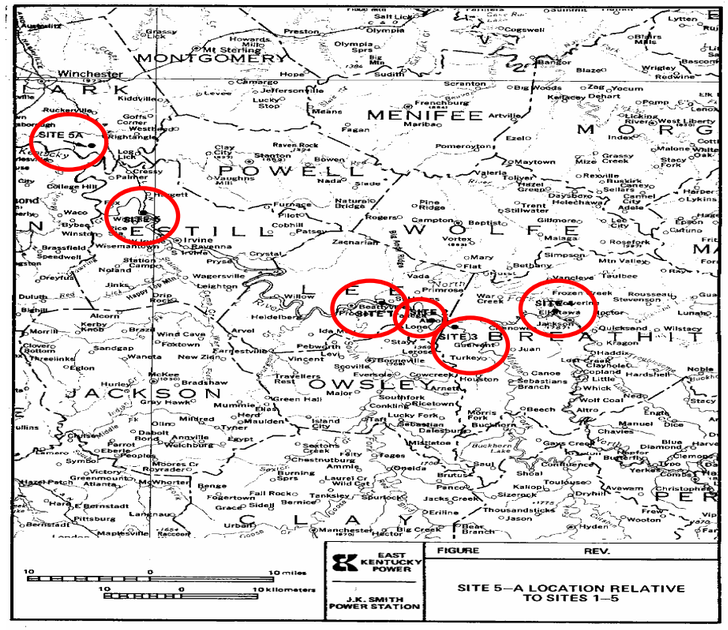
Air Pollution Control and Air Quality Impacts - The meteorology and existing ambient air quality of a site should enable relatively economic construction of a station with acceptable impacts on air quality.

Station Staffing - A site within an hour's commute of an urban area is considered advantageous.

Site Physical Characteristics - An advantageous site should have low relief onsite and surrounding, historically low seismicity, competent bedrock near the surface, and no adverse flooding.

Site Use Displacement - An excellent site should not be in current use, have low potential for nonindustrial development, and provide marginal habitat for fish and wildlife.

Archaeological and Historical Resources - The site should not have these important resources which would be lost by site development.



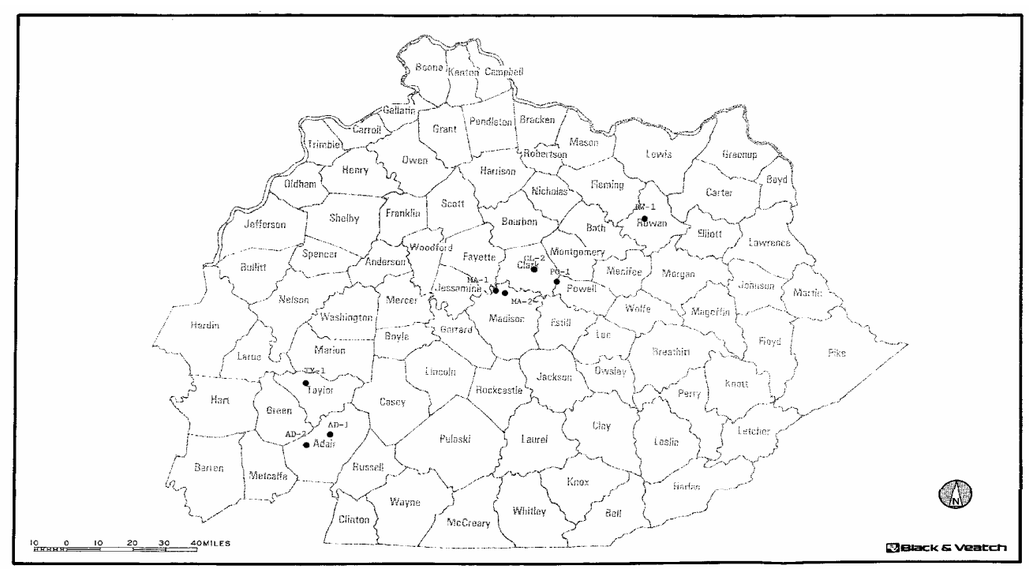

Source: REA, 1980; B&V 1991

1991 B&V Study

### Scores of Tentative Site Locations

| Tentative Site Locations | County | Score |
|---|---|---|
| AD-1 | Adair | 2 |
| AD-2 | Adair | 2 |
| BA-1 | Barren | 3 |
| BR-1 | Barcken | 4 |
| BR-2 | Barcken | 4 |
| CA-1 | Casey | 3 |
| CA-2 | Casey | 3 |
| CL-1 | Clark | 3 |
| CL-2 | Clark | 2 |
| CL-3 | Clark | 3 |
| CR-1 | Carroll | 4 |
| GA-1 | Garrard | 4 |
| GA-2 | Garrard | 3 |
| GN-1 | Greenup | 5 |
| GN-2 | Greenup | 5 |
| MA-1 | Madison | 1 |
| MA-2 | Madison | 2 |
| MA-3 | Madison | 3 |
| PO-1 | Powell | 1 |
| RW-1 | Rowan | 1 |
| TY-1 | Taylor | 1 |
| TY-2 | Taylor | 3 |

Note: Each site location was given an alpha-numeric designation consisting of a two-letter code prefix for the county in which the site is located.



## Table 5-4 Site Evaluation

1980 EIS

### Identification of Alternative Sites Guidelines

Site Area and Topography - A potential site should have sufficient space and suitable topography for development of at least two 600-MW class generating unit.

Proximity to Water Supply - A potential site should be relatively close to the Kentucky River.

Proximity and Access to Railroad and Highway - A potential site should be relatively close to a railroad and a heavy duty highway, and there should be suitable access ways to the site.

Air Quality - To minimize potential air quality plume impact, a potential site should be located in areas which are not surrounded by elevations significantly higher than the assumed height of the cooling towers and/or stacks.

Flood Potential - A potential site should be situated above a flood plain to minimize the problems of diking and construction of flow, which may cause flooding upstream.

Fuel Supply

Water Supply

Transportation Access

Transmission

Station Staffing

Site Physical Characteristics

Archaeological and Historical Resources

Air Traffic Safety

Solid Waste Disposal

Wastewater Disposal

Station Uses of Public Facilities and Services

Ultimate Station Development

Source: REA, 1980; B&V 1991

1991 B&V Study

### Potential Site Evaluation Summary

| Criteria | Group Weight % | Site AD-1 | Site AD-2 | Site TY-1 | Site MA-1 | Site MA-2 | Site PO-1 | Site CL-2 | Site RW-1 | Maximum Possible |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Evaluation Scores of Potential Sites | | | | | | | | |
| Environmental | 31 | 2.55 | 2.21 | 2.28 | 2.32 | 2.21 | 2.01 | 2.20 | 1.80 | 3.10 |
| Engineering | 56 | 3.94 | 3.31 | 4.12 | 3.97 | 4.68 | 4.54 | 3.94 | 3.93 | 5.60 |
| Costs | 13 | 1.30 | 1.30 | 1.04 | 1.04 | 1.04 | 1.04 | 1.04 | 1.04 | 1.30 |
| Total Score | | 7.79 | 6.82 | 7.44 | 7.33 | 7.93 | 7.59 | 7.18 | 6.77 | 10.0 |
| Rank | | 2 | 7 | 4 | 5 | 1 | 3 | 6 | 8 | --- |
| Recommended Sites | | Yes | No | Yes | No | Yes | Yes | No | No | --- |

### Top Evaluated Potential Sites

| Site I.D. | Percent Score | Overall Rank | Sensitivity Rank: Emph Env | Sensitivity Rank: Emph Eng/Cost | Key Resources: Water | Key Resources: Transmission | Key Resources: Oil | Key Resources: Natural Gas(1) | Conflicting Development | Suitability for SCCT Development |
|---|---|---|---|---|---|---|---|---|---|---|
| MA-2 | 79.3 | 1 | 2 | 1 | Kentucky River, 3.1 mi. | EKPC 138 kV Dale-Fawkes line adjacent to site. | By truck; <100 mi. | TET (3 lines) lines), 1.1 mi; TGP (5 lines), 2 mi. | Minimal at site; at edge of increasing suburban development | Excellent due to existing site resources, including multiple gas pipelines and proximity to transmission interties. |
| AD-1 | 77.9 | 2 | 1 | 3 | Green River Lake, 4.1 mi. | EKPC 69 kV Coburg-Columbia/ Windsor line adjacent to site. | By truck; <100 mi. | TET (3 lines) adjacent to Site; CGT (3 lines), 0.25 mi. | Low, site is rural cropland, scattered rural housing in region. | Excellent;, weaker transmission access. But multiple gas pipelines. |
| PO-1 | 75.9 | 3 | 6 | 2 | Kentucky River, 7.2 mi. | EKPC 69 kV Clay City-Hunt line 2 mi. south. Planned EKPC 138 kV. Dale-Powell County line will pass adjacent to site. | By truck; <100 mi. | TGP (5 lines) Compressor Station No. 106 adjacent to site. | Minimal at site, area is rural, small unincorporated community within 1 mi. | Very good |
| TY-1 | 74.4 | 4 | 3 | 4 | Green River Lake, 11 mi. | EKPC 161 kV Marion County-Green County line adjacent to site. | By truck; <100 mi. | TGP (5 lines) Compressor Station No. 96 adjacent to site. | Low, some existing rural development. Small unincorporated community within 1 mi. | Very good. Weaker water access. |

NOTES: (1) TET - Texas Eastern Transmission Corporation
TGP - Tennessee Gas Pipeline Company
CGT - Columbia Gulf Transmission Company

## 5.5 Site Evaluation

Potential sites were further evaluated.

### 5.5.1 Selection of Candidate Sites

Based on the scores found in Table 5-4, the following sites were selected as candidate's sites in the 1991 Study:

MA-2 – Madison County

AD-1 – Adair County

PO-1 – Powell County

TY-1 – Taylor County

The 1980 Study identified the following candidate sites:

Site 1 – Lee County

Site 2 – Lee County

Site 3 – Breathit County

Site 4 – Breathit County

Site 5 – Estill County

Site 5A, the J.K. Smith site in Clark County was added for further evaluation.

