



Total Project Cost	\$ 248,000,000
Approval Level:	Full BOR

FORMAL PROJECT APPROVAL REQUEST

TO: Pat Gamble
President

THROUGH: Kit Duke *Kit Duke*
AVP Facilities and Land Management

THROUGH: Brian Rogers *Brian Rogers*
Chancellor

THROUGH: Pat Pitney *Pat Pitney*
Vice Chancellor

THROUGH: Scott Bell, P.E.
Associate Vice Chancellor

THROUGH: Gary Johnston *Gary Johnston 11/11/13*
Director

FROM: Michael Ruckhaus, P.E. *M. Ruckhaus*
Sr. Project Manager

DATE: November 8, 2013

SUBJECT: Project Type: Renewal and Replacement
Project Name: UAF Heat and Power Major Upgrade
Project No.: 2012031 CPHR

cc: (CPHR) 101



Non- Academic Project Program Resource Planning Status Report

UAF Combined Heat and Power Plant Major Upgrade

Formal Project Approval

This project involves construction of a replacement combined heat and power plant for the UAF Main Campus. This Atkinson building is 49 years old and the systems have experienced several critical failures in recent years.

Milestone #0

Mission Area Analysis: (Replacement of existing facilities) Date: N/A
Statement of Need: (Replacement of existing facilities) Date: N/A

Milestone #1

Statewide Academic Council (SAC) Review: Date: N/A
(Not required for non-academic projects)

Milestone #2

Preliminary Administrative Approval: Date: 08/13/13

Milestone #3

Statement of Requirements: (Developed as a part of the FPA) **Date: 12/16/13**

Milestone#4

Business and Financing Plan: Date: N/A
Operating Budget Request (none requested, facility replaces existing) Date: N/A
Capital Budget Request: FY12, FY13, FY14 and FY15
Legislative Funding: FY12, FY13, & FY14 received for permitting and preliminary design
Board Approval of Capital Budget Distribution: Date: _____

Milestone #5

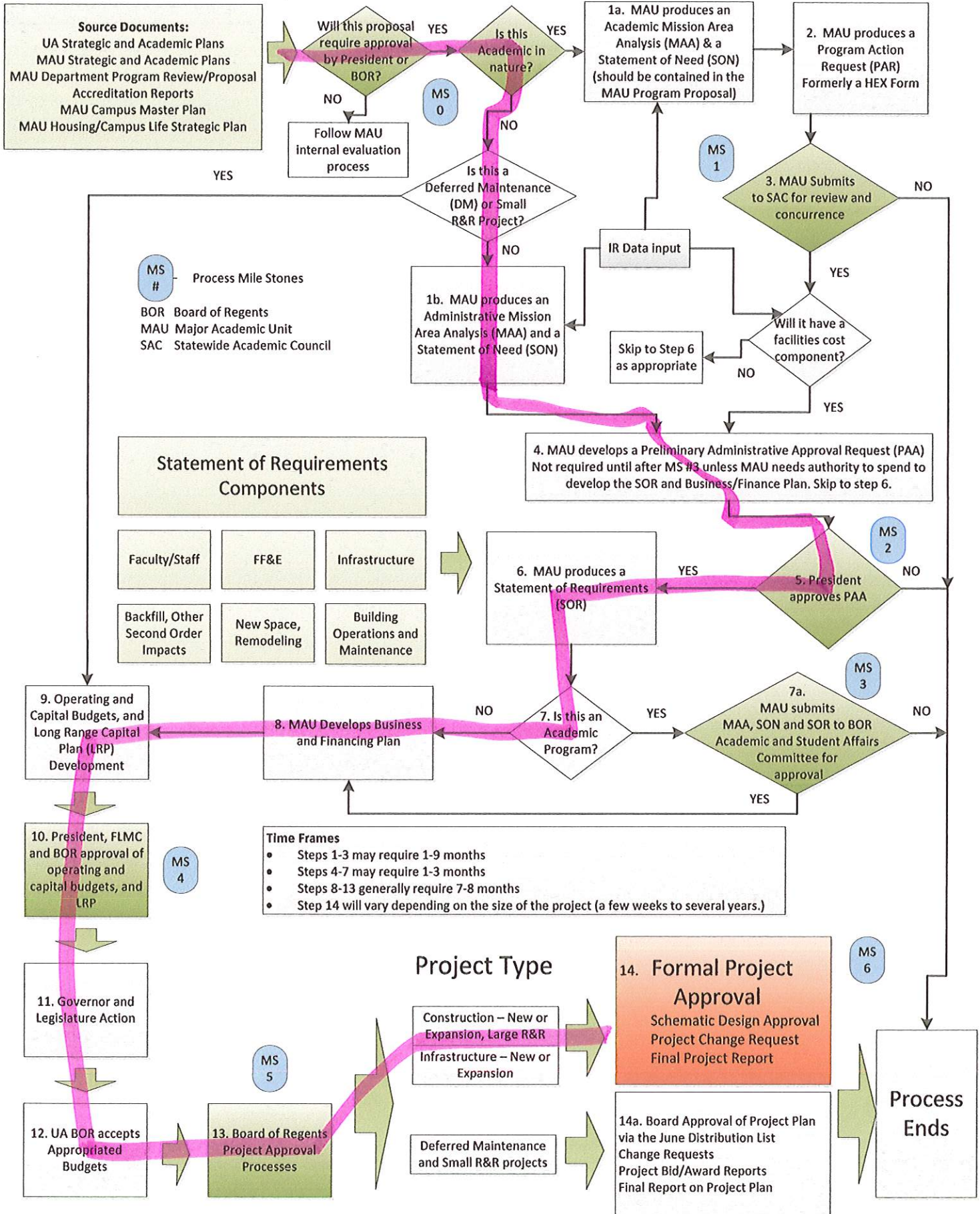
Formal Project Approval: For EPA Permitting Date: 12/08/11
Formal Project Approval: (for design and construction) **Date: 12/16/13**
Schematic Design Approval: Date: _____

Milestone #6

Construction Started: Date: _____
Construction Completed: Date: _____
Beneficial Occupancy: Date: _____
Final Project Report: Date: _____

University of Alaska Program Resource Planning Academic, Budget and Project Planning Process

Rev. 9-8-11





FORMAL PROJECT APPROVAL

Name of Project: UAF Heat and Power Plant Major Upgrade
Project Type: Renewal and Replacement
Location of Project: UAF, Fairbanks Campus, Atkinson Building-Power Plant # FS802, Fairbanks
Project Number: 2012031 CPHR
Date of Request: November 8, 2013

Total Project Cost:	\$ 248,000,000	
Approval Required:	Full BOR	
Prior Approvals:	Preliminary Administrative Approval	August 13, 2013
	FPA Environmental Permitting (\$3,000,000)	December 8, 2011

A Formal Project Approval (FPA) is required for all Capital Projects with a Total Project Cost in excess of \$250,000.

FPA represents approval of the Project including the program justification and need, scope, the total project cost, and the funding and phasing plans for the project. Requests for formal project approval shall include a signed project agreement or facilities pre-design statement, the proposed cost and funding sources for the next phase of the project and for eventual completion of the project, and a variance report identifying any significant changes in scope, budget, schedule, deliverables or prescriptive criteria associated with a design-build project, funding plan, operating cost impact, or other cost considerations from the time the project received preliminary administrative approval. It also represents authorization to complete project development through the schematic design, targeting the approved scope and budget, unless otherwise designated by the approval authority.

