5.0 ASSESSMENT OF NEW AND SIGNIFICANT INFORMATION

NRC

"…The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware." 10 CFR 51.53(c)(3)(iv)

When applying to the U.S. Nuclear Regulatory Commission (NRC) for license renewal, licensees of domestic nuclear power plants must provide an application that includes an Environmental Report (ER) (10 CFR 54.23). NRC regulations, 10 CFR 51, prescribe the environmental report content and identify the specific analyses the applicant must perform. In an effort to perform the environmental review efficiently and effectively, NRC has resolved most of the environmental issues generically (designated as Category 1 issues), but requires an applicant's analysis of all the remaining applicable issues (designated as Category 2 issues).

While NRC regulations do not require an applicant's ER to contain analyses of the impacts of generically resolved environmental issues [10 CFR 51.53(c)(3)(i)], the regulations do require that an applicant identify any new and significant information of which the applicant is aware [10 CFR 51.53(c)(3)(iv)]. This requirement serves to alert NRC staff to such pertinent information, so the staff can determine whether to seek NRC's approval to waive or suspend application of the rule with respect to the affected generic analysis. NRC has explicitly indicated, however, that an applicant is not required to perform a site-specific validation of its conclusions in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS)* (NRC 1996).

Nuclear Management Company, Inc. (NMC) expects that new and significant information would include:

- Information that identifies a "significant" environmental issue the GEIS does not cover and is not codified in the regulation, or
- Information not covered in the GEIS analyses that leads to an impact finding different from that codified in the regulation.

NRC does not define the term "significant." For the purpose of its review, NMC used guidance available in Council on Environmental Quality (CEQ) regulations. The National Environmental Policy Act (NEPA) authorizes CEQ to establish implementing regulations for federal agency use. NRC requires license renewal applicants to provide NRC with input, in the form of an environmental report, that NRC will use to meet NEPA requirements as they apply to license renewal (10 CFR 51.10). CEQ guidance provides that federal agencies should prepare environmental impact statements for actions that would significantly affect the environment (40 CFR 1502.3), focus on significant environmental issues (40 CFR 1502.1), and eliminate from detailed study issues that are not significant [40 CFR 1501.7(a)(3)]. The CEQ guidance includes a lengthy

definition of "significantly" that requires consideration of the context of the action and the intensity or severity of the impact(s) (40 CFR 1508.27). NMC expects that moderate or large impacts, as defined by NRC, would be "significant." NMC presents NRC definitions of "Moderate" and "Large" impacts in Section 4.1.2 of this environmental report.

NMC prepared this Prairie Island Nuclear Generating Plant (PINGP) ER in accordance with NRC regulations at 10 CFR 51.53(c). In response to 10 CFR 51.53(c)(3)(iv), NMC implemented a process for identifying new and significant information in preparation of this environmental report for PINGP License Renewal application. The process was directed by the License Renewal Environmental Project Manager and included the following actions:

1. Assembly of an investigative team comprised of key representatives of NMC, Xcel Energy, and Tetra Tech NUS, Inc. to support preparation of the environmental report and to conduct the new and significant information review (NMC and Xcel Energy representatives consisted of individuals specifically knowledgeable about plant systems, the site environment, and plant environmental issues);

2. Interviews with subject matter experts from NMC and Xcel Energy related to the conclusions in the GEIS as they relate to PINGP;

3. Review of the environmental management programs, permits, procedures, and practices in place for PINGP to understand their scope and effectiveness for managing potential impacts of PINGP operations and/or as mechanisms for staff to become aware of new and significant information;

4. Review of internal and external documents and records related to environmental aspects of PINGP, its environs, and its associated transmission lines, including but not limited to, environmental assessments and monitoring reports, procedures, and other management controls, compliance history reports, and environmental resource plans and data;

5. Correspondence with state and federal regulatory agencies to determine agency environmental concerns related to PINGP operations;

6. Interface with nuclear power industry representatives to ensure current knowledge of events at other plants with potential to affect environmental issues;

7. Review of other license renewal application submittals for pertinent issues;

8. Crediting the oversight provided by inspections of plant facilities by state and federal regulatory agencies; and

9. Correspondence with tribal governments, including the Prairie Island Indian Community, to determine environmental concerns related to PINGP operations.

Information obtained as a result of these activities, including information from state and local agencies and tribal governments, was evaluated with respect to the criteria described above. As a result of this process, NMC is not aware of any new and significant information regarding the environmental impacts of PINGP license renewal.

In addition to this process, NMC notes that state and federal regulatory agencies routinely inspect PINGP facilities and records as part of their oversight of the plant and its operation and to ensure that permit conditions are met. These inspections (and less frequent permit reviews) have identified no new and significant information.

5.1 REFERENCES

NRC (U.S. Nuclear Regulatory Commission). 1996. *Public Comments on the Proposed 10 CFR 51 Rule for Renewal of Nuclear Power Plant Operating Licenses and Supporting Documents: Review of Concerns and NRC Staff Response.* Volumes 1 and 2. NUREG-1529. Washington, DC. May.

6.0 SUMMARY OF LICENSE RENEWAL IMPACTS AND MITIGATING ACTIONS

6.1 LICENSE RENEWAL IMPACTS

Nuclear Management Company (NMC) has reviewed the environmental impacts of renewing the Prairie Island Nuclear Generating Plant (PINGP) operating licenses and has concluded that impacts would be SMALL and would not require mitigation. This Environmental Report documents the basis for the conclusion. Section 4.1.1 incorporates by reference U.S. Nuclear Regulatory Commission (NRC) findings for the 57 Category 1 issues that apply to PINGP, all of which have impacts that are SMALL (Table A-1, Attachment A). Sections 4.2 through 4.17 analyze Category 2 issues, all of which are either not applicable or have impacts that would be SMALL. Table 6-1 identifies the impacts that PINGP license renewal would have on resources associated with Category 2 issues.

6.2 MITIGATION

NRC

"The report must contain a consideration of alternatives for reducing adverse impacts…for all Category 2 license renewal issues…" 10 CFR 51.53(c)(3)(iii)

"The environmental report shall include an analysis that considers and balances…alternatives available for reducing or avoiding adverse environmental effects…" 10 CFR 51.45(c) as incorporated by 10 CFR 51.53(c)(2) and 10 CFR 51.45(c)

Impacts of license renewal would be SMALL and would not require mitigation. Current operations include monitoring activities that would continue during the license renewal term. NMC performs routine monitoring to ensure the safety of workers, the public, and the environment. These activities include the biological monitoring program, radiological environmental monitoring program, air monitoring, effluent chemistry monitoring, and effluent toxicity testing. In addition, focused surveys for sensitive resources (e.g., threatened or endangered species) are conducted for onsite land-disturbing activities. These monitoring programs ensure that the plant's permitted emissions and discharges are within regulatory limits and any unusual or off-normal emissions/discharges would be quickly detected, mitigating potential impacts.

6.3 UNAVOIDABLE ADVERSE IMPACTS

NRC

The environmental report shall discuss any "...adverse environmental effects which cannot be avoided should the proposal be implemented..." 10 CFR 51.45(b)(2) as adopted by 10 CFR 51.53(c)(2)

This environmental report adopts by reference NRC findings for applicable Category 1 issues, including discussions of any unavoidable adverse impacts (Table A-1, Attachment A). NMC examined 21 Category 2 issues and identified the following unavoidable adverse impacts of license renewal:

- Some larval, juvenile, and adult fish are impinged on the traveling screens at the Intake Screenhouse, but most are returned to the Mississippi River unharmed via the fish return line. Based on studies conducted in the 1980s, gizzard shad, channel catfish, and freshwater drum are the species most often impinged on coarse-mesh intake screens, which are in service from September 1 through March 31. Freshwater drum eggs and larvae, Cyprinid larvae, gizzard shad larvae, and carp larvae (and other early life stages) are most often impinged on fine-mesh intake screens, which are in service from April 1 through August 31.
- Some larval fish are entrained at the Intake Screenhouse, but flow (withdrawal) restrictions and fine mesh screens substantially reduce the total number. Based on a 1975 study, most eggs entrained are those of freshwater drum, while most young fish entrained are shiners, gizzard shad, suckers, white bass, carp, and freshwater drum.
- NMC expects that existing "surge" capabilities would enable PINGP to perform the increased surveillance, monitoring, inspections, testing, trending, and recordkeeping (SMITTR) workload through the addition of no more than two staff members. However, for the purpose of this analysis, NMC has assumed that license renewal could necessitate adding as many as 60 staff. The assumed addition of 60 direct workers to Dakota and Goodhue counties, Minnesota and Pierce County, Wisconsin, where approximately 83 percent of the PINGP workforce resides, could result in small impacts to housing availability, public water supply, offsite land use, and transportation infrastructure (see Sections 4.11, 4.12, 4.14, and 4.15).

6.4 IRREVERSIBLE AND IRRETRIEVABLE RESOURCE COMMITMENTS

NRC

The environmental report shall discuss any "...irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented…" 10 CFR 51.45(b)(5) as adopted by 10 CFR 51.53(c)(2)

Continued operation of PINGP for the license renewal term will result in irreversible and irretrievable resource commitments, including the following:

- Nuclear fuel, which is utilized in the reactor and converted to radioactive waste;
- Land required to dispose of spent nuclear fuel, low-level radioactive wastes generated as a result of plant operations, and sanitary wastes generated from normal industrial operations;
- Elemental materials that will become radioactive; and
- Materials used for the normal industrial operations of the plant that cannot be recovered or recycled or that are consumed or reduced to unrecoverable forms.

These irreversible and irretrievable resource commitments are manageable and low impact.

6.5 SHORT-TERM USE VERSUS LONG-TERM PRODUCTIVITY OF THE ENVIRONMENT

NRC

The environmental report shall discuss the "...relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity..." 10 CFR 51.45(b)(4) as adopted by 10 CFR 51.53(c)(2)

The current balance between short-term use and long-term productivity at the PINGP site was established with the decision to construct the plant. The Final Environmental Statement related to the Prairie Island Nuclear Generating Plant (AEC 1973) evaluated the impacts of constructing and operating PINGP in Goodhue County, Minnesota. Short-term use of natural resources would include land and water. Much of the 560-acre site was under cultivation before its acquisition. Approximately 240 acres were disturbed and modified by plant construction activities, and 60 acres are occupied by plant structures and related facilities. Because Northern States Power (NSP) was able to take advantage of existing transmission corridors, it was only necessary to acquire 33 miles of new right-of-way. Dredging of the cooling water system canals resulted in some disruption of aquatic environments in a limited area of the river. The cooling towers historically produced some localized fogging and icing, particularly during winter months, but are now used primarily in spring and summer (AEC 1973).

After decommissioning, many environmental disturbances would cease and some restoration of the natural habitat would occur. Thus, the "trade-off" between the production of electricity and changes in the local environment is reversible to some extent.

NMC notes that the current balance between short-term use and long-term productivity of the environment at the PINGP site is now well-established and can be expected to remain essentially unchanged by renewal of the operating license and extended operation of PINGP. Extended operation of PINGP would postpone restoration of the site and its potential availability for uses other than electric power generation. It would also result in other short-term impacts on the environment, all of which have been determined to be small on the basis of NRC's evaluation in the Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) and NMC's evaluation in this Environmental Report (ER).

