HEATING SYSTEM CARBON REDUCTION & ENERGY EFFICIENCY IMPROVEMENTS

Capital Project Proposal 2017-2019

Active Minds Changing Lives

WESTERN WASHINGTON UNIVERSITY

Institution
Western Washington University
Project Title
Heating System Carbon Reduction & Energy Efficiency Improvements
Project Location (City)
Bellingham

1. Problem Statement (short description of the project – the needs and the benefits)

Heating System Carbon Reduction & Energy Efficiency Improvements:
Western Washington University currently operates a central heating plant and distribution system based on high pressure steam. Steam production through burning of natural gas represents just over 33% of Western's annual carbon footprint, and at current commodity prices, about 20% of our utility budget. Nearly every building on campus receives heat and building hot water through this central system, with boilers at a central steam plant and roughly 4.5 miles of high pressure steam and condensate return lines distributing steam throughout campus.

Western Washington University is seeking predesign funding to study the best alternative to this campus-wide infrastructure project.

From an engineering standpoint, centralized hot water heating is roughly 30% more energy efficient than steam, thus Western proposes to convert its steam operations to hot water. This project has the potential to reduce Western Washington University's annual CO2 emissions by roughly 10%, and by as much as 33% in the long term.

From a carbon footprint standpoint, our project will evaluate the potential for moving off natural gas to a less carbon intensive fuel source. The pre-design will evaluate the viability of current and emerging technologies such as geothermal, biofuel, solar, etc.

Given the current cost of natural gas, the energy savings alone is not sufficient to cover the total costs of construction – some level of additional capital appropriations is needed to make the conversion financially viable. A pre-design is needed to thoroughly analyze the economic and engineering requirements of the conversion, defining expected construction costs as well as expected energy savings which can be used to offset the costs of construction. The analysis will take into account our need for major renewal and replacement to the steam system over the next decade, and develop a menu of design & construction scenarios that might be chosen based on available funds.

2. History of the project or facility

The State of Washington has legislatively mandated emissions limits that Western, as a State agency, is required to meet (RCW 70.235.35):

- *By July 1, 2020 reduce emissions by 15% from 2005 emissions levels.*
- *By 2035 reduce emissions to 36% below 2005 levels.*
- *By 2050 reduce emissions to 57.5% below 2005 levels or 70% below the expected state government emissions that year.*

Additionally, Western is a signatory to the American College and University Presidents Climate Commitment which compels Western to attain even more rigorous carbon reduction milestones than required by the State. See Appendix B.

Roughly one-third of Western's carbon emissions are from our central steam heating plant, which is powered by natural gas. With such a large impact on our overall carbon emissions, reduction or elimination of carbon fuels in our central heating system is essential to making substantive progress in our overall carbon reduction goals. In 2011 Western contracted with University Mechanical Contractors (UMC) for a study that analyzed the feasibility of modifying the steam plant to use carbon neutral biomass fuel instead of natural gas, potentially removing more than 14,000 tons of CO2 from our inventory. UMC's report indicated the likely technical and financial viability of such a conversion, and recommended a more comprehensive design development of the baseline hot water conversion to better define the project parameters. See Appendix C.

With an aging infrastructure that requires major investment in renewal and replacement over the coming decade, it is appropriate to strategically design a central heating district that meets current and future campus needs while taking into account our economic and environmental impact. In simple terms, heating our campus with hot water would reduce our natural gas budget need by about $220,000 per year and reduce our annual CO2 emissions by roughly 10% (3,700+ tons). We will also need to invest as much as $15M in progressive repairs and replacement to the steam system over the next 10-12 years.

3. University programs addressed or encompassed by the project

All programs on the Western campus are operated out of and depend on efficient, reliable, and fully functioning buildings. As an infrastructure system, the central steam heating system described in this proposal supports every program and operation on campus.

Campus auxiliary programs, while beneficiaries of the infrastructure, will bear the costs of converting their buildings and heating systems to a new system.

4. Significant Health, Safety, and Code Issues:

The project will enable the University to meet state and university goals (Appendix F) for energy efficiency, reduction of greenhouse gas emissions, and utility reliability.

- RCW 39.35 – Energy Conservation in Design of Public Facilities. The predesign shall include an analysis and evaluation of the potential for a combined heat and power system.
- RCW 43.19.668, 669, 670, 682 – Energy Conservation-Legislative finding-Declaration. "State government should undertake an aggressive program designed to reduce energy use in state buildings, facilities……"
- RCW 70.94 – Washington Clean Air Act. This project will reduce boiler emissions reported under Western's air emissions permit.
- RCW 70.235 – Limiting Greenhouse Gas Emissions. The completed project will reduce Western's greenhouse gas emissions.

5. Evidence of increased repairs and/or service interruption:

The majority of the steam distribution system was installed between 1950 and 1980, meaning the majority of the system is between 35 and 65 years old. Roughly 1/3 of the system has been renewed through minor capital preservation investment over the past several biennia, however there remains an over $7M backlog of maintenance and repairs for the steam system and steam plant. In addition, 4 of the 5 boilers are due for replacement in the next 15 years:

Boiler	Installed	Expected End of Life
#2	1943	2022
#3	1960	2025
#4	1966	2027
#5	1971	2030
#6	1995	2040

While the existing system is reliable and operated as efficiently as possible, its economic and operational efficiency is limited by its design. It is anticipated that utility costs (natural gas consumption) will decrease through this project. It is also anticipated that modern heating plant equipment, including new boilers, will reduce the current staffing requirement.

