STATE OF IOWA
DEPARTMENT OF COMMERCE
THE IOWA STATE UTILITIES BOARD

MIDAMERICAN ENERGY COMPANY

REPORT IN FULFILLMENT OF IOWA CODE 476.6.22

Iowa Nuclear Feasibility Assessment in a Carbon-Constrained Environment

ASSESSMENT BACKGROUND

In 2009, significant national and state interest was focused on the implementation of carbon emission constraints on US fossil fueled generating facilities. This effort was highlighted in the US House of Representatives' July 26, 2009 passage of the American Clean Energy and Security Act (a/k/a Waxman-Markey); which would have implemented a "cap and trade" approach to reducing carbon emissions for US fossil generating facilities and implemented significant greenhouse gas emission reductions[1]. With the potentially significant compliance costs for carbon emissions from Iowa's fossil fueled electricity generation, utilities, Office of Consumer Advocate, legislators and other stakeholders supported the adoption of state legislation to assess if nuclear generation would be viable in Iowa in a carbon constrained environment. The 2010 Iowa legislation adopted established a new section to the Iowa Code (i.e., Section 476.6.22), attached as Schedule 1. Section 476.6.22(a) states,

It is the intent of the general assembly to require certain rate-regulated public utilities to undertake analyses of and preparations for the possible construction of nuclear generating facilities in this state that would be beneficial in a carbon-constrained environment.

[1] Waxman Markey would have begun the cap and trade program by 2012 based upon allowances (metric ton of CO_2 emissions); in addition the bill would have implemented greenhouse gas emission reductions from 2005 levels of 17 percent by 2020 and 42 percent by 2030.

Section 476.6.22 contained other provisions addressing:

- Recovery of reasonable and prudent costs associated with the analysis, 476.6.22(b)
- Filing of annual reports with the Iowa Utilities Board ("IUB" or "Board") and other information the Board deems appropriate, 476.6.22(b)
- Description of costs eligible for the rider includes those consistent with Nuclear Regulatory Commission ("NRC") guidance as well as *"…costs related to the study and use of sites for nuclear generation."* 476.6.22(c)

This report communicates MidAmerican's findings in the "analysis of and preparations for the possible construction of nuclear generating facilities" in Iowa that would be beneficial in a carbon-constrained environment as required by Iowa Code 476.6.22.

Consistent with the annual report filings to the IUB, MidAmerican has focused on four major questions necessary to meet the requirements outlined above:

- Can future Iowa nuclear generation deployments be cost effective in a carbon constrained environment?,
- Are there suitable preferred candidate sites for Iowa nuclear generating facilities and, if so, where would they be located?,
- Are nuclear technologies technically feasible for an Iowa deployment, especially light-water-cooled, passive, small modular reactor ("SMR") technologies currently under development?, and
- Are there significant economic development benefits for Iowa and the local region associated with nuclear generation development?

The above questions were viewed in the long-term with potentially 2,400 MW of generation being deployed at suitable Iowa candidate sites in the 2020s and 2030s and having a 60 year nuclear operating life[2]. Future carbon constraints were viewed by the external experts as resulting in the elimination of the construction of new coal fueled facilities in the near-term[3], imposing limitations and early retirements on the existing U.S. fossil fueled steam generating fleet[4], and possibly imposing a carbon fee[5] for each ton of carbon dioxide emitted.

This report is not intended to recommend the construction or development of any specific generation resource, nor complete the determination of proposed sites. The identification of a specific generating capacity type and need and the timing of that need in Iowa would be put forth under the requirements of Iowa Code 476A. This timing would be determined, in part, as the carbon and other environmental constraints continue to develop, available generation technologies emerge, unit retirements are considered and additional load growth continues net of energy efficiency programs.

To complete this assessment effort MidAmerican obtained the services of nationally recognized experts in the fields of nuclear and natural gas financial analysis, nuclear generation technology and nuclear facility site analysis. The key principal subject matter experts for this report included:

[2] The generation was assumed to be deployed in 300 MW increments over 13 years, see Figure 21: Exhibit RJS-4, "A Comprehensive Financial and Economic Assessment of Future Iowa Baseload Generation in a Carbon-Constrained Environment", NERA Economic Consulting (NERA), February 2013; in addition

[3] The NERA assessment resulted in no new coal fueled generation being added without carbon capture and sequestration beginning in 2013. For scenarios with carbon pricing, new coal generation with carbon capture and sequestration is projected to emerge in 2040; without carbon pricing, carbon capture and sequestration on new coal units is projected to emerge in 2060. See pages 32 through 35 and 54 through 58: Exhibit RJS-4

[4] In 2020, NERA Economic Consulting (NERA) envisioned New Source Performance Standards (NSPS) requiring a 2% improvement from the weighted average heat rate of the same fuel type and state as in 2012. This standard tightens by an additional 1% every five years. The NERA models exogenously implements this rule's impact by setting retirement years for generating units that did not meet the heat rate standards. See page 34, Exhibit RJS-4

[5] NERA incorporated a $20.27 per metric ton of CO_2 (2011$) beginning in 2020 in the economic analysis, See page 35, Exhibit RJS-4.

<u>Sargent & Lundy LLC ("Sargent & Lundy") and its subcontractors:</u>

- Nuclear site analysis
- Nuclear business plans (budgets and staffing)
- Nuclear technology evaluations

<u>NERA Economic Consulting ("NERA") and its subcontractors:</u>

- Natural gas price forecasting and modeling
- Economic assessments
- State economic development impacts

ASSESSMENT CONCLUSIONS

The assessment's subject matter experts prepared the following key reports:

- "Site Selection Study", prepared by Sargent & Lundy, December 2012, 289 pages (Exhibit RJS-2)
- "Site Selection Phase II Report", prepared by Sargent & Lundy, April 2013, 91 pages (Exhibit RJS-3)
- "A Comprehensive Financial and Economic Assessment of Future Iowa Baseload Generation in a Carbon-Constrained Environment", prepared by NERA Economic Consulting, February 2013, 142 pages (Exhibit RJS-4)

These summary reports were supported by various topical reports on the technical aspects of the assessment completed. MidAmerican used the findings of these key reports and other inputs in reaching the following conclusions:

1. In a carbon constrained environment[6], nuclear generation deployments in Iowa offer the potential to be a cost effective generating option over their operating life when compared to natural gas combined cycle units. Critical evaluation inputs into this analysis include the future domestic natural gas supply, level of future economic growth, U.S. carbon pricing policy and the pricing of SMR engineering, procurement and construction contracts.
2. Following a detailed site selection process, a site in Muscatine County appears suitable for nuclear generation deployment; no conditions that would be expected to make this site unlicensable or economically unfeasible were identified after an initial assessment. However, significant additional analysis and submittal of an Early Site Permit application to the Nuclear Regulatory Commission ("NRC") would be necessary to confirm the site can be licensed; a process that would take several years and could cost an estimated $50 million.
3. Small modular reactors appear to have several potential advantages for an Iowa deployment compared to existing legacy[7] nuclear designs, including: improved safety, smaller required investment and the ability to incrementally match load growth. However, the NRC certification of the designs may take well into this decade to complete.

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6 For the economic assessment, NERA projected a "carbon constrained environment" as having three components:
- Carbon capture and sequestration requirements for new coal units,
- Carbon emission limitations on existing fossil steam generating units, generally retiring the least efficient units earlier, and
- A potential price on carbon dioxide emissions applied at point of emission in all energy sectors.

For additional specific NERA details see Exhibit RJS-4,"A Comprehensive Financial and Economic Assessment of Future Iowa Baseload Generation in a Carbon-Constrained Environment" pages 17 through 20 and 53 through 56.

7 Legacy nuclear designs are those generally developed during the 1960s and 1970s that are characterized by the use of multiple, redundant, active safety systems to provide an increased depth of safety and protection to the public.

4. An Iowa nuclear deployment could result in considerably greater Iowa economic development benefits than a comparable natural gas combined cycle deployment based upon positive impacts on employment, gross state product, and personal disposable income in Iowa. In the site's local region, an estimated 795 employees would work at a fully developed 1,500 MW site; these operational employees would stimulate the creation of approximately 1,107 additional induced and indirect jobs in the local region. Total employment income for the local region during the plant's operating life, from all sources, is estimated at $134 million annually.

5. There is not an apparent urgency to proceed with IUB or NRC applications for the deployment of a nuclear facility in Iowa. Potentially, the next several years could add clarity regarding:

   a. The structure, level of reductions, schedule, and application of US Environmental Protection Agency ("EPA") greenhouse gas restrictions for new and existing fossil fueled generation[8], including any resulting forced shutdown of fossil generation on MidAmerican and the region.

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[8] On April 12, 2012, the EPA proposed a New Source Performance Standard for Carbon Dioxide Emissions from New Coal and Natural Gas Fueled Units. The rule would establish a nationwide standard of 1,000 pounds of carbon dioxide emitted per megawatt-hour. The proposed rule has not been finalized. On April 10, 2013 the acting EPA administrator commented the EPA would begin working with states to regulate greenhouse gas emissions from existing power plants in fiscal 2014. However, the EPA later released the statement "To clarify, EPA currently has no plans to regulate GHG emissions from existing power plants. As the Acting Administrator said today, a variety of potential options are on the table, but the Agency is currently focused on reviewing the more than 2 million comments received on its proposed standards for new power plants." Midwest Energy News, April 12, 2013 Midwest Energy News » Comments Feed

b. Refined reserve estimates, development restrictions (if any), export approvals, resource recovery and risks associated with future domestic natural gas supply.

c. Regulatory approvals of SMR designs and associated NRC rulemakings.

d. Firming of price commitments from SMR vendors for engineering, procurement and construction contracts; assessed as a critical input for decision making between generation alternatives.

When there is an established need for baseload generation in the future, and should it be demonstrated to be beneficial for customers to be nuclear fueled, it is anticipated MidAmerican would need to begin the data collection and filing of applications with the IUB and NRC approximately 8 to 10 years prior to any nuclear unit commercial operation, to accommodate the extensive regulatory review process.

APPROACH TO REQUIREMENTS OF IOWA CODE 476.6.22

The following underlined key sections of 476.6.22 were identified as providing the requirements of the nuclear assessment:

1. “It is the intent of the general assembly to require certain rate-regulated public utilities [MidAmerican] to undertake analyses of and preparations for the possible construction of nuclear generating facilities in this state that would be beneficial in a carbon-constrained environment.” (476.6.22(a))

   To comply with the requirements of the underlined portions of the Iowa Code, MidAmerican completed analyses to address the following questions:

   a. Can future Iowa nuclear generation deployments be cost effective in a carbon constrained environment?,

b. Are there suitable preferred candidate sites for Iowa nuclear generating facilities and where would they be located?,

c. Are nuclear technologies technically potentially feasible for an Iowa deployment, especially the light-water passive SMR technologies currently under development?, and

d. Are there economic development differences for Iowa and the local region surrounding potentially suitable candidate sites, if the future Iowa baseload generation mix includes nuclear generation alternatives?

