PSC REF#:146720

Public Service Commission of Wisconsin
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CapX2020

Delivering electricity you can rely on

April 5, 2011

ELECTRONIC FILING
Robert Norcross, Administrator
Public Service Commission of Wisconsin
PO Box 7854
510 North Whitney Way
Madison, WI 53707-7854

Re: Joint Application of Dairyland Power Cooperative, Northern States Power Company - Wisconsin, and Wisconsin Public Power Inc., for Authority to Construct and Place in Service 345 kV Electric Transmission Lines and Electric Substation Facilities for the CapX Twin Cities - Rochester - La Crosse Project, located in Buffalo, Trempealeau and La Crosse Counties, Wisconsin
PSCW Docket No. 5-CE-136

PSC Staff IR 02-2

Dear Mr. Norcross:

Please find enclosed an original and 11 copies of the response to Public Service Commission Staff Information Request 02-2 dated March 14, 2011 and a supplemental response to Information Request 01-10. The enclosed information is submitted on behalf of the Applicants; Northern States Power Company, a Wisconsin corporation (Xcel Energy), Dairyland Power Cooperative (Dairyland), and WPPI Energy (WPPI). Two copies are being sent to the Wisconsin Department of Resources offices.

Please call with any questions.

Sincerely,

s/Amanda R. King
Amanda R. King

ARK/dba
Enclosures
cc: William Fannucchi - PSCW
Ken Rineer – PSCW
Udaivir Singh Sirohi - PSCW
Cheryl Laatch – DNR (2 copies)

CapX2020
Hampton – Rochester – La Crosse
345 kV Transmission Project
Docket 5-CE-136
Completeness Response: Item 02-2

Date of PSCW Request: March 14, 2011
Date of Response: April 5, 2011

Item 02-2

Provide analyses on how additional, hypothetical generation might be built and deployed within the La Crosse study area to resolve the reliability issues addressed by the proposed project and to replace the proposed project with performance comparable to the proposed project. Consider all of the following:

- Generation from non-combustible renewable resources such as wind or solar power
- Generation from combustible renewable resources such as biomass or landfill gas/bio-gas
- Natural gas-fired generation

For each possibility, consider whether and how such generation could be cost-effective, technically feasible, and environmentally sound.

Response

Introduction

In evaluating alternatives for the Project, Applicants studied the availability of demand side management (DSM) and generation as alternatives to meet the three needs identified in this Application (community service reliability, generation support and regional reliability). Applicants concluded that additional generation would not satisfy any of these identified needs.

The Project is designed first, to strengthen the transmission network to meet several thousand megawatts (MW) of additional demand for electrical power anticipated in Minnesota, Wisconsin and parts of surrounding states by 2020. This need cannot reasonably be satisfied by DSM or installing additional local generation without transmission. While the addition of local generation can improve local reliability in some circumstances, that local generation cannot provide for the type of region-wide benefits that the proposed 345 kV lines will provide. To make generation available to more than just the local area, the transmission proposed would have to be built. Also, local generation does not have the same reliability characteristics as transmission and cannot be used to provide overall regional system enhancements. Further, by constructing additional 345 kV transmission lines, the regional system is benefited as a whole because those additional connections provide for a more robust system that will be better able to withstand system contingencies.

Second, the line will support generation development by providing foundation bulk transmission facilities across the Minnesota/Wisconsin border to enable future power transfers into Wisconsin. Neither DSM nor the addition of generation itself can support generation development.

Third, the Project will address the need for additional transmission facilities to provide reliable service to the growing communities in the Rochester and Winona/La Crosse areas. While local reliability deficiencies can theoretically at times be addressed through generation and/or DSM, generation and DSM cannot resolve the significant load serving issues in Rochester and La Crosse. In conducting this analysis, Applicants identified the amount of load reduction that would be required by 2020 to provide equivalent capacity of the Project and maintain transmission system flows within their normal ratings. Applicants determined that an alternative would need to provide 98 MW of capacity in the Winona/La Crosse area and 220 MW of capacity in the Rochester area. This is the amount of capacity the Project adds to each load serving area.

Load Reduction

A DSM alternative would require the immediate elimination of 3 MW of peak loading in the La Crosse/Winona area and 153 MW of load in the Rochester area.[1] Going forward, growth would need to remain stagnant until 2020. In other words, there would need to be a total reduction of 98 MW of load in Winona/La Crosse and 220 MW of load in Rochester. Reductions in existing demand and a zero growth scenario through conservation is not a reasonable scenario.

Further, to ensure that load did not exceed levels that might cause problems to the transmission system, conservation measures such as a demand control program would have to be actively managed on a continuous basis. Voluntary compliance would not ensure the needed reduction in load levels. No such regulatory authority or system is currently in place in either the Winona/La Crosse or Rochester areas. Additionally, the Applicants to not have the authority to create or mandate compliance with a load control program. Therefore, Applicants were not able to determine the cost-effectiveness of such a program.

Generation

Applicants also evaluated renewable and non-renewable alternatives that could potentially address local load serving needs in the La Crosse/Winona and Rochester communities in the 2015-2020 timeframe. These alternatives include wind, photovoltaics, biomass, landfill gas and fired combustion turbines. Applicants concluded that these alternatives would not satisfy the identified needs.

Wind

Wind energy generation is a "variable" resource that is dependent on the availability of wind to operate. The capacity of a typical wind turbine is 1.5 or 1.65 MW. However, while a wind turbine may have a nameplate capacity of 1.5 MW, its average net operating output may range from 20% to 40% of its nameplate capacity. A wind plant is a "nondispatchable" resource and cannot be relied on to serve peaking needs in the same way that a conventional plant of the same rating (e.g., natural gas fired) which is a "dispatchable" resource and can be brought on-line fairly quickly. In addition, peak electrical generation at wind facilities generally occurs in the fall, winter, and spring, and does not overlap with peak demand periods which occur in the summer.

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[1] These levels are those supportable by the transmission system under contingency conditions.

As a result, wind energy is generally relied upon as a source of energy but does not provide the type of capacity that is required to ensure reliable customer service for those times when the wind is not blowing. Rather, wind generation is typically integrated into the transmission system along with dispatchable resources such as natural gas peaking plants and hydro, which are capable of generating power during those hours when customer demand is high but the wind is not blowing. Due to the variability of wind, this would provide no capacity to support users in the La Crosse and Rochester areas.

Moreover, the addition of wind generation would not obviate the need for transmission. This operating characteristic creates two separate issues, each of which can be alleviated by the development of high voltage transmission. First, the system must be capable of importing power to the affected community during those hours when sufficient wind energy is not being generated to satisfy the entire need (i.e., high demand/low wind scenario). Second, the system must be capable of exporting power from the affected community during those hours when more wind energy is being generated than can be used by the local community (i.e., low demand/high wind scenario). Thus, transmission improvements would be required to support wind generation.