Action Requested

The Facilities and Land Management Committee recommends that the Board of Regents approve the Formal Project Approval request for the University of Alaska Fairbanks Heat and Power Plant Major Upgrade, as presented in compliance with the approved campus master plan, and authorizes the university administration to proceed through Schematic Design not to exceed a total project cost of \$248,000,000. This motion is effective December 12, 2013.

Project Abstract

The two coal-fired boilers in Atkinson Combined Heat and Power Plant are at the end of their useful life and need to be replaced. A facility addition to the Atkinson Plant will house two coal/biomass fired boilers (total capacity 280,000 lbs/hr steam) and a steam turbine with 17 MW of electrical output. This facility will have an expected life of 50 years. The current Atkinson Plant will remain in place continuing to house the two backup boilers (one gas and one oil-fired), water treatment, and machine shop.

RATIONALE AND REASONING

Background

The Combined Heat and Power Plant Major Upgrade project has been UAF's most mission critical capital issue for the last five years. Significant planning has been accomplished and the Board of Regents has received regular progress updates since 2010. Although a Formal Project Approval was received December 8, 2011 for the environmental permitting at \$3,000,000 (referred to below as Initial Project Development Cost), for consistency within the facility policy requirements, UAF seeks Formal Project Approval for the entire Combined Heat and Power Plant Major Upgrade project for a total of \$248,000,000 inclusive of the \$3,000,000 permitting phase funded in December 2011.

The plan for required project approvals is: (1) FY15 capital budget request at \$245,000,000 (\$195M GF, \$50M NGF) November 2013; (2) Formal Project Approval December 2013; (3) Partial Schematic Design Approval (for site work) June 2014; (4) Schematic Design Approval December 2014.

The Combined Heat and Power operation at UAF, housed at the Atkinson Power Plant, is reaching a crossroad. The plant was constructed in 1964 with additional capacity added in 1972, 1982, 1986, and 1998. It provides all of the heat and most of the electricity for the 3 million square feet of facilities on the UAF Fairbanks campus. Much of the infrastructure in the plant is nearing the end of its useful life, especially the two coal-fired boilers which are both almost 50 years old. Engineering analyses have identified a number of critical upgrades necessary to the heat and power infrastructure at UAF.

A 2006 study of the existing heat and power plant recommended the replacement of the oldest components of the existing plant and rehabilitation of the remaining equipment. It concluded UAF's best approach for the future would be to construct a 20MW combined coal/biofuel replacement plant. In 2010, an analysis was performed for additional options including natural gas. This study also concluded that the best option for UAF's future heat and power needs are new combined coal/biofuel boilers and a 17MW turbine, which is a little smaller than the 2006 recommendations.

Scope of Work

The proposed facility upgrade will provide a total of 280,000 lbs/hr of steam and 17MW of electricity with two coal/biomass fueled boilers and a steam turbine with controlled extraction ports for providing low pressure steam for heating the campus. The size of the facility is based on projected campus growth for the next 20 years. There is known growth in the next five years after the Murie Building including the Wood Center Dining Addition and the new Engineering Building. Steady growth for the remaining 15 years is assumed (see attached Plant Sizing Methodology and Analysis), however, projecting the rate of new facility construction is uncertain in this fiscal environment.

The proposed boilers use Circulating Fluidized Bed (CFB) technology. This technology is more efficient and produces fewer emissions than the current stoker boilers. The permitting strategy is based on the new boilers producing fewer emissions than the existing coal boilers. The CFB boilers are also fuel flexible and will be able to burn approximately 85 percent coal and 15 percent biomass. If other solid fuels become available in the future, the CFB boilers would be able to burn them as well. The boilers can also be retrofitted to burn natural gas, should it become available at an attractive price.

The facility addition will be located immediately east of the Atkinson Heat and Power Plant and will connect to the current Atkinson Plant and the campus utilidor system. It will also connect to the campus electrical system at the Campus Switchgear Building. The facility will be approximately 100 feet high. The existing Atkinson Heat and Power Plant will remain, but the two coal boilers, coal handling system, and ash handling equipment will be decommissioned. The existing Boilers 3 and 4 will be able to burn oil or natural gas and, when used with existing Turbine 3, will provide redundancy for the new CFB

boilers and turbine. The existing facility water treatment, condensate collection and treatment and machine shop will remain in service.

Programmatic Need

See attached Statement of Need (SON).

Strategic Importance

See attached Statement of Need (SON).

Impact Analysis

See attached Statement of Need (SON).

Project Impacts

The project will have impacts on the following items:

Parking: The existing parking lot at the Atkinson Plant will be displaced. The staff is expected to be the same size as the current staff and new parking will be provided in the vicinity of the new facility.

Disruptions of Utilities during construction and commissioning: The new facility will need to connect to existing low pressure steam, high pressure steam, water, boiler feedwater, condensate, electric, and sewer. These may require outages to facilitate the connections. Commissioning of the plant has the risk of causing outages to campus for steam and power. The impacts of these potential outages will be mitigated by maintaining a connection to GVEA and the existing Atkinson equipment.

Potential Phasing of Funding and Construction: The funding could be phased but construction cannot. Phased funding, however, will most likely add additional time, cost and risk to the project. The project requires a significant early financial commitment to purchase major equipment. The lowest risk method for phasing would be to defer labor costs to later in the schedule, and fully fund equipment, design, and a large percentage of materials early in the schedule.

Project Site Considerations

The site that was selected is immediately east of the Atkinson Plant. The new boilers and turbine need to be located close to the Atkinson Plant as there are shared services. The Atkinson Plant will function as back-up to the new boilers and therefore steam, condensate, power, and boiler feedwater need to be connected between both facilities. The only site that satisfies this criteria is the existing parking lot east of the Atkinson Plant.

Incremental Costs

The new facility will lower UAF's annual operating costs significantly. The fuel cost savings are estimated at \$4,400,000 per year. The new boilers will offset burning expensive oil and purchasing power from GVEA. The savings will be used to pay the project bond debt.

Variances

None

Special Considerations

Early Procurement: In order to advance the design of the facility upgrade, major equipment vendors will need to be selected first as the facility is designed around the actual equipment that will be installed. The major equipment is CFB boilers, steam turbine, air cooled condensers and plant controls. The proposed selection process will include bids, but the commitment to the vendors will only extend to provide

engineering drawings and data to support the overall design of the facility. A Notice to Proceed for the purchase of the equipment will not be done until after Schematic Design Approval is obtained. The estimated combined value of this equipment is \$45,000,000.

Schematic Design Approval(s) – If FY15 funding is obtained it is anticipated that a partial Schematic Design Approval will be needed in summer 2014 to perform some limited site work in 2014. The Schematic Design Approval for the overall project is scheduled to be submitted in December 2014.

Air Quality Permit – ADEC has issued a draft air quality permit and the public comment period has expired with UAF the only commenter. UAF submitted comments to correct conflicts and inaccuracies in the draft permit. Additionally, ADEC plans to accept the federal EPA comments that were delayed due to the federal government shut-down in October. A final permit is expected to be issued in January 2014.