2. The utility shall file such information with the board as the board deems appropriate, including the filing of an annual report identifying and explaining expenditures identified in the rider as items for cost recovery, and any other information required by the board. (476.6.22b)

a. MidAmerican filed the first annual report identifying and explaining expenditures on November 23, 2011 (Docket TF-2011-0134). The Board issued a request for additional information on December 12, 2011, which MidAmerican provided on December 22, 2011. The Board closed the docket on January 13, 2012.

b. MidAmerican filed its second annual report identifying and explaining expenditures on November 16, 2012 (Docket TF-2012-0636). The Board provided MidAmerican an approval letter on December 14, 2012.

c. This filing is intended to present to the Board a final summary of the findings of the analysis of the preparations for the possible construction of nuclear generating facilities in Iowa.

3. "Costs that may be recovered through the rider described in paragraph "b" shall be consistent with the 'United States Nuclear Regulatory Guide, Section 4.7, General Site Suitability Criteria for Nuclear Power Stations, Revision Two, April 1998,' including costs related to the study and use of sites for nuclear generation." (476.6.22 c)

To fulfill the requirements of the underlined sections MidAmerican completed the following:

a. Retained an outside consultant experienced in completing the site selection process consistent with Regulatory Guide 4.7 (i.e., Sargent & Lundy);
b. Used an accepted industry methodology to complete the "study and use" of a potential site consistent with Regulatory Guide 4.7, beginning with the state of Iowa as the region of interest;
c. Obtained options to land at the identified potentially suitable candidate sites to facilitate additional on-site investigations; and
d. Completed the economic and technical assessment to evaluate if the use of a site could be necessary.

DISCUSSION OF MIDAMERICAN'S CONCLUSION 1

Conclusion 1: *In a carbon constrained environment, nuclear generation deployments in Iowa offer the potential to be a cost effective generating option over their operating life when compared to natural gas combined cycle units. Critical evaluation inputs into this analysis include the future domestic natural gas supply, level of future economic growth,* *US carbon pricing policy and the pricing of SMR engineering, procurement and construction contracts.*

MidAmerican selected NERA Economic Consulting (”NERA”) to assess whether nuclear generation could be a cost effective generating option in Iowa. In response, NERA completed the study*, “A Comprehensive Financial and Economic Assessment of Future Iowa Baseload Generation in a Carbon-Constrained Environment”.* (Exhibit RJS-4)

In this report, NERA concluded, “A nuclear SMR deployment could be a cost effective choice for MidAmerican’s customers compared to a deployment of natural gas combined cycle over the anticipated 60-year life of a nuclear SMR facility.”[9] This conclusion was based upon NERA’s independent analysis presented in the referenced report, which assume the future would be carbon constrained.

<u>NERA Analytical Approach</u>

To complete the assessment, NERA developed an analytical approach summarized as follows:

- NERA developed projections for eight specific US energy market scenarios through 2080 based upon three primary drivers: 1) domestic natural gas supply availability, 2) economic growth, and 3) US environmental and carbon policy, assigning a specific probability of occurrence to each of the eight energy market scenarios.
- Using a nationally-recognized forecasting model (i.e., National Energy Modeling System or “NEMS”) developed by the Department of Energy’s (“DOE”) Energy Information Administration (“EIA”), NERA produced eight national and Iowa-

[9] See Executive Summary pages 1 through 9, Exhibit RJS-4

specific natural gas price projections for a carbon constrained future, adjusting for the three primary drivers in each of the eight specific energy market scenarios.

- Using the projections from the NEMS model along with two different baseload generation deployment plans for MidAmerican (either natural gas combined cycle or nuclear SMR), NERA completed revenue requirement comparisons over the period 2012 through 2080 for a gradual 2,400 MW (nominal) deployment of baseload natural gas and nuclear generation in Iowa between 2020 and 2033.

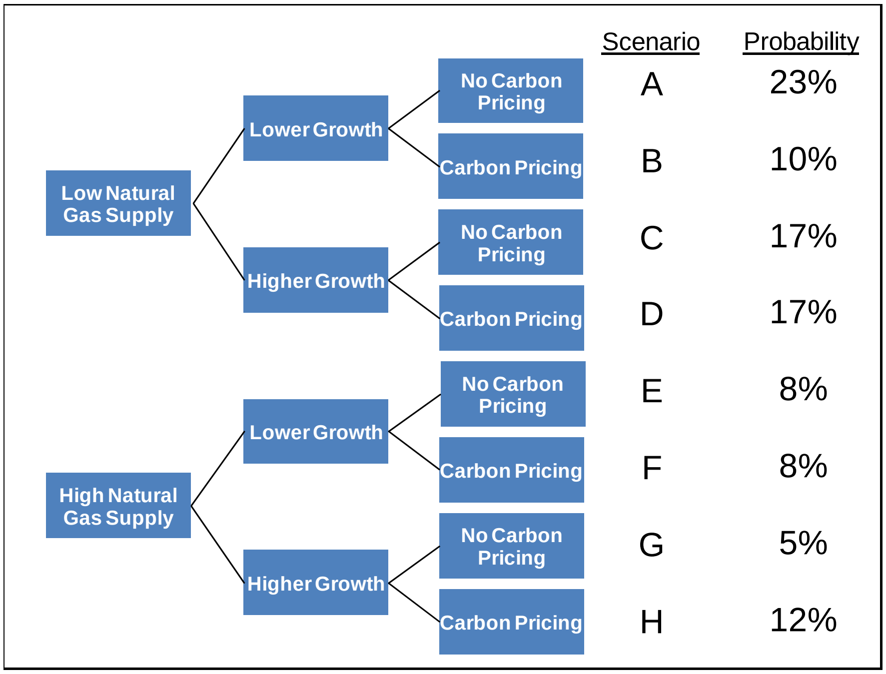
<u>NERA Energy Market Scenarios</u>[10]

NERA developed eight specific energy market scenarios based upon the combination of natural gas supply, economic growth, and federal environmental policy, which are shown in the figure below. Each of the input variables was weighted based upon NERA's assessment of the probability of the occurrence[11]. This resulted in a probability of the likely outcome of each of the eight energy scenarios.

[10] The eight energy market scenarios are discussed in Section II. Energy Market Scenarios, Exhibit RJS-4 pages 13 through 26

[11] See Figure 12, Exhibit RJS-4, page 23 for weighting factors for each variable.

Energy Market Scenario Tree

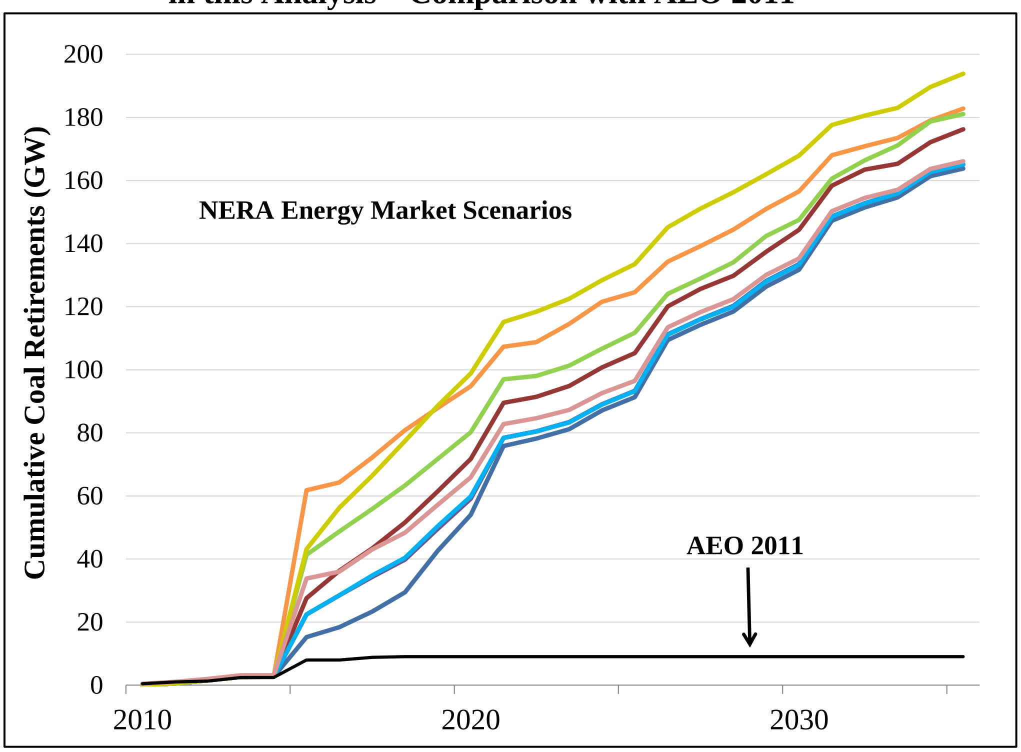


- NERA used two natural gas supply projections: one directly from the EIA assumptions from the Annual Energy Outlook ("AEO") 2011 Reference Case (i.e., High Natural Gas Supply), and a second (i.e., Low Natural Gas Supply) based upon a combination of EIA assumptions selected by NERA experts[12] to reflect an alternative natural gas resource and recovery projection with comparable likelihood to that of the 2011 AEO Reference Case.
- For economic growth[13], NERA utilized two values of US gross domestic product ("GDP") (annual growth of 2.7% and 3.2% from 2012 through 2035) consistent with EIA's AEO 2011 Reference Case and High Economic Growth Case.
- To capture the "carbon constrained environment", NERA projected potential EPA environmental constraints on emissions of greenhouse gases ("GHGs") and other

[12] In the 2012 AOE, EIA reduced its Reference Case natural gas resource assumption by 42%, which is more consistent with the NERA expert opinion, see Figure 11, page 22, Exhibit RJS-4
[13] The resulting average electricity growth rates vary between 0.3% and 1.2% for the eight energy market scenarios, see Figure 57, page 100 Exhibit RJS-4.

emissions associated with fossil fueled generation. To incorporate GHG constraints for all eight scenarios, NERA developed a representation of the implementation of new source performance standards ("NSPS") for GHGs from existing coal and other fossil fueled steam units[14]. The NERA NSPS representation sets efficiency limits by state. This would result in a significant increase in coal unit retirements between 2010 and 2035, as shown below (these GHG policies are not reflected in EIA's AEO 201 Reference Case shown for comparison, which assumes no carbon constraints).

