EXECUTIVE SUMMARY

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AMES MUNICIPAL ELECTRIC SYSTEM

The City of Ames operates a municipal electric utility, the Ames Municipal Electric System (AMES). The utility owns and operates a variety of resources to meet the expected demand of the customers. These resources include two coal fired units (7 and 8) located at the downtown power plant and two diesel fired simple cycle combustion turbines located at the Dayton Avenue power plant. In addition, the utility makes purchases and sales from the area market under short term transactions. The utility is confronted with several issues associated with the operations of the coal-fired facilities and meeting future load growth on the system. AMES desired a methodology to help it identify the attractive futures it could consider in meeting this future growth and the major factors that influenced the futures.

Burns & McDonnell was authorized to assist the utility in developing this methodology. In discussions with the utility, AMES noted its desire that the process take into consideration a variety of futures, include issues outside of the utility, such as municipal solid waste and steam sales to the local hospital, and allow the utility to modify the analysis with refined assumptions as they were developed. The methodology selected relied on a decision tree process as the primary vehicle to identify the costs of the various futures supported by a variety of supporting spreadsheet analyses.

This report develops the process, describes the methodology and presents a summary of the analysis used to develop the expected ranges of incremental costs associated with the various futures developed.

Existing Conditions

AMES provides electric service to the service area generally comprised of the Ames city limits. The resources at the downtown power plant are at a stage in their life where decisions need to be made about future operations and investments. The utility is also confronted with numerous considerations of investment in new resources needed to meet projected demand and energy growth within the City. These decisions need to be made at a time when there are significant potential impacts to utilities due to pending legislation involving carbon emissions.

AMES has several options under consideration to meet the projected load growth. These options include changes in Units 7 and 8, new units constructed at the downtown power plant location, new units constructed off site and participation in area resources being developed by others. These options could also include a variety of fuel inputs such as coal, gas and bio-fuel.

The AMES' Units 7 and 8 provide a substantial portion of the energy for the utility. These resources also provide a means to dispose of refuse within the county through the combustion of refuse derived fuel prepared by the Ames' public works department and provided to AMES for combustion in Units 7 and 8. This RDF provides an offset to the amount of coal that AMES would have to burn if it was not available. In addition, steam is provided to the Mary Greeley Medical Center, replacing the need for the hospital to generate process steam through a gas-fired boiler.

AMES also desires to obtain a portion of its energy from renewable sources. The area around Ames has significant wind resources being developed. AMES is working with other municipal utilities who are investigating wind projects. AMES is also working with Iowa State University on development of cost effective bio-fuels.

Table ES-1 provides a summary of the AMES' balance of loads and resources. Table ES-2 provides a projection of AMES load forecast and as adjusted for energy to be provided by renewable resources. Although the table shows the effects of obtaining renewable energy in 2015, AMES is currently pursuing the acquisition of renewable energy. The amount acquired will be used to offset production from the existing resources as it is available prior to 2015.

Table ES-1

BALANCE OF LOADS AND RESOURCES

	Demand (Including Reserves)	Existing Unit 7	Existing Unit 8	Existing Cts	Total	Surplus (Deficit)*
2008	152	38	70	45	153	1
2009	154	38	70	45	153	(1)
2010	156	38	70	45	153	(3)
2011	158	38	70	45	153	(5)
2012	160	38	70	45	153	(7)
2013	162	38	70	45	153	(9)
2014	164	38	70	45	153	(11)
2015	165	38	70	45	153	(12)
2016	167	38	70	45	153	(14)
2017	169	38	70	45	153	(16)
2018	171	38	70	45	153	(18)
2019	173	38	70	45	153	(20)
2020	175	38	70	45	153	(22)
2021	177	38	70	45	153	(24)
2022	180	38	70	45	153	(27)
2023	182	38	70	45	153	(29)
2024	184	38	70	45	153	(31)
2025	186	38	70	45	153	(33)

* Due to Ames combining its reporting requirements with Iowa State University, the actual deficits begin to occur in approximately 2012.