6. Impact on Institutional Operations without the Infrastructure Project:

The existing steam system will continue to function, but Western will not be operating as efficiently as is technologically possible. Over the course of the next several biennia, Western will continue to invest in replacing or renewing an increasingly obsolete technology.

- High pressure steam is more expensive and more hazardous to maintain than hot water. Maintenance of steam systems can only be accomplished by a system shutdown. The high temperatures and high pressure at which steam is produced and distributed make it too dangerous to work on “live” piping. Maintenance and operation of heating controls would be greatly simplified.
- Operation and maintenance of the high pressure steam boilers and auxiliary equipment is more complex and requires full time dedicated FTE to monitor and manage production. Modern hot water boilers are simpler and less expensive to operate.

The operational cost savings could be redirected or eliminated from the budget, depending on the financial model chosen through the project predesign.

7. Reasonable Estimate:

In 2011, Western contracted for a Phase 1 Report for the Biomass Gasification Plant Feasibility Study which included a rough estimate range to convert the steam distribution to hot water

based on a number of economic and financial assumptions. That preliminary estimate is the basis for this predesign project estimate (inflated to the expected midpoint of construction). We based our project estimate on the mid-range of cost alternates in the study until we can develop a more detailed project scope during the predesign study. See Appendix A for C-100 Cost Estimate.

8. Engineering Study:

Previously referenced, Western contracted for a Phase 1 Report for the Biomass Gasification Plant Feasibility Study. This project request puts into motion the first step recommended by that study.

9. Supports Facilities Plan:

This project is fully aligned with Results Washington Goal 3 – Sustainable Energy and a Clean Environment – reducing greenhouse gas emissions by decreasing non-electric fossil fuel consumption. See Appendix D.

One of Western's strategic goals is to "serve as a model for institutional effectiveness, innovation, diversity and sustainability." Consistent with that goal Western prides itself on its reputation as a "green" school, and that reputation is a significant aspect of our recruiting strategy. (Appendix E). Also consistent with being a model of sustainability, Western is a signatory on the Presidents' Climate Commitment, which generally commits Western to work toward a zero carbon footprint by 2050. In support of that commitment, Western has a Climate Action Plan and a Sustainability Action Plan, both of which bring Western Washington University closer to its zero carbon footprint goal. See Appendix F.

Investment in this significant carbon reduction sends a clear message about Western's commitment to preserve and enhance our institutional excellence.

11. Resource Efficiency and Sustainability:

As mentioned throughout this document, Western will reduce its consumption of natural gas by roughly 33%, with commensurate reduction in carbon footprint impact. Conversion from steam to hot water also provides a multiplicative opportunity for future utilization of alternative and/or supplemental heating sources such as: heat recovery from buildings, geothermal, solar thermal, biomass, etc. Most known non-petroleum based energy sources like these do not contain sufficient stored energy to make steam, and rely on hot water or other less energy intensive distribution media for efficiency. It is anticipated that future building renewals, renovations, and construction will be able to include such alternative energy technologies once the baseline hot water distribution system is in place.

In the long term, we can expect the market cost of natural gas to increase over current levels. As recently as 2010, the market price of natural gas was 2-3 times higher than it is now. Although there is no forecast for commodity prices to increase to that high market level, normal inflationary pressures will increase the market costs. Reduction of our demand will help offset the impacts of those future increases.

Heating System Carbon Reduction & Energy Efficiency Improvements

Appendix Contents

Appendix A

OFM

380 - Western Washington University
Capital Project Request

2017-19 Biennium

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Version: WV Working Version 2017-19 Budget Req

Report Number: CBS002
Date Run: 7/29/2016 3:48PM

Project Number: 30000773
Project Title: Heating System Carbon Reduction & Energy Efficiency Improvements

Description

Project Phase Title: Predesign
Starting Fiscal Year: 2018
Project Class: Program
Agency Priority: 12

Project Summary

Western Washington University currently operates a central heating plant and distribution system based on high pressure steam. Steam production through burning of natural gas represents just over 33% of Western's annual carbon footprint, and at current commodity prices, about 20% of our utility budget. Western is asking for predesign funding for an infrastructure project that will replace the steam system with a system that will reduce the utility budget and carbon emissions significantly.

Project Description

Western Washington University is seeking predesign funding to study the best alternative to a central heating plant and distribution system based on high pressure steam. Steam production through burning of natural gas represents just over 33% of Western's annual carbon footprint, and at current commodity prices, about 20% of our utility budget. Nearly every building on campus receives heat and building hot water through this central system, with boilers at a central steam plant and roughly 4.5 miles of high pressure steam and condensate return lines distributing steam throughout campus. From an engineering standpoint, centralized hot water heating is roughly 30% more energy efficient than steam, thus Western proposes to convert its steam operations to hot water. This project has the potential to reduce Western Washington University's annual CO2 emissions by roughly 10%, and by as much as 33% in the long term.