TABLE 6-1
ENVIRONMENTAL IMPACTS RELATED TO LICENSE RENEWAL AT PINGP

No.	Issue	Environmental Impact
	Surface Water Quality, Hydrology, and Use (for all plants)	
13	Water use conflicts (plants with cooling ponds or cooling towers using makeup water from a small river with low flow)	SMALL. Consumptive use represents less than 1 percent of the mean annual flow of the Mississippi River and would have little or no effect on the Mississippi River and its riparian ecological communities.
	Aquatic Ecology (for plants with once-through and cooling pond heat dissipation systems)	
25	Entrainment of fish and shellfish in early life stages	SMALL. PINGP has a current NPDES permit which constitutes compliance with CWA Section 316(b) requirements to provide best technology available to minimize entrainment.
26	Impingement of fish and shellfish	SMALL. PINGP has a current NPDES permit which constitutes compliance with CWA Section 316(b) requirements to provide best technology available to minimize impingement.
27	Heat shock	SMALL. PINGP discharges meet state water quality standards and have very little impact on local aquatic life.
	Groundwater Use and Quality	
33	Groundwater use conflicts (potable and service water, and dewatering; plants that use > 100 gpm)	SMALL. Drawdown through the current license is expected to be 0.4 feet at the nearest offsite well and there would be no additional drawdown during the license renewal period.
34	Groundwater use conflicts (plants using cooling towers or cooling ponds withdrawing makeup water from a small river)	SMALL. PINGP consumptive use has little impact on Mississippi River flow, even during low flow conditions, and therefore have little effect on recharge to the alluvial aquifer.
35	Groundwater use conflicts (Ranney wells)	NONE. This issue does not apply because PINGP does not use Ranney wells.
39	Groundwater quality degradation (cooling ponds at inland sites)	NONE. This issue does not apply because PINGP does not use cooling ponds.
	Terrestrial Resources	
40	Refurbishment impacts	SMALL. Refurbishment activities would occur in an area that is devoid of important plant and animal habitats. Peregrine falcons nest at PINGP and have presumably become habituated to activities at the plant.
	Threatened or Endangered Species	
49	Threatened or endangered species	SMALL. Several federally-listed species are found in the general vicinity of PINGP, but none is believed to be jeopardized by plant operation. NMC has no plans to change plant operations and transmission line maintenance practices.

TABLE 6-1 (CONTINUED)
ENVIRONMENTAL IMPACTS RELATED TO LICENSE RENEWAL AT PINGP

No.	Issue	Environmental Impact
		Air Quality
50	Air quality during refurbishment (non-attainment and maintenance areas)	SMALL. Refurbishment activities would be of short duration. Goodhue County is in attainment for all criteria pollutants. Fugitive dust resulting from construction activities would be minimal. Impacts from exhaust emissions would not impact nearby maintenance areas.
		Human Health
57	Microbiological organisms (public health) (plants using lakes or canals, or cooling towers or cooling ponds that discharge to a small river)	SMALL. PINGP periodically chlorinates the circulating water system to control microbiological organisms in accordance with the NPDES permit, thereby preventing migration of these organisms to the Mississippi River.
59	Electromagnetic fields, acute effects (electric shock)	SMALL. The largest modeled induced current under the PINGP lines is less than the 5 milliampere limit. Therefore, the lines conform to the NESC provisions for preventing electric shock from induced current.
		Socioeconomics
63	Housing impacts	SMALL. NRC concluded that housing impacts would be SMALL in medium and high population areas having no growth control measures. PINGP is located in a high population area with no growth control measures.
65	Public services: public utilities	SMALL. Excess water capacity in the region of influence (ROI) is more than sufficient to handle the temporary refurbishment workforce and the permanent license renewal population growth.
66	Public services: education (refurbishment)	SMALL. Anecdotal evidence from the 2004 steam generator replacement suggests that the majority of the refurbishment workforce would not relocate families to the plant site region for a project of this short duration, having little impact on school enrollment.
68	Offsite land use (refurbishment)	SMALL. A refurbishment workforce of 750 would represent less than a 5 percent increase in the population of Goodhue County and an even smaller percent increase in the populations of the largest cities within the 50-mile region.
69	Offsite land use (license renewal term)	SMALL. No changes in offsite land use are expected to occur as a result of license renewal.
70	Public services: transportation	SMALL. Increased traffic flow during shift changes is expected during refurbishment activities, but the capacities of area roads are more than adequate. The increase in traffic flow as a result of license renewal would most likely be unnoticeable.
71	Historic and archeological resources	SMALL. License renewal would have little or no effect on historic or archeological resources. Refurbishment may require limited ground-disturbing activities, but only in previously-disturbed areas. In addition, PINGP has an excavation procedure in place to protect potential archeological, historical, or cultural resources.

TABLE 6-1 (CONTINUED)
ENVIRONMENTAL IMPACTS RELATED TO LICENSE RENEWAL AT PINGP

No.	Issue	Environmental Impact
		Postulated Accidents
76	Severe accidents	SMALL. NMC identified 2 potentially cost beneficial SAMAs for each unit; however none were related to aging management. NMC will evaluate these enhancements for future implementation.

6.6 REFERENCES

AEC (U.S. Atomic Energy Commission). 1973. *Final Environmental Statement related to Prairie Island Nuclear Generating Plant.* Northern States Power Company. Docket Nos. 50-282 and 50-306. Directorate of Licensing. Washington, DC. May.

7.0 ALTERNATIVES TO THE PROPOSED ACTION

NRC

The environmental report shall discuss "Alternatives to the proposed action…." 10 CFR 51.45(b)(3), as adopted by reference at 10 CFR 51.53(c)(2)

"...The report is not required to include discussion of need for power or economic costs and benefits of ... alternatives to the proposed action except insofar as such costs and benefits are either essential for a determination regarding the inclusion of an alternative in the range of alternatives considered or relevant to mitigation...." 10 CFR 51.53(c)(2)

"While many methods are available for generating electricity, and a huge number of combinations or mixes can be assimilated to meet a defined generating requirement, such expansive consideration would be too unwieldy to perform given the purposes of this analysis. Therefore, NRC has determined that a reasonable set of alternatives should be limited to analysis of single, discrete electric generation sources and only electric generation sources that are technically feasible and commercially viable…" (NRC 1996a)

"…The consideration of alternative energy sources in individual license renewal reviews will consider those alternatives that are reasonable for the region, including power purchases from outside the applicant's service area...." (NRC 1996b)

The U.S. Nuclear Regulatory Commission (NRC) considers the environmental impacts of the proposed action (i.e., license renewal) and alternatives to the proposed action in accordance with its National Environmental Policy Act (NEPA) implementing regulations when deciding whether to approve renewal of an applicant's operating license [10 CFR 51.95(c)]. In this chapter, Nuclear Management Company, LLC (NMC) identifies reasonable alternatives to renewal of the Prairie Island Nuclear Generating Plant (PINGP) operating licenses and presents its evaluation of associated environmental impacts. This chapter also includes descriptions of alternatives NMC considered but determined to be unreasonable to consider in detail, and associated supporting rationale.

NMC divided its alternatives discussion into two categories, "no-action" and "alternatives that meet system generating needs." In Section 7.1, NMC addresses the "no-action alternative" in terms of the potential environmental impacts of not renewing the PINGP operating licenses, independent of any actions taken to replace or compensate for the loss of generating capacity. In Section 7.2, NMC describes feasible alternative actions that could be taken, which NMC also considers to be elements of the no-action alternative, and presents other alternatives that NMC does not consider to be reasonable. Section 7.3 presents environmental impacts for the reasonable alternatives.

The environmental impact evaluations of alternatives presented in this chapter are not intended to be exhaustive. Rather, the level of detail and analysis rely on NRC's decision-making standard for license renewal, as follows:

> "…the NRC staff, adjudicatory officers, and Commission shall determine whether or not the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy planning decision makers would be unreasonable" [10 CFR 51.95(c)(4)].

Therefore, NMC generally structured the analyses to provide enough information to support NRC decision-making by demonstrating whether an alternative would have a smaller, comparable, or greater environmental impact than the proposed action. This approach is consistent with the Council on Environmental Quality regulations, which provide that the consideration of alternatives (including the proposed action) be adequately addressed so reviewers may evaluate their comparative merits [40 CFR 1502.14(b)].

NMC characterizes environmental impacts in this chapter using the same definitions of SMALL, MODERATE, and LARGE used in Chapter 4 of this Environmental Report (ER) and by NRC in its Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) (NRC 1996a). In Chapter 8, NMC presents a summary comparison of environmental impacts of the proposed action and alternatives.

7.1 NO-ACTION ALTERNATIVE

NMC considers the no-action alternative addressed in this ER to be a scenario in which NRC does not renew the current PINGP operating licenses, PINGP ceases operation and is decommissioned, and Xcel Energy or others take appropriate action to replace or compensate for the loss of generating capacity. Section 7.1.1 addresses potential environmental impacts of terminating operations and decommissioning exclusive of actions to replace power from PINGP. NMC discusses alternatives for replacing or compensating for the loss of generating capacity in Section 7.2 of this ER.

7.1.1 TERMINATING OPERATIONS AND DECOMMISSIONING

In the event the NRC does not renew the PINGP operating licenses, NMC assumes the units would be operated until their current licenses expire in 2013 and 2014, then decommissioned in accordance with NRC requirements. Decommissioning denotes the safe removal from service of a nuclear generating facility and the reduction of residual radioactivity to a level that permits release of the property for unrestricted or restricted use, and termination of the license [10 CFR 50.2]. NMC assumes PINGP would be decommissioned for unrestricted use. The two decommissioning options typically selected for U.S. reactors are (NRC 2002a):

- immediate decontamination and dismantlement (DECON), and
- safe storage of the stabilized and defueled facility for a period of time followed by decontamination and dismantlement (SAFSTOR).

Regardless of the option chosen, decommissioning methods would be described in the post-shutdown decommissioning activities report, which must be submitted to NRC within two years following cessation of operations [10 CFR 50.82(a)(4)]. Decommissioning activities, in accordance with 10 CFR 50.82(a)(3), must be completed within 60 years after operations cease (NRC 1996a). Related NRC requirements ensure that the decommissioning activities, when defined, would be subject to required environmental reviews in accordance with NEPA [10 CFR 50.82, 10 CFR 51.53(d)].

In the GEIS, the NRC provides a summary of decommissioning activities, generic environmental impacts of the decommissioning process, and an evaluation of potential changes in impact that could result from deferring decommissioning for up to 20 years (NRC 1996a). This GEIS analysis is based on a 1988 generic environmental impact evaluation of decommissioning, NUREG-0586 (NRC 1988), which uses the 1,175-megawatt electric (MWe) Trojan Nuclear Plant, as representative of decommissioning activities for pressurized water reactor, the reactor type used at PINGP (Section 3.1.1 of this ER).

The NRC concluded from the GEIS generic evaluation that decommissioning would have SMALL impacts with respect to radiation dose, waste management, air quality, water quality, socioeconomic impacts and ecological resources, and that impacts would not be significantly greater as a result of the proposed action (NRC 1996a, 10 CFR 51).

Considering the information presented in the GEIS and the fact that the PINGP has smaller reactors than the GEIS reference plant, NMC considers the NRC's generic evaluation and associated conclusions in the GEIS bound PINGP for purposes of this ER. The NRC has updated the 1988 generic environmental impact evaluation of decommissioning on which the GEIS is based. This update, Supplement 1 to NUREG-0586, expanded the original analysis by addressing impacts of dismantling structures, systems, and components required to operate the reactor and also considered characteristics of plants currently operating in the U.S. (NRC 2002a). Of the 23 environmental issues evaluated in this updated analysis, the NRC concluded that the following were site-specific: impacts on land use from offsite activities; impacts on aquatic and terrestrial ecology and cultural and historic resources from activities beyond operational areas; impacts on threatened and endangered species; and environmental justice impacts. The NRC concluded that all of the remaining issues were generic with SMALL impacts (NRC 2002a).

Based on its review of Supplement 1 to NUREG-0586, NMC considers these generic conclusions to be appropriate for PINGP for purposes of this ER. With respect to those environmental issues identified as site-specific:

- NMC has no reason at this time to believe that PINGP decommissioning would involve land use disturbance off-site or beyond current operational areas.
- Decommissioning activities would be subject to substantial environmental reviews as noted above.
- No significant historic or archeological resources that exist on the site would be disturbed during decommissioning (Section 2.10 of this ER).
- The closest minority or low-income population to PINGP is located adjacent to PINGP, the Prairie Island Indian Community (PIIC), and is the only minority or low-income population (as defined by NRC) in the Dakota, Goodhue, and Pierce County area (Table 2.5-2 and Figure 2.5-2 of this ER).
- Only three threatened, endangered, or candidate species are known to occur at the PINGP site (Section 2.3.3 of this ER), for which the following are decommissioning impact considerations:
    - Peregrine falcons (state-threatened) successfully nest on the PINGP Unit 1 Containment Building. Removal of the containment building would eliminate one of only 25 successful nesting sites that currently exist in the State. Adverse impacts could be noticeable, but not destabilizing (i.e., MODERATE) in the absence of mitigation. However, NMC would work with the Minnesota Department of Natural Resources (MN DNR) to provide alternative nesting habitat and ensure that adverse impacts would be SMALL.