Table ES-2

ENERGY FORECAST

Year	Non-Adjusted MWh	Adjusted for Renewable Energy MWh
2007	585519	585519
2008	606013	606013
2009	627223	627223
2010	646040	646040
2011	665421	665421
2012	685383	685383
2013	702518	702518
2014	720081	720081
2015	738083	664275
2016	756535	680882
2017	775449	697904
2018	794835	715351
2019	810731	729658
2020	826946	744251
2021	843485	759136
2022	860355	774319
2023	877562	789806
2024	895113	805602
2025	913015	821714

DECISION TREE DEVELOPMENT

Decision tree analysis allows the comparison of various futures that could be followed by an entity. These futures are influenced by factors that are under control by the entity and represented by decision nodes. These nodes represent choices that the entity can make. Other factors are outside the control of the entity and are represented by chance nodes. These nodes represent the probability that certain outcomes will come about and influence the path chosen by the entity. Part II of the report describes the decision tree process and the specific tree developed for AMES.

AMES Tree Development

The development of the tree for AMES began with a meeting between AMES staff, member of the utility advisory board (EUORAB), Ames city administration, members of other Ames departments and Burns & McDonnell. The meeting was held in Ames. Inherent in the discussion about the development of the decision tree were the following values of the City and Utility:

- Maintain local control,
- Include 10 percent renewables above current operations,
- Keep RDF process,
- Continue with ownership of electric utility,
- Consideration of potential impacts to energy sales to ISU,
- Have diversity of supply,
- Incorporate impacts beyond Ames' electric customers in evaluation,
- Incorporate Demand Side Management (DSM).

Specific to the utility, factors were considered such as:

- The retirement or refurbishment of Units 7 and 8
- The maintenance investments needed and the resulting impacts on Unit 7 and 8 operations
- The provision of future needs by either coal or natural gas fired resources or potential bio-fuels
- Impacts of existing and potential emission regulations
- Requirements for expanded transmission facilities in order to import additional capacity and energy.
- The inclusion of the renewable energy objectives of Ames.
- The effects of demand side management (DSM)
- The utility would continue to operate within the MidAmerican Energy balancing authority.

In discussion of the initial question, a variety of options were considered. The initial question was agreed to as

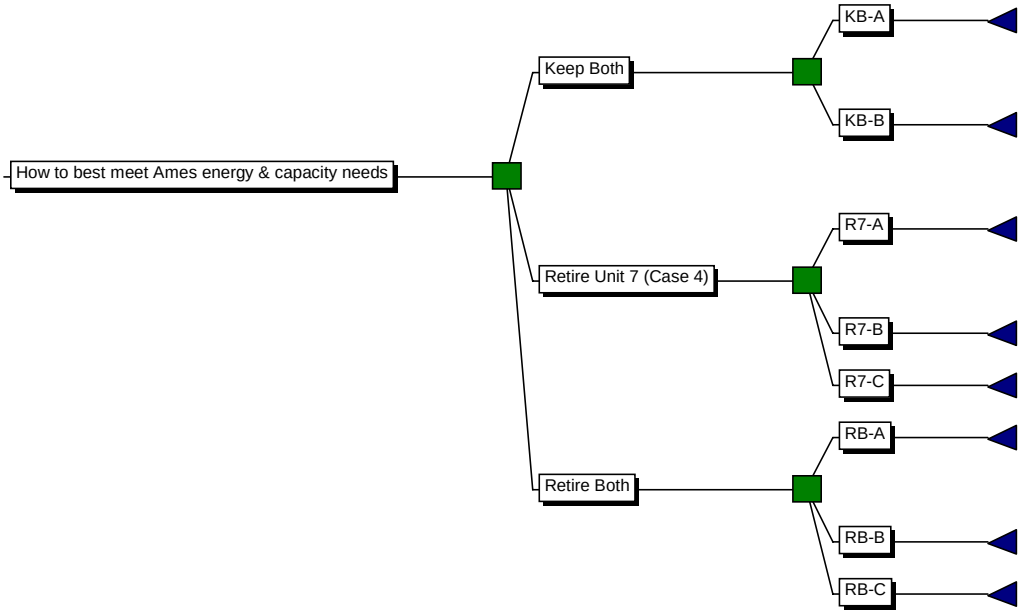
"How do we meet Ames' future energy and capacity needs?"