Another consideration with respect to wind generation is space requirements. Using National Renewable Energy Laboratory unit spacing approximately 60 acres are needed in placing 1 MW worth of wind. This would yield about 6000 acres needed for a 100 MW installation. Additional ROW would be needed for the placement of lines to collect power from the turbines and transmission lines to move the power.

Photovoltaic

Unlike wind power, photovoltaic resources have the benefit of peak electrical generation overlapping part of the period of peak demand—during hot, summer days. However peak load often extends into summer nights as well, when photovoltaic systems stop generating electricity. Without sufficient storage capacity, this problem limits their usefulness in resolving the identified electrical deficiencies in the La Crosse/Winona and Rochester areas.

Currently, there are no photovoltaic installations that large enough to be considered in transmission planning studies or dispatched to the Midwest Independent Transmission System Operator, Inc. market located in the La Crosse/Winona and Rochester areas. Voluntary construction of new systems, would most likely not meet the minimum additional capacity within the time period needed to ensure transmission grid reliability. Additionally, solar power is expensive. Costs for the equipment installed in a solar array is approximately $2.50/watt. This does not include installation costs, structural analysis costs, or costs to meet local zoning/permitting requirements. Assuming that the nameplate of the solar arrays was available capacity to provide power on peak, 100 MWs of capacity would cost about $250M pre-installation.

The watts of electricity provided by 1 sq ft. of photovoltaic cells can range between 4.9 and 13 watts. Generally the lower density of power production yields the lower cost of equipment. 100 MWs of power would take about 470 acres worth of panels at a power density of 4.9 watts/sq. ft. Local zoning restrictions, statutes, aerial obstructions and other factors may increase the area needed to install this capacity.

Biomass

As with the other renewable technologies, additional facilities would have to be constructed to meet the 98 MW and 220 MW minimum additional capacity required to ensure transmission grid reliability in the Rochester and La Crosse areas.

Attachment 1 represents recent information received from vendors. The attachment includes information regarding unit costs, performance data and effluent estimates is attached. Based on the data in this attachment, it appears that multiple biomass plants would be required and would not be a cost-effective alternative to the proposed Project.

Landfill gas/biogas

There is not sufficient available landfill gas in the Winona/La Crosse or Rochester areas to meet the minimum additional capacity needed in each community to ensure transmission grid reliability. These small units are not likely to trigger a need for new transmission assets. Therefore, landfill gas/biogas is not a technically feasible non-transmission alternative.

Gas-fired combustion turbine alternatives

Applicants also analyzed constructing gas generation as an alternative for community service reliability. To do so, Applicants assessed the level of deficiency, the amount of generation required to meet the deficiency and estimated costs.

The community service reliability issues arise in each community under peak conditions. In general, adding gas-fired generation, even a very large generator, helps the reliability of serving the load in only a relatively small geographic area. This is largely due to the lack of high capacity transmission lines from one load center to adjacent load centers. Therefore, the following analyses of generation to avoid transmission focuses on building relatively small generating plants to support specific load centers. This alternative solution of building small generators, however, decreases the benefit-cost ratio of building generation to avoid transmission because it is less economical than building large generating stations.

To provide generation capacity comparable to the capacity of transmission, more megawatts of generation would need to be installed than the actual deficit. For example, it is not sufficient to conclude that if a local area has a 50 MW deficit that adding a single 50 MW peaking unit would be sufficient. Rather, to provide an accurate comparison, sufficient generation must be considered that will replicate the reliability provided by adding transmission.

Transmission lines have the ability to operate more than 99% of the time. This reliability level is one of the benefits of constructing transmission lines. For comparison purposes peaking generation cannot be assumed to be available to operate more than 95% of the necessary hours. Consequently, to replicate the 99% reliability found in transmission, redundant generation would need to be installed. Using the 50 MW deficit as an example, four 25 MW units would have to be installed to ensure that two were operational at any given time.

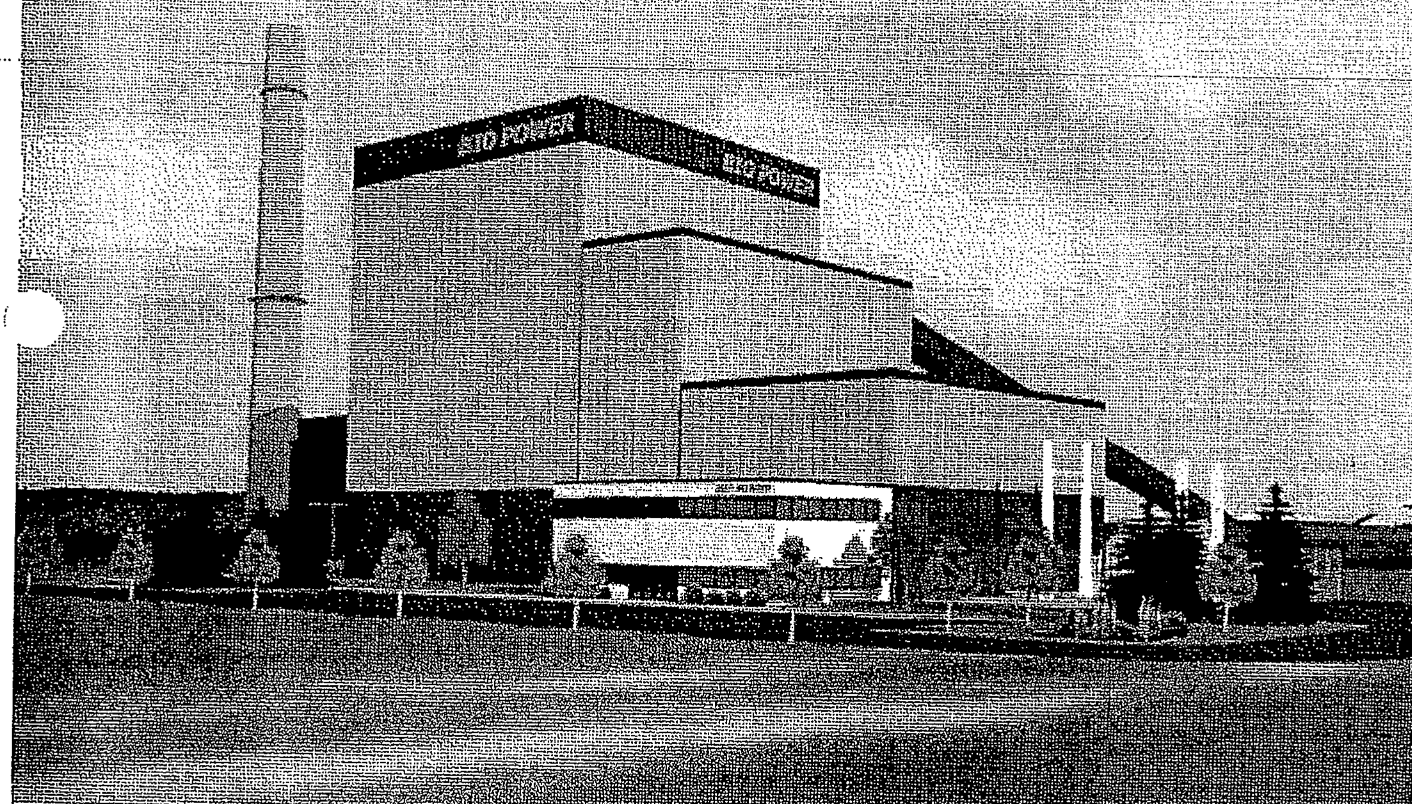
Applying this ratio here, to provide capacity similar to the 318 MW of capacity provided by the Project, and assuming the need were located in a single location rather than two distant communities, four units of 159 MW would be required. Applicants estimate that the capital cost each of these plants would exceed $100 million each.