Total Project Cost and Funding Sources

<u>Funding Title</u>	<u>Fund Account</u>	<u>Projected Estimate</u>
Series S Bond (UAF Debt DM)	514552-50216	\$800,000
Series Q Bond (UAF Debt DM)	514537-50216	\$1,547,000
FY14 Deferred Maintenance	571366-50216	653,000
Initial Project Development Cost		\$3,000,000
		(\$1,870,000 expended)
FY15 Capital appropriation		\$195,000,000
FY15 UA revenue bond		\$50,000,000
Remaining Project Cost		\$245,000,000
Initial Project Development Cost		\$3,000,000
Remaining Project Cost		\$245,000,000
Total Project Cost		\$248,000,000

Annual Program and Facility Cost Projections

<u>Program Cost</u>	<u>Amount</u> <u>Projected Estimate</u>
The new facility staffing needs are identical to the existing facility.	
Facilities Cost	
Maintenance & Repair	(\$200,000)
Operations (fuel cost savings)	(\$4,200,000)
Annual O&M Cost Reductions	(\$4,400,000)
Savings committed to Debt Service	\$4,400,000

The new facility will require the same staffing as the existing facility, but there will be a significant reduction in repairs and maintenance due to the new equipment.

The reduction in fuel savings is due to reduced purchases of power from GVEA and reduced purchases of natural gas and oil. The cost of oil on a BTU basis is \$26.90/MMbtu and the cost of coal is \$4.41/MMbtu.

Proposed Project Schedule

DESIGN

Conceptual Design Development for Permitting	December 2011 – February, 2013
Air Permit Issued	December 2013
Formal Project Approval	December 2013
Major Equipment Selection (for Engineering)	January 2014
Partial Schematic Design Approval (for Site Work)	June 2014
Schematic Design Approval	December 2014

CONSTRUCTION

CM@R Selection	May 2014
NTP for Equipment Procurement	December 2014
Site Work	August 2014
Start of Construction	April 2015
Start of Commissioning	May 2018
Commencement of Operation	November 2018

This schedule assumes state funding is approved in the FY15 state capital budget.

Project Delivery Method

The Construction Manager at Risk (CM@R) is being used for this project. The project is very complex and large, which is a good fit for CM@R. The pre-purchase of major equipment by UAF is an important factor in selecting CM@R. It is extremely difficult, and financially risky to manage and integrate owner purchased equipment into other project delivery methods. It is anticipated that some elements of construction will commence prior to having the design 100% complete. CM@R is ideally suited to smoothly integrate different work packages as the design is completed. CM@R selection will be both qualifications- and cost-based and the selected CM@R will be required to competitively bid subcontracts.

Affirmation

This project complies with Regents' Policy and the campus master plan.

Supporting Documents

- One Page Budget
- Statement of Need
- UAF Risk Management Evaluation of Atkinson Combined Heat and Power Plant
- Plant Sizing Methodology and Analysis
- Drawings
 - Preliminary Engineering Drawings (25 pages) including Site Map

Approvals

The level of approval required for FPA shall be based upon the estimated TPC as follows:

- **TPC > \$4.0 million will require approval by the board based on the recommendations of the Facilities and Land Management Committee (FLMC).**
- TPC > \$2.0 million but not more than \$4.0 million will require approval by the FLMC.
- TPC > \$1.0 million but not more than \$2.0 million will require approval by the Chair of the FLMC.
- TPC ≤ \$1.0 million will require approval by the AVP of Facilities and Land Management.

UNIVERSITY OF ALASKA	
Project Name: UAF Heat and Power Plant Major Upgrade	
MAU: UAF	
Building:	Date: 24-Oct-13
Campus: Fairbanks	Prepared by: Mike Ruckhaus
Project #: 2012031 CPHR	Acct #: TBD
Total GSF Affected by Project: N/A	
PROJECT BUDGET	FPA Budget
A. Professional Services	
Advance Planning, Program Development, Permitting	\$3,000,000
Consultant: Design Services	\$14,600,000
Consultant: Construction Phase Services	\$2,000,000
Consultant:	
Site Survey (included above)	
Soils Testing & Engineering (Included above)	
Special Inspections	\$100,000
Plan Review Fees / Permits	\$200,000
Other	
Professional Services Subtotal	\$19,900,000
B. Construction	
General Construction Contract(s)	\$140,500,000
Other Contractors (List: _____)	
Construction Contingency (includes 4 years escalation)	\$31,200,000
Construction Subtotal	\$171,700,000
<i>Construction Cost per GSF</i>	N/A
C. Building Completion Activity	
CFB Boilers (2)	\$35,000,000
Turbine	\$6,500,000
Air Cooled Condenser	\$3,800,000
Signage not in construction contract	
Move-Out Costs	
Move-In Costs	\$50,000
Art	
Other (Interim Space Needs or Temp Reloc. Costs)	
OIT Support	\$25,000
Maintenance Operation Support	\$100,000
Building Completion Activity Subtotal	\$45,475,000
D. Owner Activities & Administrative Costs	
Project Plng, Staff Support	\$7,350,000
Project Management	\$3,500,000
Misc. Expenses: Advertising, Printing, Supplies, Etc.	\$75,000
Owner Activities & Administrative Costs Subtotal	\$10,925,000
E. Total Project Cost	\$248,000,000
<i>Total Project Cost per GSF</i>	N/A
F. Total Appropriation(s)	\$248,000,000

Statement of Need for UAF Combined Heat and Power Plant

June 2013

The core mission of UAF depends on having reliable light and heat in all of the facilities. The existing Atkinson Combined Heat and Power facility has succeeded in reliably supporting the UAF mission since 1964. While the facility has seen some growth and very limited renewal over the years, the primary coal boilers are at the end of their useful life. These boilers are the heart of the plant and they are showing signs of age by increased outages and maintenance over the last 10 years. In addition to increased operating costs, the risk of a catastrophic failure that prevents the plant from providing heat and power to the campus is increasing every year. The campus experienced a 10-hour heat and power outage on December 11, 1998 when a boiler tube ruptured and filled the plant with steam. This was a serious event and some corrective action has been taken since that event to mitigate the effects if it should reoccur. The campus electrical distribution system is in the process of being removed from the Atkinson Plant to the new Campus Switchgear Facility. This will allow the campus to be powered from GVEA in the event of a similar outage, but most of the buildings would freeze with the lights on without the ability to deliver steam for heating.

In the 2012 update and all prior institutional risk evaluations, a failure of the Atkinson Combined Heat and power Plant is listed No. 1. The attached 2012 UAF Risk Evaluation provided to the Board of Regents' Audit Committee in February 2012 details those risks. The critical nature of providing reliable, reasonable cost heat and power to the UAF campus has led to this project being the top capital request priority.

The design and capacity of the Atkinson Plant has served the campus well for nearly 50 years. It is time to make the significant investment again to provide reliable heat and power for the future.



Office of the Chancellor

390 Signers' Hall, P.O. Box 757500, Fairbanks, Alaska 99775-7500
www.uaf.edu

Brian Rogers, Chancellor
(907) 474-7112
(907) 474-6785 fax
uat.chancellor@alaska.edu

Bob Shefchik, Executive Officer
(907) 474-7489
(907) 474-7475 fax
rshefchik@alaska.edu

MEMORANDUM

DATE: February 7, 2012

TO: Pat Gamble, President, UA *KG*
Nikki Pittman, Director, Internal Audit, UA

FROM: Brian Rogers, Chancellor, UAF *BR*

SUBJECT: Audit Committee Report on UAF CHP Risks

We must address the replacement funding in 2014 without fail... possibly even as early as 2013. PKG

The Board of Regents (BOR) audit committee requested a report on the risks related to the Atkinson Combined Heat and Power (CHP) Plant for its scheduled meeting on February 15, 2012. This memorandum and the attached updated Risk Management Plan for Risk # 01-2010 UAF provide that report.