### 5.5.2 Selection of Preferred and Alternate Sites

The four candidate sites in the 1991 Study were combined with EKPC's existing Smith (CL-4) and Spurlock (MS-1) sites to form the list of final candidate sites. These sites were investigated to determine which sites could most advantageously be developed. This investigation considered environmental factors, engineering factors, and the economics of site development. The final candidate sites from the 1991 study are shown in Table 5-4. The J.K. Smith Site was added to the five sites considered in the 1980 EIS (see Table 5-5) as the base case. Cost estimates from both reports are found in Table 5-5.

# Table 5-5 Site Evaluation

1980 EIS

## Supplemental Considerations

Site Area and Availability - Sites were evaluated for the feasibility of acquiring the site area and for any potential conflicts with development plans by others.

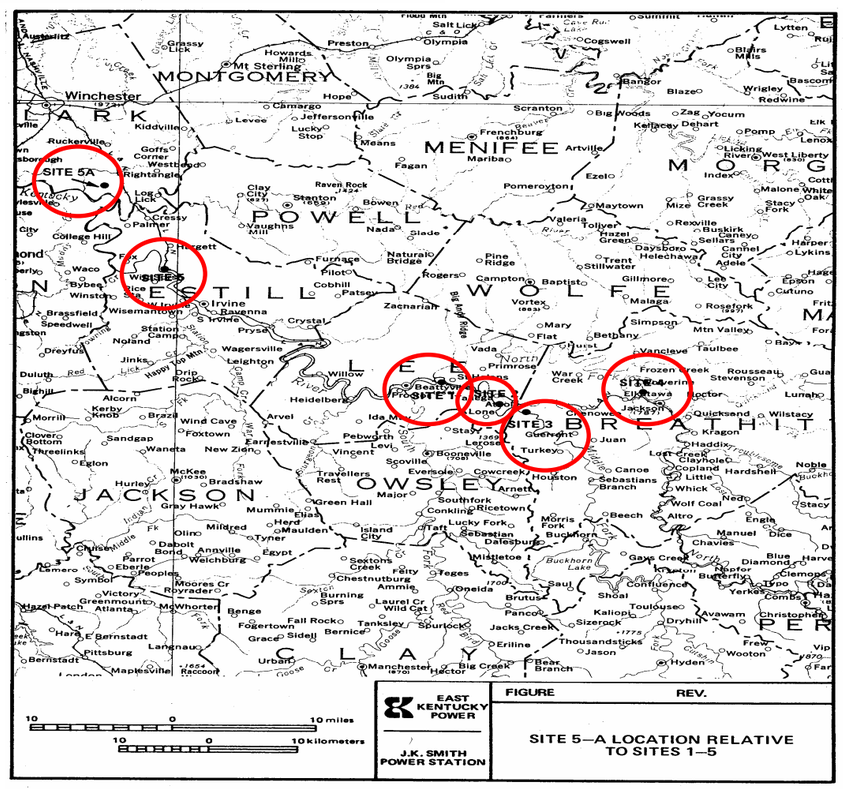
Air Pollution Control and Air Quality Inputs - A potential site's station emissions should not violate NAAQS and/or cause the applicable PSD increments to be exceeded.

Site Use Displacement -
- Land Use - Sites were considered more favorable where the fewest number of public/semi-public facilities, farm and nonfarm residences, farms, industrial and commercial enterprises would be relocated.
- Wildlife - Impacts on wildlife habitat and endangered or threatened species.
- Prime and Unique Farmland - Sites should minimize impacting this resource.

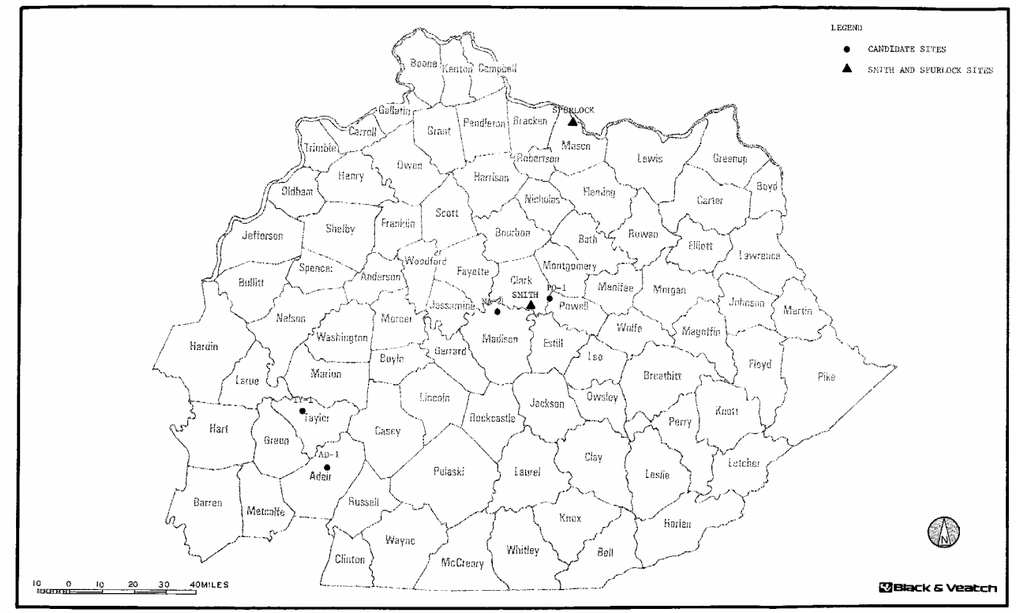
Land Use and Water Use Compatibility - In addition to aesthetic, aquatic ecology and surrounding land use compatibility, a site should also be compatible with existing and planned land uses for the site area, and zoning ordinances.

Construction Labor Availability - Labor market analysis was conducted to determine if the available labor supply within commuting distance of a site was sufficient for construction manpower requirements.

Construction Workforce Community Impacts - Housing Availability - Sites were not considered as favorable if there was a tight housing market in commuting counties.




1991 B&V Study




Source: REA, 1980; B&V 1991

## Table 5-5 Site Evaluation (continued)

1980 EIS

### Comparative Differential Site-Related Development Costs ($1,000)

| | Site 1 | Site 2 | Site 3 | Site 4 | Site 5 | Site 5-A |
|---|---|---|---|---|---|---|
| Central Generating Complex | | | | | | |
| Land | 810 | 390 | 570 | 620 | 470 | Base |
| Grading | 590 | 540 | Base | 1,390 | 120 | 1,490 |
| Road | 130 | 1,100 | Base | 170 | 100 | 350 |
| Railroad | 1,030 | 1,010 | Base | 1,760 | 110 | 1,080 |
| Flood Protection | * | ** | Base | * | 640 | Base |
| Subtotal | 1,990 | 2,470 | Base | 3,370 | 870 | 2,350 |
| Water Supply | | | | | | |
| Reservoir | | | | | | |
| Land | 70 | 50 | 70 | 110 | 120 | Base |
| Clearing and Dam | 190 | 2,320 | 1,430 | 4,270 | Base | 20 |
| Pipeline | 60 | 660 | Base | 360 | 1,200 | 660 |
| Subtotal | Base | 2,710 | 1,180 | 4,420 | 1,000 | 360 |
| Solid Waste Disposal | | | | | | |
| Reservoir | | | | | | |
| Land | Base | 10 | 80 | 20 | 10 | 50 |
| Clearing and Dam | 1,690 | 720 | 900 | 3,110 | 12,920 | Base |
| Pipeline | 540 | Base | 260 | 540 | 670 | 70 |
| Subtotal | 2,110 | 610 | 1,120 | 3,550 | 13,480 | Base |
| Transmission | 16,300 | 18,000 | 19,500 | 24,800 | 3,500 | Base |
| Total | 17,690 | 21,080 | 19,090 | 33,430 | 16,140 | Base |

NOTES: *Flood protection would be provided by the railroad spur embankment.
**Flood protection would be provided by the access road embankment.

1991 B&V Study

### Differential Site Capital Costs

| Capital Cost Component | Powell PO-1 | Adair AD-1 | Madison MA-2 | Taylor TY-1 | Spurlock MS-1 | Smith CL-4 |
|---|---|---|---|---|---|---|
| | $ (1990) | $ (1990) | $ (1990) | $ (1990) | $ (1990) | $ (1990) |
| Land Aquisition | 330,000 | 400,000 | 150,000 | 210,000 | Base | Base |
| Electrical Transmission | 1,500,000 | 4,000,000 | Base | 4,700,000 | 15,900,000 | 500,000 |
| Access Roads | 60,000 | 150,000 | 150,000 | 50,000 | Base | 60,000 |
| Gas Supply Pipeline | Base | Base | 760,000 | Base | 19,000,000 | Base |
| Water Pipeline | 1,010,000 | 570,000 | 430,000 | 1,540,000 | Base | Base |
| Site Development | | | | | | |
| Clearing & Grubbing | 210,000 | 50,000 | 10,000 | Base | Base | Base |
| Earthwork | 230,000 | 210,000 | 230,000 | 210,000 | 90,000 | Base |
| Fencing | 80,000 | 100,000 | 50,000 | 60,000 | Base | Base |
| Field Labor Adjustment | 3,000,000 | Base | 3,000,000 | Base | 3,600,000 | 3,000,000 |
| Total Capital Cost | 6,420,000 | 5,480,000 | 4,780,000 | 6,770,000 | 38,590,000 | 3,560,000 |

### Differential Site Operting Costs First Year Estimated Annual Costs

| Operating Cost Component | Powell PO-1 | Adair AD-1 | Madison MA-2 | Taylor TY-1 | Spurlock MS-1 | Smith CL-4 |
|---|---|---|---|---|---|---|
| | $/y (1990) | $/y (1990) | $/y (1990) | $/y (1990) | $/y (1990) | $/y (1990) |
| Electrical Transmission Losses | 22,000 | 39,000 | Base | 20,000 | Base | 15,000 |
| Natural Gas Supply | 62,500 | Base | Base | 62,500 | 112,500 | 62,500 |
| Oil Supply | 430,000 | 430,000 | 430,000 | 430,000 | Base | 430,000 |
| Makeup Water | Base | Base | Base | Base | 100,000 | Base |
| Total Operating Cost | 514,500 | 469,000 | 430,000 | 512,500 | 212,500 | 507,500 |