In addition to the extra capital investment, the additional costs of higher operations and maintenance of generators when compared to such expenses for transmission must also be considered. Once constructed, transmission lines require relatively modest ongoing operations and maintenance costs. Peaking generators, by contrast, require much more costs for ongoing operations, including fuel, and maintenance. Another obstacle to installing generation is that transmission typically cannot be avoided altogether. Unless the generation can be built to interconnect to existing lines with sufficient capacity, new lines would have to be built to accommodate the new generation. This needed transmission further increases the cost of that generation alternative.

Compared to the proposed Project, this does not appear to be a cost-effective non-transmission alternative.

"Mulch to Megawatts"

25 MW Biomass Power Plant

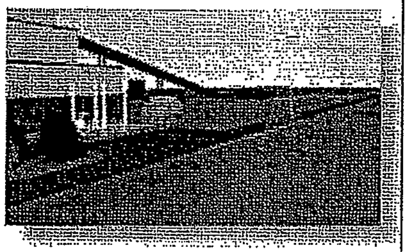


Barr Engineering Company
4700 West 77th Street • Minneapolis, Minnesota 55435
Phone: 952-832-2600 • Fax: 952-832-2601 • www.barr.com

BARR

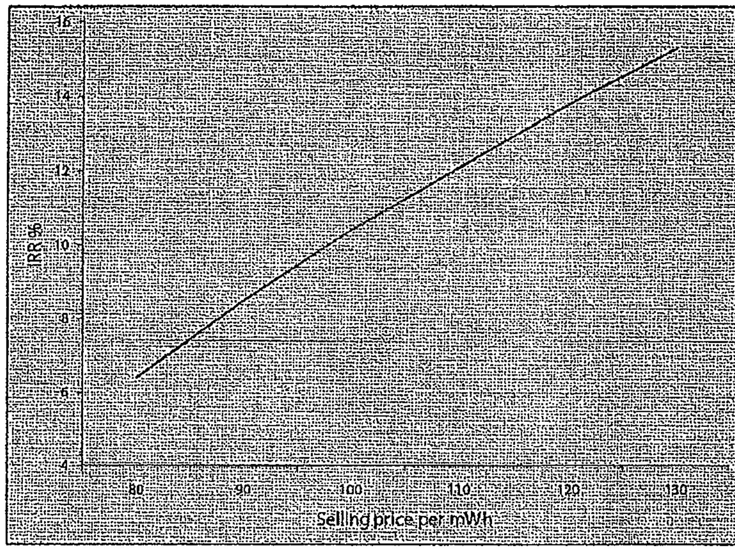
Cook Engineering
740 South Syndicate Ave. • Thunder Bay, Ontario P7E 1E9
Ph: 807-625-6700 • Fax: 807-623-4491 • www.cookeng.com

Biomass Business Strategy

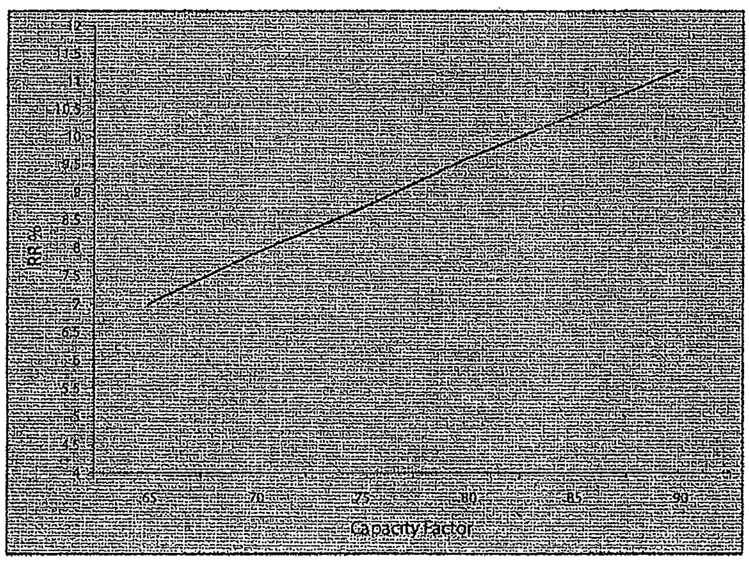


Project life - 25 years
Depreciation - MACRS
Capital cost - $3335 per KW
Fuel cost - $2.50 per MMBTU
Tax Credits - 1.1 cent per KW
IRR - Unleveraged
Staff - 27 personnel

Success = Sustainable Rate of Return

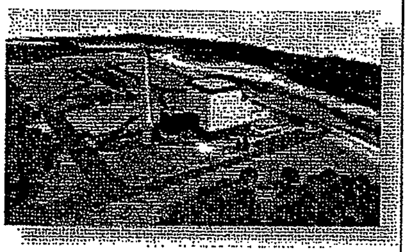


Reliability = High Capacity Factor = High Returns

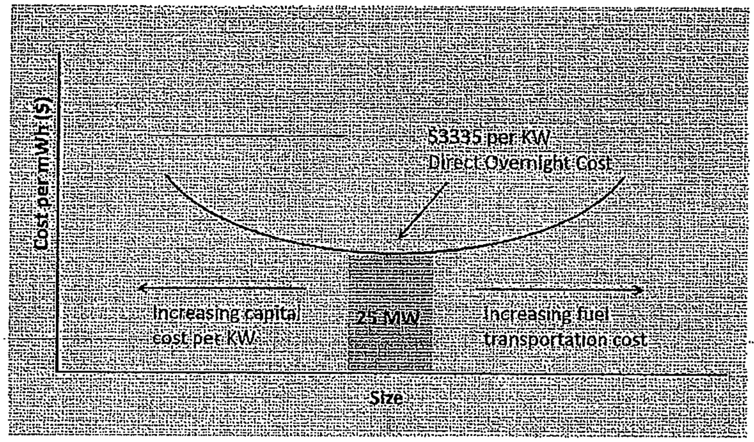


Utility-grade equipment +
Robust design =
Highest returns

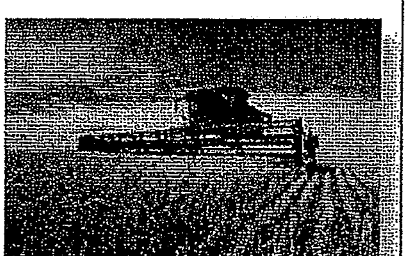
Why 25 MW Biomass?



