State of Wisconsin/
University of Wisconsin-Madison
Power Plant Review Questions

Submitted by Friends of Responsible Energy, April 1, 2003

A. Policy & Process

1. MGE's Senior Vice President asserts that UW/DOA approached MGE for the Madison campus utility project, while DOA indicates that MGE approached them. Please specify the original executive or government official responsible and the initial rationale.

2. Please also list all other entities UW/DOA approached for competitive bids for the Madison campus utility project. If there were none, why not?

3. We understand that previous state administrations mandated a master lease arrangement for electric generation equipment and buildings coupled to complex exchange agreements. Does the current administration consider the master lease and associated exchange agreements logical, necessary, or cost-effective?

4. Do the $12M of state sunk costs and $40M of MGE sunk costs quoted by UW officials correctly measure non-recoverable costs and to which parties the costs are allocable? When were these outlays committed?

5. Will DOA affirm that its decision will not count any MGE or UW sunk costs against non-MGE alternatives? Note that electric generation conflicts with the 1996 Master Plan agreement between UW, the city, and the neighborhoods, funded and endorsed by DOA, and there has been no subsequent update of that Master Plan to include plans for electric generation turbines, let alone outlays for them.

6. How much of MGE's sunk costs were discretionary, non-required, pending final decisions either by the governor or PSC? What MGE outlays required DOA approval; what costs could DOA veto? Outlays by MGE and UW can be construed as an attempt to influence the governor or PSC to favor the MGE proposal.

7. Who selected the particular 45 MW configuration ("Sebesta option A") to be compared to the 150-MW configuration, and why? What other alternatives would meet UW needs and why were they dismissed? Did Sebesta add sunk costs to the non-MGE alternatives? If so, how much of the sunk costs are non-recoverable, and who would be expected to bear those costs, ratepayers or taxpayers?

8. What other public universities have engaged in a similar arrangement (legal/financial/ operational) with a publicly regulated investor-owned electrical utility? What are the similarities and differences between the proposed 150-MW arrangement and University of Florida's facility? Are lessons to be learned from that example?

9. Two consultants, Burns&McDonnell and Sebesta Blomberg, have recommended smaller 45 MW alternatives. Why have these recommendations been dismissed by UW officials, who continue to publicly advocate MGE's 150-MW plant?

10. Campus building occupants are known to open windows in winter because the buildings are too warm. Has UW measured the extent to which energy efficient design and conservation retrofits could offset campus load growth in power, steam and chilled water? If so, what are the results and what are the barriers to rapid implementation?

11. Will the present administration support the legislative call for repeal of the July 2002 budget provision requiring UW to negotiate with MGE for a 150-MW plant?

12. The design of the 150-MW single-season cogeneration plant was forged under previous state administrations and has inherent inefficiencies (UW may not need steam when MGE needs electricity, and vice-versa). Is the current administration compelled by the July 2002 budget provision, sunk costs, or the outlook for MGE's investors to overlook the inefficiencies and favor the 150-MW proposal over more efficient and environmentally benign alternatives?

13. Please detail the advantages of a staged build-out of campus utilities, such as a 14+14+14 MW plan.

14. What are the differences in transmission costs and upgrades – including costs allocable to ATC -- between the alternatives and have these been factored into the evaluation?

15. Please provide the project status letter from Cramer & Ives dated approximately December 2002 and addressed to Lightbourne, Wiley, Lyall and Wolter.

16. With respect to the 150-MW alternative, what is the difference between the state's cost of money and MGE's cost of money? Does the state intend to fund through MGE, and to what extent?

17. With respect to the 150-MW alternative, what is the difference between state labor costs and MGE's labor costs? Does the state intend to fund through MGE's labor costs?

18. MGE, UW, and their allies have cited urban cogeneration facilities in Philadelphia and Germany as precedents for the 150-MW facility. However, unlike MGE's single-season 150-MW design, both of those examples replaced aging, dirtier plants and achieved net air quality improvements for their respective regions. Please justify on contemporary public policy grounds a 150-MW alternative that degrades rather than improves urban air quality.