Cumulative US Coal Retirements (in GW) in Eight NERA Energy Market Scenarios in this Analysis – Comparison with AEO 2011



In addition to the NSPS GHG constraints, NERA also included the probability of "Carbon Pricing" of $20.27 per metric ton of CO_2 emissions beginning in 2020 and

[14] For discussion of these environmental assumptions see Section III C. 3, Environmental, Exhibit RJS-4, page 31 through 34.

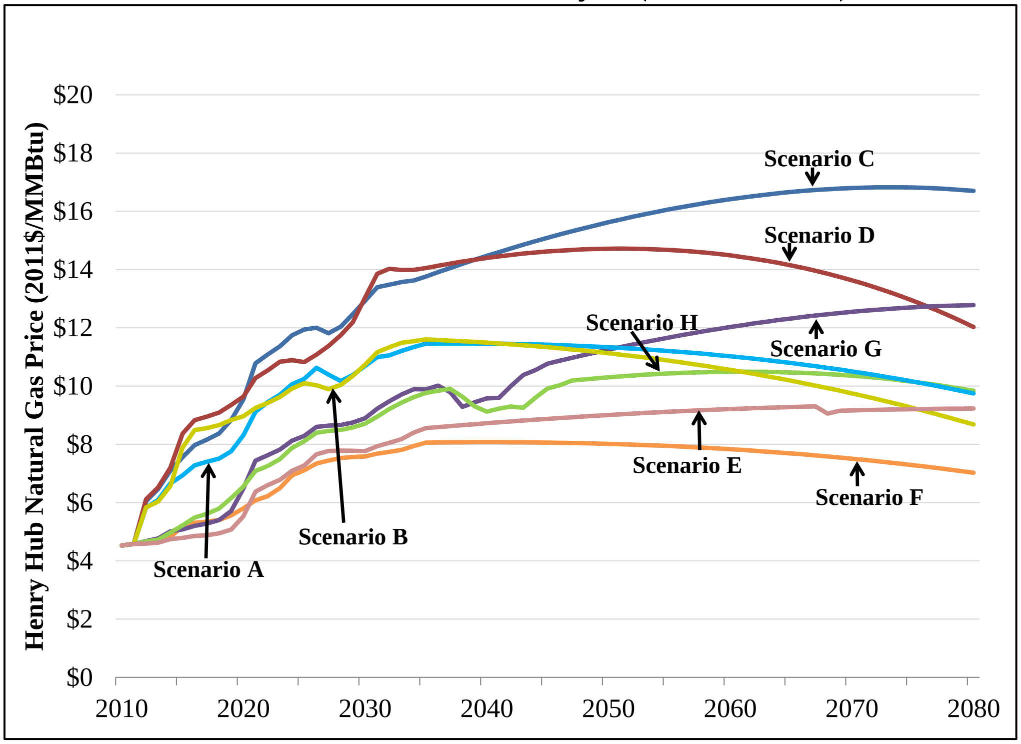
escalating at 5% per year in real terms in four of the energy market scenarios so identified.

Resulting NERA Natural Gas Price Projections[15]

NERA developed a natural gas forecast for each of the eight energy market scenarios. The NERA forecast method used EIA's integrated NEMS model[16] through 2035, which assessed the energy needs across all US energy consuming sectors (e.g., electricity, industrial and commercial use, residential heating use, transportation, etc.). NERA then extrapolated these results through 2080 using NERA-developed techniques that considered changes in natural gas demand in both electric and non-electric sectors over time. As shown on the following figure, the energy market scenario with high natural gas supply, low economic growth and carbon pricing results in the lowest natural gas price forecast through 2080, while the energy market scenario with low natural gas supply, high economic growth and no carbon pricing provides the highest natural gas prices.

[15] For discussion of results see Section IV. Natural Gas Forecast and Other Key Results for Energy Market Scenarios, Exhibit RJS-4, pages 44 through 58.
[16] The National Energy Modeling System or NEMS is disused in additional detail in Appendix B – Model Descriptions, Exhibit RJS-4, page 120 through 124.

Henry Hub Natural Gas Price Projections through 2080 under Eight Energy Market Scenarios in this Analysis (2011$/mmBtu)



Energy Market Scenario	A	B	C	D	E	F	G	H
Natural Gas Supply	Low	Low	Low	Low	High	High	High	High
Economic Growth	Low	Low	High	High	Low	Low	High	High
Carbon Price	No	Yes	No	Yes	No	Yes	No	Yes
Probability	23%	10%	17%	17%	8%	8%	5%	12%

247 <u>Revenue Requirement Comparisons: Nuclear Compared to Natural Gas Combined</u>
248 <u>Cycle</u>[17]

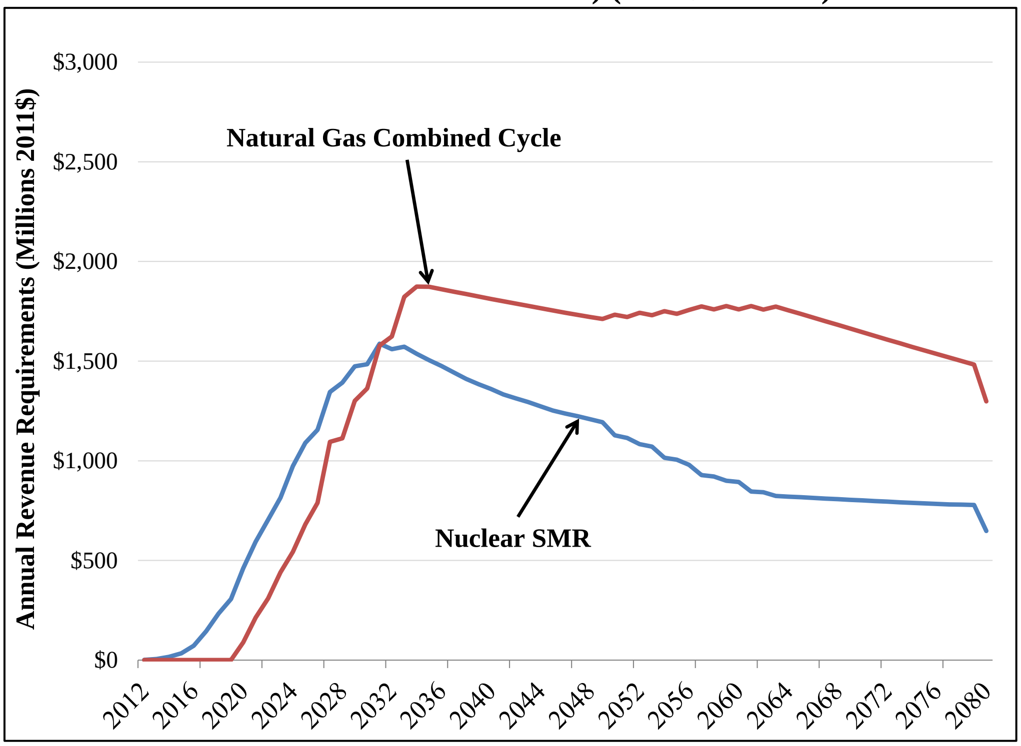
249 NERA calculated revenue requirements for each of the eight energy market scenarios
250 assuming either an Iowa natural gas combined cycle or nuclear SMR 2,400 MW
251 (nominal) gradual deployment from 2020 through 2033. The revenue requirements

[17] Financial analysis of the natural gas and nuclear deployment options are discussed in Section V. Financial Analysis of Exhibit RJS-4, pages 61 through 89 and Appendix A, Key Additional Results, pages 105 through 119

utilized NERA information from the natural gas price projections along with natural gas combined cycle unit information (primarily from EIA's AEO 2011), combined with nuclear SMR information from Sargent & Lundy and utility revenue requirement models. NERA evaluated the results as differences in the present value of these revenue requirements through 2080.

The comparison of the revenue requirements of an Iowa 2,400 MW nuclear or natural gas combined cycle deployment between 2020 through 2033 for the energy market scenario considered most likely by NERA (i.e., Scenario A) is shown on the following figure. The years prior to 2033 show higher annual revenue requirements for the nuclear project because of the financing costs during the construction of the nuclear facility. However, during the operational period the nuclear facility shows lower annual revenue requirements (costs) because of the higher fuel costs associated with the delivered natural gas fuel. On a present value basis, the nuclear deployment scenario has a $315 million (2011$) lower present value for this energy market scenario; exhibiting lower annual revenue requirements for about 50 years (i.e., 2030 through 2080).

Annual Revenue Requirements for Nominal 2,400 Nuclear and Natural Gas Deployment for Scenario A, 2012-2080 (Low Natural Gas Supply, Low Economic Growth and No Carbon Price) (2011$ Millions)



Each of the eight energy scenarios exhibit an annual revenue requirement stream similar in shape to the one provided above for Scenario A[18]. However, the discounting of future years provides a reduction in the present value to the future years. Therefore, as shown on the following figure, the present value of the natural gas scenarios may be lower even though the nuclear scenario has lower revenue costs during the last 50 years of the study period.

[18] Revenue requirements for all eight energy market scenarios are provided in Appendix A – Key Additional Results, Exhibit RJS-4, pages 105 through 112.