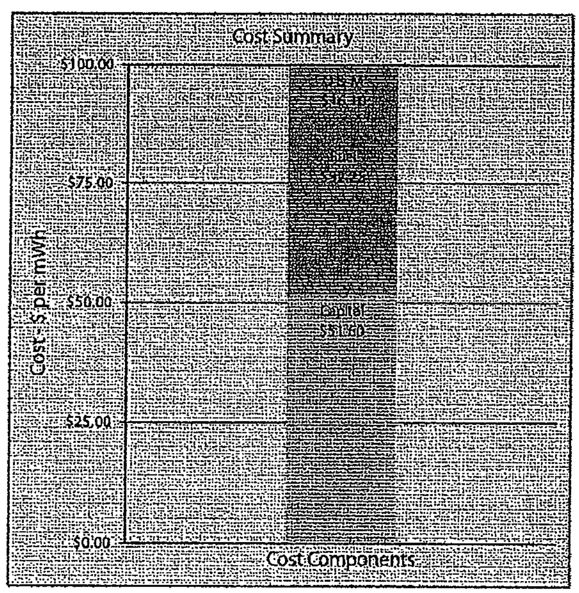
25 MW = Optimum Cost



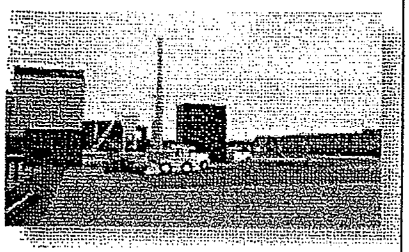
Assuming a typical biomass supply for a new power plant site, 25 megawatts is an optimal-sized project with respect to capital costs and fuel supply costs. Smaller projects will be more expensive to build (per KW) and larger projects will require a larger fuel-aggregation radius, which may trend toward unsustainable transportation costs. This determination may not hold for projects with their own special advantages, such as repowering of existing assets or having a captive fuel supply in close proximity.

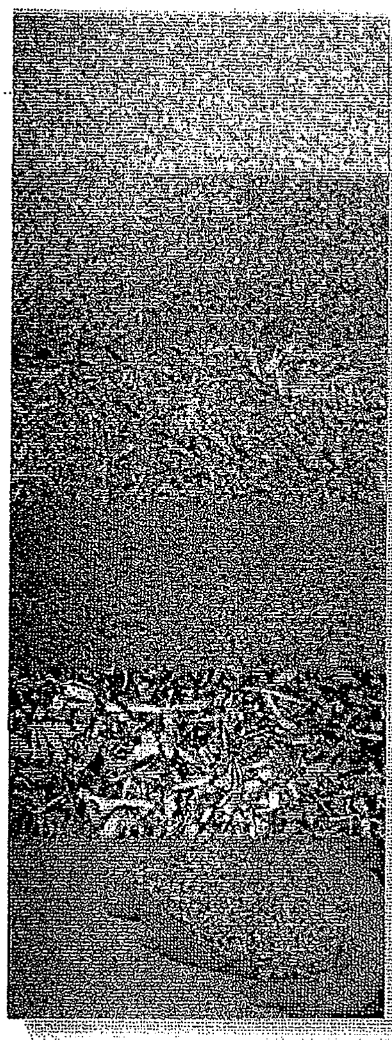


Agricultural residuals, such as wheat straw, can be part of a biomass fuel supply.



Biomass Fuel Flexibility





Increased Fuel Flexibility = Reduced Project Risk

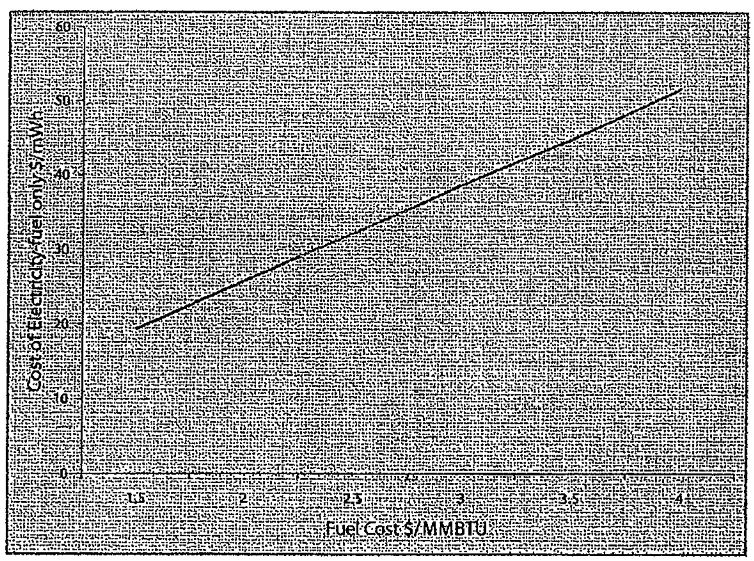
Closed-loop fuels include:
- Switchgrass
- Corn stover
- Hybrid poplars
- Canary grass
- Sorghum
- Animal waste (turkey litter, etc.)

*From Title 26 (Tax Code), Subtitle A, Chapter I, Subchapter A, Part IV, Subpart D, Sec. 45(c)(2): "The term '**closed-loop biomass**' means any organic material from a plant which is planted exclusively for purposes of being used at a qualified facility to produce electricity."*

Open loop fuels include:
- Whole tree chips
- Hog fuel
- Wastewood

*From Title 26 (Tax code), Subtitle A, Chapter I, Subchapter A, Part IV, Subpart D, Sec. 45(c)(3): "The term '**open-loop biomass**' means - (I) any agricultural livestock waste nutrients, or (II) any solid, nonhazardous, cellulosic waste material or any lignin material which is segregated from other waste materials and which is derived from (I) any of the following forest-related resources: mill and harvesting residues, precommercial thinnings, slash, and brush, (II) solid wood waste materials, ... but not including municipal solid waste, gas derived from the biodegradation of solid waste, or paper which is commonly recycled, or (III) agriculture sources."*

* These fuels can be burned singly or in combination.



Biomass fuel options include (top to bottom) corn screenings, malt screenings, mustard screenings, oats screenings, hogged wood fuel, and wheat chaff.