The measurement of the "best" path was determined to be performed with net present values of the costs associated with the available futures. The study period for the analysis was determined to be from 2007 to 2025.

After the initial question was developed, the immediate branches to the right were considered. The discussion led to the major decision paths being associated with large decisions the City would be making with the units at the downtown plant. This discussion led to the development of three major paths which

were considered to contain all of the realistic options associated with the utility's future. These paths were:

- Keep both Units 7 and 8
- Retire both Units
- Retire Unit 7



PATH DESCRIPTIONS

Keep Both Future

The Keep Both path assumed that Unit 7 and 8 would remain in service throughout the study period of now through 2025. This path assumed the existing combustion technology and operations would remain as currently exists at the plant. Although there are options for repowering Units 7 and 8, they were not included in this path, but considered in the Retire 7 and 8 or Retire 7 paths. The Keep Both path branches off into either a base or high level maintenance path performed on the existing units.

Retire Both Units 7 and 8 Future

The Retire Units 7 and 8 path required the consideration of replacement of the 108MW of capacity retired. A variety of options were considered. The options included:

1. Increasing the level of participation in a new coal facility being considered.
2. Repowering Units 7 and 8 with new combustion technologies, such as circulating fluidized bed boilers with the same capacity as the existing units.
3. Construction of a new Unit 9 with a nominal rating of 60MW either at the downtown plant location or at an off site location.

Under the paths that included participation in an increased level of a regional coal plant under development or construction of an off site unit, there would be no capacity remaining at the downtown location. Under these futures, the As Is RDF path would not be an option. Also, sales of steam to the hospital would be removed.

Retire Unit 7 Future

The third future considered that only Unit 7 was retired. This path included the same coal and CT options for new capacity needed in the 2015 time frame. Replacing the lost capacity for Unit 7 was considered through either repowering or replacement with a new unit. The retirement of Unit 7 required adjustment of the level of participation in the coal unit in those paths for which consideration of Unit 9 or new coal capacity was included. Maintenance issues remained for Unit 8 as in the Keep Both future. It should be noted that the earliest date for retirement of Unit 7 would be around 2013 to 2015. In discussions with AMES, the planned changes to the unit for NOx controls are expected to have a payback of only two to three years. Therefore, these improvements would still provide a return on the investment if the unit was retired. Also, since new units can often have an initial period of increased outages until the systems are fully worked in, the unit should be maintained as planned for one to two years past the in-service date of any replacement unit.

ASSUMPTIONS

The development of the projected investments and operating costs for each of the futures required making assumptions about numerous variables. Part III of the report discusses the assumptions, their source, and the values used. The assumptions included the following major categories:

- Load Projections
- Capital costs of alternatives
- Operations and maintenance performance and costs of alternatives
- Fuel and market projections
- Transmission upgrades for the futures
- Economic parameters
- Emissions

Each of these assumptions was reviewed and agreed to by AMES prior to performing the analysis of the futures.

ANALYSIS

The analysis to determine the net present values associated with each future required the development of the sources of energy (dispatch) anticipated for each future. It was also necessary to determine the amount of capacity anticipated on each path. The analysis reflected historic dispatch patterns of the units as well as potential dispatch depending on other available options. Although excess energy would be available to sell into the area market or to ISU, no explicit costs and revenues for these sales are included. Part IV of the report discusses the approach to the estimation of capacity added, energy provided by each source associated with each future, the application of assumptions and the results from the analysis.