Source: REA, 1980; B&V 1991

1980 EIS

## Table 5-5 Site Evaluation (continued)

### Summary of Site Specific Concerns

| Consideration | Relative Favorability Assessment* Site 1 | Site 2 | Site 3 | Site 4 | Site 5 | Site 5-A |
|---|---|---|---|---|---|---|
| **Comparison Considerations** | | | | | | |
| Fuel Supply | A | A | A | A | B | B |
| Water Supply | B | B | B | C | A | A |
| Transportation Access | B | C | C | C | B | B |
| Transmission | B | B | B | C | A | A |
| Station Staffing | B | C | C | C | A | A |
| Site Physical Characteristics (Flooding) | B | B | A | B | C | A |
| Archaeological & Historical Resources | A | A | A | A | A | A |
| Air Traffic Safety | A | A | A | B | B | A |
| Solid Waste Disposal | B | A | B | B | C | A |
| Wastewater Disposal | C | A | A | A | A | A |
| Station Uses of Public Facilities & Services | A | A | A | A | A | A |
| Ultimate Station Development | A | C | C | B | B | A |
| **Supplemental Considerations** | | | | | | |
| Site Area & Availability | C | B | B | C | C | A |
| Air Pollution Control & Air Quality Impacts | B | B | B | B | C | A |
| Site Use Displacement | | | | | | |
| Land Use | C | A | A | C | B | A |
| Wildlife | B | C | B | C | A | A |
| Prime & Unique Farmland | C | B | B | A | B | A |
| Land Use & Water Use Compatibility | | | | | | |
| Land Use/Aesthetics | C | A | A | C | B | A |
| Aquatic Ecology | B | C | C | A | A | A |
| Construction Labor Availability | B | C | C | C | A | A |
| Construction Workforce Community Impacts | B | C | C | C | A | A |
| Overall Ranking (Best to Worst) | 5th | 4th | 3rd | 6th | 2nd | 1st |

NOTE: *For ease of discussion, relative favorability is summarized using the following notation.

A - Highly favorable for development
B - Favorable
C - Least favorable

1991 B&V Study

### Summary of Stage 3 Analysis Base Evaluation for Final Candidate Sites

| Criteria Group | Group Weight | Site TY-1 | AD-1 | MA-2 | PO-1 | CL-4 | MS-1 | Maximum Possible |
|---|---|---|---|---|---|---|---|---|
| Environmental | 48% | 3.58 | 4.01 | 4.10 | 3.79 | 4.39 | 3.74 | 4.80 |
| Engineering | 15% | 1.03 | 1.18 | 1.19 | 1.26 | 1.29 | 0.92 | 1.50 |
| Capital Costs | 25% | 2.28 | 2.38 | 2.43 | 2.30 | 2.50 | 0.00 | 2.50 |
| Operating Costs | 12% | 0.53 | 0.60 | 0.80 | 0.52 | 0.56 | 0.60 | 1.20 |
| Total Scores | 100% | 7.42 | 8.17 | 8.52 | 7.87 | 8.74 | 5.26 | 10.00 |

Source: REA, 1980; B&V 1991

## Table 5-5 Site Evaluation (continued)

1980 EIS

**Summary of Site Specific Concerns**

| Topical Area of Concern* | 1 | 2 | 3 | 4 | 5 | 5-A |
|---|---|---|---|---|---|---|
| Air Quality/Meteorology | | | | | A | |
| Construction Workforce Impact | A | A | A | A | | |
| Flood Plain Locations | A | A | | | A | |
| Operational Staffing | B | B | B | B | | |
| Prime Farmland | A | A | | | A | X |
| Site Accessibility | A | B | B | A | | |
| Site Availability | B | | | | B | |
| Site Development & Layout | | A | B | A | | |
| Solid Waste Disposal | B | | | A | | |
| Treated Wastewater Discharge | A | | | | | |
| Water Reservoir Development | | | A | A | | |
| Water Supply | | | A | A | | |

NOTE: *"A" represents concern raised by various state and federal regulatory agencies.

"B" represents additional concerns of EKPC and/or UE&C developed either before or after site visits with regulatory agencies.

"X" represents the same concerns addressed for Sites 1 through 5 which were also identified for Site 5-A as a result of ongoing siting investigations described in the Siting Investigation Supplement No. 2.

1991 B&V Study

**Stage 3 Evaluation of Final Candidate Sites**

| Rank | Base Evaluation Score | | Emphasize Environmental Factors | | Emphasize Engineering/cost Factors | |
|---|---|---|---|---|---|---|
| 1 | CL-4 | 8.74 | CL-4 | 8.93 | CL-4 | 8.55 |
| 2 | MA-2 | 8.52 | MA-2 | 8.52 | MA-2 | 8.50 |
| 3 | AD-1 | 8.17 | AD-1 | 8.25 | AD-1 | 8.08 |
| 4 | PO-1 | 7.87 | PO-1 | 7.87 | PO-1 | 7.87 |
| 5 | TY-1 | 7.42 | TY-1 | 7.42 | TY-1 | 7.40 |
| 6 | MS-1 | 5.26 | MS-1 | 6.51 | MS-1 | 4.10 |

Source: REA, 1980; B&V 1991

**5.5.2.2 Candidate Sites Evaluation.** Each final candidate site was evaluated using the analysis method (objectives) and scoring systems. Scoring for sites in both studies is found in Table 5-5.

Two sensitivity test variations were also evaluated in the 1991 study.

### 5.5.3 Selection of Preferred and Alternate Sites

The selection of the B&V preferred and alternate sites was based on a synthesis of the quantitative analysis and the sensitivity tests.

The recommended sites were:

- Preferred Site: CL-4 (J.K. Smith)
- Alternate Site: MA-2

Site 5A (J.K. Smith) was the preferred site for two 600 MW coal-fired units. Site 5 in Estill County was ranked second in the 1980 EIS.

## 5.6 Selection of Preferred and Alternative Sites

Both the 1980 EIS and the 1991 B & V documents found the J.K. Smith site most suitable for either combustion turbines or coal-fired generation. In 1980, REA committed to guarantee a loan for two 600 MW coal-fired steam electrical generating units at the J.K. Smith site. Seven combustion turbines are located on the Smith site and EKPC plans on the installation of at least another four CT units.

The Smith site was also the location for a proposed 540 MW demonstration power station comprised of two synthesis gas-fired combined cycle unit. An EIS concerning the project was project was prepared by the Department of Energy in 2002 (see Appendix C). The project was cancelled for the Smith site in 2005 as the proposed partners could not agree on project development cost-sharing.

Based on previous studies and current location of combustion turbines on the site, the J.K. Smith Power Station is the preferred location for the two 278 MW CFB units.

Extensive site work has been completed at J. K. Smith. Initially, substantial work on the site was completed for the 600 MW units that were subsequently cancelled. This work included a rail spur, site roads, grading, utility systems, and environmental studies. Other work has been completed at the site in support of the CTs located at the site. This includes water treatment facilities, diesel fuel storage, additional roads, and extensive transmission facilities.

EKPC's John Sherman Cooper site and a site in Estill County currently being planned as a 110 MW CFB unit on a 500 acre site near Irvine, Kentucky have been selected as alternate sites to the J.K. Smith Plant Site.

Figure 5-2 shows the location of the preferred and alternative sites. Nearby cities and towns are also shown.

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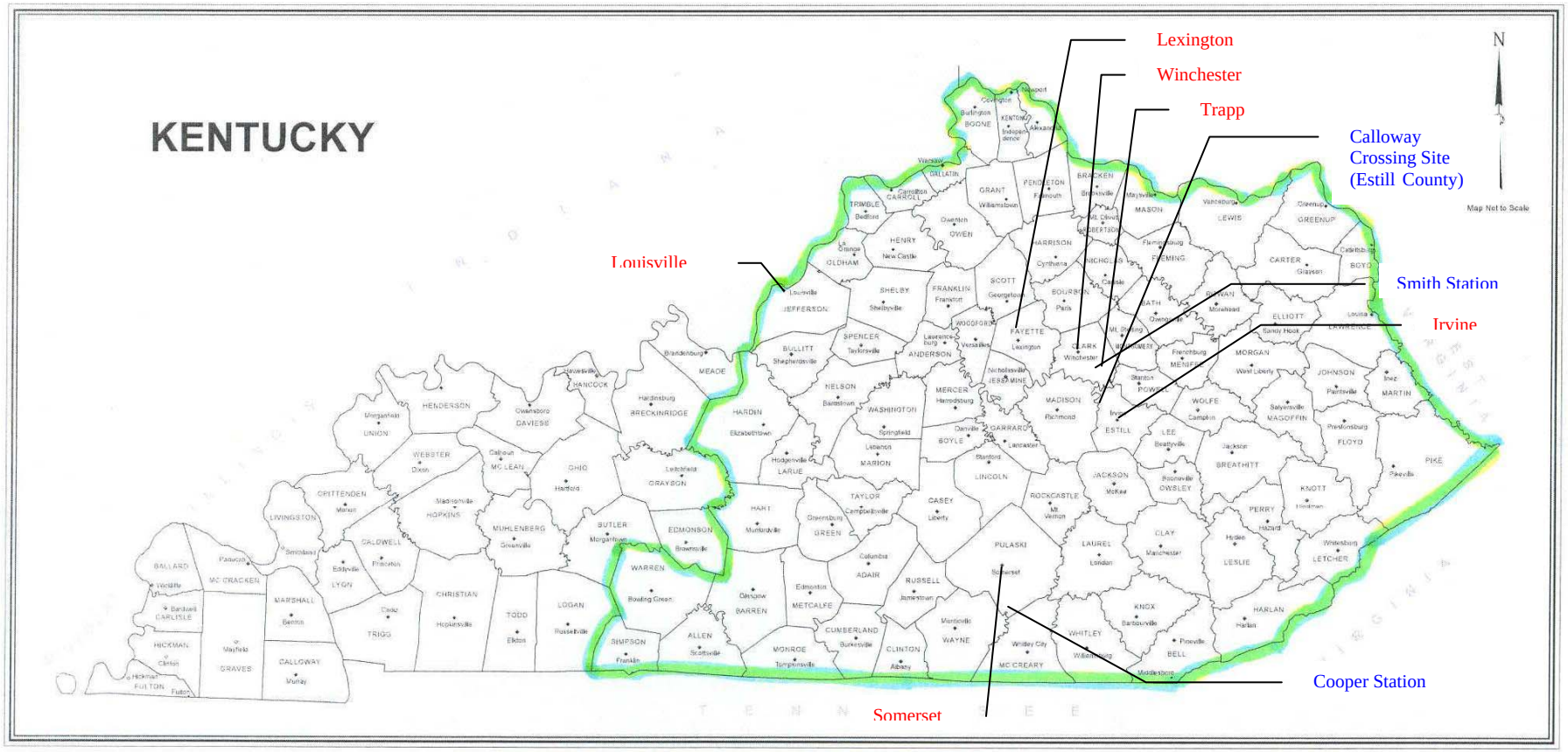