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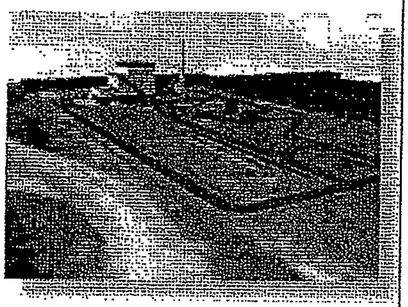
Environmental Impacts



Comprehensive Environmental Evaluation = Straight-forward Permitting

Air-Emission-Control Technologies

- Fabric filter for particulate
- SNCR for NOx

Estimated Air Emissions Profile

	lb per MMBtu*	Heat Input (MMBtu/hr)	Control	Controlled PTE (tpy)**	lb per MMBtu - controlled
PM_{10}	0.1	335	0.9	17.6	0.012
NOx	0.2	335	0.5	147	0.10
CO	0.15	335	0	220	0.15
SO_2	0.025	335	0	36.7	0.025
CO_2	195	335	0	286,000	195

* Uncontrolled rates provided by B&W, US EPA RBLC and US EPA AP-42

** PTE = Potential to Emit (emissions for 8760 hr/yr)

Ash Disposal

- 3,300 tpy
- Land application
- Concrete amendment (possible)
- Industrial landfill

Wastewater Discharge

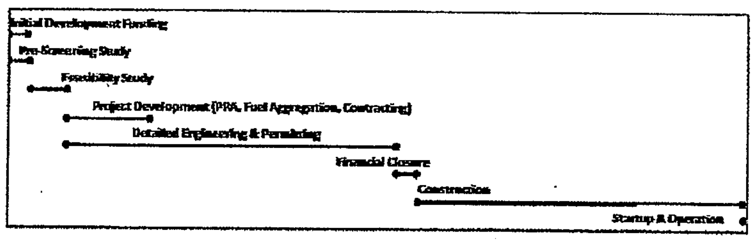
- 25 gpm boiler blowdown
- Cooling-water blowdown

Water Supply

- 25 gpm boiler-water makeup
- 215 gpm cooling-tower makeup

Project Schedule

Realistic Expectations = Achievable Plan



Typical biomass power projects will have a sequence of milestones as indicated in the timeline above:

- The overall timeline will vary depending upon project-specific circumstances, but two-three years is a reasonable outlook.
- Steps that depend on funding can be delayed by complexity.
- Construction can be hindered by weather.
- Environmental permitting is an often underestimated aspect that is getting increasing attention from the public. Allow 6-24 months for permitting.

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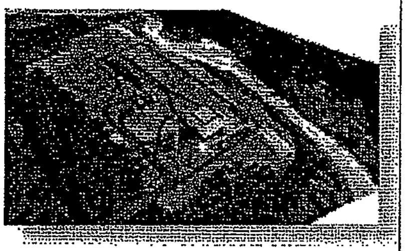
Base Plant Equipment



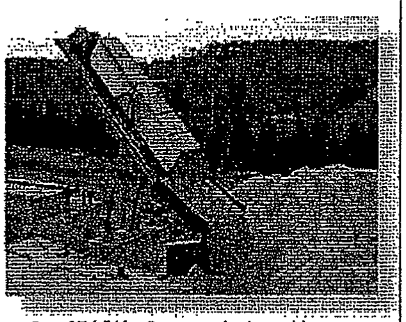
Summary Plant Description

The biomass plant is sized at 25MW using a bubbling fluid bed boiler and a condensing-steam turbine. Woody biomass is used as the primary fuel with approximately 40% moisture and a heating value of 5,160 BTU/lb.

Base Plant Equipment

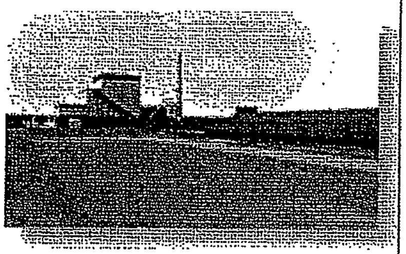
The base plant consists of the following major equipment and facilities:

- One single-drum bubbling fluid-bed power boiler with back-end emissions control equipment consisting of a baghouse and selective non-catalytic reduction (SNCR); boiler has an operating temperature and pressure of 950°F and 1,500 psig
- One single-casing, axial-exhaust, steam turbine with generator and associated accessories
- One natural gas fired auxiliary package boiler sized at 25,000 lb/hr.
- Two, 100-percent-capacity boiler feed pumps; one motor-driven and one steam-turbine-driven
- Separate deaerator and storage tank, one closed low pressure and two closed high pressure feed water heaters
- Two, 100-percent-capacity condensate feed pumps
- One, water-cooled condenser
- One, mechanical-draft cooling tower with 2x100% circulating water pumps
- One, biomass island (four-day supply) consisting of one truck scale, one truck dumper, one stacker, one reclaimer, and a processing area and boiler biomass feed conveyor
- Control room and administration area
- Water treatment area
- Transformers, circuit breakers and bus duct
- Plant maintenance and laydown areas
- Building enclosure for the boiler, steam turbine, water treatment, control, administration and wood processing areas



Our 25 MW reference plant would require approximately one truck per hour during operating hours or about 7,000 trucks per year of biomass fuel.

Operating Data and Specifications



Steam Production Rates and Properties

Steam Flow (pph)	Steam Pressure (psig)	Steam Temperature (Degrees F)	FW Temperature (Degrees F)	Net Plant Heat Input (MMBtu/hr)
250,000	1,500	950	480	335

Boiler Fuel Specification

H_2O (% Wt.)	Ash (% Wt.)	S (% Wt.)	H_2 (% Wt.)	C (% Wt.)	N_2 (% Wt.)	O_2 (% Wt.)	HHV (Btu/lb)	Annual Use (Tons)
40	1.2	0.07	3.24	32.3	0.6	22.7	5,160	212,210

Process Water Rates

Circulating Water Flow (gpm)	Make-Up Water Flow (gpm)	Cooling Tower Evaporation (gpm)	Boiler Blowdown (gpm)	Cooling Tower Blowdown (gpm)
15,000	292	217	25	50

Uncontrolled Air Emissions and Waste Generation Rates (Estimated)

PM (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	NOx (tpy)	CO (tpy)	SO_2 (tpy)	VOC (tpy)	Pb (tpy)	CO_2 (tpy)	Ash Generation (tpy)
150	148	147	293	220	37	73	0.15	286,000	3,300

Controlled Air Emissions (Estimated)

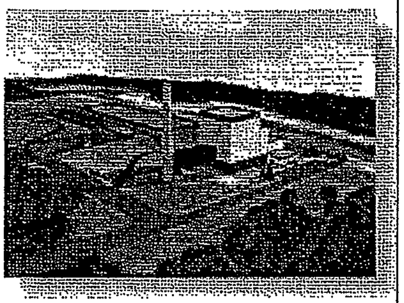
PM (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	NOx (tpy)	CO (tpy)	SO2 (tpy)	VOC (tpy)	Pb (tpy)	CO_2 (tpy)
22	18	44	147	220	37	73	0.15	286,000

Post Control Boiler Emission Factors (lb/MMBtu)

PM	PM_{10}	$PM_{2.5}$	NOx	CO	SO2	VOC	Pb
0.015	0.012	0.03	0.10	0.15	0.025	0.05	0.0001

Notes:
[1] Controlled and uncontrolled air emissions include fugitive emissions from a ten-acre biomass storage pile.
[2] NOx is controlled through the use of SNCR.
[3] PM, PM10, PM2.5 are controlled through the use of a fabric filter.