- The paddlefish (state-threatened) was once common in the Mississippi River from Lake Pepin downstream. Paddlefish are still found in these areas and are occasionally collected during fish population studies. NMC expects that termination of PINGP operations and decommissioning would not involve activities beyond current operational areas. NMC assumes there would be little or no opportunity for significant adverse impacts on this species from decommissioning.

- The Higgins eye pearlymussel (Federal and state-endangered) is a small to medium-sized freshwater mussel. It is found in rivers in areas of deep water and moderate currents. Because termination of PINGP operations and decommissioning would not involve activities beyond current operational areas, NMC assumes there would be little or no opportunity for significant adverse impacts on this species from decommissioning.

NMC notes that decommissioning activities and their impacts are not discriminators between the proposed action and the no-action alternative. License renewal would only postpone decommissioning for 20 years, and NRC has established in the GEIS that the timing of permanent cessation of plant operations does not substantially influence the environmental impact of decommissioning. NMC adopts by reference the NRC findings that the impacts of delaying decommissioning until after the license renewal terms would be SMALL (10 CFR 51).

Environmental impacts that could result more directly from terminating plant operations (e.g., from cessation of thermal effluents, reduced property tax payments, workforce reductions) are not in the scope of the analyses presented in Chapter 7 of the GEIS or in Supplement 1 to NUREG-0586, but are discussed in Section 8.4 of the GEIS and in the latter document (NRC 2002a). With the potential exception of ecological resources and socioeconomics, the NRC's generic evaluation of these issues indicates that environmental impacts of terminating operations would be SMALL (NRC 1996a). Based on its review of the discussion in these documents and information presented in this ER, NMC considers NRC's generic evaluation and conclusions in Section 8.4 of the GEIS to be appropriate for PINGP. With particular respect to ecological resources and socioeconomics impacts:

- NMC expects that termination of PINGP operations would have little, if any, adverse effect on ecological resources, considering occurrence and habitat affinities of threatened or endangered species (Section 2.3 of this ER), the small significance of current operational impacts (Chapter 4 of this ER), and the expectation that transmission lines from PINGP addressed in this ER would continue to be used (Section 3.1.4 of this ER).

- NMC notes that terminating PINGP operations would result in a decrease in tax revenues to local jurisdictions 20 years sooner than if the PINGP operating licenses are renewed. Property tax payments attributable to PINGP represent more than 30 percent of the operating budget for the City of Red Wing (Section 2.7 and

Table 2.7-1 of this ER) and, by NRC criteria, losses greater than 20 percent have destabilizing impacts on the governments involved (NRC 2002a).

In consideration of the above, NMC concludes that terminating operations and decommissioning PINGP could result in SMALL impacts on ecological resources and LARGE socioeconomic impacts from loss of tax revenues by the City of Red Wing 20 years earlier than would occur if the PINGP operating licenses were renewed. NMC further concludes that terminating operations and decommissioning PINGP would result in SMALL impacts with respect to the remaining resource areas evaluated, providing little or no basis for discriminating between the proposed action and the no-action alternative. The environmental impacts of replacement options considered in Section 7.3 of this ER provide additional information useful for evaluating the relative environmental merits of the proposed action versus the no-action alternative.

7.1.2 REPLACEMENT CAPACITY

PINGP is a baseload facility, providing a net baseload capacity of 1,044 MWe (NMC 2005) and in 2006 generated approximately 8.1 terawatt-hours of electricity (EIA 2006). This power, equivalent to the energy used by approximately 800,000 residential customers, would be unavailable to Xcel Energy's customers if the PINGP operating licenses were not renewed. If the PINGP operating licenses were not renewed, Xcel Energy would need to build new baseload generating capacity, purchase power, or reduce baseload power requirements through demand reduction to ensure they meet the electric power requirements of their customers. Replacement options discussed in Section 7.2 include purchasing power, building new generating facilities, delaying retirement of non-nuclear assets, and reducing power requirements through demand reduction.

7.2 ALTERNATIVES THAT MEET SYSTEM GENERATING NEEDS

In Section 7.2.1, NMC provides background information pertinent to the identification and selection of alternatives available to replace PINGP baseload generation. Alternatives NMC considers to be reasonable are described in Section 7.2.2. Section 7.2.3 describes other alternatives NMC evaluated and rationale for not considering them further in this ER.

7.2.1 GENERAL CONSIDERATIONS

7.2.1.1 Current and Projected Generating Capability and Utilization

Current and anticipated future electric power generating capability and utilization are indicative of the technical and economic viability of technologies for generating electricity, and therefore of potential alternatives to replace baseload power produced by PINGP. In 2005, electric generators in Minnesota had a total generating capacity of 12,105 MWe. This capacity includes units fueled by coal (45.0 percent), natural gas (26.1 percent), nuclear (13.4 percent), other renewables (7.9 percent), petroleum (6.1 percent), hydroelectric (1.5 percent), and other (0.1 percent). In 2005, the electric industry in Minnesota provided approximately 53.0 terawatt-hours of electricity. Actual utilization of generating capacity in Minnesota was dominated by coal (62.1 percent), followed by nuclear (24.2 percent), natural gas (5.2 percent), other renewables (5.0 percent), petroleum (1.5 percent), hydroelectric (1.5 percent), and other (0.6 percent) (EIA 2007). Figures 7.2-1 and 7.2-2 illustrate Minnesota's electric industry generating capacity and utilization, respectively.

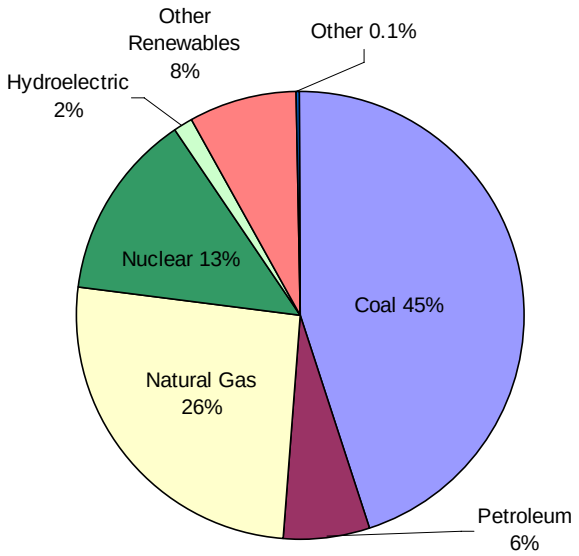

FIGURE 7.2-1. 2005 MINNESOTA GENERATING CAPACITY BY FUEL TYPE (EIA 2007)

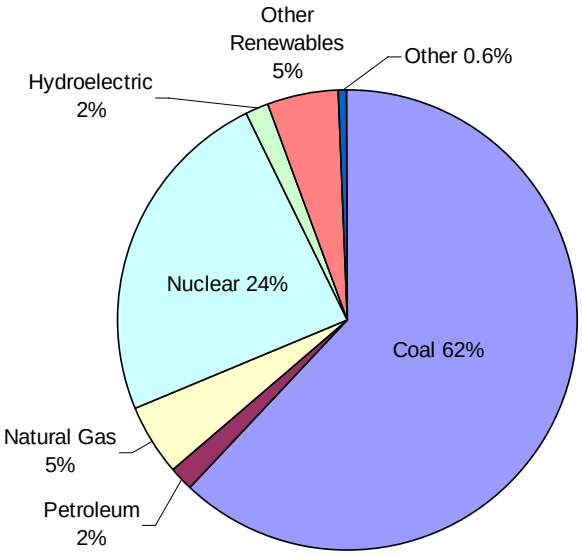

FIGURE 7.2-2. 2005 MINNESOTA GENERATION BY FUEL TYPE (EIA 2007)

Comparison of generating capacity with actual utilization of this capacity indicates that coal and nuclear are used by electric generators in Minnesota substantially more relative to their capacity than either petroleum-fired or gas-fired generation. This condition reflects the relatively low fuel cost and baseload suitability for nuclear power and coal-fired plants, and relatively higher use of petroleum and gas-fired units to meet peak loads. The use of petroleum and gas-fired units to meet peak loads is indicative of higher cost and greater air emissions associated with gas and petroleum firing. Capacity from renewable resources is limited and utilization can vary substantially depending on resource availability.

Insight regarding Minnesota's future generation portfolio can be gained from U.S. Department of Energy (DOE) Energy Information Agency (EIA) projections for the nation and the Mid-Continent Area Power Pool (MAPP) region, which includes Minnesota and all or part of surrounding states and two Canadian provinces (Manitoba and Saskatchewan) (MAPP 2007). Nationally, coal-fired generation is expected to remain the predominant source of electricity through 2025 and the relative amount of generation from natural gas and coal is expected to increase. Aggregate generation from nuclear plants is expected to remain near present levels with no new facilities expected in the MAPP region. Generation from renewable sources is expected to exhibit relatively slow growth because of the relatively low costs of fossil-fired generation and because competitive electricity markets favor less capital-intensive technologies (EIA 2004a, EIA 2004b).

Projected increases in capacity and generation in the MAPP region for the 2004-2010 and 2004-2025 periods (EIA 2004b) are illustrated by the following selective summary tabulation:

MAPP Projected Capacity Increase					**MAPP Projected Generation Increase**				
	2004-2010		**2004-2025**			**2004-2010**		**2004-2025**	
Source	**MW**	**%**	**MW**	**%**	**Source**	**GWh**	**%**	**GWh**	**%**
Coal Steam	- 40	- 1	5,240	45	Coal	14,380	78	53,300	85
Nuclear	0	0	0	0	Nuclear	110	1	110	< 1
Combined Cycle	210	7	620	5	Natural Gas	890	5	5,140	8
Combustion Turbine/Diesel	1,750	62	4,730	41	Petroleum	- 30	< 1	860	1
Renewables	810	29	950	8	Renewables	2,970	16	3,530	5
All Sources	2,810		11,610		All Sources	18.320		62,940	

As indicated by this data summary, EIA projects there will be no appreciable change in nuclear capacity or generation the MAPP region. No coal-fired capacity additions are projected in the MAPP region in the 2004-2010 period, but in 2004-2025 most capacity addition is from coal-fired units; by far the greatest increase in generation during both periods is expected to be from coal. Combustion turbine/diesel and combined cycle together represent significant projected capacity additions in both periods, but the increase is predominantly peaking capacity because most is from combustion

turbine/diesel units (likely to be nearly all combustion turbines), and the contribution to projected generation from natural gas and petroleum, typical combustion turbine fuels, is low.

EIA projects a greater relative increase in capacity and generation from renewables in MAPP than is projected nationally through 2025. This is particularly true in the 2004-2010 period, when its contribution to generation increases is expected to exceed that of natural gas. This phenomenon is mostly the result of ongoing and projected development of regional wind-conversion facilities, which are projected to account for approximately 90 percent or more of renewable capacity and generation in the 2004-2010 and 2004-2025 periods (EIA 2004b). Minnesota has the potential to develop wind energy resources, particularly in the Buffalo Ridge area in the southwestern part of the state (MDC 2006).

The MAPP regional information above does not include predictions based on legislation recently signed by the Governor of Minnesota. The Next Generation Energy Act of 2007 establishes statewide greenhouse gas emissions reduction goals of 15 percent by 2015, 30 percent by 2025, and 80 percent by 2050. Additional legislation signed earlier in the year also requires Minnesota's electric utilities to provide 25 percent of the electricity generated to be from renewable sources by 2025 (Office of the Governor 2007). This required reduction in greenhouse gas emissions and increased generation requirements from renewable sources may preclude the development of additional coal-fired capacity as described above and replace that generating capacity with renewable sources.