**Preferred and Alternative Sites**

**Figure 5-2**

# Section 6

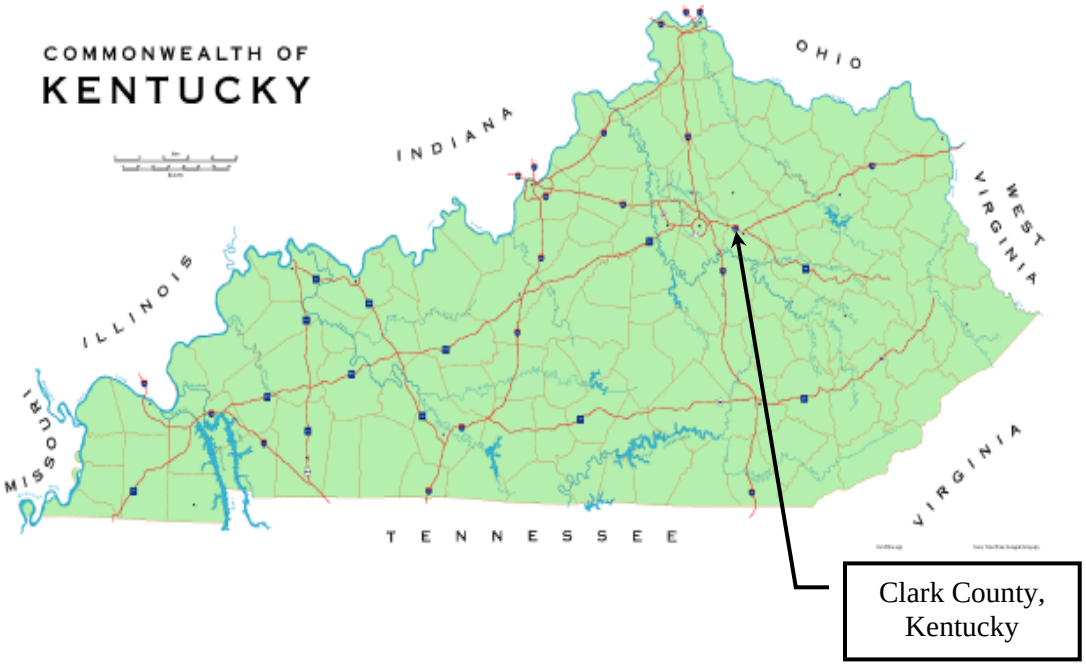
# Site Description

## 6.1 Site Alternatives

The preferred site (herein after referred as the "proposed" site) for two 278 MW CFB units is EKPC's J.K. Smith 3,220 acre site in Clark County, Kentucky. Two alternative sites have been selected, EKPC's John Sherman Cooper Power Station and a 500 acre site in Estill County.

### 6.1.1 Applicant's Proposed Site

The proposed site for the J.K. Smith CFB generating units is located in Clark County, Kentucky, 21 miles southeast of the city of Lexington, 8 miles southeast of the city of Winchester, and 1 mile west of the community of Trapp. Figure 6-1 presents a general location map of the J.K. Smith site.



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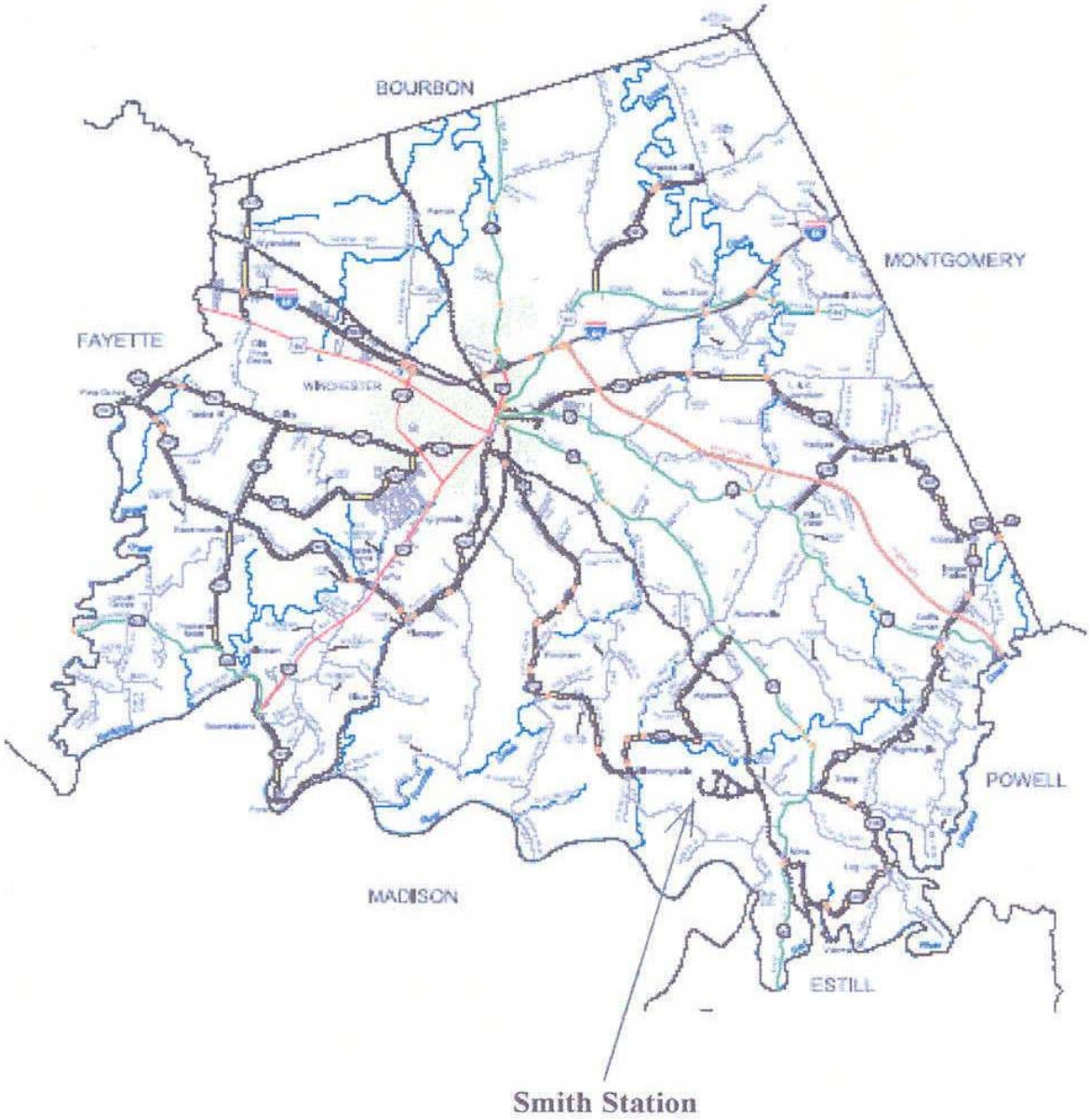


**Proposed Site Location**
**Figure 6-1**

The CSX Railroad marks the eastern boundary of the site, and the Kentucky River flows near its southern boundary. Upper Howards Creek flows to the north and west, forming part of the northern site boundary and its western boundary. The total site area is approximately 3,220 acres. The United States Geological Survey's Hedges 7.5 minute quadrangle shows the site. Figure 6-2 presents a topographic map of the J.K. Smith site.

Much of the existing infrastructure on the Smith Site would be used for the new CFB Units. The rail spur, roads, potable water, water treatment facilities, diesel fuel storage, a coal pile retention basin, and transmission facilities are in place to support the proposed units. Some new roads, additional trackage, substation, coal handling and storage facilities, and a plant oil-water separator would be constructed on the site to support the new units. Photographs on the following pages illustrate current on-site conditions. Figure 7-2 shows existing and proposed site facilities.

### 6.1.2 Alternative Sites

EKPC's John Sherman Cooper Power Station Site on Lake Cumberland near Somerset, Kentucky is one alternative to the J. K. Smith Site. There are two coal-fired units on the site, Unit 1, 116 MW, completed in 1965 and Unit 2, 225 MW, placed in service in 1969. See Figure 6-3 for a topographic map of this alternative site.

A 500 acre site in Estill County near Irvine, Kentucky, is a potential alternative site. However, a merchant 110 MW CFB unit may possibly locate there. Figure 6.4 presents a topographic map of the Estill County alternative site