Low-value wood species can be chipped as part of a diversified biomass supply.



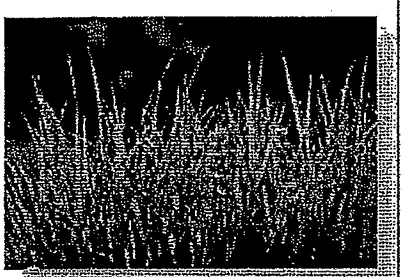
Potentially-Applicable Permitting Issues

Air Permitting

- **Prevention of Significant Deterioration (PSD):** Our 25-MW reference facility specified would require PSD permitting because uncontrolled NOx emissions are estimated to be 293 tons per year. A Best Available Control Technology (BACT) study would be required to determine the control equipment installed, and dispersion modeling would be required to comply with the increment of air quality deterioration allowed by the regulation. If a project locates in a PSD non-attainment area, the applicability thresholds are lower, more pollutants would be regulated and permitting would be more complex, with likely stricter emission limits and a requirement for emission offsets. Note that green house gas (primarily CO_2) emission standards for new facilities are pending and may become part of the PSD applicability determination.
- **New Source Performance Standards (NSPS):** NSPS are set to regulate criteria pollutants from certain facilities and processes. NSPS Db is a federal regulation that sets standards for boilers with a heat input rating greater than 250 MMBtu/hr. Boiler air emissions will need to meet the NSPS standards if no other stricter limits are imposed on the facility (e.g., BACT limits).
- **New Emission Standards for Hazardous Air Pollutants (NESHAPS or MACT Standards):** NESHAPS are standards that set emission limits and determine the type of add-on controls needed for reducing a facility's hazardous air pollutant (HAP) emissions. Note that EPA is proposing new HAP standards for boilers in April 2010 which will likely aim to regulate all types of boilers and fuel.
- **State Specific Rules:** Industrial-air-emission regulations vary somewhat from state to state. Some states adopt and cite the federal regulations; others impose stricter rules to further control industrial site emissions. State rules should always be considered during the permitting process.

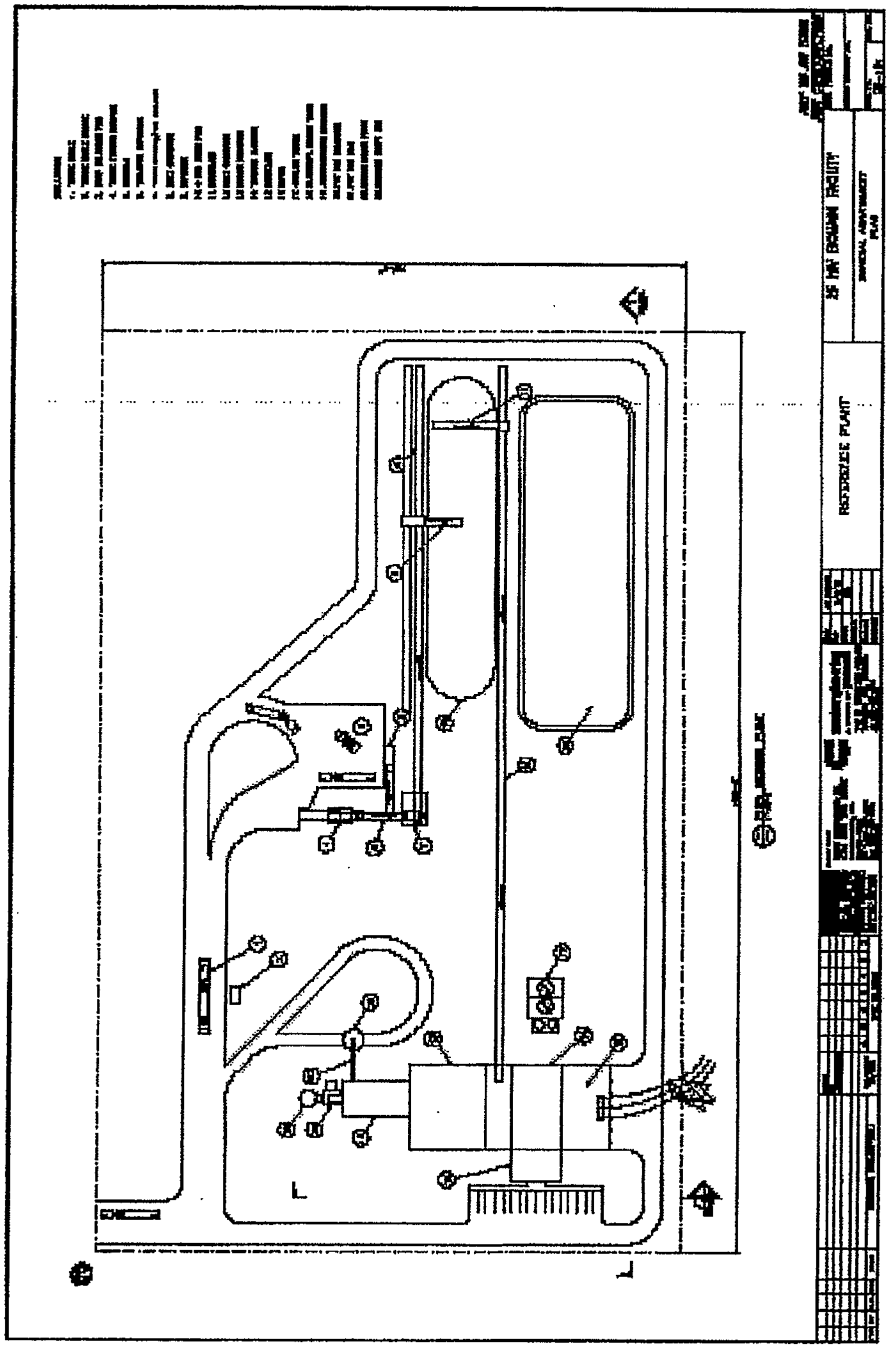
Water Permitting

- **National Pollutant Discharge Elimination System (NPDES):** The NPDES program controls water pollution by regulating point sources that discharge pollutants into the waters of the U.S. NPDES permits contain limits for pollutant discharges into water bodies. If a water body is classified as impaired and is regulated by a TMDL limit, it is possible that no increase in specific pollutants will be allowed, thereby significantly impacting the design or feasibility of a project.
- **Storm Water:** Stormwater discharges associated with construction and industrial activity require permits under the NPDES Stormwater Program. Facilities are required to develop a stormwater management program designed to prevent runoff from washing harmful pollutants into receiving water bodies or from being dumped directly into municipal stormwater systems.