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Description

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Project Schedule:

Predesign Start: September 2017
Construction End: July 2023

OFM

380 - Western Washington University
Capital Project Request
2017-19 Biennium

*

Version: WV Working Version 2017-19 Budget Req

Report Number: CBS002
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Project Number: 30000773
Project Title: Heating System Carbon Reduction & Energy Efficiency Improvements

Description

Location
City: Bellingham **County:** Whatcom **Legislative District:** 040

Project Type
Infrastructure (Major Projects)

Growth Management impacts
none

New Facility: No

Funding

Acct Code	Account Title	Estimated Total	Expenditures Prior Biennium	Current Biennium	2017-19 Fiscal Period Reapprops	New Approps
057-1	State Bldg Constr-State	53,165,000				415,000
	Total	**53,165,000**	**0**	**0**	**0**	**415,000**

Acct Code	Account Title	Future Fiscal Periods 2019-21	2021-23	2023-25	2025-27
057-1	State Bldg Constr-State	4,750,000	48,000,000		
	Total	**4,750,000**	**48,000,000**	**0**	**0**

Operating Impacts

No Operating Impact

STATE OF WASHINGTON
AGENCY / INSTITUTION PROJECT COST SUMMARY

Agency	Western Washington University
Project Name	Heating System Carbon Reduction & Energy Eff. Improvements
OFM Project Number	30000773

Contact Information	
Name	Rick Benner, FAIA
Phone Number	(360) 650-3550
Email	rick.benner@wwu.edu

Statistics			
Gross Square Feet		MACC per Square Foot	
Usable Square Feet		Escalated MACC per Square Foot	
Space Efficiency		A/E Fee Class	B
Construction Type	Other Sch. B Projects	A/E Fee Percentage	9.83%
Remodel	Yes	Projected Life of Asset (Years)	50
Additional Project Details			
Alternative Public Works Project	Yes	Art Requirement Applies	No
Inflation Rate	2.80%	Higher Ed Institution	No
Sales Tax Rate %	8.70%	Location Used for Tax Rate	
Contingency Rate	10%		
Base Month	July-16		
Project Administered By	Agency		

Schedule			
Predesign Start	September-17	Predesign End	June-18
Design Start	September-19	Design End	May-21
Construction Start	July-21	Construction End	July-23
Construction Duration	24 Months		

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Project Cost Estimate

Total Project	**$45,300,590**	Total Project Escalated	**$53,164,712**
		Rounded Escalated Total	**$53,165,000**

STATE OF WASHINGTON		
AGENCY / INSTITUTION PROJECT COST SUMMARY		
Agency	Western Washington University	
Project Name	Heating System Carbon Reduction & Energy Eff. Improvements	
OFM Project Number	30000773	

Cost Estimate Summary

Acquisition			
Acquisition Subtotal	**$0**	**Acquisition Subtotal Escalated**	**$0**

Consultant Services			
Predesign Services	$376,964		
A/E Basic Design Services	$1,939,852		
Extra Services	$1,950,675		
Other Services	$1,021,528		
Design Services Contingency	$528,902		
Consultant Services Subtotal	**$5,817,921**	**Consultant Services Subtotal Escalated**	**$6,586,760**

Construction			
GC/CM Risk Contingency	$510,400		
GC/CM or D/B Costs	$5,119,115		
Construction Contingencies	$2,600,000	Construction Contingencies Escalated	$3,068,780
Maximum Allowable Construction Cost (MACC)	$26,000,000	Maximum Allowable Construction Cost (MACC) Escalated	$30,687,800
Sales Tax	$2,977,968	Sales Tax Escalated	$3,514,896
Construction Subtotal	**$37,207,483**	**Construction Subtotal Escalated**	**$43,915,994**

Equipment			
Equipment	$508,218		
Sales Tax	$44,215		
Non-Taxable Items	$0		
Equipment Subtotal	**$552,433**	**Equipment Subtotal Escalated**	**$652,037**

Artwork			
Artwork Subtotal	**$0**	**Artwork Subtotal Escalated**	**$0**

Agency Project Administration			
Agency Project Administration Subtotal	$994,633		
DES Additional Services Subtotal	$0		
Other Project Admin Costs	$0		
Project Administration Subtotal	**$994,633**	**Project Administation Subtotal Escalated**	**$1,173,966**

Other Costs			
Other Costs Subtotal	**$728,120**	**Other Costs Subtotal Escalated**	**$835,955**

Project Cost Estimate			
Total Project	**$45,300,590**	Total Project Escalated	**$53,164,712**
		Rounded Escalated Total	**$53,165,000**

Cost Estimate Details

Acquisition Costs					
Item	**Base Amount**		**Escalation Factor**	**Escalated Cost**	**Notes**
Purchase/Lease					
Appraisal and Closing					
Right of Way					
Demolition					
Pre-Site Development					
Other					
Insert Row Here					
ACQUISITION TOTAL	**$0**		**NA**	**$0**	

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Cost Estimate Details

Consultant Services				
Item	**Base Amount**	**Escalation Factor**	**Escalated Cost**	**Notes**
1) Pre-Schematic Design Services				
Programming/Site Analysis				
Environmental Analysis				
Predesign Study	$376,964			
Other				
Insert Row Here				
Sub TOTAL	**$376,964**	**1.0915**	**$411,457**	Escalated to Design Start
2) Construction Documents				
A/E Basic Design Services	$1,939,852			69% of A/E Basic Services
Other				
Insert Row Here				
Sub TOTAL	**$1,939,852**	**1.1169**	**$2,166,621**	Escalated to Mid-Design
3) Extra Services				
Civil Design (Above Basic Svcs)	$790,000			
Geotechnical Investigation	$160,000			
Commissioning	$60,000			
Site Survey	$80,000			
Testing	$160,000			
LEED Services				
Voice/Data Consultant				
Value Engineering	$80,000			
Constructability Review	$80,000			
Environmental Mitigation (EIS)				
Landscape Consultant	$160,000			
Travel & Per Diem	$160,000			
Hazmat Consultant	$100,000			
Other	$120,675			
Sub TOTAL	**$1,950,675**	**1.1169**	**$2,178,709**	Escalated to Mid-Design
4) Other Services				
Bid/Construction/Closeout	$871,528			31% of A/E Basic Services
HVAC Balancing				
Staffing				
On-Site Rep.	$150,000			
Insert Row Here				
Sub TOTAL	**$1,021,528**	**1.1803**	**$1,205,710**	Escalated to Mid-Const.
5) Design Services Contingency				
Design Services Contingency	$528,902			
Other				
Insert Row Here				
Sub TOTAL	**$528,902**	**1.1803**	**$624,263**	Escalated to Mid-Const.
CONSULTANT SERVICES TOTAL	**$5,817,921**		**$6,586,760**	