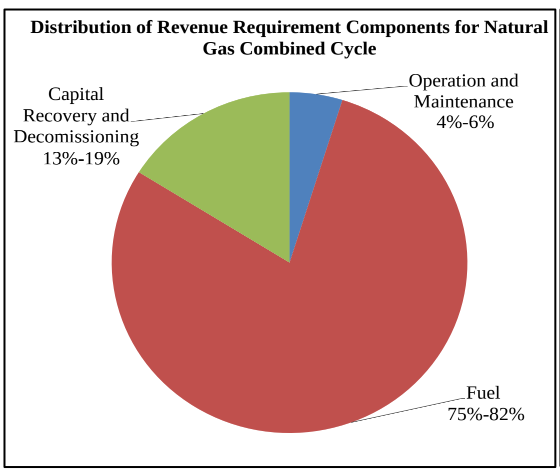
Net Present Value of Revenue Requirements for 2,400 MW Nuclear SMR and Natural Gas Combined Cycle Deployment for Eight Discrete NERA Natural Gas Forecasts (2011$)

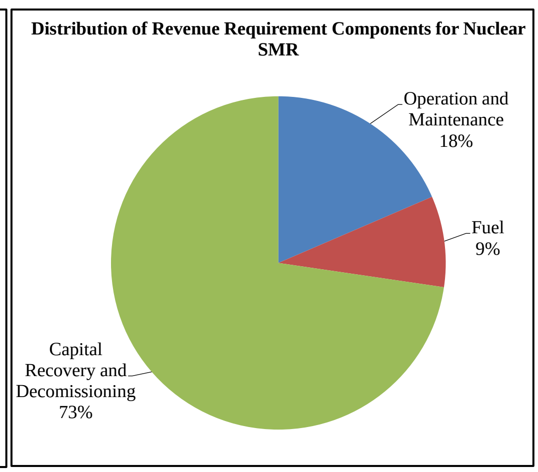
Energy Market Scenario	NPV of Combined Cycle Revenue Requirement (Millions$)	NPV of Nuclear SMR Revenue Requirement (Millions$)	NPV of Difference in Revenue Requirements (Millions$)
A	$13,080	$12,765	$315
B	$15,417	$12,765	$2,652
C	$15,655	$12,765	$2,890
D	$17,726	$12,765	$4,961
E	$11,051	$12,765	($1,713)
F	$12,806	$12,765	$41
G	$12,621	$12,765	($144)
H	$14,556	$12,765	$1,791
Probability Weighted Average	$14,482	$12,765	$1,717

Energy Market Scenario	A	B	C	D	E	F	G	H
Natural Gas Supply	Low	Low	Low	Low	High	High	High	High
Economic Growth	Low	Low	High	High	Low	Low	High	High
Carbon Price	No	Yes	No	Yes	No	Yes	No	Yes
Probability	23%	10%	17%	17%	8%	8%	5%	12%

As shown above, the nuclear deployment scenarios have a lower present value of revenue requirements in a carbon constrained environment except in energy market scenarios characterized by high natural gas supply and no carbon pricing.

A breakout of the revenue requirements for the natural gas and nuclear deployment scenarios is shown in the following figures. For the natural gas combined cycle deployment, NERA estimated that 75% to 82% of the revenue requirements over the 60-year study period would be related to the delivered price of firm natural gas fuel. The smallest share of revenue requirements are the operation and maintenance costs, representing 4% to 6% of the costs, which are attributable to the small staffing requirements of approximately 25 employees per 500 MW natural gas combined cycle unit. For a nuclear deployment, 73% of the revenue requirement is related to the investment and financing of the capital expenditures for the facility. The next largest component of cost is related to the operation and maintenance of the nuclear facility, the nuclear facility having a significantly larger operating staff compared to the combined cycle facility.





Based upon these results, NERA completed a comparison of the two primary differentiators in present value of revenue requirements: 1) the delivered firm natural gas price projection, and 2) the engineering, procurement and construction ("EPC") contract price (i.e., capital investment) of the nuclear SMR generating unit deployment. For each natural gas price projection, NERA determined a breakeven EPC contract price holding all other independent variables at their base values. The breakeven EPC cost for nuclear

SMR ranges from a low of just over $3,000/kW to a high of almost $8,000/kW, as shown in the following figure. SMR vendors have publicly released EPC price estimates in the $4,000 to $5,000/kW range. However, no firm EPC contracts have been awarded for these SMRs.

Energy Market Scenario	Breakeven Nuclear SMR EPC Capital Cost ($/kWe)
A	$4,514
B	$6,118
C	$6,281
D	$7,702
E	$3,122
F	$4,326
G	$4,199
H	$5,527

Energy Market Scenario	A	B	C	D	E	F	G	H
Natural Gas Supply	Low	Low	Low	Low	High	High	High	High
Economic Growth	Low	Low	High	High	Low	Low	High	High
Carbon Price	No	Yes	No	Yes	No	Yes	No	Yes
Probability	23%	10%	17%	17%	8%	8%	5%	12%

If the EPC contract price that will be offered at a future decision date were to be above the breakeven contract price in the above figure, then the revenue requirements for the natural gas fueled combined cycle deployment would be lower (ignoring the possible benefits of fuel diversity, reduced fuel price volatility, economic development, etc.).

NERA reasoned that the future SMR EPC contract price and the breakeven contract price will be known with greater precision when it is time to make the actual decision to commit resources to a nuclear SMR or natural gas combined cycle facility. NERA stated the relatively short construction time for new natural gas combined cycle facility would allow MidAmerican ample time to deploy natural gas combined cycle units (instead of nuclear SMR) if the EPC prices for an SMR deployment are found to be above the breakeven contract price at that decision point and a nuclear SMR deployment is not pursued.

Sensitivities and Probability Distribution of Outcomes[19]

NERA also evaluated several uncertainties independent from the natural gas price projections to obtain a distribution of probable outcomes for deploying nuclear or natural gas in a carbon constrained environment. NERA identified three independent uncertainties as being most relevant:

1. Delay in Nuclear Deployment - The NERA nuclear delay sensitivity assumed a 2.5 year delay beginning in the second quarter of 2012. The 2.5 year delay (to the fourth quarter of 2014) in the nuclear deployment improves the present value of revenue requirements for the nuclear SMR relative to the natural gas combined cycle deployment. This reduction in nuclear deployment revenue requirements is attributable to delaying the relatively higher upfront capital costs associated with nuclear generation. The relatively small magnitude of the reduction is due to the lower offsetting costs of replacement power purchases during the period of delay. This indicates that deferring the decision for nuclear SMR or natural gas

[19] See Section V. 10. Sensitivity Analysis Summary Results, and Section E. Risk Analysis, Exhibit RJS-4, pages 81 through 89 provide additional discussion.

combined cycle deployment beyond the second quarter 2012 could be beneficial with respect to customer revenue requirements.

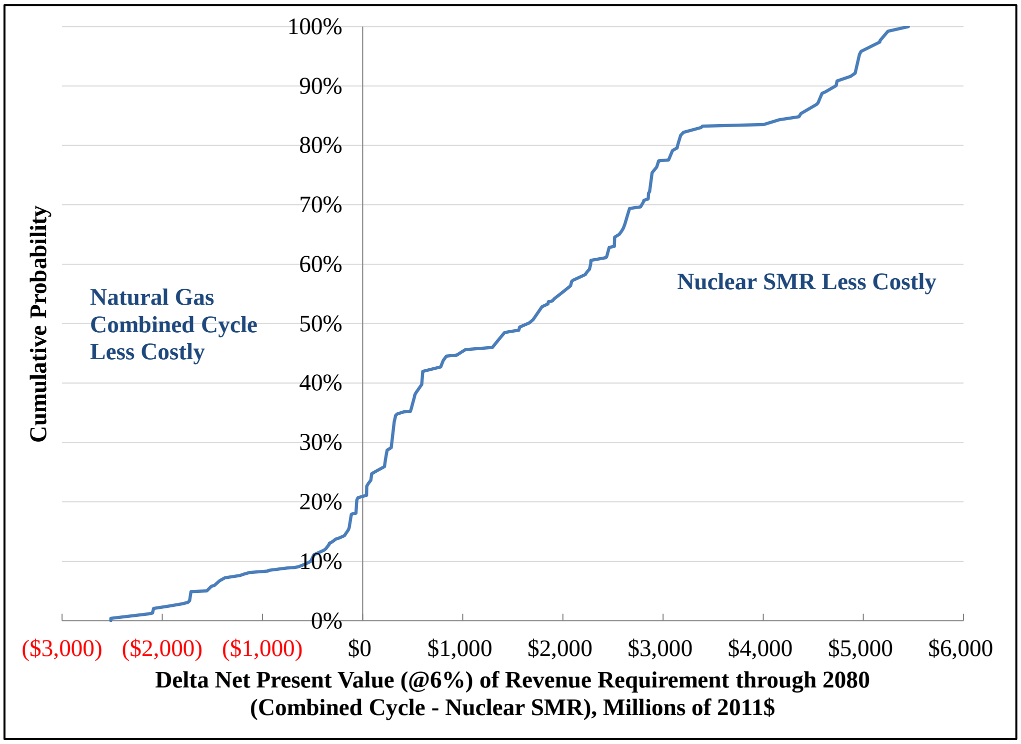
2. Uranium fuel prices - While not subject to the same volatility observed in natural gas markets, there is uncertainty associated with available stocks of uranium in the global market. NERA developed two alternatives to its base uranium fuel price forecast one with higher prices and one with lower prices assigning a probability of occurrence to each.

3. Fixed operating and maintenance ("O&M")/labor costs - There is uncertainty regarding both the cost of labor and the quantity of labor for both nuclear and natural gas combined cycle units. The fixed O&M/labor costs for the nuclear SMR units are significantly larger than those for the natural gas combined cycle generating units. NERA developed two alternatives to its base assumptions regarding fixed O&M/labor costs based on percentages of the base forecast. The higher O&M/labor assumptions benefit the natural gas combined cycle revenue requirements because of the SMR's higher percentage of fixed O&M/labor costs (lower O&M/labor assumptions benefit the nuclear deployment scenario).

Using the nuclear SMR cash flow and revenue requirements models provided by MidAmerican and Sargent & Lundy, NERA developed a cumulative probability distribution function combining the uncertainties of the various natural gas price projections and the three significant independent variables. Comparing the deployment of 2,400 MW of incremental generation installed gradually from 2020 through 2033, the projected present value of revenue requirements through 2080 would be less for a nuclear

SMR deployment relative to a natural gas combined cycle deployment in approximately 80% of the instances; assuming a carbon constrained environment.