19. Studies demonstrate that fine particulates, PM2.5, are a serious health threat. The EPA has recognized this threat and set new standards, with implementation guidance for demonstrating compliance now underway. We understand current background levels of PM2.5 to be near the new limit. In view of this, please justify on public policy grounds why a larger emitter of PM2.5 continues to be endorsed by UW officials.

20. Is meeting a campus construction schedule the most important consideration in UW's selection of a utility plant?

21. Which of the alternatives under consideration do not address UW's reliability concerns? Please provide your definition of reliability and for each such alternative quantify the shortfall.

22. Assuming that an alternative other than the 150-MW alternative is environmentally and fiscally more attractive, would UW still choose the 150-MW alternative and why?

B. Economic Analysis

1. How do rising natural gas prices impact the design considerations – for example, combined cycle verses high-pressure boiler? (The Burns&McDonnell study only considered a 10% increase in fuel cost, which may not be indicative of the market.)

2. The analysis of the 150-MW proposal is predicated on a small number of annual operating hours of the plant. Is this a reasonable assumption for a $180 million investment?

3. We understand that DOA's Focus on Energy guideline for the cost of energy via efficiency is 2.1 cents / KWh compared to 4.0 cents via generation from natural gas. Does the economic analysis of utility options for the campus consider efficiency options in lieu of supply options? If not, please provide such an analysis.

4. At present, the UW campus is one of MGE's largest and most desirable customers. MGE's revenue stream from the campus is highly predictable. If the UW campus generates more of its own electricity, as in either an incremental cogen plan or an outright 45 MW cogen plan, please confirm that MGE's consequent loss of revenue will not bias the state's decision in favor of WCCF. Please quantify both this loss of revenue and any reduction in per share earnings, as well as any benefit from reduced system demand in the form of lower electric rates for the rest of MGE's customers. What obstacles are there to UW selling excess generated electricity, should there be any, back to the grid?

5. What are the costs of the necessary water mitigation measures planned for each alternative plant option, including the costs of improved infiltration?

6. Regarding Sebasta's spreadsheet:

    a. Why are there large standby charges under variable operating expenses for the 45 MW option?
    b. Why are the major maintenance charges more for the 45 MW option than the 150-MW option?
    c. The cost of electricity for chilled water is missing under the 150-MW option; this is a significant cost, why is it missing?
    d. Why is a 200,000 lb/hr boiler added in the 45 MW option but not in the 150-MW option? Can't the Walnut and Charter St plants be used?
    e. Since electricity cogeneration opportunity is apparently lost from Charter St under the 150-MW option until the year 2020, we infer that 45 MW is too big for the first half of the 30-year period. How many kWh was lost (not generated) at Charter St each year and what is its dollar value?
    f. We still have questions about the campus steam load because actual cogeneration opportunity depends on the actual steam demand at any given time rather than the peak steam load. We would like to know exactly how

the steam production for both options shown on the spreadsheet was determined.

g. Please modify the spreadsheet to explicitly determine the cost of steam per 1000 lb, cost of chilled water per ton, and cost of electricity per kWh for each option being considered."
h. Please show a list of all the capital costs of the 45 MW and 150-MW options side-by-side and explain why some items are in one but not the other.

7. Please provide a parametric sensitivity analysis of the discount rate, cost of capital, inflation rate and especially the cost of natural gas on the cost of steam, chilled water, electricity and life cycle cost.

8. What is the cost of electricity projected to be from the new Oak Creek, WI, coal-fired power plants in 10, 15, 20, 25 and 30 years and how does this compare to the 45 MW and 150-MW alternatives? What is the impact of MGE's ownership in power from Oak Creek on its estimated needs for new capacity?

9. State labor costs per employee for staffing a utility plant are approximately half of MGE's. Please reflect these figures in comparing the life cycle costs of the alternatives.

10. How was the rate for steam for the MGE option determined (90% of the cost of independent generation)? This seems artificially high for recovered heat – why wasn't this rate set by the market in a competitive environment?

11. What is the additional cost of the MGE/UW single-season 150-MW cogeneration proposal over a 150-MW electric generation plant designed solely for MGE? Since this delta is a proxy for the value of the MGE/UW proposal that the campus should receive, does the state's share of the proposal's costs exceed this delta? If so, by how much?