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Cost Estimate Details

Construction Contracts				
Item	**Base Amount**	**Escalation Factor**	**Escalated Cost**	**Notes**
1) Site Work				
G10 - Site Preparation				
G20 - Site Improvements				
G30 - Site Mechanical Utilities				
G40 - Site Electrical Utilities				
G60 - Other Site Construction				
Other				
Insert Row Here				
Sub TOTAL	**$0**	**1.1481**	**$0**	
2) Related Project Costs				
Offsite Improvements				
City Utilities Relocation				
Parking Mitigation				
Stormwater Retention/Detention				
Other				
Insert Row Here				
Sub TOTAL	**$0**	**1.1481**	**$0**	
3) Facility Construction				
A10 - Foundations				
A20 - Basement Construction				
B10 - Superstructure				
B20 - Exterior Closure				
B30 - Roofing				
C10 - Interior Construction				
C20 - Stairs				
C30 - Interior Finishes				
D10 - Conveying				
D20 - Plumbing Systems				
D30 - HVAC Systems				
D40 - Fire Protection Systems				
D50 - Electrical Systems				
F10 - Special Construction				
F20 - Selective Demolition				
General Conditions				
MACC	$26,000,000			
Insert Row Here				
Sub TOTAL	**$26,000,000**	**1.1803**	**$30,687,800**	
4) Maximum Allowable Construction Cost				
MACC Sub TOTAL	**$26,000,000**		**$30,687,800**	

5) GCCM Risk Contingency				
GCCM Risk Contingency	$510,400			
Other				
Insert Row Here				
Sub TOTAL	**$510,400**	**1.1803**	**$602,426**	
6) GCCM or Design Build Costs				
GCCM Fee	$2,041,600			
Bid General Conditions	$2,552,000			
GCCM Preconstruction Services	$525,515			
Other				
Insert Row Here				
Sub TOTAL	**$5,119,115**	**1.1803**	**$6,042,092**	
7) Construction Contingency				
Allowance for Change Orders	$2,600,000			
Other				
Insert Row Here				
Sub TOTAL	**$2,600,000**	**1.1803**	**$3,068,780**	
8) Non-Taxable Items				
Other				
Insert Row Here				
Sub TOTAL	**$0**	**1.1803**	**$0**	
Sales Tax				
Sub TOTAL	**$2,977,968**		**$3,514,896**	
CONSTRUCTION CONTRACTS TOTAL	**$37,207,483**		**$43,915,994**	

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Cost Estimate Details

Equipment				
Item	**Base Amount**	**Escalation Factor**	**Escalated Cost**	**Notes**
E10 - Equipment	$508,218			
E20 - Furnishings				
F10 - Special Construction				
Other				
Insert Row Here				
Sub TOTAL	**$508,218**	**1.1803**	**$599,850**	
1) Non Taxable Items				
Other				
Insert Row Here				
Sub TOTAL	**$0**	**1.1803**	**$0**	
Sales Tax				
Sub TOTAL	**$44,215**		**$52,187**	
EQUIPMENT TOTAL	**$552,433**		**$652,037**	

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Cost Estimate Details

Artwork					
Item	**Base Amount**		**Escalation Factor**	**Escalated Cost**	**Notes**
Project Artwork	$0				0.5% of Escalated MACC for new construction
Higher Ed Artwork	$0				0.5% of Escalated MACC for new and renewal construction
Other					
Insert Row Here					
ARTWORK TOTAL	**$0**		**NA**	**$0**	

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Cost Estimate Details

Project Management					
Item	**Base Amount**		**Escalation Factor**	**Escalated Cost**	**Notes**
Agency Project Management	$994,633				
Additional Services					
Other					
Insert Row Here					
PROJECT MANAGEMENT TOTAL	**$994,633**		**1.1803**	**$1,173,966**	

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Cost Estimate Details

Other Costs					
Item	**Base Amount**		**Escalation Factor**	**Escalated Cost**	**Notes**
Mitigation Costs					
Hazardous Material Remediation/Removal					
Historic and Archeological Mitigation					
Plan Review	$478,120				
M & O Assist	$250,000				
OTHER COSTS TOTAL	**$728,120**		**1.1481**	**$835,955**	

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C-100(2016)
Additional Notes

Tab A. Acquisition
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Tab B. Consultant Services
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Tab C. Construction Contracts
Insert Row Here

Tab D. Equipment
Insert Row Here

Tab E. Artwork
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Tab F. Project Management
Insert Row Here

Tab G. Other Costs
Insert Row Here

Appendix B

American College & University Presidents' Climate Commitment

We, the undersigned presidents and chancellors of colleges and universities, are deeply concerned about the unprecedented scale and speed of global warming and its potential for large-scale, adverse health, social, economic and ecological effects. We recognize the scientific consensus that global warming is real and is largely being caused by humans. We further recognize the need to reduce the global emission of greenhouse gases by 80% by mid-century at the latest, in order to avert the worst impacts of global warming and to reestablish the more stable climatic conditions that have made human progress over the last 10,000 years possible.