RESULTS

The NPVs for the end branches for the decision tree were developed. The summary sheets for each of the branches are provided in Appendix C. The decision tree is provided in Appendix D. The end branches on the decision tree have two NPVs provided. The NPV under the end branch represents the costs to the utility without the NPVs represented along the branch added. The NPV to the far right is the NPV with all of the NPVs along the path added.

For example, along the Keep Both, Separate (1B), High Maintenance, CT/Mkt path, the utility NPV is shown as $634,182. To this is added the NPV for the separate RDF burning system of $25,956,000 for a total NPV of $660,138. This is the NPV for comparing this future with other futures for the total considerations represented by the decision tree.

The NPVs for the cases analyzed are summarized in Figure ES-. The NPVs include the various RDF paths.

Figure ES-1

TOTAL NPVs OF BRANCHES

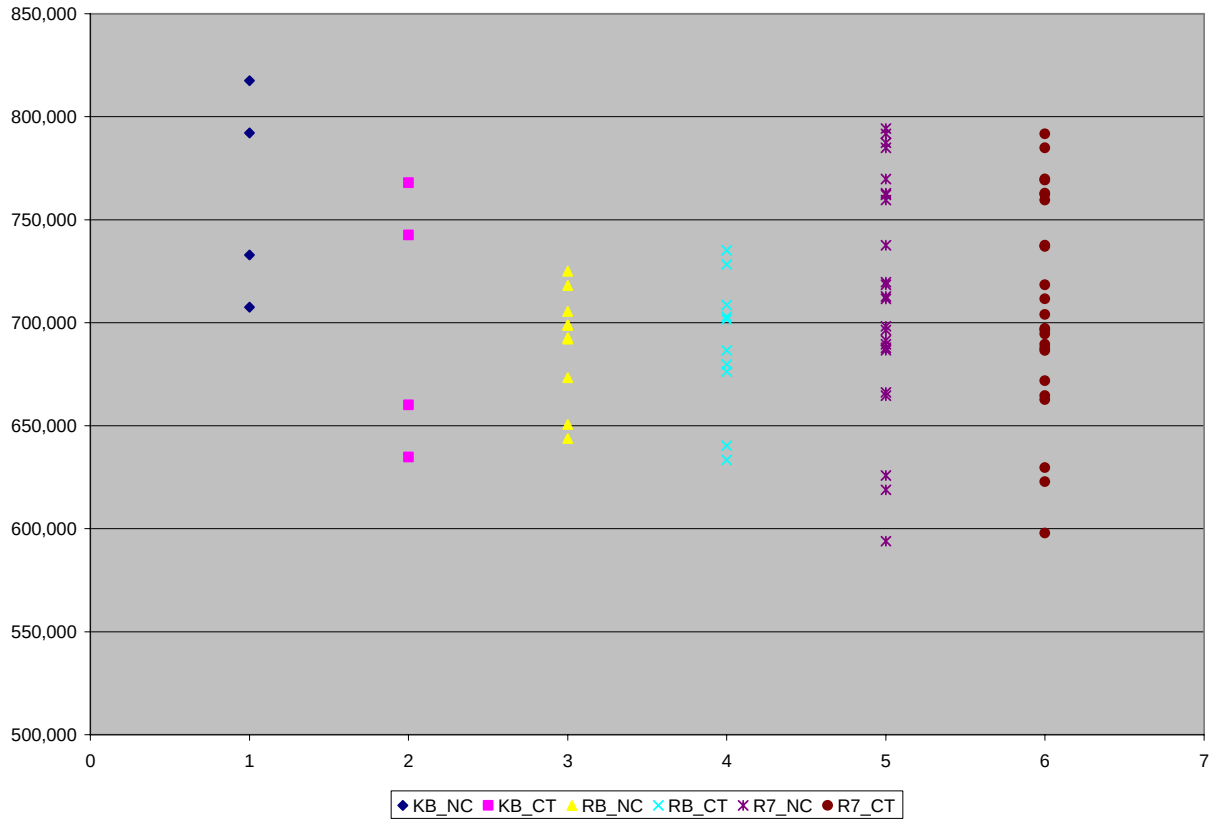


Table ES-3 summarizes the lowest paths on each future. The two paths for the R7 future are essentially equal.