12. Please quantify, under the competing scenarios, including an incremental 14+14+14 MW plan, the variable cost of utilities to physical plant's internal campus customers, such as UW Hospitals, VA Hospital, dormitories, and any others. Are those campus units aware of these comparative costs and do they need to sign off?

13. Approval of the 150-MW alternative will trigger an additional $13.6M in transmission infrastructure costs. Please include these costs in the comparison to other alternatives, since these costs are borne by ATC and presumably passed on to ratepayers and moreover ATC is partially owned by MGE.

14. Under the incremental 14 + 14 + 14 MW scenario, should the $15M cost of upgraded transmission capability on campus be removed from first costs, since the upgrade is only necessary if generation capacity exceeds about 25 MW?

15. Will steam chillers reduce life cycle costs? How much?

16. The 1996 Master Plan envisioned a parking facility on part of this site. What is the economic value to UW of the real estate at this site? If this site is committed entirely to MGE for the 150-MW alternative, UW loses the site for future development, utility or otherwise. Please quantify the dollar loss from this commitment compared to the other, smaller alternatives.

17. What is the economic value of UW to MGE? For example, can MGE construct a 150-MW electric generation facility in the city of Madison without UW? Does the joint ownership arrangement with UW provide a more favorable return to MGE investors than an MGE-only facility?

18. Isn't third party financing, assuming an open competitive bidding process, for a non-MGE alternative, significantly more attractive than MGE's offer of 9-12%?

19. Itemize the $12 M and $40 M UW officials say that UW and MGE respectively have spent. Please detail unrecoverable cancellation and change-order penalties as well as any guarantees provided by the state.

20. Please present the cost comparison by removing MGE and UW's sunk costs from the alternative proposals.

21. Have additional monies been committed to the MGE/UW 150-MW proposal by either the state or MGE since this year's evaluation of alternatives began, on or about 1/14/03? Please itemize.

22. What is the experience of other research universities with campus utility projects, particularly with true cogeneration plants at Big Ten schools and MIT and Stanford. In particular, what are their per KW first costs and how does this compare to the alternatives under consideration?

23. Is the cancellation of El Paso's Muskego Energy facility project on the grounds that it was unable to negotiate purchase contracts from regional utilities an indicator of regional supply & demand? Is it an indicator of anticipated natural gas prices? Was MGE one of these regional utilities?

C. Campus Master Plan

1. Has any coordination been done (beyond plant siting) with the University's and Department of Administration's comprehensive Master Plan of 1996?

2. Why does the projected thermal capacity of this plant greatly exceed the capacity of the campus to support the associated construction?

   Specifically, the 20,000 tons of chilling/400,000 lbs per hour steaming expansion envisioned ay all alternatives under consideration is sized to serve in excess of 6 million additional square feet. Yet the Master Plan indicated that building construction in excess of 3.5 million square feet (in 1996) required acquisition of additional real estate.

   Further, the plant's ultimate capacity of 50,000 tons implies that the infrastructure planning anticipates in excess of 15 million additional square feet over current levels, or roughly double the area of buildings on campus over that at the end of the Master Plan.

3. Where will these buildings go? Can the UW afford to commit the entire site to an MGE plant? How will the current street systems handle the vehicular traffic associated with this much development? Has the city concurred with the implications to its own infrastructure?

4. The Master Plan specifically states the following under the title “Infrastructure Requirements & Limits to Growth”:

   “The community road system is the single most limiting obstacle to future growth at the UW-Madison. Assuming aggressive transit, TDM, and infrastructure improvement programs are successfully implemented, it is estimated that the campus has the capacity to accommodate three million additional new gross square feet of buildings.”

   How can this be reconciled with any of the plant options under consideration?

   Can MGE/UW explain the difference between the growth/loads projected by the 1996 UW Master Plan and the current projections? The Master Plan recognized inherent limits to growth, land availability, roads, traffic--why has it been ignored?

5. Has the Master Plan been updated? At the time of its completion, one option for accommodating growth beyond the limits defined was a secondary campus – perhaps in Middleton or Fitchburg. Why build infrastructure capacity for the current campus when the Master Plan suggests future demand will be elsewhere?

6. Why has the concept of incremental infrastructure expansion outlined in the Master Plan been ignored by all the alternatives under consideration? Why does infrastructure investment precede actual need by as much as 10 years (or more) in such fiscally constrained circumstances? Shouldn’t investment in infrastructure be more closely timed to actual need?