While we understand that there might be short-term challenges associated with this effort, we believe that there will be great short-, medium-, and long-term economic, health, social and environmental benefits, including achieving energy independence for the U.S. as quickly as possible.

We believe colleges and universities must exercise leadership in their communities and throughout society by modeling ways to minimize global warming emissions, and by providing the knowledge and the educated graduates to achieve climate neutrality. Campuses that address the climate challenge by reducing global warming emissions and by integrating sustainability into their curriculum will better serve their students and meet their social mandate to help create a thriving, ethical and civil society. These colleges and universities will be providing students with the knowledge and skills needed to address the critical, systemic challenges faced by the world in this new century and enable them to benefit from the economic opportunities that will arise as a result of solutions they develop.

We further believe that colleges and universities that exert leadership in addressing climate change will stabilize and reduce their long-term energy costs, attract excellent students and faculty, attract new sources of funding, and increase the support of alumni and local communities.

Accordingly, we commit our institutions to taking the following steps in pursuit of climate neutrality:

1. Initiate the development of a comprehensive plan to achieve climate neutrality as soon as possible.

   a. Within two months of signing this document, create institutional structures to guide the development and implementation of the plan.

   b. Within one year of signing this document, complete a comprehensive inventory of all greenhouse gas emissions (including emissions from electricity, heating, commuting, and air travel) and update the inventory every other year thereafter.

   c. Within two years of signing this document, develop an institutional action plan for becoming climate neutral, which will include:

      i. A target date for achieving climate neutrality as soon as possible.

      ii. Interim targets for goals and actions that will lead to climate neutrality.

      iii. Actions to make climate neutrality and sustainability a part of the curriculum and other educational experience for all students.

      iv. Actions to expand research or other efforts necessary to achieve climate neutrality.

      v. Mechanisms for tracking progress on goals and actions.

(continued...)

2. Initiate two or more of the following tangible actions to reduce greenhouse gases while the more comprehensive plan is being developed.

   a. Establish a policy that all new campus construction will be built to at least the U.S. Green Building Council's LEED Silver standard or equivalent.

   b. Adopt an energy-efficient appliance purchasing policy requiring purchase of ENERGY STAR certified products in all areas for which such ratings exist.

   c. Establish a policy of offsetting all greenhouse gas emissions generated by air travel paid for by our institution.

   d. Encourage use of and provide access to public transportation for all faculty, staff, students and visitors at our institution.

   e. Within one year of signing this document, begin purchasing or producing at least 15% of our institution's electricity consumption from renewable sources.

   f. Establish a policy or a committee that supports climate and sustainability shareholder proposals at companies where our institution's endowment is invested.

   g. Participate in the Waste Minimization component of the national RecycleMania competition, and adopt 3 or more associated measures to reduce waste.

3. Make the action plan, inventory, and periodic progress reports publicly available by submitting them to the ACUPCC Reporting System for posting and dissemination.

In recognition of the need to build support for this effort among college and university administrations across America, we will encourage other presidents to join this effort and become signatories to this commitment.

Signed,

_____

President/ Chancellor Signature

_____

President/ Chancellor Name

_____

College or University

_____

Date

Please send the signed commitment document to:

Presidents' Climate Commitment
c/o Second Nature
18 Tremont St., Suite 308
Boston, MA 02108

or fax to: 320-451-1612
or scan & email to: ACUPCC@secondnature.org

Appendix C

WESTERN
WASHINGTON UNIVERSITY

WESTERN WASHINGTON UNIVERSITY

PHASE I REPORT
FOR THE
BIOMASS GASIFICATION PLANT FEASIBILITY STUDY

PREPARED BY
UNIVERSITY MECHANICAL CONTRACTORS, INC.
FVB ENERGY, INC.
SOLGEN ENERGY LLC
SONNICHSEN ENGINEERING LLC
TR MILES TECHNICAL CONSULTANTS, INC.

September 14, 2010

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1.0 EXECUTIVE SUMMARY

Process Overview

In March of 2010, Western Washington University issued a Request for Qualification for assistance in developing an initial feasibility study to analyze the potential implementation of a biomass gasification system on campus. This RFQ process was developed through the Washington State Energy Savings Performance Contracting program. University Mechanical Contractors (UMC) was ultimately selected as the Energy Services Company partner to work with on this feasibility study.

UMC brought to the table an experienced team of companies to develop this feasibility study. These companies consist of FVB Energy (lead district energy and engineering analysis), Solgen Energy LLC (3rd party ownership analysis), Sonnichsen Engineering LLC (permitting & emissions) and TR Miles Technical Consulting, Inc (fuel supply & delivery). During the ongoing development of this study, this team worked closely with WWU's Facilities Management Group, the Boiler Plant Operations Group and the Office of Sustainability. Additional assistance was provided by Nexterra Systems Corp concerning biomass gasification. The following study provides the results of this combined effort.

Renewable Energy Goals

One of the driving forces behind the development of this feasibility analysis is the recent implementation of WWU's President's Climate Commitment. As a result, WWU has committed to providing an inventory of the current greenhouse gas (GHG) emissions and to implementing a climate action plan to reduce these emissions. This climate action plan sets goals of reducing the overall GHG emissions by 36% (below 2005 levels) by 2020 and to be carbon neutral by 2050.

The current inventory of greenhouse gas emission is shown in Figure 1.1. Purchased electricity (39%) and the current steam plant (34%) account for the largest portion of these emissions.