Table ES-3

LOWEST NPVs FOR THE THREE FUTURES

($000)

Path	Utility	City of Ames
R7_AS IS_BM_NC_NC	593,937	593,937
R7_AS IS_BM_NC_CT/Mkt	597,866	597,866
KB_AS IS_BM_NC_CT/Mkt	634,776	634,776
RB_S(1B)_NC_CT/Mkt	607,446	633,402

In general, the analysis indicates that replacing the costs of Unit 7 with an equivalent amount of new coal capacity would result in the ability to offset the high investment cost of a new resource with an offsetting

savings in Unit 7's variable costs. There is a slight benefit in obtaining more coal capacity and associated energy than that equivalent to Unit 7 as is seen by the CT/Mkt path being less than 0.01percent higher cost. The major benefits with the new resource as compared to Unit 7 are derived from reduced fuel cost, better heat rate and lower operating costs. The better heat rate also reduces the amount of CO2 emitted, which reduces the exposure to carbon legislation.

The future where both units are retired appears to have a lower NPV from a utility perspective, but from an overall Ames perspective, the NPV is essentially equivalent to the Keep Both future.

Retire Unit 7 Future

The lower cost future represents replacement of the existing Unit 7 with participation in a regional coal unit in 2013. Under this future, AMES would become a participant in the construction of a new unit. There are facilities being developed in Iowa in which AMES may have an opportunity to participate. This participation could take the form of equity ownership or through a Power Purchase Agreement (PPA). The analysis has been performed assuming an equity ownership arrangement.

With the decision to make this investment having to be made immediately, it will be difficult to move from this path after this commitment is made. Issues of concern with this path include:

- The project would have to be initiated in 2008 in order to be on line near the 2013 date assumed.
- Availability due to challenges of required permits.
- Requirement that AMES keep Unit 7 operational for an indefinite time until the new resource was available.
- Potential capital investment of approximately $120 to $180 million plus $50 million for the transmission system for the 40 to 60MW of new coal resource or committing to a long term PPA.
- Flexibility of AMES to respond to issues such as new technologies which may provide new methods of generating electricity or the final impacts of carbon legislation should they be more onerous than modeled herein.
- Ames would be a minority owner in such a facility. As such, it would be unable to influence to any substantial degree annual budgets for the unit or how the unit is operated as it can currently perform with its units being totally under its control.

Keep Both Future

The lower cost path represented in this future assumes that Units 7 and 8 are continued in operation for the benefit of AMES and limited off system sales. Maintenance is at the budgeted level to keep the units availability slightly above or better than where it has been historically.

- Operation along this path would be the more familiar to AMES. Decisions on unit operations, outages, maintenance, etc would continue as are currently made.
- Opportunity to work at minimizing its operating costs and reduce the NPV further.
- Lower investments than the other main futures considered and provide more flexibility with regards to the futures that may take shape with issues such as carbon legislation being passed, changes in efficiency standards for end use appliances, etc.

Retire Both Future

Another low cost path represents a case where both of the units are replaced by a new coal resource in 2013. This path results in a major investment in the new coal plant in 2013 of approximately $300,000,000 for the unit and $50,000,000 for upgrades to the transmission interconnection. This investment is offset by lower fuel and emission costs than are currently encountered by AMES with the existing resources. As in the Retire 7 future, this acquisition of capacity could also potentially be made through a PPA. This future also results in an investment for a burner for the RDF of approximately $35,000,000. This path has the same issues as the Retire 7 path only with a greater level of investment.

CARBON TAX VARIANCE

The base analysis was performed with a carbon tax of $16 per ton applied in 2015. This tax was applied to all carbon emissions from existing and new resources and the market purchases. The variance for carbon tax from $10 per ton to $30 per ton was applied to the paths for the Retire 7 and Keep Both paths identified in Table ES-3. The ranges of NPVs across the 90 percent confidence level for the paths are provided in Table ES-4.