Difference in Net Present Value of 2012 through 2080 Revenue Requirements in a Carbon Constrained Environment



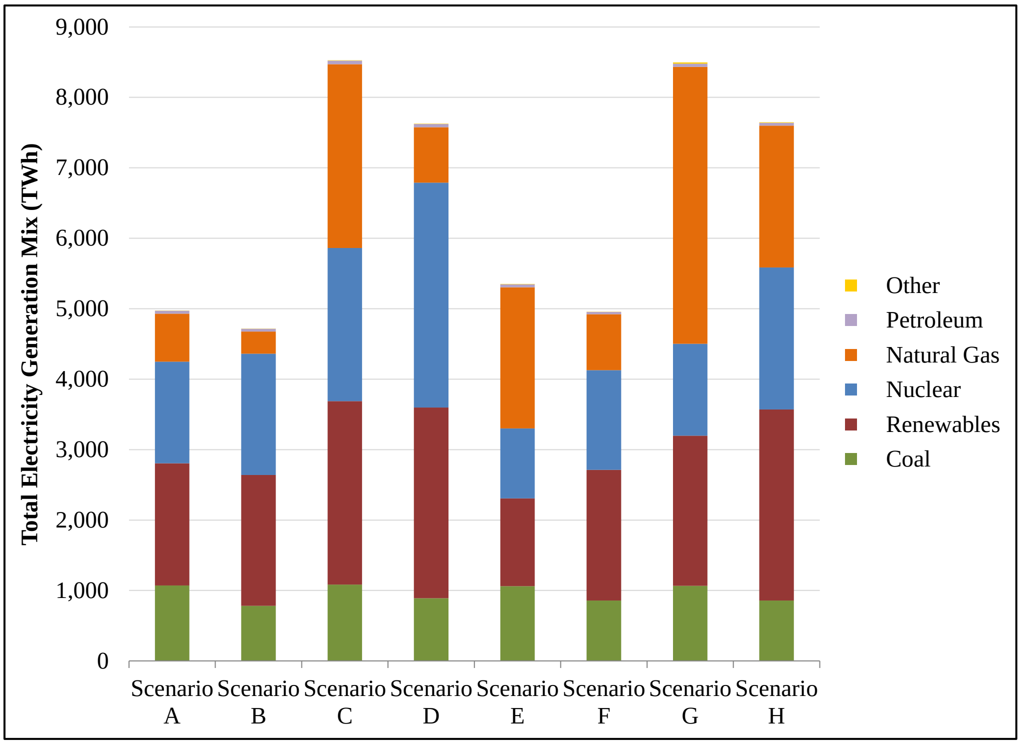
<u>Generation Mix in 2080</u>

NERA projected the 2080 US energy generation mix in a carbon constrained environment for each of the energy market scenarios. These results are shown below and can be summarized as follows:

1. All current fuel sources remain a viable portion of the generation mix with carbon capture and sequestration on coal fueled facilities beginning in 2040 (for scenarios with a carbon price) and 2060 (for scenarios without a carbon price).
2. Economic growth is a dominate driver and directly related to the amount of energy consumed.

3. The long-term supply assumption of natural gas is the primary driver in its continued use through 2080.
4. Renewable energy resources supply about 20% to 40% of electricity needs, always greater in the scenarios of a carbon price, if other things are held constant.

Energy Generation Mix in 2080 (TWh)



Energy Market Scenario	A	B	C	D	E	F	G	H
Natural Gas Supply	Low	Low	Low	Low	High	High	High	High
Economic Growth	Low	Low	High	High	Low	Low	High	High
Carbon Price	No	Yes	No	Yes	No	Yes	No	Yes

DISCUSSION OF MIDAMERICAN'S CONCLUSION 2

MidAmerican's second conclusion is as follows:

> *Conclusion 2: Following a detailed site selection process, a site in Muscatine County appears suitable for nuclear generation deployment; no conditions that would be expected to make this site unlicensable or economically unfeasible were identified after an initial assessment. However, significant additional analysis and submittal of an Early Site Permit application to the Nuclear Regulatory Commission ("NRC") would be necessary to confirm the site can be licensed; a process that would take several years and could cost an estimated $50 million.*

<u>General Assessment Process</u>

MidAmerican contracted Sargent & Lundy in May 2010 to perform an assessment for suitable candidate sites. The initial guidance to Sargent & Lundy was to identify one or more sites consistent with NRC Regulatory Guide 4.7 and which have the potential to accommodate all US light-water reactor designs, resulting in a minimum site design limit of 1,500 MW of generation. The assessment followed a systematic, industry-accepted process to characterize and select one or more sites that comply with the site suitability criteria described in NRC Regulatory Guide 4.7; and the additional guidance addressed in Iowa Code 476.6.22. The assessment utilized the Electric Power Research Institute (EPRI) report, *Siting Guide: Site Selection and Evaluation Criteria for an Early Site Permit*, ("EPRI Siting Guide"), which provides a structured process for compliance with NRC requirements. The Sargent & Lundy site assessment was completed in two phases. The purpose of the Phase I study was to identify, based on publicly available information, one or more potentially suitable sites for a possible nuclear generation in the state of

Iowa. Such sites would then be further evaluated in a Phase II study based on more detailed evaluations as to the suitability of these sites.

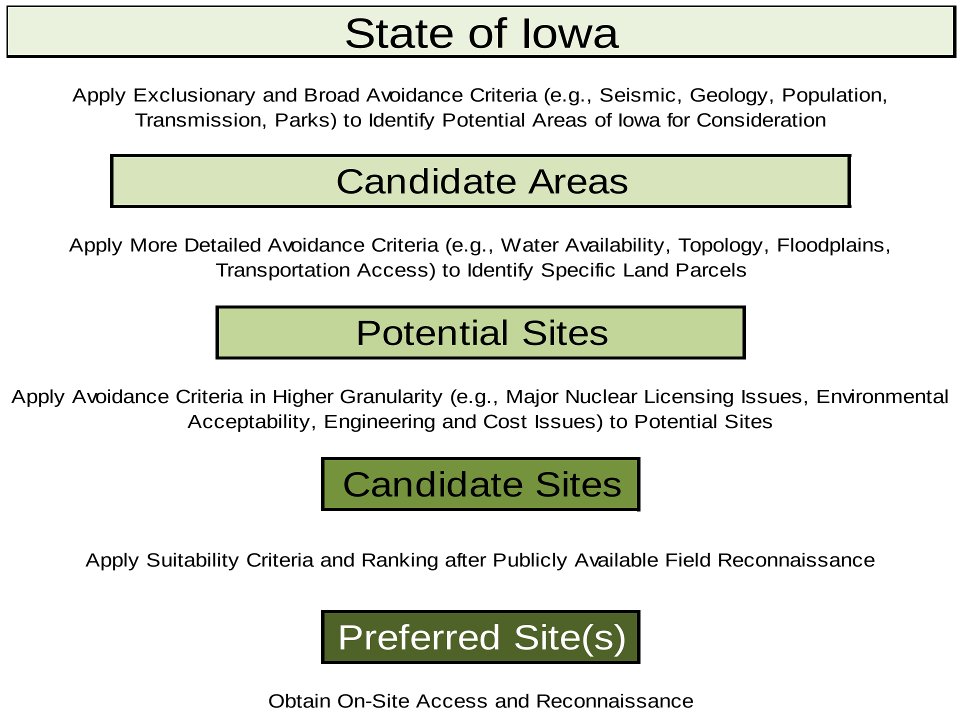
Phase I Site Selection Study

The Phase I Site Selection Study is provided as Exhibit RJS-2. The primary objectives of the Phase I Site Selection Study were to assess the entire state of Iowa for the availability of potential nuclear sites in a systematic, flexible, defensible, and quantitative manner consistent with the requirements of Iowa Code 476.6.22.

The Phase I study was based on information available in the public domain and from public access reconnaissance level site visits. The site properties were not accessible in Phase I, and on-site investigations were not feasible. Project-specific discussions with landowners and elected officials were also not practical in Phase I.

The Phase I study process applies an increasingly granular set of nuclear siting characteristics designed to select the more favorable sites during each step of the process, which is outlined in the following figure[20].

[20] See Section 3, Site Selection Process, Exhibit RJS-2, pages 3-1 through 3-16 for discussion of the general site selection process.



Completing the process required the execution of the following major tasks:

1. Establish the Region of Interest[21]. The Region of Interest[22] (ROI) is the area to be considered in performing the site selection study, and in this application was the entire state of Iowa.
2. Develop Siting Criteria. Siting criteria are the factors and conditions used to identify Candidate Areas, Potential Sites, and Candidate Sites and to perform a comprehensive evaluation of the identified Candidate Sites. In this instance the siting criteria followed the EPRI Siting Guide which incorporates the Regulatory Guide 4.7 requirements.
3. Identify Candidate Areas. Candidate Areas are areas within the ROI that remain after unsuitable areas are eliminated.

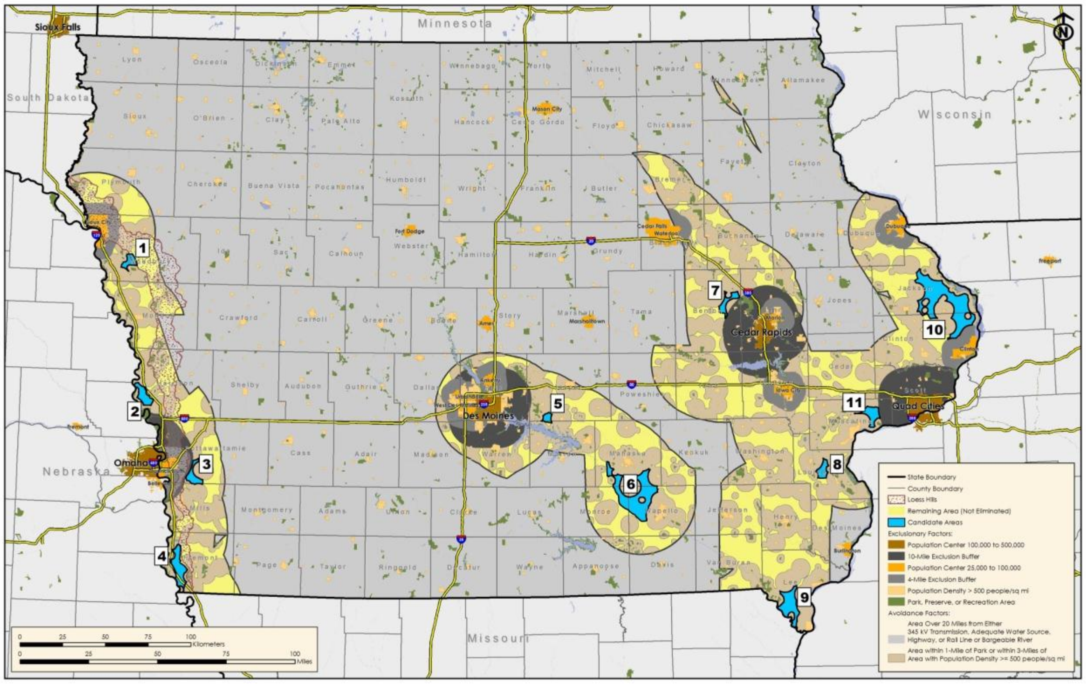
[21] See Section 4, Region of Interest, Exhibit RJS-2, pages 4-1 through 4-5 for general discussion of the region of interest.
[22] Terms are defined in defined in NUREG-1555

4. Identify Potential Sites. Potential Sites are specific locations within the Candidate Areas that are identified for preliminary assessment in establishing Candidate Sites.
5. Identify Candidate Sites. Candidate Sites are those Potential Sites that are considered to be among the best sites that can reasonably be found in the Region of Interest for the siting of a nuclear power plant.
6. Evaluate Candidate Sites. Candidate Sites were evaluated using numerical scoring criteria based on Regulatory Guide 4.7 and the EPRI Siting Guide to identify the highest ranked sites.