Since the risk management plan was prepared in the summer of 2010, UAF has made significant progress on the replacement of the Atkinson CHP Plant. Concurrently, work has been occurring to limit the possibility/probability of a catastrophic failure at the plant endangering UAF. Outlined below is a summary of the work that has occurred, the work remaining, the risks to the University based on current status, and the mitigation strategies in place that result from those risks.

Since the initial risk management plan was prepared in 2010, UAF has selected the most viable replacement option for the Atkinson CHP Plant, selected a contractor to conduct the preliminary design and permitting work for that plant, and worked to minimize the risk to the existing plant. That work is presently underway, with completion of the permit application planned for the summer of 2012.

UAF has provided regular updates on the critical electrical project and Atkinson CHP Plant upgrades to the BOR since the Risk Management Plan was put in place in August 2010. A

Alaska's First University – America's Arctic University

UAF is an AA/EQ employer and educational institution



Brian Rogers, Chancellor
(907) 474-7112
(907) 474-6725 fax
uaf.chancellor@alaska.edu

Bob Shefchik, Executive Officer
(907) 474-7489
(907) 474-7475 fax
rshefchik@alaska.edu


Office of the Chancellor

320 Signers' Hall, P.O. Box 757500, Fairbanks, Alaska 99775-7500
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Nikki Pittman, Director, Internal Audit, UA

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UAF has provided regular updates on the critical electrical project and Atkinson CHP Plant upgrades to the BOR since the Risk Management Plan was put in place in August 2010. A

significant amount of UAF major maintenance funding has been allocated to either the critical electrical project or major maintenance components of the CHP Plant for the past few years. This emphasis has minimized, but not eliminated, the risk of plant failure at UAF. Remaining work to be undertaken is focused on potential single point of failure items in the CHP Plant's electrical or heating infrastructure. The updated Risk Management Plan (attached) provides specific detail on the items that are outstanding. Those items will continue to present risks to the plant until the maintenance work is completed.

The current status of the Atkinson CHP plant is one where the risks to UAF, UA, and the State of Alaska are primarily financial risks. The risk of catastrophic failure of the heating system, the most significant risk in terms of both magnitude and lack alternatives, is minimized by the redundancy in boiler operations. Should UAF's aging coal boilers go down, sufficient capacity exists to run the main campus using the back-up oil and oil/gas boilers at the CHP Plant. However, the switch from coal to oil would dramatically increase costs for provision of heat and electricity. Annual fuel costs would rise from just under \$8 million per year to just over \$34 million per year. This increase of over \$2 million per month would rapidly drain all campus and system reserves, requiring either massive reallocations or emergency supplemental funding.

Risks at the Atkinson CHP Plant that could negatively impact the entire campus will remain until a replacement plant is completed and on-line. Actions taken by UAF and UA have worked to minimize those risks while simultaneously working on a replacement CHP plant. The fact that major components of the plant are 50+ years old increases the probability of a system failure as time passes. To that end, UAF continues to work with UA risk management and emergency services to plan for contingencies in the event of a catastrophic failure. The most recent emergency exercise, conducted February 7-8, 2012, contained a scenario with a failure at the CHP Plant.

The details provided in the attached Risk Management Plan provide the Audit Committee the opportunity to review in greater detail the status of UAF risks and mitigation efforts. I will be available at the Audit Committee meeting to respond to any question on this information.



RISK MANAGEMENT PLAN

Prepared: August 16, 2010
Updated February 15, 2012

Risk # 01-2010 UAF

Risk Owner: Brian Rogers/ Bob Shefchik
Chancellor /Executive Officer
907-474-7489

Risk Issue: Inability to replace heat and power plant with timely and cost-effective solution

Risk Statement: The UAF Atkinson Combined Heat and Power Plant is aging and needs replacement. Failure to plan for and successfully implement a replacement project places all facilities on the main UAF campus at risk of significant damage.

Summary of Risk:

The Combined Heat and Power operation at UAF, housed at the Atkinson Power Plant, is reaching a crossroads. The plant was constructed in 1964, with additional capacity added in 1972, 1982, 1986, and 1998. It provides all of the heat and most of the electricity for the 3 million square feet of facilities on the UAF main campus. Much of the infrastructure in the plant is nearing the end of its useful life, especially the two main boilers, which are both more than 45 years old. Engineering analyses have identified a number of critical upgrades necessary to the heat and power infrastructure at UAF.

Five major deficiencies of the UAF electrical distribution system were identified in a report prepared by PDC Inc. Engineers in 2001. Work is progressing on correcting those deficiencies through the UAF R&R project for "Critical Electrical Distribution Upgrades." This is a phased project; it is expected that the final phase of this work will be completed in 2012-2013. However, UAF will retain some risk until the project is fully funded and completed. *This work has been progressing as planned since the 2010 report. While some items remain unfinished on the critical electrical project, the majority of the work is completed or in progress with planned work in 2012.*

A 2006 study of the existing heat and power plant recommended replacement of the oldest components of the existing plant and rehabilitation of the remaining equipment. It concluded UAF's best approach for the future would be to construct a 20MW combined coal/biofuel replacement plant. That report is now six years old, and no work to begin design or permitting of a replacement plant has occurred. *Since 2010, significant movement on the replacement project has occurred. A project to undertake preliminary engineering and environmental permitting began in 2011. This project will result in a submitted permit application for a new plant with preliminary design and permit completion planned for the summer of 2012.*

The entire main campus physical plant is dependent on the heat and power provided by the Atkinson plant. A failure at the plant would put the 3 million square feet of facilities at risk. If an event occurred during the summer, current electrical infrastructure is insufficient to allow transmission of enough power from GVEA to meet campus demand. If an event occurred during temperatures below freezing, the physical infrastructure of UAF could suffer catastrophic damage. *Capacity to receive electricity for GVEA will improve with the completion of the switchgear installation. This project is well underway, with the new switchgear building constructed and the equipment purchased and delivered. Installation will occur during the summer of 2012 with the entire campus moving to the new switchgear during the next 2 ½ years. The risk of the entire main campus being solely dependent on heat from the Atkinson CHP plant still exists.*

Managing/Mitigating the Risk:

UAF consistently ranks the critical electrical project and the Atkinson replacement projects at the top of its major maintenance capital projects list. This has effectively positioned the critical electrical work to be designed, phased, and targeted for completion. The Atkinson Plant has lagged, partially because the critical electrical work needed to begin immediately and partially due to the high capital cost of a replacement combined heat and power plant.