Table ES-4

90% CONFIDENCE RANGE of NPVs

Carbon Tax Variance

Path	**Low NPV**	**High NPV**
R7_AS IS_BM_NC_NC	$553,500,000	$640,250,000
R7_AS IS_BM_NC_CT/Mkt	553,000,000	$650,600,000
KB_AS IS_BM_NC_CT/Mkt	$584,100,000	$687,000,000

The Retire 7 distribution has a lower range of NPVs than the Keep Both path. The carbon tax for this analysis is applied equally across MWh production from new and existing units. If the legislation takes a similar structure that previous cap and trade programs have taken, the impact may be higher for new units and less for existing. This would provide a higher potential opportunity for the NPVs on the Keep Both path to be reduced since the majority of the energy affected in this path is from the existing units.

CONCLUSIONS AND RECOMMENDATIONS

Burns & McDonnell has reviewed the various futures that AMES could pursue in meeting its capacity and energy obligations to serve its projected needs for the City of Ames. Based on the analysis, Burns & McDonnell has developed the following conclusions:

1. AMES has a capacity deficit beginning in 2012 that grows to a level of approximately 40MW in 2026. The forecast provided is based on a level of demand side management being accepted by the AMES customers. To the degree that the acceptance is not as high as considered in the forecast, the deficit could be higher than indicated. Also, the renewable energy is assumed to be provided by wind resources. By their nature, wind turbines provide energy and minimal accredited capacity. Therefore, the wind resource does not reduce the deficit.
2. At the end of the study period, the existing Units 7 and 8 would still have energy available for dispatch above that capable of being generated solely to meet AMES obligations. This available energy could be even higher when considering that market purchases at times may be lower cost than generating with the units.
3. The lower cost evaluated future for AMES includes the future whereby Unit 7 energy is replaced with more efficient capacity and energy from a regional coal unit, while Unit 8 is kept in service. In this model, it is assumed that Unit 7 is retired. However, AMES should maintain its options with regards to Unit 7 and future capacity and energy as the in-service date for the replacement capacity is more clearly defined.

4. For capacity to meet the deficits projected, AMES can pursue the addition of an additional 20MW from the coal unit or construct a local combustion turbine and uses the market for energy to minimize its operating costs. If the assumptions surrounding Unit 7 projected operating costs
5. The benefits to the new coal capacity are derived primarily from lower fuel and operating costs and the lower heat rate of a new unit when compared to those of Unit 7.
6. The consideration of repowering the units does not provide sufficient operating cost advantages to offset the investment necessary for the new boilers and emission control equipment.
7. The investments budgeted for maintenance and NOx upgrades for Unit 7 should be pursued due to the uncertain time that any actual retirement of Unit 7 would occur. It is not expected that it would occur prior to the 2013 to 2015 time frame.
8. Construction of a new unit at the downtown location is exposed to the same fuel cost disadvantage as the repowering future. Again, the investment in new units is not balanced through reduced operating costs.
9. The opportunities to participate in a new coal unit have been significantly impacted by recent environmental challenges to the construction of new resources. Pursuing a path of participation in a new coal resource could expose the utility to a prolonged in-service date from the 2013 date assumed in the analysis or complete stranding of such an investment if permitting could not be obtained. If the in-service date of the resource is delayed, the NPV will increase for this future from that calculated in this analysis.
10. The recent guidelines established by certain financial institutions regarding their requirements to support financing of new coal units could make the financing of a new coal unit more expensive and problematic.
11. The removal of Unit 7 and 8 from service would require an investment in a dedicated RDF burner. This investment would be approximately $22,000,000 for a single furnace plant and approximately $35,000,000 for a dual furnace plant. These costs have been reflected in these futures.
12. The removal of Unit 7 and 8 would require the AMES' transmission interconnection to MidAmerican to be upgraded. The estimated investment to allow increased importation of AMES demand and energy requirements is $50,000,000. This upgrade cost is a major assumption that needs to be more closely verified through detailed studies.
13. The Keep Both, As Is, CT/Mkt path will provide a lower amount of energy available for sale to ISU and the wholesale market than a future that includes a new coal resource.
14. It is probable that there will be increased pressure on conservation, renewable energy and other similar approaches to minimize the impact of greenhouse gases. Investment in new coal