7.2.1.2 Effects of Electric Power Industry Restructuring

The U.S. electric power industry began its transition from a regulated monopoly structure to a competitive retail market with the passage of the Federal Energy Policy Act of 1992 and associated state initiatives. As summarized by the EIA, the Federal Energy Regulatory Commission (FERC) Order 888 requires that all public utilities provide open access to their transmission lines, and functionally separate their wholesale power services and transmission services, and encourage the creation of independent system operators to ensure independence in transmission operations (EIA 2005). Order 889 prevents public utility power marketing organizations from having preferential access to transmission information, and requires that such information be equally shared with transmission customers. FERC Order 2000 encouraged all transmission owners to voluntarily allow operation of their transmission assets by independent Regional Transmission Operators to improve market performance and equal access (FERC 2002).

In the wake of these federal initiatives and upon approval of the Minnesota Public Utilities Commission (MPUC), Minnesota's investor-owned utilities, including Xcel Energy, have joined the Midwest Independent System Operators (MISO), and have transferred functional control (but not ownership) of their transmission facilities to MISO, the operations of which are subject to FERC approval (MDC 2004).

Sixteen states and the District of Columbia have fully implemented their legislation and commission orders and currently allow full retail access for all customers. However, no state has passed restructuring legislation since June of 2000, when the California and western power crisis was just beginning. Six states that passed restructuring legislation later delayed, repealed, or indefinitely postponed implementation. A total of 34 states have repealed, delayed, suspended, or limited retail access or are no longer considering retail access (VSCC 2006).

Minnesota has not enacted major restructuring initiatives. Rather, Minnesota and most states in MAPP region have retained the traditional regulatory model in which electric utilities are comprehensively regulated to ensure reliable electric service within pre-determined utility service territories (MDC 2004). In this context, Xcel Energy, through a regulated operating subsidiary (NSP), provides a comprehensive portfolio of energy related products and services in Minnesota, including generation, purchase, transmission, distribution, and sale of electricity; purchase, distribution and sale of natural gas to retail customers; and transport of customer-owned natural gas (Xcel Energy 2006a). Xcel Energy's service area in Minnesota is located predominantly in the southern part of the state from St. Cloud southward, including the Minneapolis-St. Paul Metropolitan area (Xcel Energy 2006b). Its Minnesota power generating facilities are also located in the southern part of the state (Xcel Energy 2006c).

Results of the utility restructuring initiatives discussed above are reflected in increases in the non-utility share of new electric generating capacity and generation. These increases are lower than national averages in Minnesota, which retains a traditional regulatory structure. Nonetheless, non-utility share of capacity in the state increased from 6.2 percent during 1990 to 12.9 percent in 2005. The non-utility share of generation increased from 3.5 percent to 11.7 percent in this same period (EIA 2007).

In the regulatory environment described above, and as specifically provided by Minnesota statute (Minnesota Statute 216B.37, 216B.04), Xcel is obligated to ensure the electric power needs of customers in its service area are met and to take appropriate action (e.g., power purchase, development of new generation capacity) to accommodate any shortfall in available power resulting from a decision by NRC to not renew the PINGP operating license. These actions would be undertaken in the context of planning and permitting requirements and activities of the MPUC, Minnesota Environmental Quality Board (MEQB), and various other state agencies, including the following:

- Integrated Resource Plan - Regulated utilities submit to the MPUC for approval biennial integrated resource plans projecting future resource needs and providing analysis and proposals to reduce and manage energy demand and develop new generating facilities (MDC 2006).

- Transmission Plan - Transmission-owning utilities in the state collaboratively identify inadequacies in the state's transmission system and propose solutions biennially (MDC 2006).

- Certificate of Need (CON) - Development in Minnesota of electric power generating plants having a capacity of 50 MW or more, high voltage transmission lines with a capacity of 200 kilovolts (kV) or more, and major natural gas pipelines (i.e., those having an operating pressure over 200 pounds per square inch (psi) and instate length of more than 50 miles) requires MPUC approval either by issuance of a CON or other means (e.g., integrated resource plan approval). The CON process includes an initial review of the project with respect to environmental impacts and alternatives, including conservation and renewable alternatives (MDC 2006).

- Site/Route Permit - Development in Minnesota of electric power generating equipment with a capacity of 50 MW or more, large wind energy conversion systems (combination of wind turbines with a capacity of 5 MW or more) and, regardless of length, transmission lines operating at 100 kV or more and natural gas pipelines more than 6 inches in diameter operating at pressures more than 275 psi are required to obtain a site or route permit from MEQB. This process entails detailed environmental review, analysis of alternatives, and opportunity for public input (MDC 2006).

- Other Environmental Approvals - A variety of additional permits and approvals from other federal, state, and local entities also may be required to develop electrical energy facilities in Minnesota.

7.2.1.3 Mixture of Generating Sources

NRC indicated in the GEIS that, while many methods are available for generating electricity and a huge number of combinations or mixes can be assimilated to meet system needs, such expansive consideration would be too unwieldy given the purposes on the alternative analysis. Therefore, NRC determined that a reasonable set of alternatives should be limited to analysis of single discrete electrical generation sources and only those electric generation technologies that are technically reasonable and commercially viable (NRC 1996a). Consistent with the NRC determination, NMC has not evaluated mixes of generating sources. However, the impacts from coal- and gas-fired generation presented in this chapter would bound the impacts from any combination of the two technologies.

7.2.2 REASONABLE ALTERNATIVES

In view of the background information presented in Section 7.2.1 and additional information presented in this section, NMC considers that purchased power and development of new generating capacity represented by modern natural gas combined-cycle and pulverized coal-fired steam power generation technologies are reasonable alternatives to replace PINGP baseload generating capacity in the event its operating licenses are not renewed. NMC describes these alternatives in the following subsections as reasonable hypothetical scenarios for analysis without regard to whether they would be developed by Xcel Energy or others.

The following sections present purchased power (Section 7.2.2.1), gas-fired generation (Section 7.2.2.2) and coal-fired generation (Section 7.2.2.3) as reasonable alternatives to license renewal. Section 7.2.3 discusses reduced demand and presents the basis for concluding that it is not a reasonable alternative to license renewal. Section 7.2.3 also discusses other alternatives that NMC has determined are not reasonable and the bases for these determinations.

NMC analyzed locating hypothetical new coal- and gas-fired units at the existing PINGP site and at an undetermined green field site. NMC concluded that sufficient room would not be available at the PINGP site for new construction. Locating hypothetical units at a greenfield site has, therefore, been applied to the representative coal- and gas-fired units.

For comparability, NMC selected gas- and coal-fired units of equal electric power capacity. One unit with a net capacity of 1,044 MWe could be assumed to replace the 1,044-MWe PINGP net capacity. However, industry experience indicates that, although custom size units can be built, using standardized sizes is more economical. For example, standard-sized units include a gas-fired combined-cycle plant of 520 MWe net capacity (Chase and Kehoe 2000). Two of these standard-sized units would have 1,040 MWe net capacity. For comparability, NMC set the net power of the coal-fired unit equal to the gas-fired plant (1,040 MWe). Although this provides slightly less capacity than the existing units, it ensures against overestimating environmental impacts from the alternatives.

It must be emphasized, however, that these are hypothetical scenarios. Xcel Energy does not have plans for such construction.

7.2.2.1 Purchased Power

Most Minnesota utilities rely on electricity generated outside of Minnesota to meet their customer's needs, and in some manner all of them, including Xcel Energy, use the regional grid to import power at various times. However, many major transmission lines into and out of Minnesota are nearing operational limits, which could affect reliability in the future and impede the ability to import power if additional transmission infrastructure is not developed. These problems are recognized by state and regional transmission planning organizations and mechanisms are in place to identify and address transmission constraints affecting system reliability (MDC 2004). Therefore, NMC assumes purchased power would be a reasonable alternative to replace power lost in the event the PINGP operating licenses are not renewed, but could involve additional environmental impacts resulting from the need to increase transmission capability into the state.

Technologies that would be used to generate the purchased power are a matter of conjecture but, based on the discussion of Minnesota capacity and utilization data and national and region projections, NMC considers that the most likely candidates would be coal-fired and nuclear sources during off-peak periods and gas-fired sources during on-peak periods, probably supplemented by power from renewable sources, particularly

wind-conversion facilities. Because of the size of the block of baseload capacity supplied by PINGP, construction of additional baseload generating capacity using one or more of these technologies would likely be required even under the power purchase scenario. Such construction could occur within or outside of Minnesota. Therefore, a power purchase alternative would likely not eliminate the need to construct replacement baseload capacity, but rather shift it to another region. Accordingly, the impacts of power purchase alternative would be expected to be similar to the impacts of baseload alternatives analyzed in Section 7.3.2 and 7.3.3 of this ER.

In view of constraints in the existing transmission infrastructure, Xcel Energy expects that substantial additions to either the 500-kV or 345-kV transmission systems in the Upper Midwest would be required to import power into Minnesota in amounts that would replace generation from PINGP. Specific plans for such additional transmission would entail detailed studies beyond the scope or purpose of this ER. However, for purposes of analysis, NMC assumes that 100 miles of new 345-kV transmission line(s) using a 150-foot wide right-of-way (ROW) would be needed in the Upper Midwest, assumed for analysis to be located in southern Minnesota south of the Twin Cities metropolitan area, the state's main load center, in an area roughly bounded by existing 345-kV lines entering the state from the south.

The location and design of the transmission line would be subject to substantial environmental restrictions and review, including site permit review and opportunity for public participation. Therefore, NMC assumes it would be sited, developed, and operated in accordance with all applicable environmental requirements and in a manner that ensures adverse environmental impacts would not be destabilizing with respect to resources of concern.

7.2.2.2 Gas-Fired Generation

For purposes of this analysis, NMC assumed development of a modern natural gas-fired combined-cycle plant with design characteristics similar to those being planned or developed elsewhere in Minnesota could be configured to replace power currently generated by PINGP. The Mankato Power Plant, developed by Calpine Corporation to generate baseload power for Xcel Energy near the city of Mankato, approximately 50 miles southwest of the Twin Cities, Minnesota, meets these general criteria. NMC used selected plant characteristics as described in the environmental assessment for that facility (MEQB 2004) as a main source of information for the representative plant characteristics. NMC assumes that the representative plant would be located at a greenfield site. Table 7.2-1 presents the basic gas-fired alternative characteristics.

The assumed representative plant consists of two combined cycle units each consisting of steam combustion turbines (CTs) with an associated heat recovery steam generator (HRSG) that supply steam to a steam turbine generator. Net generating capacity of each combined cycle unit is approximately 520 MW, for a total of 1,040 MW for the representative plant. Although capacity of the representative plant is slightly less than that of PINGP (1,044 MW), it is nonetheless reasonably comparable for purposes of this ER.

NMC assumes for conservatism that the representative plant would use natural gas as its only fuel. However, the facility could reasonably be constructed with the capability to fire oil as backup fuel for use during high demand or higher cost periods for natural gas, thus improving fuel supply capabilities and operating cost. Based on the information presented in Table 7.2-1, total annual heat input from natural gas would be approximately 48,700,000 million British thermal units, corresponding to an annual natural gas consumption of approximately 48.3 billion cubic feet.[1]

Availability of sufficient capacity from existing natural gas transmission infrastructure in Minnesota to supply the plant in 2013 is conjectural. NMC notes that only a limited number of natural gas generation facilities can be added to the existing system without significant upgrades (MDC 2006). However, the Minnesota Department of Commerce (MDC) indicates that, while existing infrastructure is near capacity, there is a potential for more natural gas supplies becoming available within the state as long as liquefied natural gas displaces natural gas supplies consumed in other parts of the country, and there appears to be adequate supplies available to meet projected demand for some time beyond 2025 (MDC 2006). In view of these considerations, NMC expects that the representative plant would likely contribute to the need for major gas supply infrastructure in the state, but assumes that no such major improvements would be needed.

NMC estimates that the representative plant with associated support facilities would occupy approximately 41 acres (TtNUS 2007a). Additional land could be needed as buffer from adjacent land uses. For example, the NRC estimates that 110 acres would be required for a 1,000 MW plant (NRC 1996a). NMC assumes that the representative plant would be located at a greenfield site. Offsite infrastructure needed for the representative plant could reasonably include a natural gas supply pipeline, transmission line, and a rail spur.

NMC assumes for this assessment that construction of the gas-fired plant would be timed to enable its operation in 2013 when the first PINGP operating license expires. NMC estimates that the plant would be constructed in approximately 3 years with a peak onsite workforce of approximately 629 workers, and that a permanent full-time workforce of approximately 35 persons would operate the plant (TtNUS 2007a).