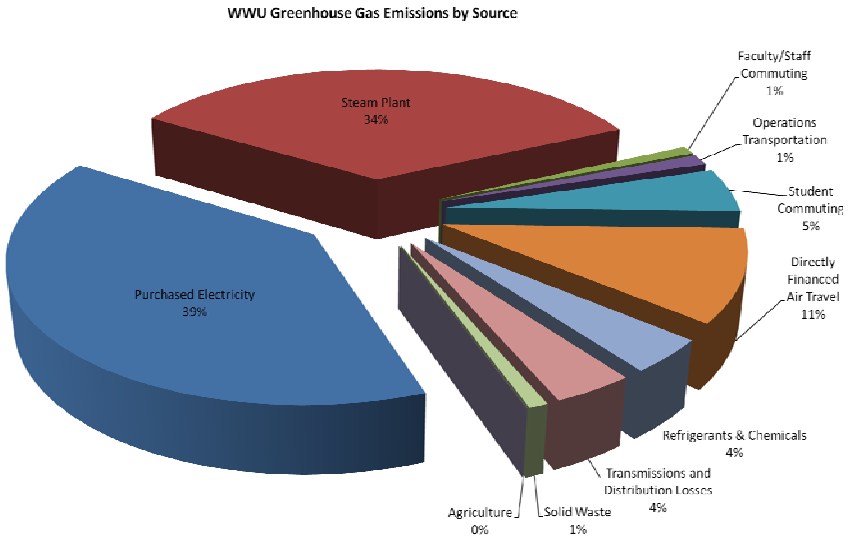

Figure 1.1 – WWU Greenhouse Gas Emissions by Source

WWU has put together an action plan to address these emission sources. The following table illustrates this action plan. As can be seen, the strategy to meet the 2020 goal is twofold. The first step is the implementation of the 10x12 (conservation and behavior modification) Program, while the second step is the application of a biomass conversion at the existing heating plant. The table on the right illustrates the alternatives considered and the savings relative to goals in the climate action plan.

Alternative	% GHG Savings	Mtons CO2e Savings
Baseline	8.6%	3,767
Alternative 0	15.8%	6,943
Alternative 1	24.9%	10,966
Alternative 2	30.0%	13,204
Alternative 3	36.7%	16,150
Alternative 1A	27.6%	12,139
Alternative 2A	30.5%	13,419
Alternative 3A	40.7%	17,898

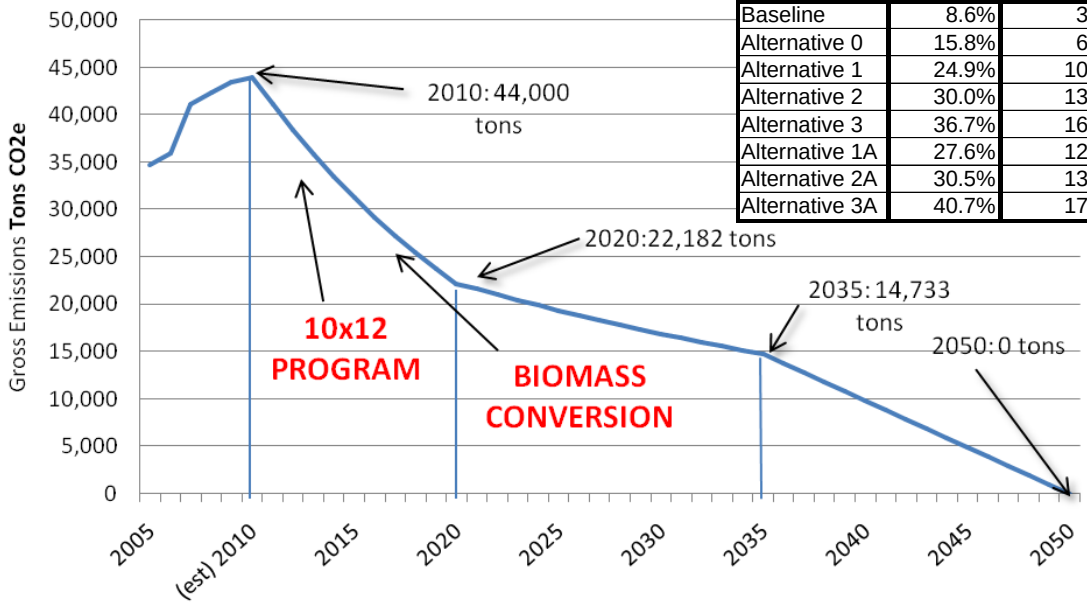

Figure 1.2 – WWU Greenhouse Gas Reduction Action Plan

The focus on implementing a biomass conversion at the central heating plant will provide a significant step in reaching the President's Climate Commitment because biomass is considered a renewable resource. The utilization of this renewable fuel for heating of the campus (in lieu of a fossil fuel – i.e. natural gas) provides a way to significantly reduce the overall carbon footprint of the university. In addition to reducing the GHG emissions, the implementation of a biomass plant also provides a reduction in fuel cost of approximately 42% (based on current rates) for all fuel displaced. And one additional benefit is that it will reduce the impact of future carbon costs that are expected to be implemented in the near future.

Alternatives Considered

During this feasibility study, various plant upgrade alternatives have been considered and analyzed. In all cases, the focus was to reduce campus GHG emissions while also lowering the annual fuel and plant operating costs. All alternatives were compared to the "Current" system operation, beginning with an investment in 2010 and extending out over a 20 year lifecycle economic model through 2030. The "Baseline", which has been applied to all alternatives, reflects a conversion of heat distribution from steam to hot water (HW).