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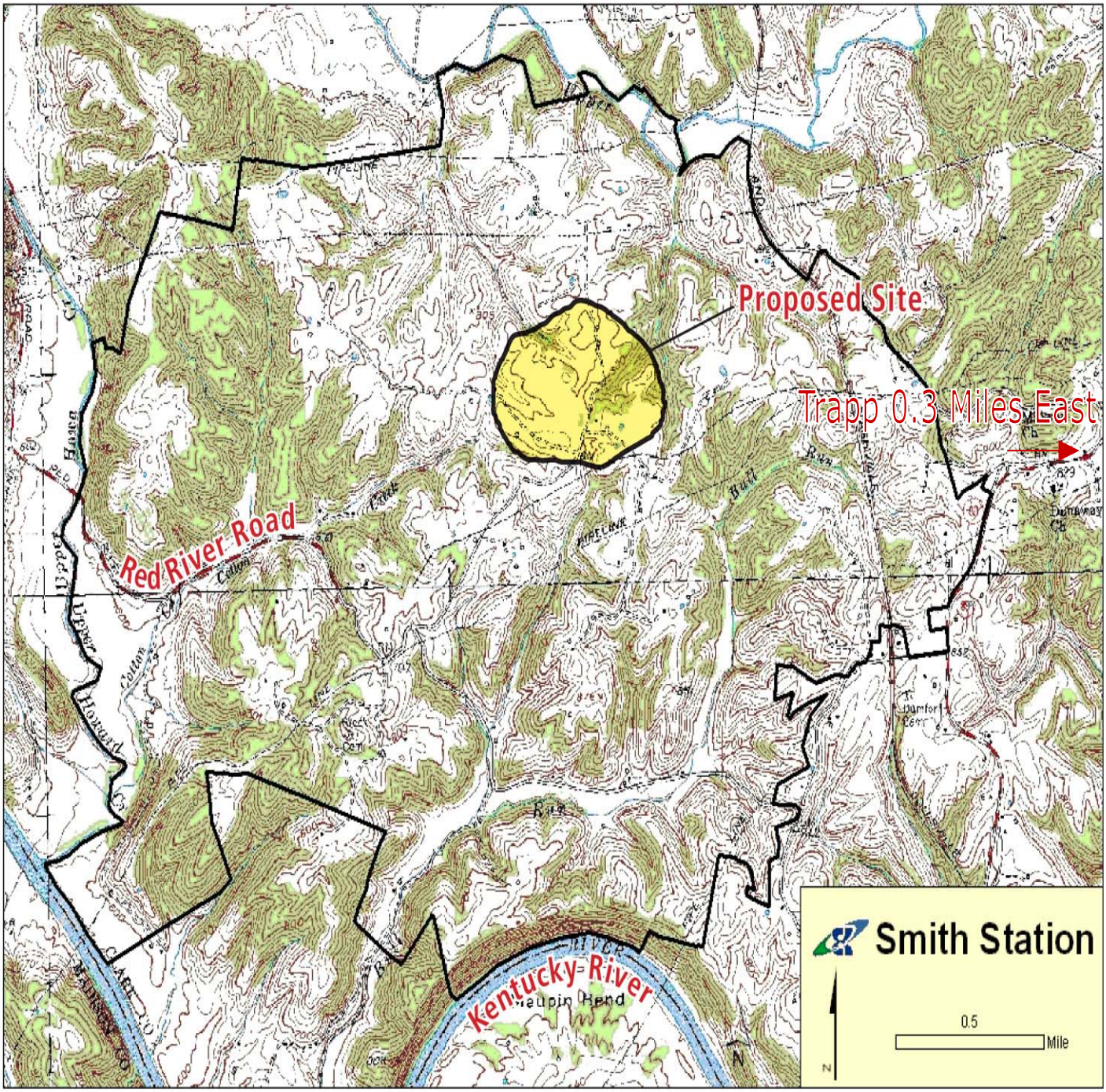


**Proposed Site Location**
**Figure 6-2**

Existing Railroad Spur

Roads

Settling Basin

Circulating Water Pump House Foundation

Proposed Main Plant Area

Existing Coal Pile Runoff Basin

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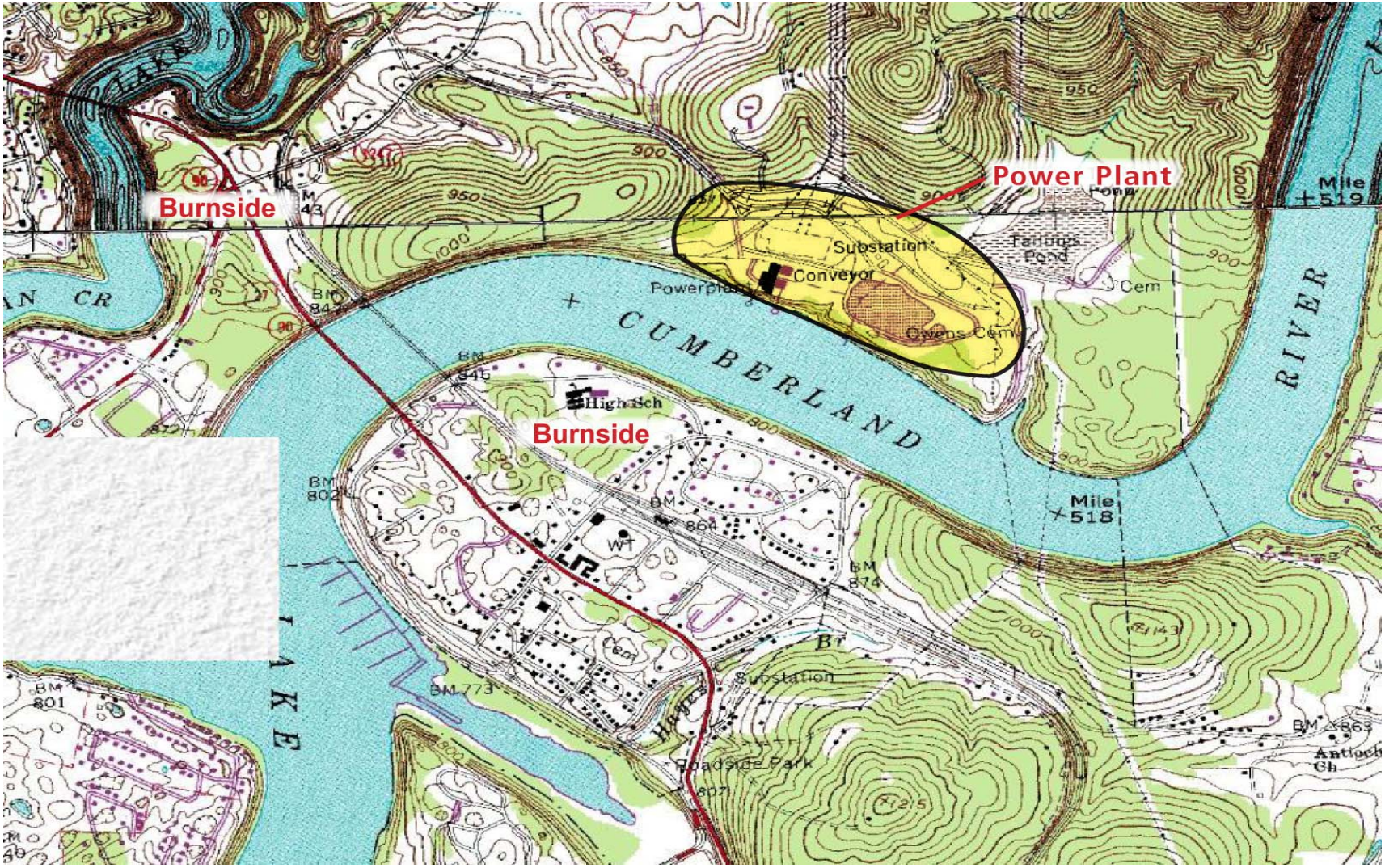


**John Sherman Cooper Station**
**Figure 6-3**

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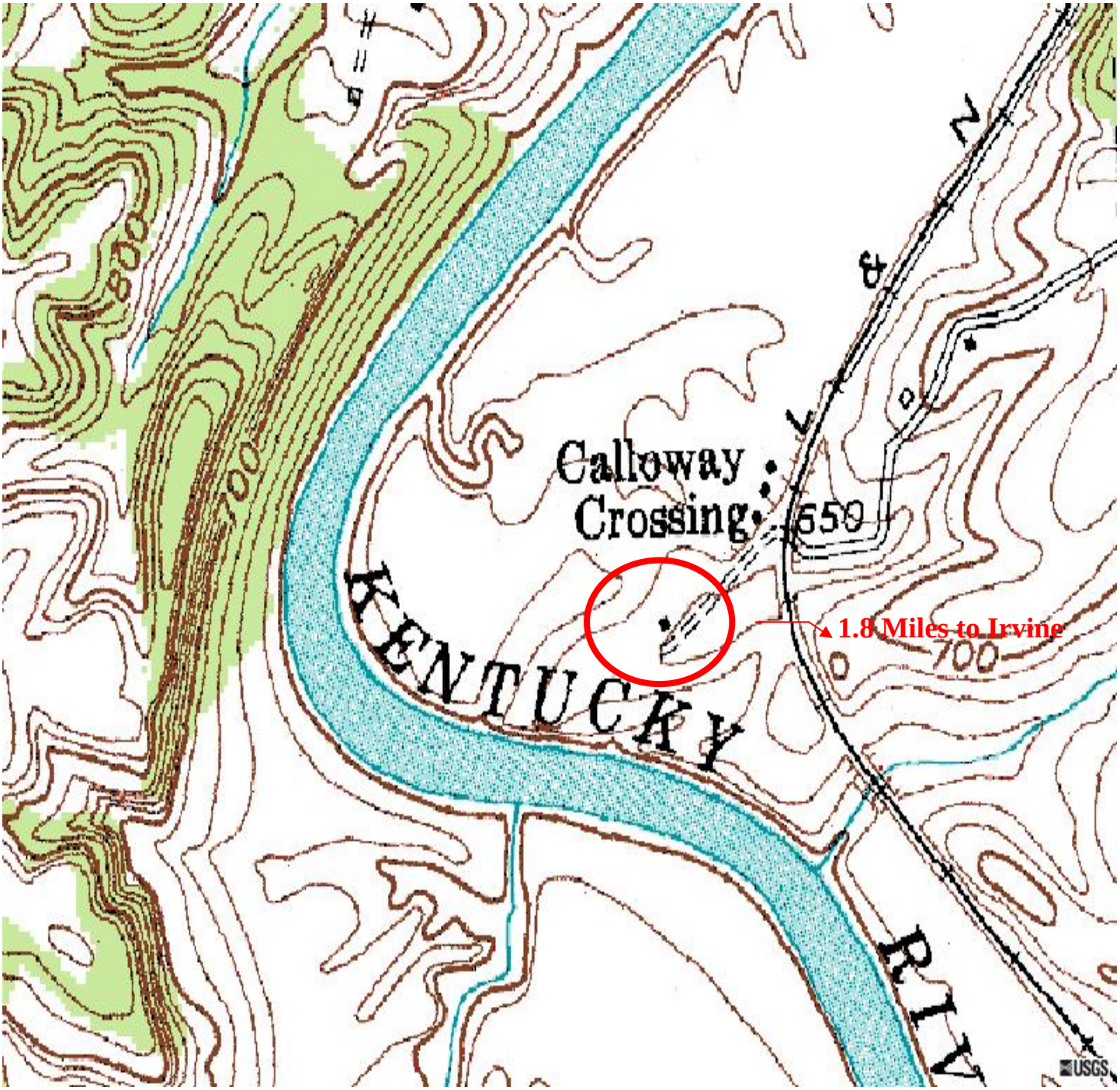


**Estill County Site**
**Figure 6-4**

# Section 7

# Project Description

## 7.0 Introduction

The proposed project consists of two 278 MW CFB coal-fired units. The CFB is considered a clean coal unit with minimal air emissions. Initially, one unit would be constructed at the proposed site. As capacity needs increase there is the possibility of constructing an additional unit.