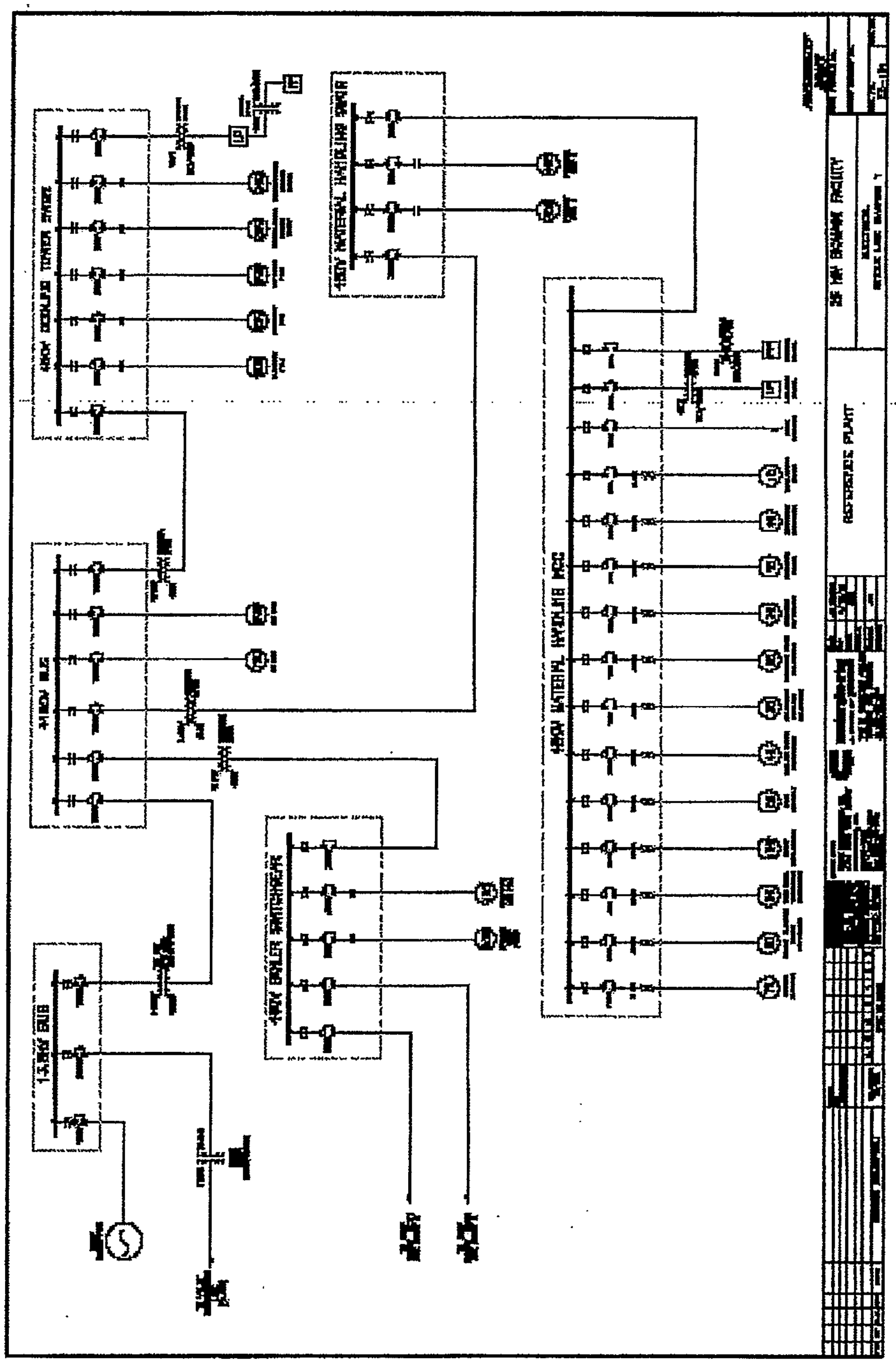


Biomass crops, such as switchgrass, are an emerging option.