Beginning with the state of Iowa as the Region of Interest, unsuitable areas within this region were eliminated. These included avoiding those areas with limited access to water, transportation, and transmission or with high population densities or potential public amenity impacts. In total, 11 suitable Candidate Areas throughout Iowa were identified as shown below[23]:

[23] The selection of the candidate areas and the criteria used are discussed in Section 5 Candidate Areas, Exhibit RJS-2, pages 5-1 through 5-19.

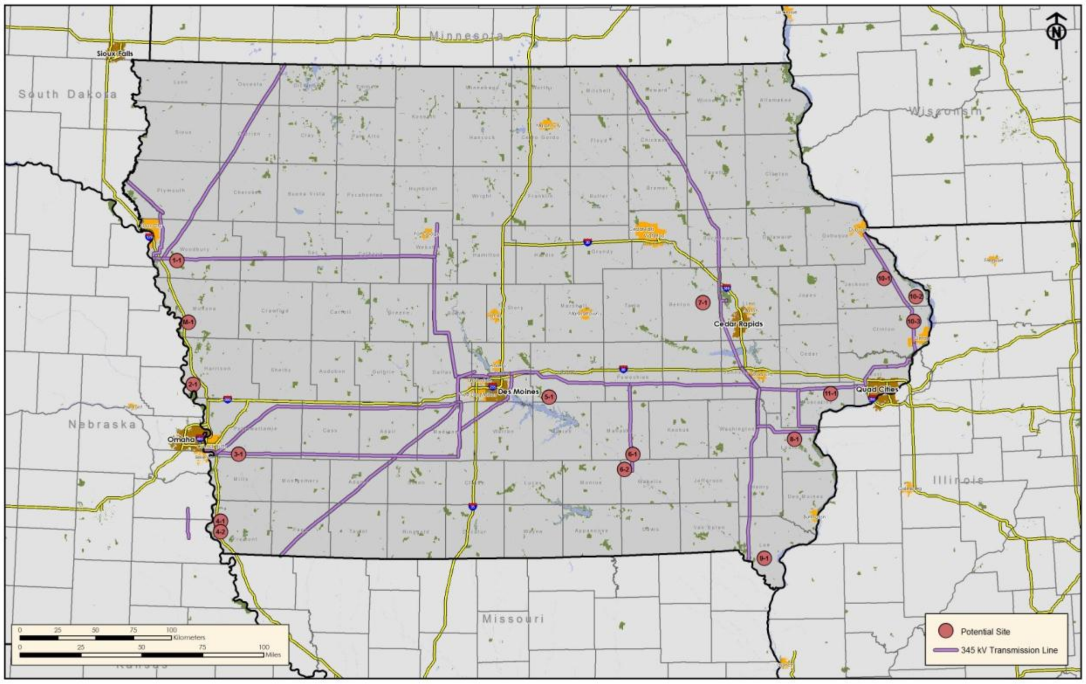
Candidate Areas



In order to identify Potential Sites[24], the Candidate Areas were screened for specific locations that appeared suitable for a nuclear generation deployment. Existing fossil power plant sites and other properties owned by MidAmerican were considered, but none were found to be suitable applying the screening criteria consistently. In addition, state and county economic development agencies were asked to identify properties that met certain minimum requirements and were potentially available for industrial development. Several agencies provided information regarding such properties, and one of these properties was found to meet the screening requirements and was included as a Potential Site. Overall, 16 Potential Sites were identified. These Potential Sites, located across Iowa, are shown below.

[24] The selection of the potential sites from the candidate areas is discussed in Section 6, Potential Sites, Exhibit RJS-2, pages 6-1 through 6-15.

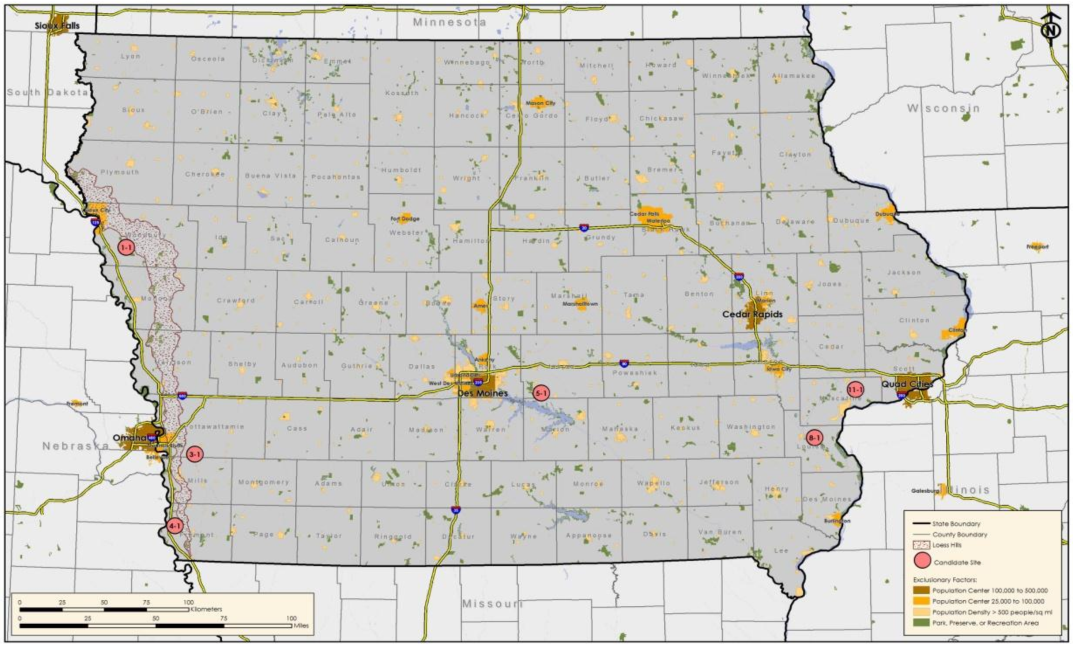
Potential Sites



The Potential Sites were subjected to an initial scoring evaluation of physical characteristics by Sargent & Lundy[25], and the six most favorable locations were selected as Candidate Sites. These Candidate Sites are shown below:

[25] The selection of the candidate sites from the potential sites is discussed in Section 7 Candidate Site, Exhibit RJS-2, pages 7-1 through 7-14. The evaluation criteria and scores of the potential sites are shown on Table 7-2, Summary of Potential Site Scores, Exhibit RJS-2, page 7-12.

Candidate Sites



The Candidate Sites were further evaluated using numerical scoring criteria based on Regulatory Guide 4.7 and the EPRI Siting Guide. The numerical scores covered 49 criteria related to Health & Safety, Environmental, Socioeconomic & Land Use, and Engineering & Cost issues[26]. The Candidate Sites were then ranked according to their numerical scores, with and without the application of importance weighting factors. As shown in the figure below, the sites in Fremont County (Site 4-1) and Muscatine County (Site 11-1) were the most favorable Candidate Sites with regard to the factors considered in Phase I.

[26] The winnowing process is discussed in Section 8, Evaluation of Candidate Site, Exhibit RJS-2, pages 8-1 through 8-37. The evaluation criteria of the candidate sites are shown in Exhibit RJS-2, Appendix M, Candidate Site Numerical Scoring Criteria, and the evaluated numerical scores on Table 8-12, Summary of Numerical Site Scores, Exhibit RJS-2, page 8-36.

Phase I Site Rankings Based on Total Weighted Scores

Site	Total Weighted Score
11-1	681
4-1	632
8-1	585
5-1	569
1-1	565
3-1	564

The Fremont County (Site 4-1) and Muscatine County (Site 11-1) sites were the highest-ranked sites based on weighted and unweighted overall scores. They also were the highest-ranked sites based on scores related to Environmental and Socioeconomic & Land Use impacts. In addition, a qualitative assessment of significant advantages and disadvantages found that the Fremont County and Muscatine County sites have the most advantages and the fewest disadvantages of all of the Candidate Sites. Therefore, these sites were selected for further study for potential use in hosting a nuclear generating facility in Phase II.

Phase II Site Selection Study[27]

The Site Selection Study Phase II objective was to perform more detailed evaluations of the suitability of the sites identified in Phase I to provide a greater understanding if one, both, or neither of the sites may be usable. The Phase II Site Selection Study included a more detailed evaluation, including obtaining additional information that was not readily

[27] Exhibit RJS-3, Site Selection Phase II Report, Completed by Sargent & Lundy LLC, April 2013 includes the discussion of all the supporting analysis that was completed.

publicly available, or which required on-site confirmation or local public contacts. The Phase II assessments were completed for each potential site in the following areas:

- Wetlands and endangered species evaluations
- Cultural resource investigations
- Socioeconomic impact studies
- Site environmental walk downs and assessment
- Water and wastewater evaluation
- External industrial and transportation hazard investigations
- External flooding evaluations
- Makeup water availability and conceptual locations
- Geotechnical investigations

One of the primary purposes of the Phase II study was to identify any prohibitive characteristics (i.e., conditions that could make a site unlicensable or economically unfeasible) that might be present at either site. Examples of potential prohibitive characteristics include: environmental conditions such as extensive wetlands and significant cultural resources; and geotechnical conditions such as excessive settlement potential, inadequate soil bearing capacity, and extensive soil liquefaction potential. The Phase II information also allowed a more complete evaluation of the siting requirements specified in Regulatory Guide 4.7 and the EPRI Siting Guide.

<u>Phase II Assessment Scores</u>

A total of 25 additional evaluation criteria which were not evaluated in Phase I were included in the Phase II numerical evaluations relying upon on-site data and site specific contacts. This resulted in a total of 74 site evaluation factors being considered in Phase I and Phase II. The two preferred sites were ranked according to their total weighted scores (obtained by summing the numerical scores after multiplying each score by its Importance Weighting Factor) and their total unweighted scores (obtained by summing the numerical scores without applying Importance Weighting Factors)[28]. The results of the Phase II scoring are shown below:

Phase II Site Rankings Based on Health & Safety Scores

Site	Weighted Score
Muscatine	335
Fremont	304

Phase II Site Rankings Based on Environmental Scores

Site	Weighted Score
Muscatine	203
Fremont	190

Phase II Site Rankings Based on Socioeconomic & Land Use Scores

Site	Weighted Score
Muscatine	147
Fremont	140

[28] Exhibit RJS-3, Table 3-3 provides the scoring of both sites for all criteria, see pages 3-52 through 3-56.