At the direction of the Vice Chancellor for Administrative Services, a working group was established to re-evaluate the 2006 recommendations and consider new options. The circumstances and economics for coal, natural gas, and other alternative fuels had changed since 2006, and it was prudent to revisit our plan in light of current conditions. GLHN (the 2006 UDP consultant) was hired to evaluate multiple options in the order of magnitude level, and then to perform a detailed evaluation of two or three viable options. The process included solicitation of input from industry, the public, and interested stakeholders. Identifying alternatives, obtaining input, and analyzing options has led to the refinement of options to plants driven by two main fuel sources: coal/biofuel and natural gas. Work continues on those two options, with a recommendation targeted in time for the 2011 legislative session. *The decision to proceed with a solid fuel replacement system, focusing on Circulating Fluidized Bed Boiler technology, was made in the spring of 2011. The current preliminary design and permitting project is based upon that decision.*

The FY2012 and FY2013 R&R priorities will contain funding for permitting and the initial design necessary to prepare, submit, and defend permit applications. These amounts, while significant, are less than \$5 million annually and within amounts reasonably expected to be received in annual capital appropriations. *This funding has been used to proceed on the replacement work.*

Depending on the options selected, capital costs will range from \$50 million to \$200 million for the replacement plant. Due to the varying cost of fuel, operating costs run in inverse proportion to the capital costs; i.e. coal/biomass options are more costly to construct but less costly to operate while gas plants are less costly to construct but significantly more costly to operate. Without a reliable, cost-effective source of gas identified in the near future, planning will proceed on the coal/biomass options. *As noted above, the selected option is for a solid fuel boiler, which places the likely capital costs at approximately \$200 million.*

While design and permitting are being conducted, UAF will explore options for significant capital funding. These will include legislative appropriations, public-private partnerships, budget approaches that include capital amortization as part of utility base funding, and sell-back of excess capacity into the grid. A campaign for awareness of need amongst members of the legislature, the state administration, and the

leaders of local government will be a critical part of ensuring support for such a large capital investment.

This work continues.

Based on the preliminary design and permitting timeline, there will not be a need for additional capital funding for the replacement plant until the summer of 2013, at the earliest. This led, in part, to the decision not to include a replacement plant funding request in the FY13 UA capital budget. It is expected that there will be a significant request for FY14 funding presented to the Board of Regents for the 2013 legislative session. The amount and type of the request from UAF will depend on the results of the preliminary engineering work. The amount and type of the request that goes to the state will be depend on the content of that request, the judgment of the UA system, and the determination of the Board of Regents.

Stakeholders:

Chancellor's Cabinet

Every member of the Chancellor's Cabinet has a stake in this risk. With the Chancellor, this group establishes UAF's capital and operating budget priorities and advocates for those priorities, both with internal (campus) and external constituencies. As evidenced by ranking this as UAF's top risk, the Cabinet understands the critical nature of the risk.

Executive Officer

The Chancellor and Vice Chancellor of Administrative Services tasked the Executive Officer to lead the team assigned to review options, receive input, and prepare recommendations on how to proceed in addressing this risk. The review team includes the head of the utilities division, the facilities services utilities project manager, the dean of the College of Engineering and Mines, representation from UAF marketing and communications, and a UAF student. It is the executive officer's responsibility to review progress, ensure that recommendations are delivered to the Chancellor and VCAS in a timely and useful manner, and that the project stays at the top of the campus priority list.

Vice Chancellor for Administrative Services (VCAS)

The VCAS is responsible for management of the facility services division, including allocating funding within that division to ensure that ongoing operations are maintained until a new plant is constructed. The VCAS will also pursue and advocate for funding options to meet the UAF's and the system's capital needs.

Facilities Services Project Manager and Director of UAF Utilities

These two individuals represent the front-line stakeholders in this risk. They are responsible for identifying near-term operational risks, maintaining operations, and analyzing the technical details presented by consultants on long-term options.

Deans, Institute Directors, all Campus Management

All of these individuals need to understand the critical nature of this risk, advocate for addressing the issue (even at the expense of their own capital needs), and promote funding for continued action on this project until successful.

Detailed Update on Known Plant Risks:

Equipment Failure Risks:

Deaerator tank: The deaerator tank has not been out of service since 1964. Piping connections leak and the possibility exists that it is near failure. The plant cannot operate without this tank. The design of the replacement is at 50% and a new tank will be ordered for installation in late summer 2012.

Feedwater heater: This equipment has had several leaks over the last 3 years that required fixing when the plant is able to be operated at reduced capacity. If it fails, the plant can only run at 50% capacity. The replacement is on the same schedule as #1 above.

High pressure steam piping: The current configuration of HP steam piping does not allow bypassing and flexibility if a valve fails to open or a boiler needs to be isolated to fix it. New valves are currently being ordered and the most critical will be installed when the plant is down for items 1 and 2 in late summer 2012.

Condensate piping and hotwell: This piping is corroded and there are some partial fixes planned as part of the new utilidor project for West Ridge. These improvements should increase capacity and replace corroded sections as well as corroded connections to the hot well. Adding additional hot well capacity is best done when the new plant is constructed.

Variable Frequency Drives (VFD's): All of the VFD's in the plant are old and have problems. These are single points of failure for individual boilers, but they do not cause the entire plant to go down. They are scheduled for replacement summer 2013. Fixing the coal boiler VFD's is not planned based on the assumption the new plant will be built in a few years.

Rail repairs: 50% of the rail siding is in bad shape and could be unusable at any time (the AKRR red-flagged one section last year that did require an emergency repair). This will require a temporary switch to fuel oil until deliveries can be configured from the other direction or accommodations made to transport the coal by truck.

Coal boiler tubes: In the event a boiler tube fails, the boiler (but not the whole plant) would be out of service for at least a week. Oil boilers could supply the necessary steam to supply campus at a significant cost. A major repair of the coal boiler tubes is being deferred (~\$10M per boiler) because a new plant would result in decommissioning of the coal boilers. The high cost of retubing would be better spent on a replacement plant.

Main Turbine: This equipment is in good shape, but is a single point of failure. If it goes down, GVEA would supply most of the campus power. Heat could still be supplied to campus during turbine repairs.

Electrical Switchgear: The plant is still dependent on the existing switchgear in the Atkinson Plant. The new equipment will be energized this summer, but in the interim, a major electrical event would knock out the campus. It will be two years before all of the campus distribution is on the new switchgear.

Major Plant Failure: A catastrophic event caused by an earthquake, fire, or explosion that took down the entire plant could eliminate all campus heat and electricity. Many major plant components are in excess of 50 years old. A catastrophic system failure that takes down the all or part of plant, although

unlikely, will increase in probability as the plant ages until the replacement plant is constructed. No back-up system for heat will exist either, until the replacement plant is constructed.

Corrective / Mitigation Efforts for Equipment Failure Risk:

Corrective plans for all of the single point of failure issues and major equipment risks are underway and part of the multi-year major maintenance program. By the end of 2012, most of the equipment issues will be resolved or well on the way to being resolved. Some issues will remain until the 2013 and 2014 construction seasons. It is expected that the annual M&R capital funding from the legislature will be sufficient to meet these needs. This approach does, however, put pressure on the other needed M&R projects at UAF.

Repairs being conducted at the Atkinson Plant are those that are necessary to avoid single points of failure across the next several years while awaiting the replacement plant or will serve as part of the reconfigured system when the new plant is constructed. Some work is being deferred on the coal boilers to avoid huge capital expenses on equipment that could be decommissioned within a small number of years.

Cost, Permitting, and Aging Risks:

Cost Risk: Failure of one or both of the existing coal boilers, absent a catastrophic event that brings down the entire plant, represents primarily a financial risk to UAF/UA. The two coal boilers are backed up by the oil and oil/gas boilers in the plant. The oil boilers are presently used to provide supplemental heat when the steam from the coal boilers is insufficient to meet the heating demands of campus. These boilers are adequately sized to meet the entire heating demand of campus without reliance on the coal boilers. However, the switch from coal to oil would dramatically increase costs for provision of heat and electricity. Annual fuel costs would rise from just under \$8 million per year to just over \$34 million per year. This increase of over \$2 million per month would rapidly drain all campus and system reserves, requiring either massive reallocations or emergency supplemental funding.