## 7.1 Facility Equipment and Layout

Each of the proposed units consist of a nominal 278 MW generating unit with one CFB boiler, one turbine-generator, one flue gas desulfurization system, one SNCR $NO_X$ control system, one baghouse, one stack, and associated balance of plant (BOP) equipment. The BOP equipment includes the turbine-generator power cycle equipment. A distributed control system is provided for responsive load changes, reliable operation, and improved thermal performance. Figure 7-1 shows a conceptual plan for CFB Unit 1. A detailed plant site arrangement is shown on Figure 7-2.

The cover of this document contains an artist's rendering of the proposed Units 1 and 2 located on the J. K. Smith site.

The facility is designed to operate continuously with minimum scheduled downtime for annual inspections and infrequent major overhauls. Facility loading may vary hourly per system loading, and the plant load is controllable from 35 percent to maximum plant capability. The boiler is a CFB type designed to deliver 2,018,142 lb/hr. of steam 2,414 psia and 1,000°F. The minimum steam flow rate for the boiler is 35 percent of boiler maximum continuous rating (MCR) without auxiliary fuel support. The boiler and auxiliaries are designed for operation when burning the design fuel at 100 percent MCR. Natural gas is used for boiler start-up.

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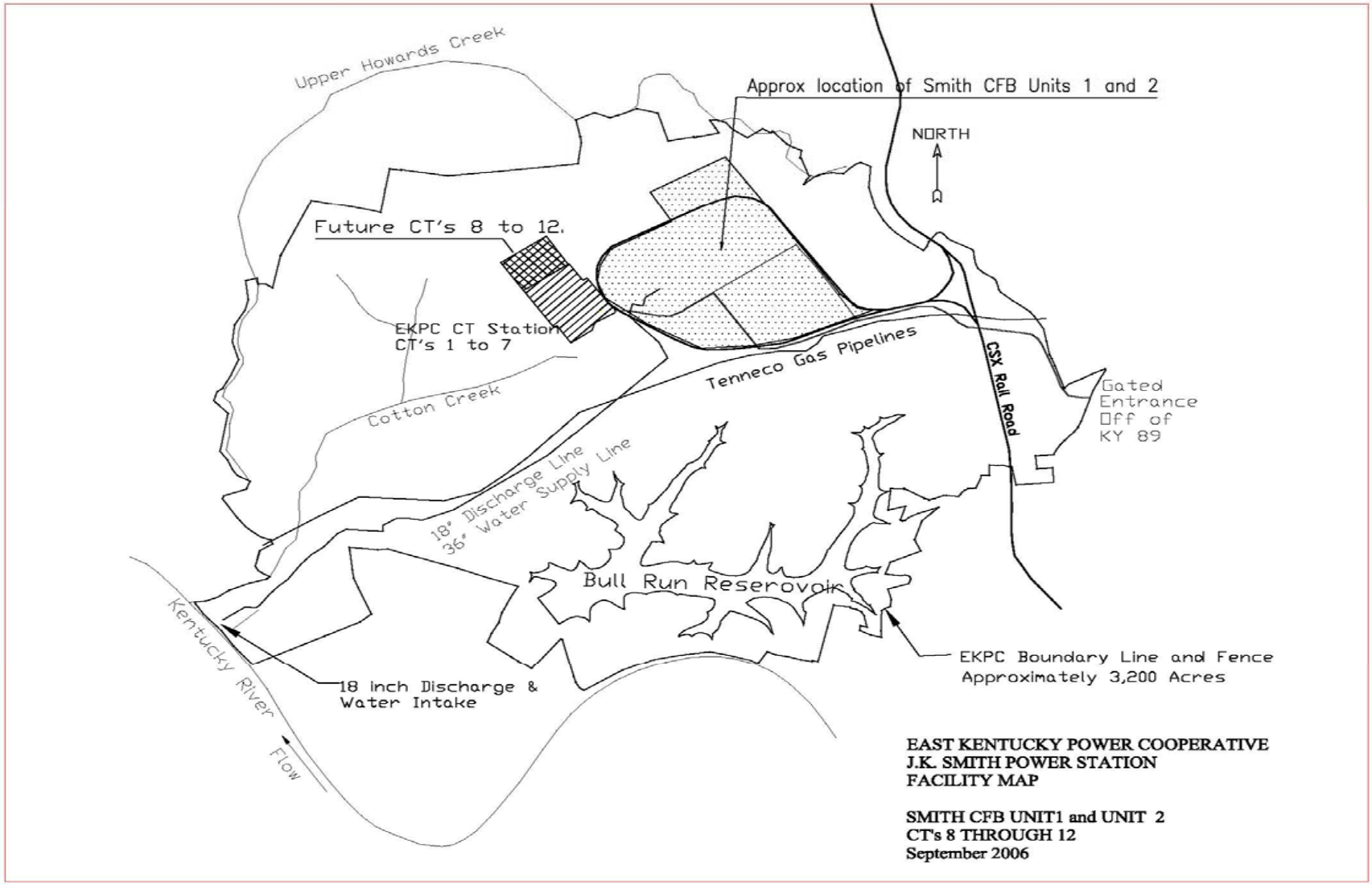


**Proposed Site Arrangement for the CFB Unit No. 1 at J.K. Smith**

**Figure 7-1**

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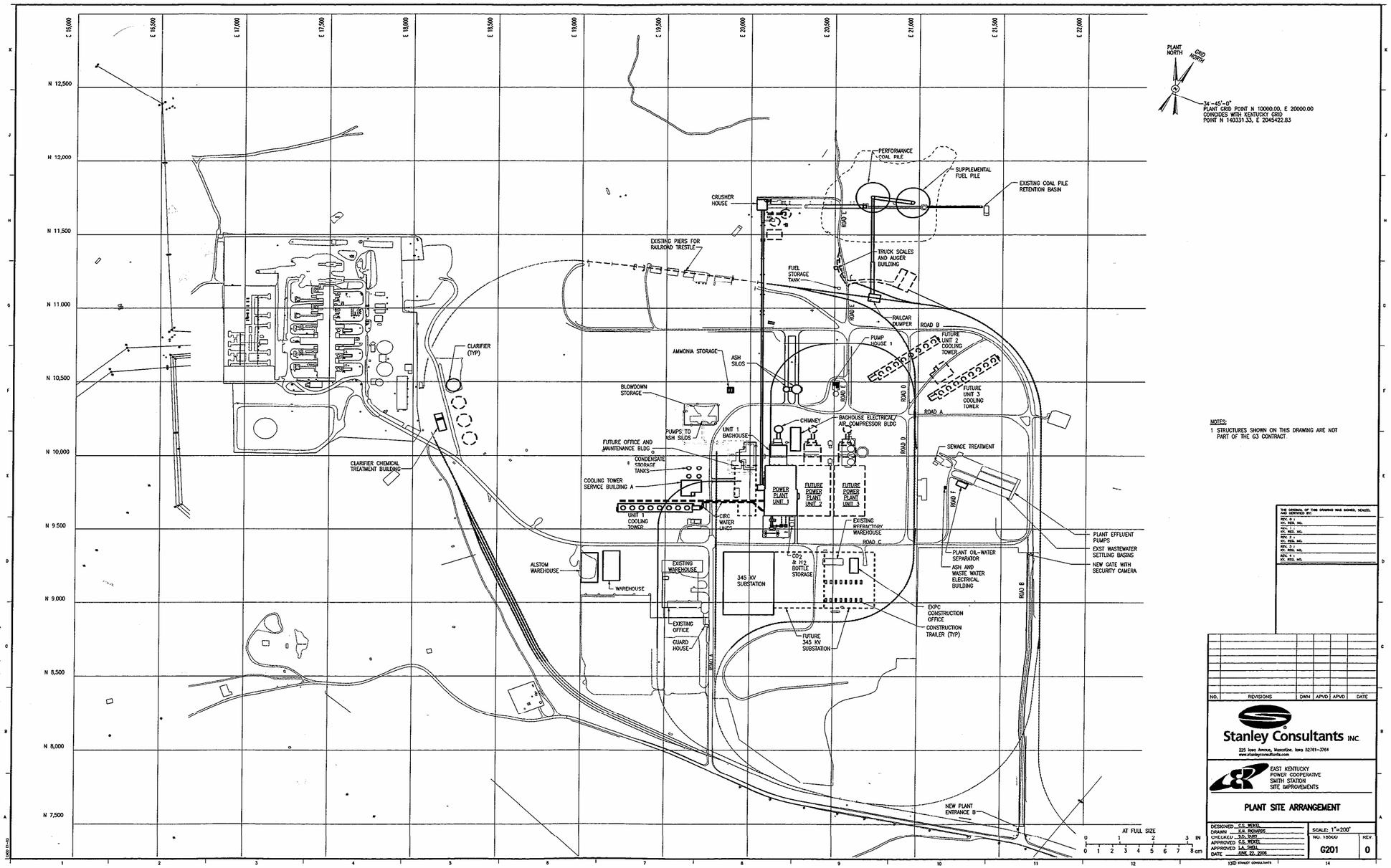


NOTES:
1 STRUCTURES SHOWN ON THIS DRAWING ARE NOT PART OF THE G3 CONTRACT.

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Stanley Consultants INC.
225 Iowa Avenue, Muscatine, Iowa 52761-3764
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EAST KENTUCKY POWER COOPERATIVE
SMITH STATION
SITE IMPROVEMENTS

PLANT SITE ARRANGEMENT

DESIGNED C.S. MERID
DRAWN K.A. RICHARDS
CHECKED S.D. MERID
APPROVED C.S. MERID
APPROVED S.A. HEIL
DATE JUNE 22, 2006

SCALE: 1"=200'
NO. 180640
G201
REV. 0

SCI PROJECT NO. 18500.02.00
25-JUN-2006
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**Plant Site Arrangement**
**Figure 7-2**

The CFB units proposed at J.K. Smith can operate effectively on a number of different fuels. Each CFB would be capable of burning fuel with an ash content up to 40 percent, a sulfur content up to 4.5 percent, and a Btu content as low as 8,700 per pound. It would also be able to utilize petroleum coke, tire-derived fuel, and biomass as alternative fuel sources. The annual burn would be approximately 1.2 million tons of coal per year per unit.