The alternatives analyzed during this study include:

- **Alternative 0** – This option analyzes the opportunity of utilizing intermittent waste heat from the nearby PSE Encogen Plant to provide heating for the campus. In addition, it assumes that the "Baseline" (steam to HW conversion) is implemented and a HW storage system is installed.
- **Alternative 1** – This option analyzes the application of a smaller, 14' diameter (nominal 15,000 MMBtu/hr) biomass gasifier to offset the existing plant heating load. In addition, it assumes that the "Baseline" (steam to HW conversion) is implemented and a HW storage system is installed.
- **Alternative 2** – This option analyzes the application of a larger, 16' diameter (nominal 24,000 MMBtu/hr) biomass gasifier to offset the existing plant heating load. In addition, it assumes that the "Baseline" (steam to HW conversion) is implemented and a HW storage system is installed.
- **Alternative 3** - This option analyzes the application of Combined Heat & Power. This alternative utilizes the installation of a larger, 16' diameter (nominal 24,000 MMBtu/hr) biomass gasifier in combination with a GE Jenbacher Engine to generate electricity. Heat from this engine will be recovered to offset the existing plant heating load. In addition, it assumes that the "Baseline" (steam to HW conversion) is implemented and a HW storage system is installed.
- **Alternative 1a** – This option takes Alternative 1 and adds the application of intermittent waste heat from the PSE Encogen Plant for serving peak heating requirements. This was considered as a long term approach for WWU to reach Carbon Neutrality by 2050.
- **Alternative 2a** - This option takes Alternative 2 and adds the application of intermittent waste heat from the PSE Encogen Plant for serving peak heating requirements. This was considered as a long term approach for WWU to reach Carbon Neutrality by 2050.
- **Alternative 3a** - This option takes Alternative 3 and adds the application of intermittent waste heat from the PSE Encogen Plant for serving peak heating requirements. This was considered as a long term approach for WWU to reach Carbon Neutrality by 2050.

A summary of these alternatives is shown in Table 1.1. Two possible sites on the WWU main campus were considered for installation of these alternatives. In addition, a separate site on the waterfront (near the PSE plant) was considered. In the case of the waterfront site, the plant could be utilized to serve heat to the main campus, WWU waterfront buildings, and additional (non WWU) loads at the waterfront and downtown Bellingham. The body of this report also illustrates our estimate of the carbon intensive natural gas displaced in 2011 and 2030 with renewable and waste heat resources.

	Current	Base	0	1	2	3	1a	2a	3a
Existing Site	xxx	xxx	xxx	xxx	xxx		xxx	xxx	
Alternative Site						xxx			xxx
Steam Distribution	xxx								
Hot Water Distribution		xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx
HW Thermal Storage			xxx	xxx	xxx	xxx	xxx	xxx	xxx
14' Gasifier				xxx			xxx		
16' Gasifier				xxx	xxx			xxx	
16' Gasifier / CHP						xxx			xxx
Off-Site Waste Heat			xxx				xxx	xxx	xxx
Power Generation						xxx			xxx
NatGas Displaced 2011			31.5%	71.4%	93.6%	50.5%	87.0%	99.7%	71.8%
NatGas Displaced 2030			52.5%	56.4%	79.4%	39.8%	87.6%	97.8%	78.7%

Table 1.1 – Summary of Alternatives

Permitting & Emissions

One of the initial goals of this feasibility study was to review the applicable permitting & emission requirements for potential roadblocks that would inhibit the application of a biomass heating plant on the WWU campus. While the emission requirements are complex and continuously evolving, there do not appear to be any significant concerns or requirements that would prevent WWU from moving ahead with this opportunity. While the current emission standards require that all facilities meet the Best Achievable Control Technology (BACT), one option to consider is that WWU voluntarily meet the more stringent emission standards know as the Maximum Achievable Control Technology (MACT). While this is not currently required (except for particulate matter and carbon monoxide), it will allow the university to demonstrate the commitment to reduce the emission levels to the lowest currently achievable. Section 3.3 provides a detailed analysis of the permitting & emission requirements.

Fuel Supply

An analysis of the fuel supply indicates that there are sufficient biomass supplies available within the area around WWU to support this project with a stable price point.

The Alternatives analyzed for a biomass gasification system will utilize approximately 15,000 MMBtu/hr (Alternative 1) or 24,000 MMBtu/hr (Alternatives 2 & 3). At a typical moisture content of 50%, the 24,000 MMBtu/hr system would require maximum wood fuel supplies of up to 30,000 wet tons (or 15,000 dry tons) per year. This is not a very large demand and would require delivery of about 3-4 trucks per day (at 30 wet tons per load).

Typically, biomass facilities target obtaining their fuel supply from an area within a 50 mile radius of the facility. The 15,000 dry tons per year required by the WWU boiler would constitute about 10% of the total biomass available in Whatcom County; or about 1.5% of the biomass available in the combined area of Whatcom, Skagit and Snohomish counties. Normally the fuel supply and prices remain stable if a single buyer consumes no more than 30% of the available supply. One additional area that is within the desired hauling range, and could be considered for fuel supply is British Columbia.

Pricing data as analyzed in June 2010 has an average, delivered "bone dry ton" (BDT) cost of $37 with a range of between $31 and $60. For the purposes of this study, we have assumed an average starting price for biomass supply of $60/BDT (including $10/BDT for reprocessing and screening). Section 3.4 provides a detailed analysis of the fuel supply.