resources could disadvantage the utility by such investments being stranded in new resources should the anticipated load be less than forecast or the renewable energy requirements be higher than assumed. Reliance on off system sales would be necessary to reduce this stranded cost. Use of biofuels in Unit 7 beyond the RDF currently consumed may be a consideration for AMES prior to the final decision to retire the unit.

15. Implementation of carbon legislation is anticipated within the next two to three years. Although not certain, the immediate impact of new legislation to control emissions is typically more onerous to new resources, with a more gradual impact to existing resources. This means that if AMES invested in a new coal unit with this uncertain carbon legislation pending, the impacts to operating costs in the existing units as modeled in this study may be higher than would actually be realized in order to comply with carbon legislation.
16. Based on the variance of carbon tax values over the two lower cost futures, the evaluated NPV for the Retire 7 path has a lower overall range of NPVs than for the Keep Both path.
17. Moving along the Retire Both path exposes AMES to investment costs that lock in the cost structure of the utility for the next 35 years. If AMES pursues the Retire Both future, it will have minimal ability to modify this cost structure based on changes in technology, environmental policy and other issues that will confront the utility industry over the next several years.

Based on the analysis performed by Burns & McDonnell and summarized in this report, Burns & McDonnell is of the opinion that AMES should:

1. Pursue a future whereby it acquires approximately 40 to 60MW of coal capacity and energy in a regional coal resource, retires Unit 7 at the downtown power plant, keeps Unit 8 in service with continuing use of market capacity and energy to minimize operating costs. In deciding to pursue this future, AMES should consider the following:
    a. The assumptions for the new coal resource considered in this study should be compared against any actual offer to participate in such a unit. Should these actual costs prove to be higher than the assumptions used herein, the consideration of this future should be reevaluated with the actual participation values.
    b. The impacts of carbon legislation on new and existing resource operations is highly uncertain at this time. Although this study provides assumptions on the impacts of such legislation, the actual impacts may vary.
    c. The investment in a new coal resource will require transmission upgrades for delivery to AMES. The cost and time to construct these upgrades may have an impact on the value of this path.

   d. Should reduced fuel costs be available at the downtown power plant location through either lower coal contracts or bio-fuels, the analysis of this future should be reevaluated with respect to the final decision on the future of Unit 7.

2. Continue to work to reduce the costs of delivered coal to the existing resources.
3. Make investments as planned in the existing coal units 7 and 8 to improve availability due to the uncertainty of the in-service date of the new resource.
4. Continue to encourage conservation of energy by the AMES customers.
5. Should AMES determine to invest in only 40MW of the new coal unit, then a 25MW combustion turbine should be considered to provide capacity deficits occurring beyond the 2013 time frame. Since these units have a lead time for construction of approximately two years, this decision could be delayed until approximately 2010. This would allow impacts of conservation and load reductions to be pursued. When definitive project costs are know for the CT option, they should be compared against the ongoing costs of keeping Unit 7 operational to provide this capacity and make market sales of the excess capacity and energy.
6. Pursue the use of renewable energy to minimize exposure to carbon legislation impacts. Construction of wind units owned and operated by AMES or procured through power purchase agreements should be considered due to the attractive wind regimes in the Ames area.
7. There is a considerable amount of research being invested in the development of biofuels for power generation units. AMES should keep abreast of this research and continually review the advances and the opportunity to use these fuels in Units 7 and 8. The cost of the fuel and any boiler modifications necessary to consume them should be evaluated against the assumptions used herein as the basis for selection of the recommended future.

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