7.2.2.3 Coal-Fired Generation

NRC has routinely evaluated coal-fired generation alternatives for nuclear plant license renewal. In the GEIS Supplement for McGuire Nuclear Station (NRC 2002b), NRC analyzed 2,400 MWe of coal-fired generation capacity. NMC has reviewed the NRC analysis, considers it to be sound, and notes that it analyzed more generating capacity than the 1,040 MWe discussed in this analysis. In defining the PINGP coal-fired

1 Annual Natural Gas Requirement (Btu) = [Natural Gas Heat Input] x [Heating Value of Fuel] = [Total Gross Capability (542 MW) x Number of Units (2) x Heat Rate (6,040 Btu/kW-hour) x 1,000 kW/MW x Capacity Factor (0.85) x 8,760 hr/yr]. Therefore: Natural Gas Heat Input = 4.872×10^{13} Btu/yr, or 4.872×10^{7} MMBtu/yr. Volume of gas required per year = Annual Natural Gas Requirement (Btu/yr) x [Heating Value of Fuel (1 scf/1,008 Btu)] = 4.833×10^{10} scf/yr, or 48.3 billion scf/yr. Table 7.2-1 lists all necessary parameters and values.

alternative, NMC has used site- and Minnesota-specific input and has applied the NRC analysis, where appropriate.

Specific coal generating technologies that would represent viable alternatives in 2013 and 2014 when the PINGP operating licenses expire are less certain than for a natural gas-fired plant, particularly in view of potentially higher air emissions compared to natural gas firing. NMC notes that integrated gasification combined-cycle (IGCC) technology could be viable based on potential development of the Mesaba Energy Project. The Mesaba Energy Project is an IGCC facility with a capacity of approximately 600 MW proposed for development in northern Minnesota (MDC 2004). However, the Mesaba facility would be the largest capacity IGCC facility constructed to date in the U.S and represents technology that is not yet fully demonstrated commercially at the size proposed. IGCC demonstration plants to date have been much smaller (MDC 2004). Given these circumstances, the long-term reliability of IGCC may not be known at the point a decision needs to be made regarding replacement of PINGP capacity. Xcel Energy recognizes modern pulverized coal-fired steam units with advanced, clean-coal technology air emission controls as currently proven technology that is economically competitive and commercially available in large-capacity unit sizes that could effectively replace PINGP. In the future, an IGCC with carbon sequestration technology might achieve lower emissions, but effective carbon sequestration technology currently does not exist. Therefore, NMC uses a representative plant of this type for purposes of impact evaluation, noting that air emissions impacts of IGCC may be lower than modern pulverized coal, but likely would be comparable to or higher than the gas-fired combined-cycle alternative (DOE 1999).

The representative plant consists of two commercially available standard-sized units having a nominal net output of approximately 520 MW each, for a total of 1,040 MW, comparable to PINGP's net capacity of 1,044 MW. Table 7.2-2 presents the basic coal-fired alternative emission control characteristics. NMC based its emission control technology and percent control assumptions on alternatives that the U.S. Environmental Protection Agency (EPA) has identified as being available for minimizing emissions (EPA 1998a). NMC assumes that the representative plant would be located at a greenfield site.

Table 7.2-2 lists basic specifications for the plant. Based on this information, annual coal consumption for the facility would be approximately 4.7 million tons[2]. The representative plant would be designed to meet applicable standards with respect to control of air and wastewater emissions. NMC estimates that approximately 64,700 tons of limestone could be needed annually to operate the scrubber assumed for control of sulfur oxides (SO_x) emissions.

NMC estimates that approximately 170 acres would be required to accommodate the generating plant and related onsite ancillary and support facilities and infrastructure

2 Coal Combusted (tons/year) = Gross Capability (553 MW) x Number of Units (2) x Heat Rate (10,200 Btu/kilowatt-hour) x 1,000 kilowatt/MW x 1/Fuel Heat Value (8,914 Btu/lb) x 0.0005 (ton/lb) x Capacity Factor (0.85) x 8,760 hr/year = 4.7 million tons/yr. All necessary parameters and values are provided in Table 7.2-1.

(e.g., coal and limestone transport, storage, and handling facilities; switchyard and onsite transmission lines; storage tanks; cooling towers; technical and administration buildings; access roads; parking) (TtNUS 2007a). The extent to which these solid wastes could be used beneficially is dependent on such factors as air emission control design specifics and future demand. However, approximately 30 percent of the ash from Xcel Energy coal-fired generating plants goes to such beneficial uses as concrete products and roadbed material (Xcel Energy 2004a). Therefore, NMC assumes for purposes of this ER that 30 percent of the ash from the representative coal-fired plant would be beneficially used, and that the remainder of this air emission control waste would be landfilled onsite. Assuming an average fill depth of 30 feet, approximately 180 acres would be required over an assumed 40-year plant life (TtNUS 2007b). Therefore, the minimum total land requirement for the plant is assumed to be approximately 350 acres. Additional land likely would be necessary to allow for a peripheral buffer. For example, the NRC estimates that a total of 1,700 acres could be required for a larger (1,000 MW) plant (NRC 1996a).

NMC assumes that construction of the coal-fired unit would be timed to enable its operation when the first PINGP operating license expires in 2013, and estimates that the plant could be constructed in approximately 5 years with peak onsite workforce of approximately 1,700 workers. Depending on the level of automation, a permanent work force of 120 full-time employees would likely be required to operate the plant (TtNUS 2007a).

7.2.2.4 Siting Considerations

Xcel Energy considers it unlikely that either of the representative plants would be developed at the PINGP site because sufficient room would not be available to site the new construction. Therefore, NMC assumes for purposes of this ER that the hypothetical alternative would be located at a greenfield site in southern Minnesota generally south of the Twin Cities. The choice of a specific location for the plant would require detailed studies and analysis beyond the scope or necessity for this ER. However, NMC notes that Northern States Power (NSP) has recently considered areas generally south of the Twin Cities (e.g., at Mankato and in the Rosemount area, near the Mississippi River immediately southeast of the Twin Cities metropolitan area), as potentially favorable for siting natural gas-fired or coal-fired power plants for new generation.

NMC has made the following assumptions to reasonably define offsite infrastructure that would be needed to locate either plant at a greenfield site. NMC assumes that 5 miles of new natural gas supply pipeline would be needed to supply the gas-fired plant and 10 miles of new rail would be required for delivery of coal and limestone to the coal-fired plant. In addition, NMC assumes 5 miles of new 345-kV transmission line would be needed to connect to the grid. NMC assumes that the supply pipeline would require a 30-foot wide ROW, a rail spur would require a 50-foot wide ROW, and the transmission line would occupy a 150-foot wide ROW.

As indicated by discussion elsewhere in this ER, the location and design of either alternative plant and associated offsite infrastructure would be subject to substantial environmental restrictions and review, including MEQB site permit review and opportunity for public participation. Therefore, NMC assumes the representative plant and associated offsite infrastructure would be sited, developed, and operated in accordance with all applicable environmental requirements and in a manner that ensures adverse environmental impacts would not be destabilizing with respect to resources of concern.

7.2.3 OTHER ALTERNATIVES

This section identifies alternatives that NMC has determined are not reasonable and the NMC bases for these determinations. NMC accounted for the fact that PINGP is a base-load generator and that any feasible alternative to PINGP would also need to be able to generate base-load power. In addition to coal-fired and natural gas-fired generation, the NRC evaluated several other generation technologies in the GEIS (NRC 1996a). NMC has considered these options as potential alternatives to continued operation of PINGP and determined them to be unreasonable on the basis of economics, high land-use impacts, low capacity factors, geographic limitations, insufficiently developed technology, or other significant reasons.

7.2.3.1 Demand Side Management

Under provisions of Minnesota Statute 216B.241, Minnesota public utilities, rural electric cooperatives, and municipal utilities are required to invest 1.5 percent of in-state revenues in projects designed to reduce their customers' consumption of electricity and improve efficient use of energy resources. Utilities that operate nuclear generating facilities like PINGP are required to invest 2.0 percent of revenues in this manner. Cost of this program, which is administered by the MDC, is recovered from utility customers (MDC 2006). Each utility is required to submit to the MDC for approval an annual conservation improvement plan (CIP) which details its energy-saving programs (MDC 2006). Within certain limits as specified under Minnesota Statute 216B.241, the MDC may specifically direct utilities like Xcel Energy in regards to investments and expenditures to be made for energy conservation.

In this context, Xcel Energy has in place a wide variety of electrical energy conservation (i.e., demand-side management, or DSM) programs and activities, including:

- Conservation Programs – programs like Xcel Energy's Energy Solutions newsletter and internet-based information resources designed to educate and inform customers about energy efficiency and Xcel Energy offerings.

- Energy Efficiency Programs – programs like ConservationWise from Xcel Energy^{SM} that help customers increase energy efficiency by providing rebates, pricing, or other incentives to purchase energy efficient systems or components (e.g., boilers, air conditioning systems, lighting, motors); renovate facilities that meet specific energy

efficiency standards (e.g., roofing); undertake energy conservations assessments; and obtain expert energy conservation design assistance.

- Load Management Programs – programs such as OperationWise from Xcel Energy^{SM} that encourage customers to switch load to customer-owned standby generators during periods of peak demand, and include features like Saver's Switch® that encourage customers to allow a portion of their load to be interrupted during periods of peak demand.

Details of Xcel Energy DSM programs are provided in its most recent CIP.

In Xcel Energy's 2004 Integrated Resource Plan, Xcel Energy established the DSM goals for the 2005-2019 planning period. This plan established aggressive targets of 3,773 gigawatt-hours (GWh) of cumulative energy savings and 1,063 MW of cumulative peak demand savings in Xcel Energy's service area over this period (Xcel Energy 2004b).

Recent legislation, the Next Generation Energy Act of 2007, signed in May of 2007 by the Governor of Minnesota, introduces reforms to the existing DSM programs in Minnesota (Office of the Governor 2007). This legislation includes a provision for utilities to reduce electricity demand by 1.5 percent per year. It also transitions the CIP program from a spending program to an energy savings program. These reforms are expected to double the amount of electricity saved (MDC 2007).

NMC notes that even if these aggressive annual DSM savings targets required by the CIP and the Next Generation Energy Act of 2007 were achieved, the cumulative savings through 2013 would be insufficient to replace generation lost as a result of PINGP operations termination at the end of its current operating licenses. Moreover, Xcel Energy credits these DSM goals from the CIP in its demand forecasts, which indicate the need for substantial amounts of energy to meet obligations in its service area even assuming the PINGP operating license is renewed. In addition, DSM tends to reduce peak demand, and has less effect on reducing demand for baseload capacity. Therefore, NMC concludes that DSM does not represent a meaningful alternative to renewal of the PINGP operating license.

7.2.3.2 Wind

Wind power, by itself, is not suitable for large base-load generation. As discussed in Section 8.3.1 of the GEIS, wind has a high degree of intermittence, and average annual capacity factors for wind plants are relatively low (less than 30 percent). Wind power, in conjunction with energy storage mechanisms, might serve as a means of providing base-load power. However, current energy storage technologies are too expensive for wind power to serve as a large base-load generator.

Based on American Wind Energy Association (AWEA) estimates from 2005, Minnesota has the technical potential (the upper limit of renewable electricity production and capacity that could be brought online, without regard to cost, market acceptability, or

market constraints) for roughly 75,000 MWe of installed wind power capacity. The full exploitation of wind energy is constrained by a variety of factors including land availability and land-use patterns, surface topography, infrastructure constraints, environmental constraints, wind turbine capacity factor, wind turbine availability, and grid availability. When these constraints on wind energy development are considered, the achievable wind energy potential is expected to fall in the range of 20-40 percent of technical potential estimates or 15,000 - 30,000 MWe. As of the end of 2005 a total of 744 MWe of wind energy had been developed in Minnesota (AWEA 2006).