7. How can UW endorse the 150-MW alternative when it conflicts with the State Department of Administration’s 1996 Master Plan agreement between UW, the city, and the neighborhoods? Shouldn't the parties have updated the Master Plan with the city and neighborhoods prior to endorsing a utility alternative that contradicts anticipated growth limits?

8. What is UW’s commitment to sustainable design and how does this impact the Master Plan and utility plant?

9. How many additional students and staff beyond 2002-2003 levels does the UW project on the Madison campus in the next 10 years?

D. Utility Reliability

1. Electrical

   a. When UW officials are quoted as concerned about “electrical reliability” what is the specific load in megawatts that is critical on campus? What amount of on-campus electrical generation does UW need for reliability concerns?
   b. Since UW officials argue that stem cell lines may perish if the 150-MW proposal is not built, it is imperative that a quantitative reliability analysis be performed to show the statistical likelihood of the death of a stem cell line under each alternative scenario, keeping in mind that electric failures are predominantly distribution failures rather than generation failures.
   c. What backup power arrangements are presently in place to assure the safety of stem cell lines on the UW campus and at the UW Research Park? Please

identify those labs that are currently at risk of loss of stem cell lines due to inadequate backup power.

d. Isn't the biggest factor distribution not generation with regard to reliable supply? How is distribution failure factored into the analysis?
e. Can the risk of distribution failure be quantified, i.e., probability of occurrence, redundancies, multiple system failures, and can this be ensured against?
f. What is the history of outages on campus, either by service area, or by building?
g. What is the installed capacity of campus standby/emergency generators by building?
h. Does electric reliability refer only to redundancy or are there other consideration such as separate sources? For example, generation redundancy still has risks with distribution, fuel and dispatch, where as photovoltaic cells that are coincident with peaking conditions can be independent from the grid and still be available to the load.
i. What portion of the UW electric load is under load management control (i.e., interruptible)?
j. The UW says it wants to be able to be an "island" in the event of brownouts or other outages. Is this consistent with legal requirements and normal interconnecting rules that would apply to the MGE proposed plant?

2. Thermal

    a. What is the risk of the unique legal, financing, and operating structures to the ability of the UW to provide uninterrupted thermal utilities?
    b. How can a heat recovery device in an electrical generating plant be considered as standby/backup boiler capacity?
    c. Are there reliability concerns with chilled water? If so, is cool storage part of that strategic thinking?
    d. Steam loads in 2011 are already expected to be more than twice the growth limit projected in the 1996 Master Plan. Please explain what projected growth beyond 2011 is based on.

3. Fuels

    a. What is the impact of the rapid increase in natural gas power plants on the availability and cost of natural gas? Is there any attempt to develop or explore Wisconsin resources for fuel?

E. Heating & Cooling Load Projections

1. How are the projected thermal load increases (20,000 tons/400,000 lbs/hr) affected by the current fiscal crisis? What will be cancelled? Deferred? Please modify the projected load curve to show the effect of delayed and cancelled projects.

    Examples include:

    a. Student Health Facility – The Governor’s budget includes no funds for this project
    b. Mechanical Engineering – Will the construction of the project be funded so that its loads must be served in 2005?
    c. Microbial Sciences – Same as above

d. Forest Products Lab Cooling – Is this project on track for a 2005 completion? What is the source of funds to make the connection and building system changes? Have these been designed and are they under construction?

2. Has increased cooling usage efficiency been incorporated into projections?

3. Firm load or worst-case analysis, i.e. the biggest piece of equipment going down on the coldest day, underpins the analysis. Why not use reality-based data and/or factor in safety features already in place? Is it the norm for large campuses to ensure that "firm" capacity for steam exceeds demand? How can MGE's HRSGs be considered firm, since they require that the primary turbines be running?

4. Using current actual capacity and not current firm capacity, and assuming no additional steam capacity is built, calculate the probability of a steam shortfall, the mean duration of the shortfall, and describe the effect on campus buildings.