UAF is working to mitigate operating cost risk in two ways. First, the efforts to mitigate the equipment risk reduce the likelihood that a switch to oil will be required. Secondly, UAF is actively working within the community on approaches to bring natural gas to Fairbanks. These efforts, through the Interior Delegation, the Chamber of Commerce, the FNSB, and GVEA/Flint Hills, offer the opportunity to reduce the cost risk by approximately 50%.

Permitting Risk: It is premature to assess permit risk until the work presently underway on preliminary design and permit preparation is complete or nearly completed. Known risks include permit delays, negative regulatory environment for coal, actions of external groups, and design/cost problems. A plan for assessment and mitigation of permit risks may be presented to the Board of Regents in the fall of 2012.

Aging Risk: Every year the Atkinson Plant ages and components grow another year older. The known equipment risks are identified in this plan. In addition, the annual aging of the plant increases the probability that some component will fail. The consequences of that failure on the plant will be unknown until the failure occurs. It could be a simple pump that stops working and is replaced in a day's time. It could also be as serious as the steam tube that ruptured in 1998 that shut down the entire plant. The balance of continuing preventative maintenance on a 50-year old boiler while working to replace that same boiler is one that contains risks. The fact that the back-up heating boilers are part of the same facility and infrastructure that serves the entire campus means the risk of heat loss from a failure in the

older part of the plant will continue to exist and will grow during the time that UAF/UA is working to construct the replacement CHP plant.

Risk Triggers/Metrics:

Warning Events:

- *Failure to complete initial design and permitting work in advance of the 2013 legislative session.*
- *Failure to complete switchgear project.*
- *Failure to complete or schedule single point of failure projects in FY13.*
- Episodic breakdowns – failures that interrupt heat/power to UAF's main campus

Tracking Mechanisms:

- Construction progress on the "Critical Electrical Infrastructure" project
- Funding received for permitting and initial design
- Reports to VCAS of activities of the combined heat and power
- *Existence of completed permit application by September 2012*

Communications Plan:

- Reports to the Board of Regents on the "Utilities Upgrade Plan" at regularly scheduled meetings by UAF facilities services
- Reports to the Board of Regents on the "Critical Electrical Infrastructure" at regularly scheduled meetings by UAF facilities services
- UA capital budget priorities presented to the Board of Regents annually

PLANT SIZING METHODOLOGY AND ANALYSIS

The University of Alaska – Fairbanks
Combined Heat and Power Plant Replacement

BACKGROUND

The existing coal boilers in the Ben Atkinson Heat and Power Plant were constructed in 1964 and either significant renewal or replacement is needed to continue to provide heat and power to the University of Alaska Fairbanks (UAF) campus. UAF has made the decision to replace the existing coal boilers and auxiliary equipment with a new combined heat and power plant that will be fueled with a combination of coal and biomass. This report documents the process used to develop the steam and electrical generation requirements of the new facility and summarizes the results of the analysis.

METHODOLOGY

The recommended steam and electrical generation capacity of the new combined heat and power plant was established through a multi-step process that involved utilizing historical plant data and projected campus building growth to develop future campus steam and electric load growth projections for a 20 year period.

OPERATIONAL BASELINE AND HISTORICAL GROWTH TRENDS

The facility operational baseline was established by reviewing recent plant data to establish peak, average, and minimum values for high pressure steam, low pressure campus steam, and electrical generation. The operational baseline data obtained from this analysis are reflected in Table 1. The historical growth trends for campus steam and electrical generation were derived from data found in historical facility operations reports and through the use of the plant database. While data extracted from the plant database was only available for the past several years, data was obtained from operational reports dating as far back as 1990. The data obtained was analyzed for year-over-year peak generation trends which were then converted to a growth rate in the form of a 2% compounded annual increase for electrical generation and a 1.5% annual increase for campus steam demand.

Once calculated, these values were validated by comparing them to the predicted square footage growth rate published in the 2010 UAF Campus master plan. The comparison indicated that energy consumption was predicted to grow slightly slower than campus facility square footage. This difference is attributable to the effects of campus energy conservation programs.

FUTURE ENERGY DEMAND PREDICTION

The process of establishing future peak steam and electrical generation requirements involved an analysis of expected energy demands at two different time horizons. The first horizon analyzed was five years in the future. This time period was chosen both because it is the expected date of completion of the new plant, and because the capital projects plan for the next several years, and the associated impacts to campus energy use, is considered to be reasonably well known. The second horizon analyzed was 25 years in the future (2037) or, alternatively, twenty years after the new plant becomes operational.

As previously stated, the peak campus steam and electrical demands (campus energy demands) for the year 2017 were established by incorporating the predicted energy requirements for facilities that the University intends to build over the next five years into the current operating baseline. The following buildings were assumed to be operational by 2017:

- Life Sciences – 700kW electrical demand, 7 KPPH steam demand
- Engineering – 700 kW electrical demand, 7 KPPH steam demand
- Housing & Dining – 700 kW electrical demand, 5 KPPH steam demand

Peak campus energy demands for the year 2037 were established by applying the growth rates calculated from historical data to the operating baseline and extending the values out over 25 years.

Winter average campus energy demands for both 2017 and 2037 were obtained by calculating the percent growth in the peak values and applying that growth to the baseline winter average. For example, the 2017 winter electrical average demand was calculated by dividing the 2017 peak electrical demand by the 2012 peak electrical demand and then multiplying that value by the 2012 winter average demand.

The methodology to predict the future minimum campus energy demands proved difficult to develop given the continuing energy conservation efforts on the UAF campus. Subjective criteria such as operational experience and knowledge of current trends in energy conservation were used to estimate minimum campus energy use trends. Adjustment of the peak campus energy demands to account for future energy conservation was not necessary as the historical data already includes the effects of all campus conservation efforts to date.

Once established, the electrical and campus steam demands were entered into a power cycle modeling program called ThermoFlow. This information, when entered into a model that represents the likely configuration of the future plant, can allow the program to calculate the necessary amount of high pressure steam that is needed to meet the desired steam and electrical output. A model run was performed for each case (peak, winter average, and minimum) in 2017 and 2037 to determine the necessary boiler capacity.

RESULTS OF SIZING ANALYSIS

The current and future campus energy demands resulting from the above methodology are summarized in the following table. The values shown for the peak demand in the year 2037 represent the basis for the recommended size of the new combined heat and power facility.

		Electrical Generation (Gross MW)	Campus Steam (KPPH)	High Pressure Steam (KPPH)
2012 (Operational Baseline) ¹	Peak	10.6	130	190
	Winter Average	8.5	85	117
	Minimum	7	40	105
2017	Peak	13 ²	150 ²	230 ⁸
	Winter Average	11 ⁶	98 ⁶	190 ⁸
	Minimum	7.5 ⁷	50 ⁷	135 ⁸
2037	Peak	17 ^{3,5}	190 ⁴	280 ⁸
	Winter Average	14 ⁶	124 ⁶	230 ⁸
	Minimum	10 ⁷	60 ⁷	165 ⁸

TABLE 1 - CURRENT AND PREDICTED FUTURE ENERGY DEMAND

Notes:

- 1) Based on recent operating data obtained from the plant database
- 2) Based on projected energy usage of buildings currently in the capital projects plan
- 3) Based on 2% annual growth rate for electrical demand
- 4) Based on 1.5% annual growth rate for campus steam demand
- 5) Includes predicted campus electrical load plus 1 additional megawatt for station service power consumption.
- 6) $(\text{Future Peak}/2012 \text{ Peak}) * 2012 \text{ Winter Average}$
- 7) Based on operational experience
- 8) Calculated by Thermoflow software based on required campus steam and electrical generation demands.