Phase II Site Rankings Based on Engineering & Cost Scores

Site	Weighted Score
Muscatine	277
Fremont	229

Phase II Site Rankings All Areas

Site	Total Weighted Score
Muscatine	962
Fremont	863

The total weighted scores for the Muscatine County and the Fremont County sites were 962 and 863, respectively. The unweighted scores for the Muscatine County and the Fremont County sites were 280 and 255, respectively. The Muscatine County site has significantly higher weighted and unweighted overall total scores. In addition, the Muscatine County site ranks higher according to the scores in each of the four categories of issues considered (Health & Safety, Environmental, Socioeconomic & Land Use, and Engineering & Cost).

<u>Phase II Assessment of Risks</u>

In summary, the Phase II evaluations did not uncover any conditions or characteristics which would be expected to prohibit licensing at either of these preferred candidate sites. The two sites are similar to one another with regard to many of the factors evaluated. However, there is the potential for significant economic risks for the Fremont County site resulting from external flooding issues. The worst-case maximum flood level due to upstream dam failures could range between Elevation 963 feet and Elevation 982 feet.

These high flood levels would greatly impact the economic suitability of the Fremont County site because they may require raising the site grade as high as 50 feet above the existing grade or constructing a protective berm, requiring fill to be trucked in at a significant expense. The upstream dam failure evaluations for the nearby Fort Calhoun and Cooper nuclear generating stations are in progress by the licensees of those facilities. These evaluations will provide additional NRC regulatory certainty for the dam failure flood evaluation methodology for the Fremont County site. Until then, there are significant economic risks related to external flooding hazards at the Fremont site. The cost of raising the site grade at the Fremont County site for flood protection is estimated to be greater than $500 million. By comparison, the total earthwork cost for the Muscatine County site is in the range of $35 million to $115 million. In addition, due to the high groundwater table and alluvial soils at the Fremont County site, dewatering for deep SMR foundations at the site would be significantly more complex and expensive compared to that at the Muscatine County site.

No karst features were encountered during the Phase II on-site geotechnical investigations at the Muscatine County site, but based on regional geology, this site has low to medium risks associated with the potential for karst features. These risks could be managed through grouting and foundation design provisions, if they were identified in the future.

Initial, transmission line stability evaluations have shown that the new transmission infrastructure required for the Fremont County site is more elaborate and more costly than that for the Muscatine County site. The Muscatine County site required about 185 fewer miles of transmission infrastructure, as an initial estimate.

Phase II Site Assessment Conclusions [29]

The results of Sargent & Lundy's Phase II evaluations indicate that the Muscatine County site is the more favorable site with regard to the issues considered. In addition to having the highest overall scores for the 74 site evaluation factors considered, the Muscatine County site has less economic risks associated with external flooding, soils, dewatering, transmission, and to a more limited extent industrial hazards.

The Phase II assessment provided valuable insight into suitability of sites when comparing the Muscatine County and Fremont County sites, both which were considered viable.

DISCUSSION OF MIDAMERICAN'S CONCLUSION 3

Conclusion 3: *Small modular reactors appear to have several potential advantages for an Iowa deployment compared to existing legacy nuclear units, including: improved safety, smaller required investment and the ability to incrementally match load growth. However, the NRC certification of the designs may take well into this decade to complete.*

A critical step in completing the "analyses of and preparations for the possible construction of nuclear generating facilities in this state that would be beneficial in a carbon-constrained environment" is to assess the technical viability of emerging nuclear reactor technologies. Because of their smaller incremental size and passive safety features, light-water-cooled, pressurized water small modular reactors (SMRs) may be a preferred reactor technology for a deployment in Iowa. The future decision to deploy this specific technology requires the assessment of available SMR technologies, including the capabilities of the SMR technology suppliers, and other business and strategic

[29] A complete discussion of Sargent & Lundy's conclusions is included in Exhibit RJS-3, Section 4. Summary and Conclusions, pages 4-1 through 4-7

considerations. To assess the viability of these SMR technologies, MidAmerican completed the following:

- MidAmerican staff directly participated in the Nuclear Energy Institute Small Modular Reactor Task Force to understand the regulatory and licensing issues. This included public meetings with the NRC to discuss SMR specific regulatory topics.
- Nondisclosure agreements were negotiated with SMR vendors that allowed MidAmerican and its technical expert, Sargent & Lundy, to meet with each of the SMR vendors to freely discuss and assess the feasibility of SMRs; including items which may be considered confidential and proprietary by the vendors.
- MidAmerican staff directly participated in the SMR reactor vendors' customer or industrial advisory committees, which allowed for utility representatives to be briefed on the designs' progress and provide feedback to the reactor vendors on each design.
- MidAmerican directed its technical expert, Sargent & Lundy to provide its assessment as to each of the proposed SMR vendor's: a) technical design, b) ability to be licensed, c) ability of the reactor vendor consortium to deliver the technology as promised and d) cost effectiveness.

The SMR technologies assessed included those being designed by NuScale Power, LLC; Generation mPower, Inc; Westinghouse Electric Company; and SMR LLC (Holtec International Company). The information used in these assessments is confidential and subject to non-disclosure agreements with the corresponding SMR suppliers.

The four SMR designs evaluated all have passive safety design features and have enhanced safety[30] and design benefits when compared to the current operating fleet of Generation III reactors, including those of the Fukushima Daiichi plant in Japan.

The Sargent & Lundy review noted the following general potential benefits of a SMR design employing passive safety systems:

- Plant designs with orders of magnitude in improved safety when compared to initial US nuclear deployments,
- Reduction or elimination of the number of active safety systems resulting in increased safety, lower overnight construction costs and lower operation and maintenance (O&M) costs;
- Increased levels of automation for plant operations potentially resulting in the need for fewer plant operators and more economical plant operations;
- Improved integration of the: a) handling and storage of used fuel, b) generation and storage of low-level radioactive waste, and c) plant security requirements into the initial physical plant design making these operations safer and less expensive; and
- Designs which permit standardized off-site manufacturing for modular construction, potentially resulting in lower costs, shorter on-site construction schedule, and improved quality.

While these are potential benefits of the SMR designs, the certification of a reactor design is completed by the NRC only after an extensive review process. The SMR vendor submittals of the design certification applications to the NRC are reported as follows:

[30] For example, NuScale Power LLC has recently announced that its SMR design is expected to achieve safe cool down indefinitely, with no operator actions, no AC or DC (battery) power and no additional water.

- Generation mPower, LLC: Third quarter 2014
- NuScale Power, LLC: Third quarter 2015
- Westinghouse Electric Company: Second quarter 2014

Assuming a four to five year review process by the NRC, design certifications would be awarded by the end of this decade.

DISCUSSION OF MIDAMERICAN'S CONCLUSION 4

Conclusion 4: *An Iowa nuclear deployment could result in considerably greater Iowa economic development benefits than a comparable natural gas combined cycle deployment based upon positive impacts on employment, gross state product, and personal disposable income in Iowa. In the site's local region, an estimated 795 operational employees would work on a fully developed 1,500 MW site; these operational employees would stimulate the creation of approximately 1,107 additional induced and indirect jobs in the local region. Total employment income for the local region during the plant's operating life, from all sources, is estimated at $134 million annually.*

To assess the economic development impacts of a SMR nuclear or natural gas combined cycle deployment, MidAmerican completed two evaluations:

- NERA evaluated the differences in Iowa employment, gross state product and disposable income, if 2,400 MW of nuclear compared to natural gas generation was deployed across Iowa; including the impact of differential electricity prices in Iowa, and
- The impact on direct, indirect and induced jobs, tax revenues, home values and support services in the local region around the preferred sites were assessed by Sargent & Lundy.

Iowa Statewide Economic Development Impacts

NERA evaluated the Iowa economic development impacts for the 2,400 MW Iowa nuclear SMR and natural gas combined cycle deployment options using the nationally recognized REMI Policy Insights Plus ("PI+") model[31]. The REMI PI+ model includes as inputs the estimates of the types and locations of the cash flows associated with the alternative baseload generation deployments and the resulting revenue requirements impact on Iowa electricity and natural gas rates.

The deployments of nuclear SMR and natural gas combined cycle generation have fundamental differences in the timing and composition of costs over the lifetime of each asset. This directly impacts economic development in Iowa. These differences include:

1. Higher on-site employment and expenditures for supplies at a nuclear SMR site;
2. Higher fuel costs for a natural gas combined cycle deployment that results in higher payments to entities outside Iowa; and
3. Differential Iowa electricity rates over the period through 2080 for the nuclear SMR and natural gas combined cycle deployments.

The economic development benefits to Iowa are more positive for a nuclear SMR deployment compared to a natural gas combined cycle generation deployment for each of the eight energy market scenarios, as shown below.

[31] Macroeconomic impacts on Iowa of the natural gas and nuclear deployment options are discussed in Section VI. Iowa Economic Development Analysis of Exhibit RJS-4, pages 90 through 104.

Comparison of Difference in Macroeconomic Results through 2080: Nuclear SMR less Natural Gas Combined Cycle in Iowa (All dollar values in 2011$)

Scenario Characteristics				Iowa Macroeconomic Results		
Energy Market Scenario	Average Henry Hub Price ($/mmBtu)	Average Electricity Demand Growth Rate	CO_2 Price in 2020 (2010$/ metric ton)	Present Value Increase in Iowa GSP (Millions$)	Average Annual Increase in Iowa Employment (Jobs)	Present Value Increase in Disposable Personal Income (Millions$)
A	$10.77	0.4%	$0	$5,336	7,039	$4,922
B	$10.46	0.3%	$20	$8,786	9,932	$7,104
C	$14.97	1.2%	$0	$6,744	7,396	$5,775
D	$13.53	1.0%	$20	$8,435	8,365	$6,813
E	$8.64	0.5%	$0	$2,358	5,109	$3,055
F	$7.60	0.4%	$20	$4,584	6,657	$4,454
G	$11.08	1.1%	$0	$3,625	5,269	$3,813
H	$9.94	1.0%	$20	$5,705	6,778	$5,096

Energy Market Scenario	A	B	C	D	E	F	G	H
Natural Gas Supply	Low	Low	Low	Low	High	High	High	High
Economic Growth	Low	Low	High	High	Low	Low	High	High
Carbon Price	No	Yes	No	Yes	No	Yes	No	Yes
Probability	23%	10%	17%	17%	8%	8%	5%	12%

The specific findings shown in the above figure are summarized below:

1. The present value of the Iowa Gross State Product ("GSP") through 2080 is estimated to be approximately $5 billion higher for a nuclear SMR deployment for the most likely energy market scenario (Scenario A – low natural gas supply, low economic growth, no carbon price), with a range of increases in Iowa GSP

across the eight energy market scenarios for the nuclear scenarios of $2.4 billion to $8.8 billion.