Wind farms, the most economical wind option, generally consist of 10-50 turbines in the 1-3 MWe range. Estimates based on existing installations indicate that a utility-scale wind farm would occupy about 50 acres per MWe of installed capacity (McGowan & Connors 2000). Wind farm facilities would occupy 3 to 5 percent of the wind farm's total acreage (McGowan and Connors 2000). Therefore, replacement of PINGP generating capacity with wind power, even assuming ideal wind conditions, would require about 149,000 acres (230 square miles) of which about 4,500 acres (7 square miles) would be occupied by turbines and support facilities. Based on the amount of land needed to replace PINGP, the wind alternative would require a large green field site, which would result in a large environmental impact. Additionally, wind plants have aesthetic impacts, generate noise, and can harm flying birds and bats.

The scale of this technology is too small to directly replace a power plant of the size of PINGP, capacity factors are low (30 to 40 percent), and the land requirement (7 square miles) is large. The expected increase in wind energy generation will likely meet the additional renewable generation required by the Next Generation Energy Act of 2007 and not be available to replace base-load generation. Therefore, NMC has concluded that wind power is not a reasonable alternative to PINGP license renewal.

7.2.3.3 Solar

By its nature, solar power is intermittent. In conjunction with energy storage mechanisms, solar power might serve as a means of providing base-load power. However, current energy storage technologies are too expensive to permit solar power to serve as a large base-load generator. Even without storage capacity, solar power technologies (photovoltaic and thermal) cannot currently compete with conventional fossil-fueled technologies in grid-connected applications, due to high costs per kilowatt of capacity (NRC 1996a). However, Xcel Energy's portfolio includes purchased power of 8 megawatts of solar.

The amount of solar radiation that Minnesota receives ranges from 4.0 kilowatt hours per square meter per day in the northeast part of the state to nearly 5.0 kilowatt hours per square meter per day in the southwest corner (NREL 2006). Estimates based on existing installations indicate that utility-scale plants would occupy about 7.4 acres per MWe for photovoltaic and 4.9 acres per MWe for solar thermal systems (DOE 2004). Utility-scale solar plants have only been used in regions, such as southern California, that receive high concentrations (5 to 7.2 kilowatt hours per square meter per day) of solar radiation. NMC believes that a utility-scale solar plant located in Minnesota, which

receives 4.0 to 5.0 kilowatt hours of solar radiation per square meter per day, would occupy about 10.62 acres per MWe for photovoltaic and 7.03 acres per MWe for solar thermal systems. Therefore, replacement of PINGP generating capacity with solar power would require dedication of about 16,000 acres (26 square miles) for photovoltaic and 26,000 acres (41 square miles) for solar thermal systems. The existing PINGP site is approximately 578 acres. Neither type of solar electric system would fit at the PINGP site, and both would have large environmental impacts at a greenfield site.

NMC has concluded that due to the high cost, limited availability of sufficient incident solar radiation, and amount of land needed (approximately 26 to 41 square miles), solar power is not a reasonable alternative to PINGP license renewal.

7.2.3.4 Hydropower

According to the U.S. Hydropower Resource Assessment for Minnesota (Francfort 1996), there are no sites in Minnesota that would be environmentally suitable for a large hydroelectric facility. As the GEIS points out in Section 8.3.4, hydropower's proportion of United States generating capacity is expected to decline because hydroelectric facilities have become difficult to site as a result of public concern over flooding, destruction of natural habitat, and alteration of natural river courses.

The GEIS estimates land use of 1,600 square miles per 1,000 MWe for hydroelectric power. Based on this estimate, replacement of PINGP generating capacity would require flooding approximately 1,700 square miles, resulting in a large impact on land use. Further, operation of a hydroelectric facility would alter aquatic habitats above and below the dam, which would impact existing aquatic communities.

NMC has concluded that due to the lack of suitable sites in Minnesota for a large hydroelectric facility and the amount of land needed (approximately 1,700 square miles) hydropower is not a reasonable alternative to PINGP license renewal.

7.2.3.5 Geothermal

As illustrated by Figure 8.4 in the GEIS (NRC 1996a), geothermal plants might be located in the western continental United States, Alaska, and Hawaii, where hydrothermal reservoirs are prevalent. However, because there are no high-temperature geothermal sites in Minnesota, NMC concludes that geothermal is not a reasonable alternative to PINGP license renewal.

7.2.3.6 Wood Energy

As discussed in the GEIS (NRC 1996a), the use of wood waste to generate electricity is largely limited to those states with significant wood resources. The pulp, paper, and paperboard industries in states with adequate wood resources generate electric power by consuming wood and wood waste for energy, benefiting from the use of waste materials that could otherwise represent a disposal problem. According to the U.S.

Department of Energy, Minnesota does not have enough wood resources to replace the generating capacity of PINGP (Walsh et al. 2000).

Further, as discussed in Section 8.3.6 of the GEIS (NRC 1996a), construction of a wood-fired plant would have an environmental impact that would be similar to that for a coal-fired plant, although facilities using wood waste for fuel would be built on a smaller scale. Like coal-fired plants, wood-waste plants require large areas for fuel storage, processing, and waste (i.e., ash) disposal. Additionally, operation of wood-fired plants has environmental impacts, including impacts on the aquatic environment and air. Wood has a low heat content that makes it unattractive for base-load applications. It is also difficult to handle and has high transportation costs.

NMC has concluded that, due to inadequate resources, the lack of an environmental advantage, low heat content, handling difficulties, and high transportation costs, wood energy is not a reasonable alternative to PINGP license renewal.

7.2.3.7 Municipal Solid Waste

As discussed in Section 8.3.7 of the GEIS (NRC 1996a), the initial capital costs for municipal solid waste plants are greater than for comparable steam turbine technology at wood-waste facilities. This is due to the need for specialized waste separation and handling equipment.

The decision to burn municipal solid waste to generate energy is usually driven by the need for an alternative to landfills, rather than by energy considerations. The use of landfills as a waste disposal option is likely to increase in the near term; however, it is unlikely that many landfills will begin converting waste to energy because of unfavorable economics.

Estimates in the GEIS suggest that the overall level of construction impacts from a waste-fired plant should be approximately the same as that for a coal-fired plant. Additionally, waste-fired plants have the same or greater operational impacts (including impacts on the aquatic environment, air, and waste disposal). Some of these impacts would be moderate, but still larger than the environmental effects of PINGP license renewal.

NMC has concluded that, due to the high costs and lack of environmental advantages, burning municipal solid waste to generate electricity is not a reasonable alternative to PINGP license renewal.

7.2.3.8 Other Biomass-Derived Fuels

In addition to wood and municipal solid waste fuels, there are several other concepts for fueling electric generators, including burning energy crops, converting crops to a liquid fuel such as ethanol (ethanol is primarily used as a gasoline additive), and gasifying energy crops (including wood waste). As discussed in the GEIS, none of these

technologies has progressed to the point of being competitive on a large scale or of being reliable enough to replace a base-load plant such as PINGP.

Further, estimates in the GEIS suggest that the overall level of construction impacts from a crop-fired plant should be approximately the same as that for a wood-fired plant. Additionally, crop-fired plants would have similar operational impacts (including impacts on the aquatic environment and air). These systems also have large impacts on land use, due to the acreage needed to grow the energy crops.

NMC has concluded that, due to the high costs and lack of environmental advantage, burning other biomass-derived fuels is not a reasonable alternative to PINGP license renewal.

7.2.3.9 Petroleum

Minnesota has several petroleum(oil)-fired power plants; and from 1990 to 2005 the percentage share of power produced by oil-fired generating plants decreased from 9.0 percent to about 5.9 percent (EIA 2007). However, oil-fired generation represents a small portion of the overall generation mix in Minnesota and is more expensive than nuclear or coal-fired generation. Future increases in petroleum prices are expected to make oil-fired generation increasingly more expensive than coal-fired generation. Also, construction and operation of an oil-fired plant would have environmental impacts. For example, Section 8.3.11 of the GEIS (NRC 1996a) estimates that construction of a 1,000-MWe oil-fired plant would require about 120 acres. Additionally, operation of oil-fired plants would have environmental impacts (including impacts on the aquatic environment and air) that would be similar to those from a coal-fired plant.

NMC has concluded that, due to the high costs and lack of obvious environmental advantage, oil-fired generation is not a reasonable alternative to PINGP license renewal.

7.2.3.10 Fuel Cells

Fuel cell power plants are in the initial stages of commercialization. While more than 700 large stationary fuel cell systems have been built and operated worldwide, the global stationary fuel cell electricity generating capacity in 2004 was only 132 MWe. In addition, the largest stationary fuel cell power plant is only 11 MWe (Fuel Cell Today 2003 and 2005). Recent estimates suggest that a company would have to produce about 100 MWe of fuel cell stacks annually to achieve a price of $1,000 to $1,500 per kilowatt (Kenergy Corporation 2000). However, the production capability of the largest stationery fuel cell manufacturer is 50 MWe per year (CSFCC 2002). NMC believes this technology has not matured sufficiently to support production for a facility the size of PINGP. NMC has concluded that, due to cost and production limitations, fuel cell technology is not a reasonable alternative to PINGP license renewal.

7.2.3.11 Advanced Nuclear Reactor

Increased interest in the development of advanced nuclear power plants has been expressed recently by members of both industry and government. However, it is extremely unlikely that a replacement for the PINGP could be planned, licensed, constructed, and on line by the time the operating licenses expire in 2013 and 2014. Further, there is currently a moratorium in Minnesota on the construction of new nuclear plants. In addition, a new nuclear plant would have environmental impacts similar to those for PINGP but would also incur the new construction impacts. Therefore, constructing a new nuclear plant would not be expected to be environmentally superior to the continued operation of PINGP.

7.2.3.12 Delayed Retirement of Existing Non-nuclear Units

As the NRC noted in the GEIS (NRC 1996a), extending the lives of existing non-nuclear generating plants beyond the time they were originally scheduled to be retired represents another potential alternative to license renewal. However, delaying retirement in order to compensate for PINGP generally would be unreasonable without major construction to upgrade or replace plant components. Xcel Energy undertakes upgrades of its older baseload plants in cases where it is reasonable to do so. Such actions are currently accounted for in Xcel Energy's plans to meet anticipated demands irrespective of the loss of generating capacity if the PINGP operating license is not renewed and, therefore, do not represent a realistic option. In addition, NMC expects that the environmental impacts of implementing such upgrades and operating the upgraded plants are reasonably bounded by assessments presented in this chapter for the gas-fired and coal-fired alternatives.

7.3 ENVIRONMENTAL IMPACTS OF ALTERNATIVES

NMC evaluations of environmental impacts for the feasible replacement power alternatives are presented in the following sections. Section 7.3.1 provides NMC's impact assessment of the purchased power alternative. Sections 7.3.2 and 7.3.3 address impacts associated with the natural gas-fired and coal-fired plant alternative, respectively. Chapter 8 presents a summary comparison of the environmental impacts of license renewal and the alternatives discussed in this section.

The evaluations presented below focus on the impacts specific to these alternatives. Impacts associated with terminating operations and decommissioning PINGP (i.e., base case, Section 7.1.1 of this ER) are expected to be of SMALL significance for all resource areas addressed except socioeconomics; therefore, these generally are not further discussed. However, conclusions expressed below regarding the significance of impact for each alternative denote the total expected impact for each resource area, inclusive of the base case. The influence of the base case on these conclusions is noted where appropriate.

The new generating plants addressed in Sections 7.3.2 and 7.3.3 would not be constructed only to operate for the period of extended operation of PINGP. Therefore, NMC assumes for this analysis a typical design life of 30 years for the combined-cycle natural gas-fired plant and 40 years for the coal-fired plant, and considers impacts associated with operation for the entire design life of the units in this analysis. As discussed in Section 7.2, NMC assumes that construction of these plants would be phased to provide replacement capacity in 2013 and 2014 when respective PINGP operating licenses expire.

7.3.1 PURCHASED POWER

Because it would be replacing PINGP's baseload capacity, NMC assumes that the generating technology used under the power purchase alternative would likely be coal-fired or gas-fired generation capable of baseload operation. Further, because of the large block of baseload power provided by PINGP, NMC assumes that if power purchases were used to replace this power over the twenty year replacement term, construction of new generation would still be required, albeit potentially in another state, region or Canada. Therefore, NMC assumes that the generation-related impacts associated with a power purchase alternative would be similar to those evaluated in Sections 7.3.2 and 7.3.3 of this ER. NMC is also adopting by reference the NRC analysis of the environmental impacts from those technologies. Under the purchased power alternative, environmental impacts would still occur, but they would likely originate from a power plant located elsewhere in Minnesota, the region, the U.S., or Canada. However, for purposes of comparative analysis, NMC assumes that overall generation-associated adverse impacts would be no greater than are identified in this ER for the representative gas-fired and coal-fired plant alternatives.