LIMITING FACTORS

Once determined, the proposed plant size was analyzed for potential limiting factors such as turndown, redundancy requirements, air permit constraints, and projected capital costs. The potential impacts of the use of a biomass fuel or the purchase of as-available wind power were also considered. The campus growth rates utilized in the calculations and the resulting equipment sizing conclusions were compared to the conclusions reached in the 2006 Utilities Study to confirm that the results were consistent with the conclusions that were reached in the previous study.

EMISSIONS

The plant size was evaluated for potential emissions limitations by first calculating the required heat input to meet the required output and then using that value to calculate predicted emissions characteristics. The conversion of plant capacity to a required heat input was accomplished through the use of the Thermoflow software. The required steam flows and electrical output were entered into a model that represented the likely configuration of the steam cycle in the new plant. The software then calculated the required energy input to the boilers based on the information provided. The resulting value, 370 MMBTU/hr, was then entered into a spreadsheet developed by the project environmental consultants (SLR International Corporation) to determine predicted pollutant emissions rates and total annual emissions. Additional information was solicited from potential boiler vendors to ensure the accuracy of the results of the emissions spreadsheet.

The predicted emissions obtained from the calculations were then compared to the limits established in current environmental regulations. The results of this comparison indicated that boilers rated for the required heat input would be capable of meeting all applicable emissions regulations including the New Source Performance Standards (NSPS), National Emissions Standards for Hazardous Air Pollutants (NESHAPS), and regulations associated with the Prevention of Significant Deterioration (PSD).

TURNDOWN

While the sizing analysis provided the required boiler size to meet the peak energy demands for the next 25 years, it did not provide any information as to the performance of the boiler or boilers during periods of low energy demands. This scenario was evaluated by comparing the minimum projected steam flow (2017 Minimum High Pressure) against the typical minimum load for boilers of this type. Discussions with potential boiler vendors indicated that 40% of Maximum Continuous Rating (MCR) would be a conservative minimum load estimate.

	Full Load (total steam gen)	Minimum Load	Minimum Demand	Remaining Turndown
One Boiler	280 KPPH	112 KPPH	135 KPPH	23 KPPH
Two Boilers (two operating)	280 KPPH	112 KPPH	135 KPPH	23 KPPH
Two Boilers (one operating)	140 KPPH	56 KPPH	135 KPPH	79 KPPH

TABLE 2 - TURNDOWN EVALUATION

The results of this analysis indicate that either one larger boiler or two smaller boilers are capable of operating at the predicted minimum load in 2017. It also reveals, however, that utilizing two smaller boilers in the new facility will provide additional turndown flexibility. Should there ever be a need to operate at a load lower than 112 KPPH, the two boiler option will allow facility operators to remove one boiler from service while still supplying campus with steam from the new facility.

REDUNDANCY

Redundancy is a key factor in ensuring a reliable supply of steam to the campus under all conditions. Traditionally UAF has used an N+ 1 redundancy criterion which requires that there be sufficient installed capacity to supply the maximum campus demand in the event of the failure of any single unit.

The redundancy evaluation of the new facility with a single boiler sized at 280 KPPH or 2 boilers sized at 140 KPPH is summarized below. Backup steam generation capacity will be supplied from the two existing package boilers. Each boiler is rated for 100 KPPH of steam generation.

	Lost Generation Capacity (single unit failure)	Available Backup Capacity	Demand Shortfall	N+1 Criterion Satisfied?
One Boiler	280 KPPH	200 KPPH	80 KPPH	NO
Two Boilers	140 KPPH	200 KPPH	0 KPPH	Yes

TABLE 3 - REDUNDANCY

The results shown in Table 3 indicate that the proposed size of the new facility can meet the N+1 redundancy requirement only if the steam generation capacity is evenly split between two units.

IMPACTS OF RENEWABLE ENERGY SOURCES

UAF has identified two potential sources for renewable energy that could potentially impact the sizing requirements of the new facility.

BIOMASS

UAF has expressed a strong desire to include provisions for the future use of woody biomass (wood chips or pellets). Given the heat input required to operate the new boilers at full load and the limited potential supply of woody biomass available in the immediate vicinity of Fairbanks, the maximum biomass firing rate is expected to be limited to a maximum of 30% of MCR at any time.

AS-AVAILABLE WIND GENERATED POWER

UAF is currently investigating the potential to purchase up to 1 megawatt of wind generated power from the Golden Valley Electric Association (GVEA). When this power is available, it will result in a corresponding reduction in the electrical output of the steam turbine-generator. The availability of wind generated power, however is highly dependent on current weather conditions and cannot be relied upon as a continuous source of power for the university. Therefore the steam turbine-generator should be sized to meet the entire predicted campus electrical demand.

As previously stated, the purchase of wind generated power would reduce the need for electrical generation from the steam turbine-generator. During periods of low campus energy demand, this could potentially force the boilers to operate below their recommended minimum load. This could be a limiting factor should a single, large boiler be installed. In the event that two, smaller boilers are provided, the situation could be resolved by removing one of the boilers from service.

CONCLUSION

It has been determined that the existing stoker-type boilers at the Ben Atkinson Heat and Power Plant are at the end of their service life and should be replaced. This analysis details the methodology used in sizing the replacement boilers and steam turbine in order to meet the energy demands of the campus for the next 25 years and beyond. It also details the results of the sizing calculations and the subsequent analysis of factors that could potentially limit the size of the boilers below the desired value.