## 7.2 Emission Controls

The proposed CFB units would be subject to the *Prevention of Significant Deterioration* (PSD) requirements of Section 101 of the federal Clean Air Act because the generating units would have the potential of emitting greater than 250 tons per year of a regulated criteria pollutant. These pollutants are particulate matter, carbon monoxide, sulfur dioxide, nitrous oxide, and volatile organic compounds. EKPC has projected the proposed units would run a maximum of 8,700 hours per year but has estimated that the units would actually be operated approximately 8,500 hours per year. However, the proposed units would be permitted for an unlimited number of hours per year. Based on an unlimited number of hours of operation with 100 percent coal, the proposed new units would have the potential to emit the following tons per year of criteria pollutants:

| | |
|---|---|
| Carbon Monoxide (CO) | 1,642.50 |
| Nitrogen Oxides ($NO_X$) | 1,095.00 |
| Sulfur Oxides ($SO_X$) | 2,190.00 |
| Inhable Particulate Matter (PM/10) | 328.50 |
| Volatile Organic Compounds (VOC) | 39.42 |
| Sulfuric Acid ($H_2SO_4$) | 54.75 |

EKPC is in the process of applying for an air quality construction and operation permit from the Kentucky Department for Environmental Protection, Division for Air Quality (KDAQ). A Title V Permit is required for the J.K. Smith units. The Title V Permit includes a construction permit and a review for PSD. EKPC would commence the construction of the unit within the 18-month period allowed under the permit. Once the units are constructed, EKPC will test run the units, taking pollutant measurements from the stack emissions. These measurements would be sent to KDAQ to demonstrate that the units meet the PSD requirements and to secure an operating permit for the units. EKPC has received a *Certificate of Public Convenience and Necessity* and a *Site Compatibility Certificate* from the Kentucky PSC for the CFB units.

The proposed CFB generating units with added controls would have the best available control technology (BACT). The PSD review requirements apply to major sources and modifications for pollutants with an increase that would exceed PSD significant emission rates. The above table shows that the PSD significant emissions rates would be exceeded for $PM_{10}$, $SO_2$, $NO_X$, CO, and sulfuric acid mist. Therefore, the requirements to demonstrate BACT and to evaluate air quality, Class I, and secondary impacts apply for each of these five pollutants. The BACT requirements of PSD are more stringent than the new source performance standards (NSPS) as outlined in 40

CFR Part 60 for controlling $NO_X$ and $SO_2$. Therefore, by complying with the appropriate BACT requirements, the proposed CFB units would be in compliance with the relevant NSPS.

Other potential sources of air quality degradation associated with the proposed project would be the exhaust and dust associated with construction of the proposed new electric generating units. The construction activities, however, would be short-term in duration, and the affected area would be relatively small. The area where the units would be installed is currently graded. Consequently, the amount of air quality degradation to the immediate surrounding area through the construction phase of the proposed project would be expected to be negligible. An immediate return to near ambient air quality conditions for vehicle exhaust and dust is expected once the construction activities are completed.

Based on PSD modeling performed for the CFB unit, airborne pollutants that would be emitted while operating the proposed unit for the projected 8,500 hours per year with a maximum operation of 8,700 hours per year would be well below PSD significant impact levels.

## 7.3 Transmission Requirements

The proposed J.K. Smith CFB units would require minimal additional transmission facilities. Transmission lines are being upgraded and constructed for the CTs adjacent to the site and would be capable of transmitting the generation capacity for the CFB units. The upgrading and construction of CT transmission is a separate project from the proposed CFB units. An Environmental Assessment is being proposed for the CT transmission line. The proposed CFB units would require an on-site substation and transmission lines tying it to the adjacent CT site.

## 7.4 Fuel Use and Waste Disposal

Coal for the first unit would be acquired from mines in Kentucky, southern Ohio, and southern Illinois. Approximately 70 percent of the coal would be transported by rail, with the balance being delivered in trucks. Natural gas would be transported to the site by pipeline.

The coal would be stored on-site. The coal stockpile would normally contain approximately a 45-day supply. Natural gas for start-up of the CFB would be supplied from existing pipelines.

Coal combustion wastes will be collected dry and stored on-site in areas identified as suitable for waste storage and disposal. One area, a large ravine adjacent to the CFB site, has already been identified as a candidate site. Groundwater monitoring wells are already established in the site, and background data has been collected. This area was identified as an ash storage site for the originally proposed 600 MW units. Waste will be moved from the unit to the storage area by truck. Whenever possible, coal combustion waste will be used as fill material. Initially, most of the material will be used onsite. However, eventually it will be made available for beneficial reuse offsite in areas where it is considered appropriate. EKPC continues to support research efforts to discover more beneficial uses for coal combustion byproducts.

Alternative fuels, such as tire-derived fuels or biomass, would be stored on-site at or near the coal pile. These fuels would be blended with coal in low concentrations (less than 10 percent) in an effort to lower emissions, produce renewable energy, and take advantage of lower cost fuels.

## 7.5 Water Supply and Wastewater Disposal

The Kentucky River is the primary source of water for the proposed CFB units. During drought conditions or high use periods, water may be drawn from the Kentucky River to replenish a potential storage reservoir. Studies are being conducted to determine the need for a storage reservoir.

One CFB unit would require approximately 4.3 million gallons of water per day or 1.6 billion gallons annually. Most of the water use would be in the cooling towers where evaporative cooling is used to cool the condensate from the unit.

The existing CT water intake structure would be upgraded, and a pipeline constructed to draw water from the Kentucky River. Preliminary work has been performed to determine where to best site a storage reservoir on the J.K. Smith site if necessary.

Potable water would be supplied to the site by the East Clark Water District.

During operation, a CFB unit would produce approximately 850,000 gallons of wastewater daily. This waste would be treated on-site in a series of settling basins. The water would be discharged sending 700,000 gallons back through an existing pipe to the Kentucky River once it meets KPDES permit requirements.

## 7.6 Operating Characteristics

Currently, most coal units burn pulverized coal at temperature ranging from 2,200°-2,400°F. The J.K. Smith units, however, would burn coal mixed with limestone at temperatures lower than 1,650 degrees. In a CFB air is blown into the furnace to suspend or fluidize the mixture of coal and limestone. Combustion particles pass from the boiler to a cyclone structure where large, unburned particles are circulated back to the boiler. Fine particles are trapped in a bag-house and collected for disposal. This process makes the burning more thorough, reducing the volume of particles in the flue gas and lowering operating costs. Mixing the coal with limestone during combustion significantly reduces the sulfur content in the flue gases.

Each of the CFB units is expected to operate between 8,500 and 8,700 hours per year. These base-load units would operate 24 hours a day, 365 days a year except for scheduled maintenance or unscheduled outages. The availability factor is expected to be 93 percent. Maintenance operations are expected to be similar to those at other EKPC sites, consisting of scheduled shutdowns for the power plant and supporting facilities.

## 7.7 Noise

The average near field sound pressure level contribution from each of the current CT units does not exceed 96 dBA when measured in a free field (i.e., three feet in the horizontal plane and at an elevation of five feet above the turbine machine baseline or personal platforms with the equipment operating at base load according to contract specifications). During normal operation, a CFB would not be expected to exceed these levels. Therefore, the proposed new unit would not be expected to have any noise impact on the outlying area of the existing electric generating facility site during normal operations. However, during initial construction and start-up or shut-down procedures noise levels could reach higher levels. Also, venting steam during routine start-

up and shut-down can cause significant increases in noise from the plant. These events, however, rarely occur and are temporary in nature.

There is no other development located in close proximity to the preferred site. EKPC owns a fairly large buffer area of land surrounding the facility (see Figure 7-1). EKPC has also collected data regarding noise emanating from the existing generating facility since 1992. During the 16 years of CT operation there have been no complaints from residents located in the outlying areas of the existing facility regarding noise from turbine operation.

## 7.8 Transportation

The proposed plant site in Clark County is located near major transportation routes both for truck and rail travel. Interstates 64 and 75 both come within 25 miles of the site. Kentucky Route 89 ties the site to Winchester, Kentucky. The Mountain Parkway connects the site to the coalfields of eastern Kentucky via I-64 and Route 89. Although Route 89 is suitable for tractor-trailer travel, the Kentucky Transportation Cabinet has included $28 million for improvements to Kentucky 89 in the Fiscal 2006 to 2012 highway plan. Enhancement projects include road widening, bridge replacement and spot improvements. More than $15 million of those projects have been funded in the approved state budget. Replacement of the bridge at the Ruckerville Road intersection is underway.

Based on construction of the identical 278 MW Gilbert Unit about 630 work vehicles can be expected at peak construction. Peak construction would last for approximately six months, two years after the start of construction. Approximately 7,700 truck deliveries are expected during the three-year construction period. An estimated 75 percent of the deliveries would occur in the first 18 months. Truck deliveries of materials and supplies would average about 10 trucks per day, with a maximum of 30 trucks daily. Two “mass concrete pours” would require about 300 trucks each delivering concrete over 48-hour periods.

CSX has major rail facilities adjacent to the site. There are spurs in place at the site that tie it to the available rail. However, minimal additional tracks may need to be added for the proposed units.

## 7.9 Project Schedule

Initial regulatory permitting for the project is underway. If permits can be obtained, project construction is expected to begin in June of 2007. Approvals and/or permits for the project include air quality, Kentucky PSC, building permits, solid waste disposal, water withdrawal, and waste discharge. Construction would require approximately three years, with performance testing for the first unit expected in mid-2010. A tentative project schedule is shown on Figure 7-3. Delays in permitting could have a significant effect on the anticipated completion date.