Environmental impacts associated with terminating operations and decommissioning PINGP nonetheless could result in LARGE adverse socioeconomic impacts to the City

of Red Wing from loss of tax revenues 20 years earlier than would occur if the PINGP operating license is renewed. Terminating operations and decommissioning PINGP could result in SMALL impacts to the peregrine falcon and paddlefish, a state-listed threatened species, and SMALL impacts to the Higgins eye pearlymussel, a Federal and state-endangered species.

NMC assumes that 100 miles of new 345-kV transmission line on a 150-foot wide ROW in southern Minnesota, potentially affecting approximately 1,800 acres, would be required to import purchased power. Considering the nature of transmission line development and mitigation available, impacts of greatest concern are those related to changes in land use, terrestrial ecological communities, and aesthetics.

Land use and terrestrial ecological habitats in the region where it is assumed the line would be built consists predominantly of rural agricultural land interspersed in some areas with natural vegetation (e.g., forested tracts, wetlands). Therefore, NMC expects these land uses and ecological habitats, which are abundant in the region, would be most affected by transmission line development. Development of the transmission line would limit changes in future land uses on the ROW to those that are compatible with the line, but most agricultural practices and other currently compatible uses could continue.

Establishment of ROW for the transmission line(s) would have little effect on either the amount or value of habitat represented by agricultural land, the predominant habitat expected on lands traversed by these facilities, because compatible agricultural practices could continue. Similarly, open wetlands would be spanned and therefore minimally affected. Depending on route specifics, clearing of forest and shrubland, some of which may qualify as wetland, would also be required. However, hydrologic regimes of wetlands would not be appreciably affected and the conversion of ROW areas currently in forest to open (herbaceous and shrub) habitats can be advantageous to species with affinities for remnant prairie habitats, now rare in the area of interest.

Some visual impairment of the rural landscape would result from development of the transmission line. However, the topography throughout most of southern Minnesota is rolling, and forested tracts occur in some parts of the area. Both of these attributes would act to reduce the viewshed and limit potential for impairment of visual aesthetics. In addition, the presence of transmission line is not out of character for the existing rural southern Minnesota landscape.

Finally, NMC expects that routing of the line could be accomplished such that highly incompatible land uses, important habitats and associated important species, and areas of potentially high impact on visual aesthetics would be recognized and avoided or appropriately mitigated such that important attributes of these resources would not be destabilized.

On the basis of these considerations, NMC concludes that the associated impacts of the transmission line development and operation would be SMALL to MODERATE with respect to land use, ecological resources, and aesthetics. Transmission line

development could result in LARGE adverse socioeconomic impacts to the City of Red Wing from loss of tax revenues 20 years earlier than would occur if the PINGP operating license is renewed. Impacts to remaining resources would be of SMALL significance.

7.3.2 GAS-FIRED GENERATION

NRC evaluated environmental impacts from gas-fired generation alternatives in the GEIS, focusing on combined-cycle plants. Section 7.2.2.2 presents NMC's reasons for defining the gas-fired generation alternative as a combined-cycle plant on a greenfield site.

In the GEIS Supplement for McGuire Nuclear Station (NRC 2002b), NRC evaluated the environmental impacts of constructing and operating five 482 MWe combined-cycle gas-fired units as an alternative to a nuclear power plant license renewal. NMC has reviewed the NRC analysis, believes it to be sound, and notes that it analyzed more generating capacity than the 1,040 MWe of net power discussed in this analysis.

7.3.2.1 Land Use

Although potential impacts on land use would be location specific and therefore conjectural for a greenfield site, potentially affected areas are predominantly rural agricultural land interspersed in some areas with natural vegetation (e.g., forested tracts and wetlands). Based on information presented in Section 7.2.2.2 of this ER, NMC expects plant development would involve conversion of approximately 41 acres of rural agricultural land and/or natural plant communities abundant in the region to industrial use. Development of offsite infrastructure (i.e., transmission line, gas pipeline), involving approximately 110 acres of ROW, would similarly limit development of future incompatible land uses but compatible land uses, including most agricultural practices, could continue. Considering also that land use impacts would be addressed in siting and designing these facilities, NMC concludes that land use impacts could range from SMALL to MODERATE, depending on site-specific factors.

7.3.2.2 Air Quality

Natural gas is a relatively clean-burning fossil fuel that primarily emits nitrogen oxides (NO_x), a regulated pollutant, during combustion. A natural gas-fired plant would also emit small quantities of sulfur oxides (SO_x), particulate matter, and carbon monoxide, all of which are regulated pollutants. Carbon dioxide, a greenhouse gas, would also be emitted. Control technology for gas-fired turbines focuses on NO_x emissions. NMC estimates the gas-fired alternative emissions to be as follows (TtNUS 2007b):

SO_x = 83 tons per year

NO_x = 312 tons per year

Carbon monoxide = 409 tons per year

Filterable Particulates = 122 tons per year (all particulates are PM_{10})

In 2005, Minnesota was ranked 25th nationally in sulfur dioxide (SO_2) emissions (EIA 2007). Therefore, the electric power plants in 24 states emitted more SO_2 than those located in Minnesota. The acid rain requirements of the Clean Air Act Amendments capped the nation's SO_2 emissions from power plants. Each company with fossil-fuel-fired units was allocated SO_2 allowances. To be in compliance with the Act, the companies must hold enough allowances to cover their annual SO_2 emissions. Xcel Energy would need to obtain SO_2 credits to operate a fossil-fuel-burning plant at the greenfield site.

In 1998, the EPA promulgated the NO_x State Implementation Plan (SIP) Call regulation that required 22 states, including Minnesota, to reduce their NO_x emissions by over 30 percent to address regional transport of ground-level ozone across state lines (EPA 1998b). The NO_x SIP Call imposes a NO_x "budget" to limit the NO_x emissions from each state. To operate a fossil-fuel-fired plant at the greenfield site, Xcel Energy would also need to obtain enough NO_x credits to cover annual emissions either from the set-aside pool or by buying NO_x credits from other sources.

In addition, Minnesota is one of the states covered by the Clean Air Interstate Rule (CAIR), designed to reduce air pollution that moves across state boundaries. The CAIR, issued March 10, 2005, will permanently cap emissions of sulfur dioxide and nitrogen oxides in the eastern United States when fully implemented (EPA 2006). The CAIR is projected to reduce Minnesota's sulfur dioxide and nitrogen oxide emissions by 36 and 59 percent, respectively, by 2015. Minnesota must achieve the required emission reductions of the CAIR, and Xcel Energy will have to comply with Minnesota's emission reduction program.

NO_x effects on ozone levels, SO_2 allowances, and NO_x emission offsets could all be issues of concern for gas-fired combustion. While gas-fired turbine emissions are less than coal-fired boiler emissions, and regulatory requirements are less stringent, the emissions are still substantial. NMC concludes that emissions from the gas-fired alternative at a greenfield site would noticeably alter local air quality, but would not destabilize regional resources (i.e., air quality). Air quality impacts would therefore be MODERATE.

7.3.2.3 Waste Management

The solid waste generated from this type of facility would be minimal. NMC concludes that gas-fired generation waste management impacts would be SMALL.

7.3.2.4 Ecological Resources

Development of the representative plant at a greenfield site in southern Minnesota would likely result in the loss of approximately 41 acres of terrestrial habitat for onsite plant facilities, and modification of approximately 110 acres of existing offsite terrestrial habitat for a new natural gas supply pipeline and transmission line ROW. Habitat most

likely to be affected consists of rural agricultural land interspersed in some areas with natural vegetation communities abundant in the region (e.g., forested tracts and wetlands).

Impacts associated with transmission line and pipeline development would be similar to those described in Section 7.3.1 for the transmission line(s) assumed to be needed for the purchase power alternative.

The most significant potential impacts to aquatic communities relate to operation of the cooling water system. However, the cooling system for the plant would be designed and operated in compliance with the Clean Water Act (CWA), including National Pollutant Discharge Elimination System (NPDES) limitations for physical and chemical parameters of potential concern and provisions of CWA Sections 316(a) and 316(b), which are respectively established to ensure appropriate protection of aquatic communities from thermal discharges and the location and operation of cooling water intakes.

In view of these considerations and assumptions of this assessment, NMC expects that impacts on ecological resources would not noticeably alter any important attribute of the resource, particularly if located on agricultural lands, consistent with NRC's definition of SMALL impact significance. However, considering the uncertainties associated with greenfield development, NMC concludes that impacts on ecological resources could be of SMALL to MODERATE significance.

7.3.2.5 Socioeconomics

Major sources of potential socioeconomic impacts from the representative gas-fired generation alternative include:

• temporary increases in jobs, economic activity, and demand for housing and public services in communities surrounding the site during the construction period, and

• net change in permanent jobs, tax revenues, and economic activity attributable to gas-fired plant operation and termination of PINGP operations.

Although the area south of Minneapolis is predominantly rural, it is within commuting distance of relatively large population centers, including Minneapolis-St. Paul, Mankato, and Rochester. Considering the proximity of these sources of labor and services, NMC expects that most of the construction workforce would commute and relatively few would relocate to small communities near the plant such that significant demand for housing or public services would result. Associated socioeconomic impacts during construction are therefore expected to be SMALL, regardless of plant location. Considered together with impacts of the no action "base case" (terminating operations and decommissioning PINGP), the greenfield siting alternative could result in LARGE adverse socioeconomic impacts to the City of Red Wing from loss of tax revenues 20 years earlier than would occur if the PINGP operating licenses were not renewed. NMC

concludes that overall socioeconomic impact of the representative plant at the assumed greenfield site would be of MODERATE to LARGE significance.

7.3.2.6 Aesthetics

Potential aesthetic impacts of construction and operation of a gas-fired plant include visual impairment resulting from the presence of a industrial facility and associated ROWs, particularly 200-foot high exhaust stacks and condensate plume from the cooling tower. However, the topography throughout most of southern Minnesota is rolling and forested tracts are common in some areas. Both of these factors act to reduce the viewshed and limit potential for impairment of visual aesthetics. NMC assumes that adequate buffer and vegetation screens would be provided at the plant site as needed to moderate visual and noise impacts. Considering also that the location and design of the plant and associated offsite infrastructure would be decided with consideration of potential adverse aesthetic effects, NMC concludes that aesthetic impact could range from SMALL to MODERATE, depending on location.

7.3.2.7 Other Impacts

Cooling water intake and discharge flows, potable and service water use, and wastewater discharges for the representative gas-fired plant would be substantially lower than currently result from PINGP operation, due to less power derived from a steam cycle, use of a closed-cycle cooling system, and smaller operating workforce. Cooling water, wastewater, and stormwater discharges would be regulated under the CWA and corresponding state programs by NPDES permit. Potential impacts on water quality during construction would also be subject to regulatory controls.

Operation of the gas-fired alternative would generate only small quantities of municipal and industrial waste, including spent catalyst used for NO_x control, which would be disposed of in accordance with applicable regulations at a permitted offsite disposal facility.

NRC cites risk of accidents to workers and public risks (e.g., cancer, emphysema) from the inhalation of toxics and particulates associated with air emissions as potential risks to human health associated with the gas-fired generation alternative (NRC 1996a). NMC assumes that regulatory requirements imposed on facility design and operations under the authority of the Occupational Safety and Health Act, Clean Air Act, and related statutes are designed to provide an appropriate level of protection to workers and the public with respect to these risks.

The representative gas-fired plant and associated gas supply pipeline and transmission line would be located with consideration of cultural resources, and NMC expects that appropriate measures would be taken to avoid, recover or provide other mitigation for loss of any resources discovered during onsite or offsite construction.

NMC concludes that the potential adverse impacts of this alternative on water quality and use, threatened and endangered species, human health, and cultural resources would likely be SMALL.