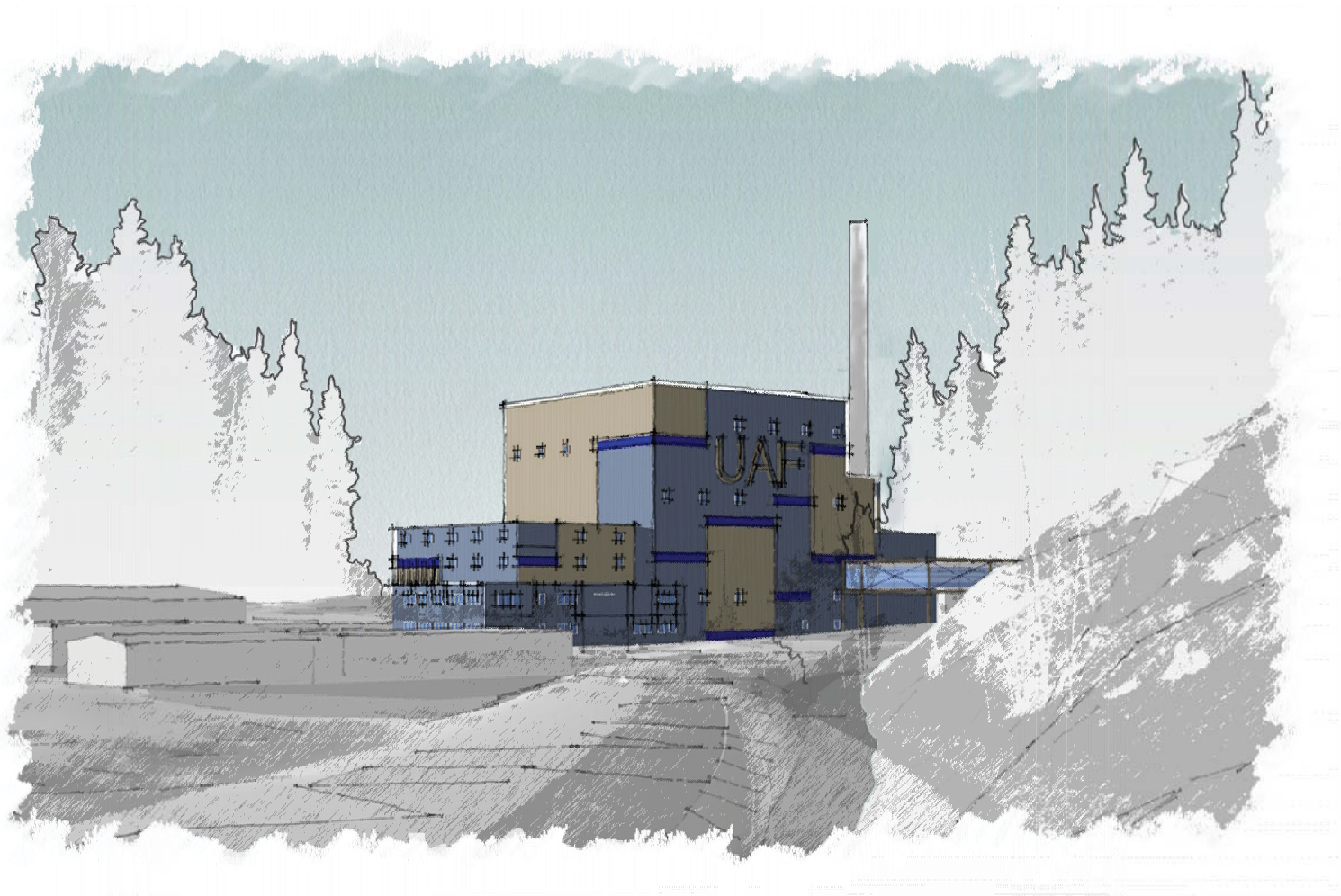
Based on the values shown in Table 1 and the results of the limiting factors analysis, it is recommended that the new facility be sized to meet the following requirements:

	Unit Capacity	Number of Units	Plant Capacity
Boilers	140 KPPH High Pressure Steam	2	280 KPPH High Pressure Steam
Steam Turbine	17 MW Gross Electrical Generation 190 KPPH Campus Steam	1	17 MW Gross Electrical Generation 190 KPPH Campus Steam

TABLE 4 - RECOMMENDED SIZING REQUIREMENTS

UAF COMBINED HEAT AND POWER PLANT

FAIRBANKS, ALASKA



UAF COMBINED
HEAT AND
POWER PLANT

ISSUE DATE 20 FEB 2013
COMM. NUMBER 191101
DESIGNED BY TEM
DRAWN BY ENT
SCALE 0" = 1"

COVER SHEET

G0.0

LIST OF DRAWINGS

GENERAL

G0.0 COVER SHEET

ARCHITECTURAL

A0.0 3D PERSPECTIVES
A0.1 3D PERSPECTIVES
A1.0 FIRST FLOOR PLAN
A1.1 SECOND FLOOR PLAN
A1.2 ADMINISTRATION AREA ENLARGED FLOOR PLANS
A2.0 EXTERIOR ELEVATIONS
A3.0 BRIDGE ELEVATIONS & DETAILS

CIVIL

C000 EXISTING CONDITIONS SITE PLAN KEY
C001 EXISTING CONDITIONS SITE PLAN - WEST
C002 EXISTING CONDITIONS SITE PLAN - CENTER
C003 EXISTING CONDITIONS SITE PLAN - EAST
C004 EXISTING CONDITIONS TOPOGRAPHIC KEY PLAN
C005 EXISTING CONDITIONS TOPOGRAPHIC PLAN - WEST
C006 EXISTING CONDITIONS TOPOGRAPHIC PLAN - CENTER
C007 EXISTING CONDITIONS TOPOGRAPHIC PLAN - EAST
C010 NEW WORK FENCING PLAN
C011 FIELD OFFICES, LAYDOWN YARD AND STAGING PLAN
C100 DEMOLITION SITE PLAN KEY
C101 DEMOLITION SITE PLAN - WEST
C102 DEMOLITION SITE PLAN - CENTER
C103 DEMOLITION SITE PLAN - EAST
C200 NEW WORK SITE PLAN KEY
C201 NEW WORK SITE PLAN - WEST
C202 NEW WORK ABOVE GROUND SITE PLAN - CENTER
C203 NEW WORK UNDERGROUND SITE PLAN - CENTER
C204 NEW WORK BRIDGE AND UTILIDOR PLAN
C205 NEW WORK SITE PLAN - EAST
C206 NEW WORK GRADING PLAN - KEY
C207 NEW WORK GRADING PLAN - WEST
C208 NEW WORK GRADING PLAN - CENTER
C209 NEW WORK GRADING PLAN - EAST
C210 TRAFFIC CIRCULATION SITE PLAN
C211 FIRE ENGINE TURNING SIMULATIONS

MECHANICAL

M1.0 PLANT VENTILATION CONCEPT ISOMETRIC
M2.0 SANITARY AND PROCESS WASTE SITE PLAN

PROCESS EQUIPMENT

GG02 GENERAL ARRANGEMENT EQUIPMENT LAYOUT BASEMENT
GG03 GENERAL ARRANGEMENT EQUIPMENT LAYOUT GROUND FLOOR
GG04 GENERAL ARRANGEMENT EQUIPMENT LAYOUT TURBINE FLOOR
GG05 GENERAL ARRANGEMENT EQUIPMENT LAYOUT FEEDER FLOOR
GG06 GENERAL ARRANGEMENT EQUIPMENT LAYOUT TRIPPER FLOOR
GG07 GENERAL ARRANGEMENT ELEVATION LOOKING SOUTH



1 3D PERSPECTIVE - UNIVERSITY AVENUE AT COLLEGE ROAD LOOKING WEST
A0.0 N.T.S.

UAF COMBINED
HEAT AND
POWER PLANT

ISSUE DATE 20 FEB 2013
COMM. NUMBER 191101
DESIGNED BY TEM
DRAWN BY ENT
SCALE 0" = 1"

3D PERSPECTIVES
COAL OPTION

A0.0



UAF COMBINED
HEAT AND
POWER PLANT

ISSUE DATE 20 FEB 2013
COMM. NUMBER 191101
DESIGNED BY TEM
DRAWN BY ENT
SCALE 0" = 1"

3D PERSPECTIVE
COAL OPTION

A0.1



1 3D PERSPECTIVE - ALUMNI DRIVE LOOKING SOUTHWEST
A0.1 N.T.S



2 3D PERSPECTIVE - ALUMNI DRIVE LOOKING EAST
A0.1 N.T.S



3 3D PERSPECTIVE - YUKON DRIVE LOOKING SOUTHEAST
A0.1 N.T.S



4 3D PERSPECTIVE - TANANA LOOP LOOKING SOUTHEAST
A0.1 N.T.S



UAF COMBINED
HEAT AND
POWER PLANT

ISSUE DATE 20 FEB 2013
COMM. NUMBER 191101
DESIGNED BY VJA
DRAWN BY JAR
SCALE 0" = 1"

TRAFFIC
CIRCULATION
SITE PLAN

C210