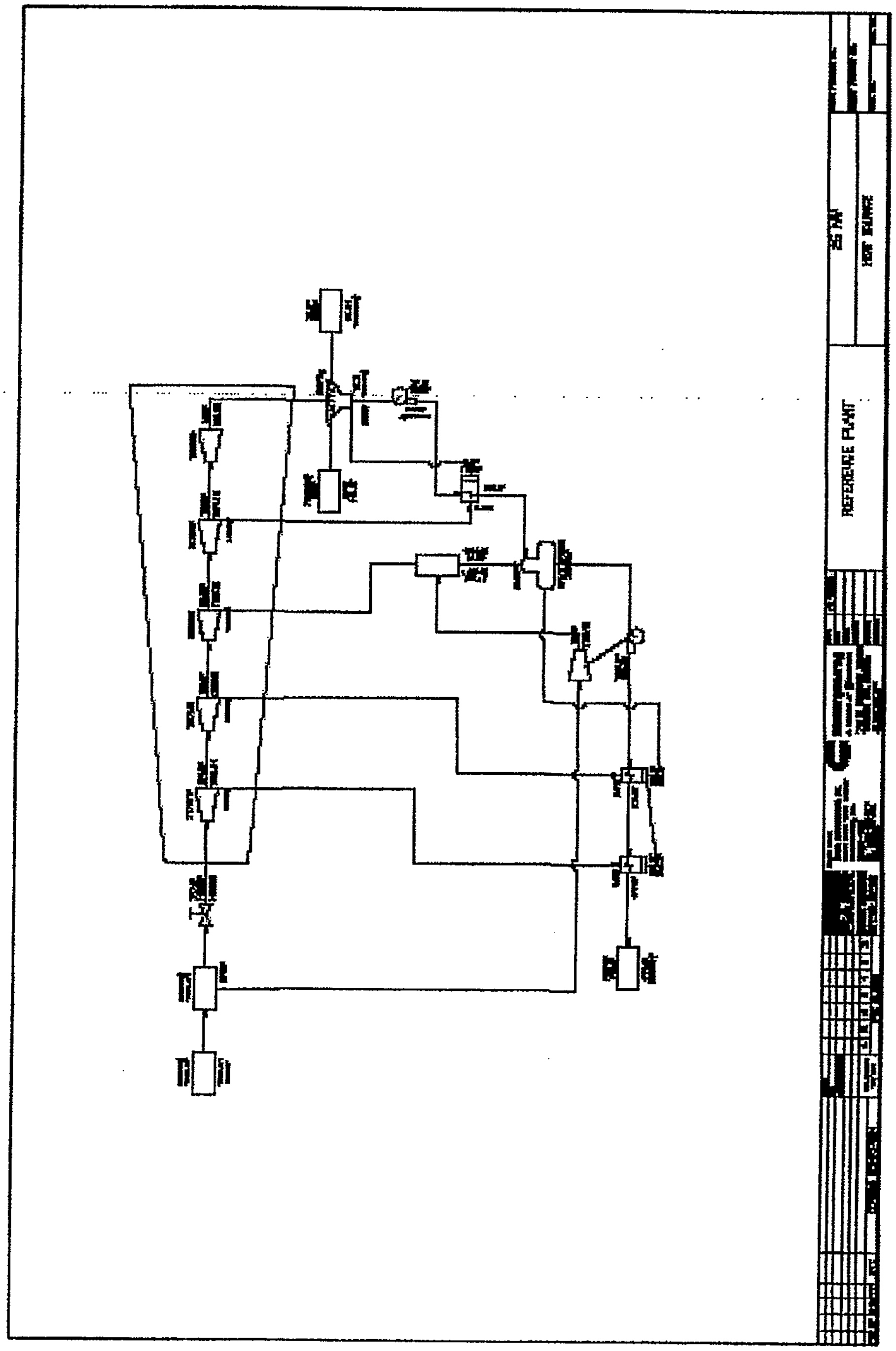
General Arrangement Plan

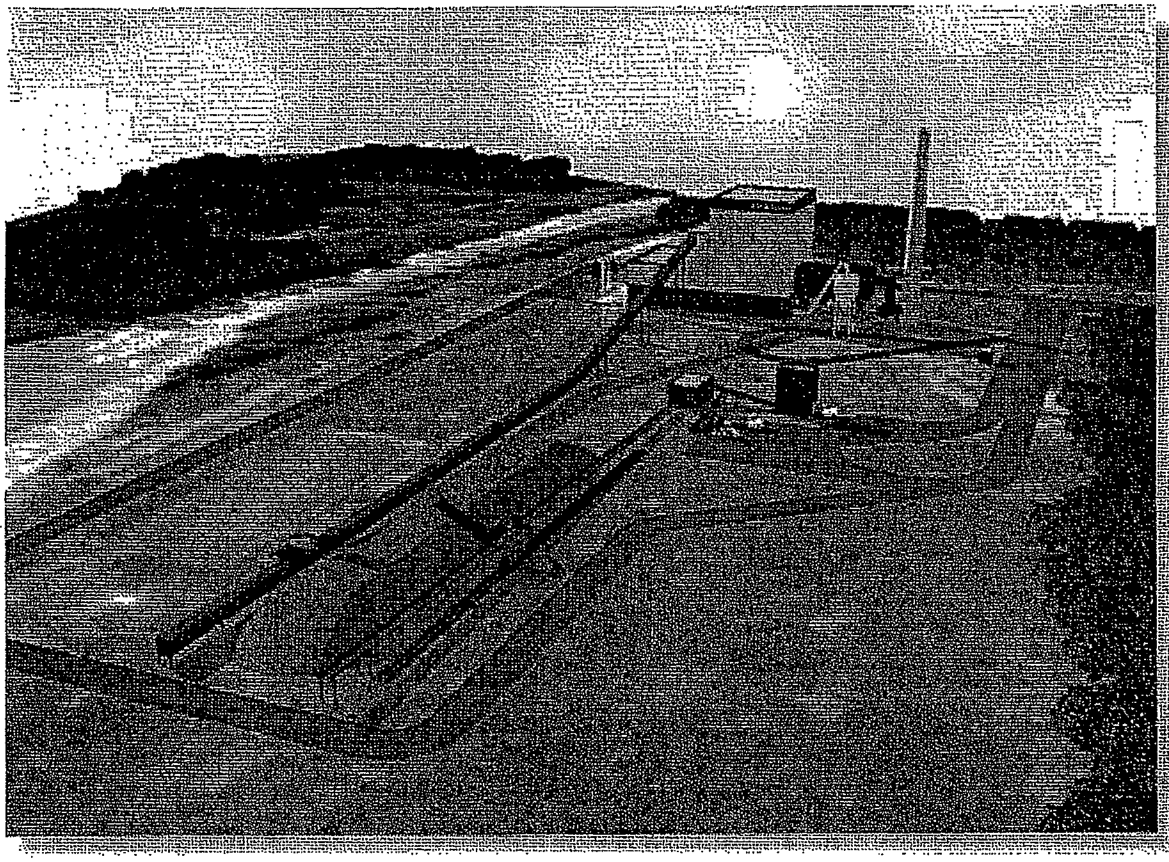


Electrical Single-Line Diagram



Heat Balance





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Contact Information

Bruce A. Browers, P.E.

Barr Engineering Company

332 W. Superior Street, Suite 600 • Duluth, Minnesota 55802

Phone: 218-529-7107 • bbrowers@barr.com

William S. McLean, P.E., P.Eng.

Cook Engineering

740 South Syndicate Ave. • Thunder Bay, Ontario P7E 1E9

Ph: 807-625-6727 • wmclean@cookeng.com

Option	La Crosse Area Load Serving Capability (MW)	Total Project Cost (escalated to in-service year dollars, includes precertification, overheads, AFUDC, etc.)	Planning Level Screening Estimates (Excludes escalation, AFUDC, overheads, etc. Includes EIF)	Regional System Reliability Issues for Alternatives	Siting and Land Acquisition Issues for Alternatives
		Wisconsin Costs Only	Wisconsin Costs Only		
345 kV Proposed project (estimate presents Wisconsin costs only)	750 MW	$195 million	$119 million		
2006 161 kV La Crosse Area Alternative	750 MW		$270 million		
2010 161kV La Crosse Area Alternative	750 MW		$330 million	No further enhancement to the reliability of the regional bulk transmission grid. No contribution to future transfer capability between Wisconsin and Minnesota	Many miles of new 161 kV ROW necessary for this alternative, including potential for a new river crossing. Major routing hurdles and resulting cost additions expected.
161 kV line from North Rochester - Briggs Road alternative (estimate presents Wisconsin costs only)	550 MW		$70 million	Regional reliability and regional transfer capability not increased	None
Double circuit 161 kV line from North Rochester - Briggs Road alternative (estimate presents Wisconsin costs only)	600 MW		$95 million + significant cost addition for new right of way	Comparable performance to 161 kV options with higher cost Regional reliability and regional transfer capability not increased	Double circuit 161 kV requires new ROW and route. Alternative route from existing DPC 161 kV Q1 line would be desired. Likely to require different river crossing. Major routing hurdles expected if not using existing ROW.
230 kV line from North Rochester - Briggs Road alternative (estimate presents Wisconsin costs only)	550 MW		$83 million	Comparable performance to single 161 kV options with higher cost New voltage introduced into both Rochester and La Crosse area. Non-standard 230/161kV transformers (0.14% of tx's on MRO model)	None

NOTE:
- Estimates are in 2010 dollars
- 345 kV, 230 kV and 161 kV alternatives all assume the same routes and configurations as proposed in Wisconsin CPCN and Minnesota route permit application, which includes plans to double circuit sections with existing
- 161 kV/161 kV scenario assumes building adjacent to the existing underlying transmission facilities. It is important to note that feasability of this adjacent configuration has not been investigated. In some places, such as portions of the Q1 route, there is no room for building adjacent to the existing 161 kV line.