7.3.3 COAL-FIRED GENERATION

NRC evaluated environmental impacts from coal-fired generation alternatives in the GEIS (NRC 1996a). NRC concluded that construction impacts could be substantial, due in part to the large land area required (which can result in natural habitat loss) and the large workforce needed. NRC identified major adverse impacts from operations as human health concerns associated with air emissions, waste generation, and losses of aquatic biota due to cooling water withdrawals and discharges. The coal-fired alternative that NMC has defined in Section 7.2.2.3 would be located at a greenfield site.

7.3.3.1 Land Use

Although potential impacts on land use would be location specific and therefore conjectural for a greenfield site, potentially affected areas are predominantly rural agricultural land interspersed in some areas with natural vegetation (e.g., forested tracts and wetlands) all of which are abundant in the region. NMC expects the total site would consist of approximately 170 acres (TtNUS 2007a). Land uses would also be precluded on 180 acres onsite for waste disposal (TtNUS 2007b). Offsite, an estimated 60 acres of land would be converted to transportation use (rail spur) and 90 acres would be converted to utility use (transmission line) (TtNUS 2007a). Similarly, development of future incompatible land uses would be precluded on the transmission ROW, but compatible land uses, including most agricultural practices, could continue. In view of the large amount of land affected and the permanent land use change from the landfill, NMC concludes that land use impacts would be clearly noticeable. Considering also the assumption that environmental review, siting and design of these facilities would ensure that land uses in affected areas would not be destabilized, NMC concludes that land use impacts would be MODERATE.

7.3.3.2 Air Quality

A coal-fired plant would emit SO_x, NO_x, particulate matter, and carbon monoxide, all of which are regulated pollutants. Non-regulated pollutants including carbon dioxide, a greenhouse gas, and mercury, would also be emitted. As Section 7.2.1.1 indicates, NMC has assumed a plant design that would minimize air emissions through a combination of boiler technology and post-combustion pollutant removal. NMC estimates the coal-fired alternative emissions to be as follows (TtNUS 2007b):

SO_x = 1,815 tons per year

NO_x = 848 tons per year

Carbon monoxide = 1,178 tons per year

Mercury = 0.2 tons per year

Particulates:

Total suspended particulates = 152 tons per year

PM_{10} (particulates having a diameter of less than 10 microns) = 35 tons per year

The Section 7.3.2.2 discussion of regional air quality is applicable to the coal-fired generation alternative. SO_2 emission allowances, low NO_x burners, overfire air, fabric filters, and scrubbers are regulatory-imposed mitigation measures. As such, NMC concludes that the coal-fired alternative would have MODERATE impacts on air quality; the impacts would be noticeable and greater than those of the gas-fired alternative, but would not destabilize air quality in the area.

7.3.3.3 Waste Management

NMC concurs with the GEIS assessment that the coal-fired alternative would generate substantial amounts of solid waste. The coal-fired plant would annually consume approximately 4,700,000 tons of coal with an ash content of 6.47 percent. After combustion, 30 percent of this ash, approximately 91,000 tons per year, would be marketed for beneficial reuse. The remaining ash, approximately 210,000 tons per year, would be collected and disposed of onsite. In addition, approximately 77,000 tons of scrubber sludge would be disposed of onsite each year (based on annual lime usage of nearly 65,000 tons). NMC estimates that ash and scrubber waste disposal over a 40-year plant life would require approximately 180 acres (a square area with sides of approximately 2,800 feet). While only half this waste volume and acreage would be attributable to the 20-year license renewal period alternative, the total numbers are pertinent as a cumulative impact (TtNUS 2007b).

NMC contends that, with proper siting coupled with current waste management and monitoring practices, waste disposal would not destabilize any resources. After closure of the waste site and revegetation, the land would be available for other uses. For these reasons, NMC contends that waste management for the coal-fired alternative would have MODERATE impacts; the impacts of increased waste disposal would be noticeable, but would not destabilize any important resource, and further mitigation would be unwarranted.

7.3.3.4 Ecological Resources

Development of the representative coal-fired plant at a greenfield site in southern Minnesota would likely result in the loss of 350 acres of terrestrial habitat for onsite plant facilities and air emission control waste landfill, loss of approximately 60 acres of offsite habitat for the rail line, and modification of 90 acres of offsite terrestrial habitat for a new transmission line to serve the plant. While the amount of habitat affected would be larger, the nature of impacts would be the same as described for the gas-fired alternative (Section 7.3.2).

The most significant potential impacts to aquatic communities relate to operation of the cooling water system, but regulatory controls would be expected to ensure appropriate protection of aquatic communities from thermal discharges and cooling water intake structures. In addition, because the plant is assumed to use closed-cycle cooling, the cooling water intake and discharge flows would be lower than that of PINGP, the impact from which is considered to be SMALL.

For the same reasons provided with respect to the gas-fired alternative, NMC concludes that impacts on ecological resources from the representative coal-fired plant could be of SMALL to MODERATE significance for the greenfield site option.

7.3.3.5 Socioeconomics

Major sources of potential socioeconomic impacts from the representative coal-fired generation alternative include:

• temporary increases in jobs, economic activity, and demand for housing and public services in communities surrounding the site during the construction period, and

• net change in permanent jobs, tax revenues, and economic activity attributable to gas-fired plant operation and termination of PINGP operations.

As indicated for the gas-fired alternative, NMC expects that socioeconomic impacts from construction to be SMALL regardless of location. Considered together with impacts of the no action “base case” (terminating operations and decommissioning PINGP), the greenfield siting alternative could result in LARGE adverse socioeconomic impacts to the City of Red Wing from loss of tax revenues 20 years earlier than would occur if the PINGP operating licenses were not renewed. NMC concludes that the overall socioeconomic impact of the representative plant at the greenfield site would be of MODERATE to LARGE significance.

7.3.3.6 Aesthetics

Potential aesthetic impacts of construction and operation of a coal-fired plant include visual impairment resulting from the presence of a industrial facility, particularly a 500-foot high exhaust stack and condensate plume from the cooling tower. However, the topography throughout most of southern Minnesota is rolling and forested tracts are common in some areas. Both of these factors act to reduce the viewshed and limit potential for impairment of visual aesthetics from onsite and offsite infrastucture. NMC assumes that adequate buffer and vegetation screens would be provided at the plant site as needed to reduce visual and noise impacts. Considering also that the location and design of the plant and associated offsite infrastructure would be decided with consideration of potential adverse aesthetic effects, NMC concludes that aesthetic impact could range from SMALL to MODERATE, depending on location.

7.3.3.7 Other Impacts

NMC expects that cooling water intake and discharge flows, potable and service water use, and wastewater discharges for the representative coal-fired plant, which has a closed-cycle cooling system would be lower than current PINGP operations, the impact from which is considered to be small. Cooling water, wastewater, and stormwater discharges would be regulated under the CWA and corresponding state programs by NPDES permit. Potential impacts on water quality during construction would also be subject to regulatory controls.

In the GEIS, NRC cites risk of accidents to workers and public risks (e.g., cancer, emphysema) from the inhalation of toxics and particulates associated with air emissions as potential risks to human health associated with the coal-fired generation alternative (NRC 1996a). NMC assumes that regulatory requirements imposed on facility design and operations under the authority of the Occupational Safety and Health Act, Clean Air Act, and related statutes are designed to provide an appropriate level of protection to workers and the public with respect to these risks.

The representative coal-fired plant and associated transmission line would be located with consideration of cultural resources, and NMC expects that appropriate measures would be taken to avoid, recover or provide other mitigation for loss of any resources discovered during onsite or offsite construction.

NMC concludes that the potential adverse impacts of this alternative on water quality and use, human health, threatened and endangered species, and cultural resources would likely be SMALL.

TABLE 7.2-1
GAS-FIRED ALTERNATIVE

Characteristic	Basis
Unit size = 520 MWe ISO rating net[a]	Manufacturer's standard size gas-fired combined-cycle plant that is < PINGP net capacity - 1,044 MWe
Unit size = 542 MWe ISO rating gross[a]	Calculated based on 4 percent onsite power
Number of units = 2	Assumed
Fuel type = natural gas	Assumed
Fuel heating value = 1,008 Btu/ft^3	2004 value for gas used in Minnesota (EIA 2007)
Fuel SO_x content = 0.0034 lb/MMBtu	EPA 2000, Table 3.1-2a
NO_x control = selective catalytic reduction (SCR)	Selected for NO_x emissions control in the feasibility study (UE 2002)
Fuel NO_x content = 0.0128 lb/MMBtu	Typical for large SCR-controlled gas fired units (EPA 2000)
Fuel CO content = 0.0168 lb/MMBtu	Typical for large SCR-controlled gas fired units (EPA 2000)
Fuel PM_{10} content = 0.005 lb/MMBtu	EPA 2000, Table 3.1-2a
Heat rate = 6,040 Btu/kWh	(Chase and Kehoe 2000)
Capacity factor = 0.85	Assumed based on performance of modern plants

a. The difference between "net" and "gross" is electricity consumed onsite.

Btu	=	British thermal unit
CO	=	carbon monoxide
ft^3	=	cubic foot
ISO rating	=	International Standards Organization rating at standard atmospheric conditions of 59°F, 60 percent relative humidity, and 14.696 pounds of atmospheric pressure per square inch
kWh	=	kilowatt hour
Lb	=	pound
MM	=	million
MWe	=	megawatt electric
NO_X	=	nitrogen oxides
PM_{10}	=	particulates having diameter of 10 microns or less
SCR	=	selective catalytic reduction
So_x	=	sulfur oxides
≤	=	less than or equal to

TABLE 7.2-2
COAL-FIRED ALTERNATIVE

Characteristic	Basis
Unit size = 520 MWe ISO rating net[a]	Calculated to be ≤ PINGP net capacity – 1,044 MWe
Unit size = 553 MWe ISO rating gross[a]	Calculated based on 6 percent onsite power
Number of units = 2	Assumed
Boiler type = tangentially fired, dry-bottom	Minimizes nitrogen oxides emissions (EPA 1998a)
Fuel type = sub-bituminous, pulverized coal	Typical for coal used in Minnesota
Fuel heating value = 8,914 Btu/lb	2004 value for coal used in Minnesota (EIA 2007)
Fuel ash content by weight = 6.47 percent[b]	2001 value for coal used in Minnesota (EIA 2007)
Fuel sulfur content by weight = 0.44 percent	2002 value for coal used in Minnesota (EIA 2007)
Uncontrolled NO_x emission = 7.2 lb/ton	Typical for pulverized coal, tangentially fired, dry-bottom, NSPS (EPA 1998a)
Uncontrolled CO emission = 0.5 lb/ton	Typical for pulverized coal, tangentially fired, dry-bottom, NSPS (EPA 1998a)
Heat rate = 10,200 Btu/kWh	Typical for coal-fired, single-cycle steam turbines (EIA 2002)
Capacity factor = 0.85	Typical for large coal-fired units
NO_x control = low NO_x burners, overfire air and selective catalytic reduction (95 percent reduction)	Best available and widely demonstrated for minimizing NO_x emissions (EPA 1998a)
Particulate control = fabric filters (baghouse-99.9 percent removal efficiency)	Best available for minimizing particulate emissions (EPA 1998a)
SO_x control = Wet scrubber - lime (95 percent removal efficiency)	Best available for minimizing SO_x emissions (EPA 1998a)

a. The difference between "net" and "gross" is electricity consumed onsite.
b. The 2002 average percent ash for coal used in Minnesota is not available.

Btu	=	British thermal unit
CO	=	carbon monoxide
ISO rating	=	International Standards Organization rating at standard atmospheric conditions of 59°F, 60 percent relative humidity, and 14.696 pounds of atmospheric pressure per square inch
kWh	=	kilowatt hour
NSPS	=	New Source Performance Standard
lb	=	pound
MWe	=	megawatt
NO_x	=	nitrogen oxides
SO_x	=	oxides of sulfur
≤	=	less than or equal to

7.4 REFERENCES

Note to reader: This list of references identifies web pages and associated URLs where reference data was obtained. Some of these web pages may no longer be available or their URL addresses may have changed. NMC has maintained hard copies of the information and data obtained from the referenced web pages.

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