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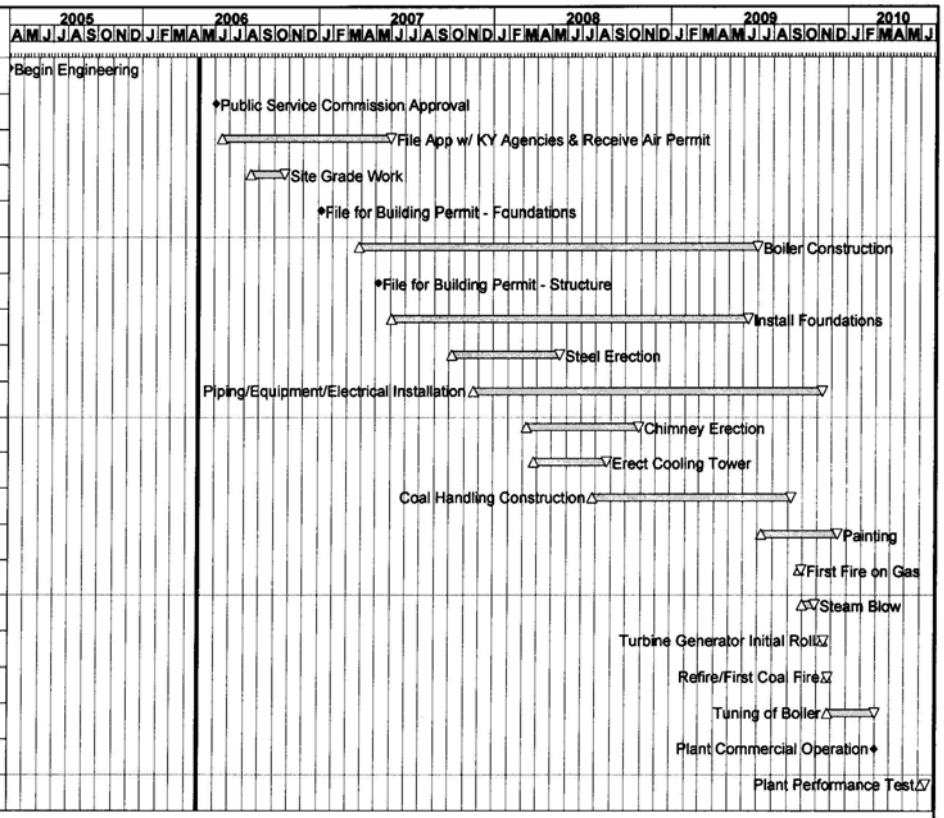
| Activity ID | Activity Description | Early Start | Early Finish |
|---|---|---|---|
| EK10005 | Begin Engineering | 04/01/05A | |
| EK10080 | Public Service Commission Approval | | 06/01/06* |
| EK10040 | File App w/ KY Agencies & Receive Air Permit | 06/16/06 | 06/01/07* |
| EK67005 | Site Grade Work | 08/14/06 | 10/23/06 |
| EK10090 | File for Building Permit - Foundations | 01/08/07 | |
| EK40045 | Boiler Construction | 03/27/07 | 06/30/09 |
| EK10130 | File for Building Permit - Structure | 05/07/07 | |
| BC65005 | Install Foundations | 06/04/07 | 06/09/09 |
| EK40075 | Steel Erection | 10/08/07 | 05/16/08 |
| BP70005 | Piping/Equipment/Electrical Installation | 11/20/07 | 11/10/09 |
| EK51005 | Chimney Erection | 03/10/08 | 10/28/08 |
| EK52010 | Erect Cooling Tower | 03/25/08 | 08/22/08 |
| EK50005 | Coal Handling Construction | 07/24/08 | 09/08/09 |
| EK80010 | Painting | 07/08/09 | 12/11/09 |
| EK90150 | First Fire on Gas | 09/26/09 | 09/28/09 |
| EK90170 | Steam Blow | 10/02/09 | 10/27/09 |
| EK90230 | Turbine Generator Initial Roll | 11/13/09 | 11/14/09 |
| EK90270 | Refire/First Coal Fire | 11/22/09 | 11/23/09 |
| EK90280 | Tuning of Boiler | 11/24/09 | 03/01/10 |
| EK90330 | Plant Commercial Operation | | 03/01/10 |
| EK90340 | Plant Performance Test | 06/07/10 | 06/16/10 |

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|---|---|
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| Finish Date | 06/16/10 |
| Data Date | 04/28/06 |
| Run Date | 04/27/06 10:41 |

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**EAST KENTUCKY POWER COOPERATIVE**

**SMITH STATION UNIT 1**

**PROJECT SCHEDULE**

Early Bar

Progress Bar

**Project Schedule**
**Figure 7-3**

## 7.10 Project Cost

The initial CFB unit at the site would cost approximately $628 million under the present construction schedule. The cost estimates for additional units are not available at this time. Cost comparisons were determined by using the RFP process carried out by an independent contractor on behalf of EKPC. The self-build option was determined to be most cost effective for the customer base of EKPC (see Section 4.7.1) member cooperatives.

## 7.11 Employment

During the construction phase, the J.K. Smith CFB would provide up to 700 construction jobs at an average annual salary of $60,000. The number of employees on-site would fluctuate with the construction schedule (see Figure 7-4). The operating power station would require approximately 60 full-time employees. These jobs would vary from moderately skilled operations staff to highly trained laboratory, electrical, and instrument technician positions. The J.K. Smith site would be manned 24 hours a day, 365 days a year.

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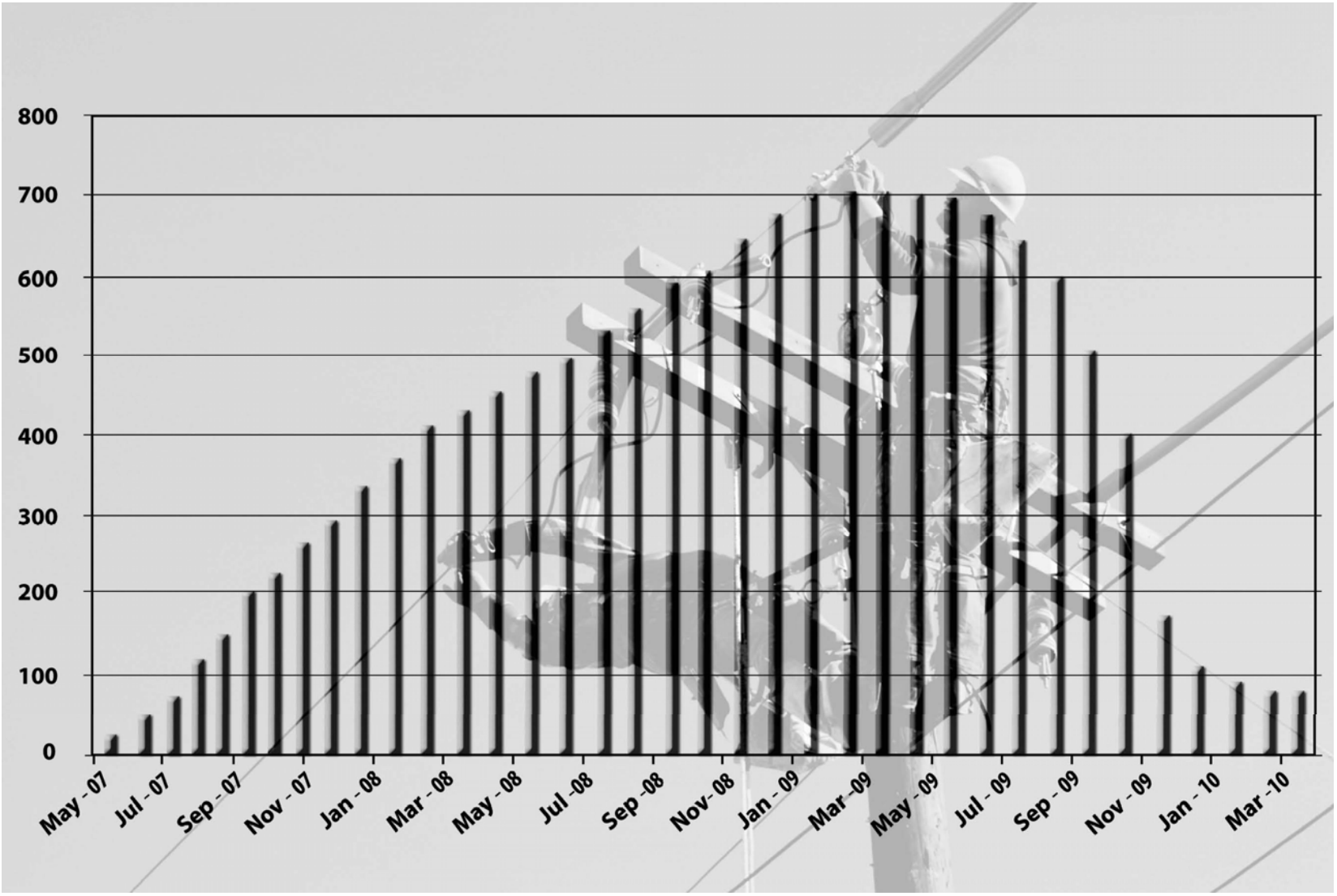


**J.K. Smith Unit #1 Manpower Loading**

**Figure 7-4**

# Appendix A

# 1980 EIS

## General

This appendix contains the 1980 document "Environmental Impact Statement Related to the proposed J. K. Smith Power Plant Station Units 1 and 2 and Associated Transmission Lines." This document is a major resource used in the preparation of the study for the J. K. Smith CFB generating units report. The Appendix material is available on the RUS website, www.USDA.gov/RUS/Electric/Environmental/Environmental/Environmental Impact Statements.

# Appendix B

# 1991 Study

## General

This appendix contains the 1991 report "East Kentucky Power Cooperative, Inc., 400 MW combustion Turbine Project Alternatives Analysis/Siting Study". This report is a major resource document for the J. K. Smith CFB generating units report. The Appendix material is available on the RUS website, www.USDA.gov/RUS/Electric/Environmental/Environmental/Environmental Impact Statements.

# Appendix C

# 2002 EIS

## General

This appendix contains selected pages from the 2002 EIS prepared by the Department of Energy regarding the selection of the J. K. Smith Site as the location for the Kentucky Pioneer Integrated Gasification Combined Cycle Demonstration Project. The Appendix material is available on the RUS website, www.USDA.gov/RUS/Electric/Environmental/Environmental/Environmental Impact Statements.

# Appendix D

# Load Forecast Report

## General

The following is the Executive Summary of the September 2004 EKPC Load Forecast Report. The load forecast projects energy demands through the year 2022. The Appendix material is available on the RUS website, www.USDA.gov/RUS/Electric/Environmental/Environmental/Environmental Impact Statements.

# Appendix E

# List of Preparers and Reviewer

## General

This report was prepared and reviewed by the following individuals:

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# Appendix F

# Integrated Resource Plan

## General

The following pages contain a redacted copy of EKPC's 2003 Integrated Resource Plan. Confidential material has been "blacked out" by cooperative personnel. The Appendix material is available on the RUS website, www.USDA.gov/RUS/Electric/Environmental/Environmental/Environmental Impact Statements.