2. The Iowa average annual employment is estimated to be 7,000 higher[32] for a 2,400 MW nuclear SMR compared to a natural gas deployment for the most likely Scenario A, with a range of increases in average annual employment across the eight energy market for the nuclear deployment scenarios of 5,109 to 9,932.
3. The present value of Iowa disposable personal income is $5 billion higher for a nuclear SMR compared to a natural gas deployment for the most likely Scenario A, with a range of increases in Iowa disposable personal income across the eight energy market scenarios for the nuclear deployment of $3 billion to $7 billion.

There is no evaluated scenario, in a carbon constrained environment, in which the Iowa economic development is better through the deployment of 2,400 MW of natural gas generation compared to nuclear generation for the assessment period.

<u>Local and Regional Socioeconomic Development Impacts[33]</u>

Because the Muscatine County potential site was assessed as a suitable preferred candidate site with the strongest characteristics, the socioeconomic development impacts as assessed by Sargent & Lundy for the Muscatine County region are presented below. The socioeconomic impacts of constructing and operating a nominal 1,500 MW SMR facility would occur primarily in a six-county region surrounding the Muscatine County site. Demographic, economic, and employment data for this region were analyzed to estimate the direct and indirect effects of constructing and operating a potential nuclear facility. The results indicate that the six-county region would experience an increase in

[32] Note the Iowa employment values include the employment associated with the operation and support of the generating facilities and the employment impacts of changes in electricity rates.

[33] See Exhibit RJS-3, Site Selection Phase II Report, page 3-11

employment, income, economic activity, population, and tax revenues as a result of a nuclear facility deployment. There would be relatively minor increases in the incremental cost of providing public services and relatively minor demands on existing housing stock. The assessment indicated the facility would have predominantly positive effects on the region, and these effects would be stable and long term.

During the peak construction years, the nuclear power facility would provide up to approximately 1,880 temporary jobs to Muscatine County, and over the 11-year construction period, the construction workforce would receive total salaries of approximately $1.2 billion. Approximately 30% of the 1,880 peak construction workforce would be expected to migrate into the region, resulting in an in-migration of 564 workers. The in-migrated construction workers would stimulate the creation of approximately 457 temporary induced and indirect jobs. These direct, indirect and induced construction jobs would generate an additional employment income of approximately $75.8 million annually during the peak construction years.

Annual Income Impacts During Peak Construction Period

Annual Increase	Description
$47.4 million	Direct salaries paid to construction workers who move into the region
$28.4 million	Indirect and induced labor income stimulated by construction workers who move into the region
$75.8 million	***Total annual income benefit to the region during peak construction period***

Operation and maintenance of the facility would require a total workforce of 1,060. Of these, 795 employees would work on site in Muscatine County. Approximately 60% of the operational workforce would be expected to migrate into the region, resulting in an in-migration of 477 workers. The total salary and wages paid to the in-migrating operational workers will be approximately $50.1 million per year. The operational employees would stimulate the creation of approximately 1,107 induced and indirect jobs. These jobs could generate additional employment income of $39.6 million per year. While approximately 60% of the operational workforce is expected to move into the six county region, the other 40% (approximately 318 people) is assumed to already live in the region, but will receive higher incomes. The differential salaries and wages of these existing residents are estimated at $24.8 million with associated indirect and induced jobs creating another $19.6 million in income.

Annual Income Impacts During Operation Period

Annual Increase	Description
$50.1 million	Direct salaries paid to operational workers who move into the region
$39.6 million	Indirect and induced labor income stimulated by operational workers who move into the region
$24.8 million	Increased direct salaries paid to operational workers who are current residents of the region
$19.6 million	Indirect and induced labor income stimulated by increased salaries paid to operational workers who are current residents of the region
$134.1 million	***Total annual income benefit to the region during operating period***

The in-migrated construction and operational workers would generate significant sales tax and income tax revenues. In addition, the nuclear facility is projected to pay approximately $7.6 million in property taxes per year with $3.6 million to $3.8 million allocated to taxing authorities in Muscatine County and the balance allocated among taxing authorities in the other Iowa counties where MidAmerican has electric operating property.

The property values of several residences within 1.5 miles of existing nuclear power facilities in Washington County, Nebraska (Fort Calhoun Nuclear Station), and Linn County, Iowa (Duane Arnold Energy Center) were compared to the average county property value. The comparisons demonstrate that proximity to the nuclear power facilities did not deter residential development or decrease property values.

DISCUSSION OF MIDAMERICAN'S CONCLUSION 5

Conclusion 5: *There is not an apparent urgent need to proceed with IUB or NRC applications for the deployment of a nuclear facility in Iowa.*

The nuclear feasibility analysis highlighted several uncertainties related to greenhouse gas policies, SMR licensing and SMR pricing that could influence the decision to deploy nuclear generation in Iowa. Potentially, the next several years could provide additional clarity regarding:

a. The structure, level of reductions, schedule, and application of EPA greenhouse gas limitations for new and existing fossil fueled generation.
b. Refined reserve estimates, development restrictions (if any), export approvals, resource recovery and risks associated with future domestic natural gas supply.
c. Regulatory approvals of small modular reactor designs and associated NRC rulemakings.
d. Firming of price commitments from small modular reactor vendors for engineering, procurement and construction contracts; assessed as a critical input for decision making between generation alternatives.

Specific activities highlight the uncertainties noted above.

Greenhouse gas emissions

- On March 27, 2012, EPA proposed the Carbon Pollution Standard for New Power Plants, which generally limits carbon dioxide emissions from new fossil fueled generation to 1,000 pounds of CO_2 per MWh, a level considered commercially unattainable by current coal fueled technology. However, the EPA delayed the final rule, which was due April 13, 2013. The EPA also declined to set a deadline for the final rules related to new fossil generation stating it had received more than 2.7 million comments on its proposed rule.
- It is anticipated the EPA will also issue proposed rules limiting the CO_2 emissions on existing fossil fueled generation. On April 10, 2013 the acting EPA Administrator indicated that drafting CO_2 emission rules from existing fossil units could start in fiscal year 2014. However, following this statement by the Acting Administrator the EPA issued the following release, which added uncertainty as to when and how the EPA would act:

  "To clarify, EPA currently has no plans to regulate GHG emissions from existing power plants. As the Acting Administrator said today, a variety of potential options are on the table, but the Agency is currently focused on reviewing the more than 2 million comments received on its proposed standards for new power plants. To assert that any decision on any additional action has been made would be incorrect."

  How the greenhouse gas rules will be structured, the magnitude and timing of emission reductions, and how they are applied are all major contributors in determining when new baseload generation will be needed.

NRC activities

- Several small modular reactor developers notified the NRC of their intent to submit design certification applications in 2014 and 2015. The NRC is under no time limitation to approve these reviews; however, a four to five year review would not be unexpected, placing the certification of the small modular reactors near the end of this decade.
- The NRC has noted potential policy, licensing and technical issues that may require NRC reconsideration in assessing the design and licensing review of SMRs (i.e., SECY-10-0034). These potential policy issues that may need to be reassessed, and potentially be beneficial for SMRs generally include:
    - Staffing requirements,
    - Emergency planning requirements,
    - Security and safeguard requirements,
    - Appropriate licensing evaluation criteria,
    - Appropriate licensing fees, decommissioning funding and insurance requirements.

  The timing on NRC staff recommendations and commission actions on these subjects will likely follow along with the design certification process through the remainder of this decade.
- In June 2012, the US Court of Appeals for the DC Circuit found that some aspects of the generic analysis that has been incorporated into the NRC's reviews for new reactor licenses through the Waste Confidence Rule needed additional analysis. The NRC has decided to stop all licensing activities that rely on the Waste

Confidence Decision and Rule until a new final environmental impact statement and rule can be issued, this report and rule is expected by no later than September 2014.

SMR vendor activities

- Four domestic vendors are actively working on the design and potential licensing of a light-water SMR.
- On November 20, 2012 the DOE awarded matching funds that could lead to the licensing of an SMR for potential commercial operation by 2022. Babcock & Wilcox Company's Generation mPower received the five year award for a potential deployment at the Clinch River, TN site with Tennessee Valley Authority ("TVA") being the licensee and operator. In February 2013, TVA reportedly signed an agreement with Generation mPower to submit an application for an SMR construction at Clinch River, TN. The DOE award is one part of the $452 million DOE effort to foster SMR development.
- On March 11, 2013, the DOE announced a five year SMR funding opportunity similar to the November 20, 2012 award however with a 2025 commercial operation target. The DOE adjusted its evaluation criteria in this SMR announcement to focus on innovation and manufacturability. Applications close for this second round award on July 1, 2013.

Schedule 1

Iowa Code 476.6.22

a. It is the intent of the general assembly to require certain rate-regulated public utilities to undertake analyses of and preparations for the possible construction of nuclear generating facilities in this state that would be beneficial in a carbon-constrained environment.

b. A rate-regulated electric utility that was subject to a revenue sharing settlement agreement with regard to its electric base rates as of January 1, 2010, shall recover, through a rider and pursuant to a tariff filing made on or before December 31, 2013, the reasonable and prudent costs of its analyses of and preparations for the possible construction of facilities of the type referenced in paragraph *"a"*. Cost recovery shall be accomplished by instituting a revenue increase applied in the same percentage amount to each customer class and not designed to recover, on an annual basis, more than five-tenths percent of the electric utility's calendar year 2009 revenues attributable to billed base rates in this state. At the conclusion of the cost recovery period, which shall extend no more than thirty-six months in total, the board shall conduct a contested case proceeding pursuant to **chapter 17A** to evaluate the reasonableness and prudence of the cost recovery. The utility shall file such information with the board as the board deems appropriate, including the filing of an annual report identifying and explaining expenditures identified in the rider as items for cost recovery, and any other information required by the board. If the board determines that the utility has imprudently incurred costs, or has incurred costs that are less than the amount recovered, the board shall order the utility to modify the rider to adjust the amount recoverable.

c. Costs that may be recovered through the rider described in paragraph *"b"* shall be consistent with the "United States Nuclear Regulatory Guide, Section 4.7, General Site Suitability Criteria for Nuclear Power Stations, Revision Two, April 1998," including costs related to the study and use of sites for nuclear generation.