F. Thermal Load Management

1. Projected thermal loads (steam and chilled water) are approximately 50% higher per unit area than current loads. While this may be consistent with the type of buildings planned (medical and science), what provisions will be employed to mitigate these loads? Examples include:

    a. Total enthalpy heat recovery
    b. Local scientific equipment/apparatus cooling (as opposed to space air supply and exhaust)
    c. High efficiency fume hoods
    d. Variable volume fume hood exhaust

2. Using thermal storage could greatly boost the capacity of the already pinched chilled water distribution system, and displace the need for a good portion of the planned new electric generating capacity, as well as making better use of existing chillers. Was thermal storage considered? Can cool storage reduce life cycle costs of all alternatives? If so, by how much?

3. What is being done systematically on a university-wide basis to reduce energy use (electric, steam, chilled water) and to reduce on-peak electric demand?

G. Additional Options

Why not optimize the potential of the Walnut Street location exclusively for the UW? This development would focus on meeting the UW utility loads, be incremental, attain much higher annual operating efficiencies, reduce overall emissions, increase the utilization of assets, and lower utility costs for the UW. In complement, meeting the needs for MGE customers could come from revitalizing their existing Blount Street plant. Blount Street has the infrastructure for fuel and distribution. And specifically, the rail system affords access to a variety of fuels, which becomes critical in coming years as fossil fuels become more constrained.

Two examples for the UW include:

1. Why not consider a minimum capital cost option that provides 10,000 tons of chilling and 200,000 lbs/hr of boiler capacity? This is a more fiscally responsible approach responding to the uncertainty over how fast loads will grow in light of the current capital budget, and to the current fiscal restraints on state government. Would UW consider staging the project, i.e., building what is needed for the immediate future with planned additions as needed.

2. Why not consider a university-owned true cogeneration facility with the following attributes:

    a. Smaller scale turbines – similar to Solar Turbines – that both meet the actual critical loads from an electrical reliability perspective, and that do not require an upgrade to the electrical transmission systems. Smaller units can be phased in as load increases.
    b. Steam-driven cooling (either steam turbine centrifugal machines, absorbers, or a combination of both).
    c. Will an incremental plan, starting with 14 MW of electric generation plus cogenerated steam and chilled water meet campus steam and chilled water needs? How much lower would first costs be assuming such an incremental plan?

3. How does DOA/UW define cogeneration? How does the MGE proposal conform to this definition? How many hours per year, and at what efficiencies, will the 150-MW proposal run in cogeneration mode? Please compare these efficiencies with efficiencies at best-of-breed campus cogeneration facilities.

4. Does Sebesta have a recommendation for a true UW cogen plant configuration that is different from the current options? The figures of merit should be cost to state and other steam and chilled water customers, efficiency, air quality, water consumption, least noise.

H. Environmental

1. Air quality:

    a. Has the cooling tower plume impact of the 150-MW facility been assessed?

    b. Should the 150-MW facility include SCONOx as a Best Available Control Technology to limit emissions?

    c. With respect to air modeling, the monitoring location at Franklin and University is upwind of the plant. How does this affect modeling results downwind of the plant?

    d. Please quantify the air quality degradation attributable to each alternative facility, including each phase of an incremental 14+14+14 MW cogen design?

    e. What are the economic and health costs when the area becomes an ozone or particulate matter non-attainment area? By how much time will the proposed 150-MW facility accelerate non-attainment status?

    f. In view of Question A.19, please indicate which alternative would result in the lowest levels of PM2.5 emissions.

g. Ammonia: The proposed 150-MW facility will emit 10 parts per million as reported in MGE's construction permit application. Given (a) the acute and chronic non-cancer health effects associated with ammonia emissions as well as (b) ammonia's role as a precursor to PM2.5 in the form of ammonium sulfate and ammonium nitrate and (c) the existence of gas turbines in the US emitting as little as 2 parts per million, why are MGE/UW proposing 10 parts per million? Are the alternative plans capable of emitting as little as 2 parts per million?

2. Sound mitigation:

    a. Are sound mitigation measures of all alternatives at least as aggressive as those applied at the Iroquois Falls, Ontario cogen plant?

    b. Have more aggressive sound mitigation measures been applied at any of the European cogen facilities visited by MGE?

3. Water:

    a. What are the impacts on the Yahara watershed of the alternatives?

    b. What are the comparative costs of water mitigation for each of the alternatives?