Summary of Economic Analysis

During the development of this study, an economic model was developed to analyze and compare each alternative's 20 year lifecycle cost estimate. This model takes into account all operating costs (fuel, labor and materials associated with operating & maintenance and the required lifecycle equipment & distribution system replacements). At the outset of the analysis, the model was set up to determine the lifecycle cost of continuing to operate in the current "business as usual" mode. This "Current" model provides the basis of comparison for all future alternatives. In addition to the annual operating costs that have been expended over the recent past, this modeling of the current system also takes into account the build-up of deferred maintenance (on both the steam distribution system & heating plant equipment) and the required additional annual O&M cost that will be required to prevent any additional future build-up of deferred maintenance. This deferred maintenance has created a significant backlog of needed upgrades (currently in excess of $7,000,000) that will need to be resolved in the near future.

Figure 1.3 provides a comparison summary (as analyzed by this 20 year economic model) of each of the alternative's annual incremental cash flow; and as measured against the current "business as usual" operation. As can be seen, the incremental cash flows for each of these alternatives become positive within the 20 year lifecycle; and most by year 10. "Year 0" indicates the initial capital cost (over and above the required capital to maintain the current operating condition and resolve the deferred maintenance issues) to implement each of the alternatives.

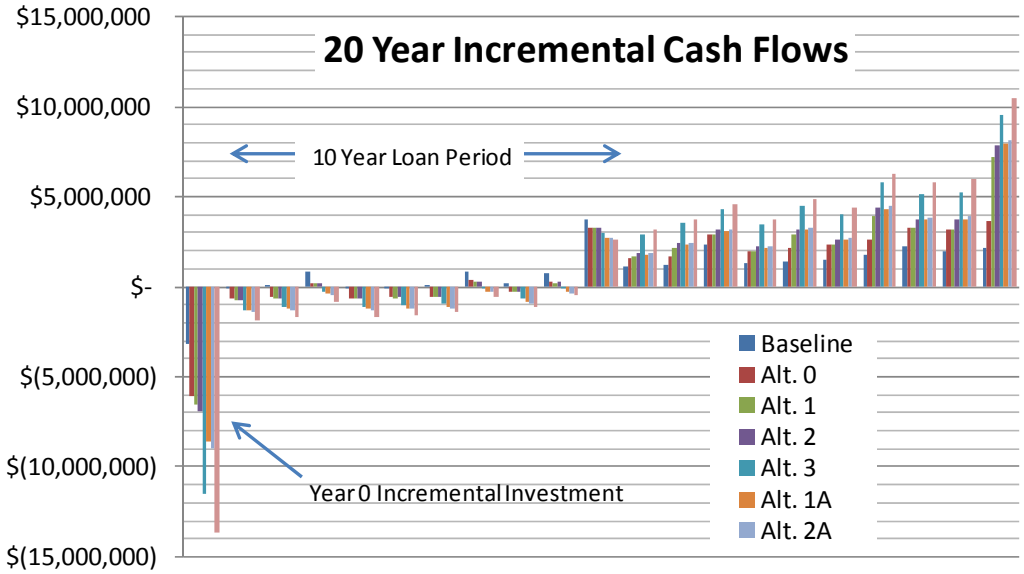

Figure 1.3 - 20 Year Incremental Cash Flows Relative to "Current" System

Table 1.2 below provides a summary of the estimated capital expenditure (CAPEX), incremental capital expenditure (Incr. CAPEX), 20 year estimated net present value (NPV) and investment

rate of return (IRR) of each alternative. The discount rate modeled in the analysis is the weighted average cost of capital assuming 70% debt (at 4% cost of capital) and 30% equity (at 15% cost of capital)..

Alternative	CAPEX $	Incr. CAPEX $	NPV	IRR
Current	$ 7,032,525	$ -	n/a	n/a
Baseline	$ 17,775,500	$ 10,742,975	$ 5,506,135	17.20%
Alternative 0	$ 27,193,500	$ 20,160,975	$ 1,732,908	8.91%
Alternative 1	$ 28,717,250	$ 21,684,725	$ 2,628,352	9.42%
Alternative 2	$ 30,121,250	$ 23,088,725	$ 3,547,435	9.96%
Alternative 3	$ 45,471,250	$ 38,438,725	$ 508,118	7.55%
Alternative 1A	$ 35,638,250	$ 28,605,725	$ (1,975,684)	6.07%
Alternative 2A	$ 37,042,250	$ 30,009,725	$ (2,360,066)	5.90%
Alternative 3A	$ 52,392,250	$ 45,359,725	$ (3,370,400)	5.92%

Note: The CAPEX provided in the analysis is considered a Rough Order of Magnitude

Table 1.2 - Summary of Alternative 20 Year Lifecycle Economics as Modeled

As can be seen in the table above (and as currently modeled), the Baseline, Alternative 0, and Alternatives 1 through 3 each have a positive NPV over the initial 20 year lifecycle. The result of this analysis indicates that these alternatives have sufficient economic viability as indicated in the initial modeling to warrant consideration for further analysis and potential implementation. Furthermore, there does not appear to be an economic case for simultaneous integration of both biomass gasification and off-site waste heat at the present time. However, phasing of one alternative in advance of the other may be a means to achieve longer range carbon emission reduction goals in a manner that makes economic sense for WWU and could provide a required step in meeting the President's Climate Commitment of carbon neutrality by 2050.

Lastly, numerous options exist for financing infrastructure investments including energy savings performance contracting (ESPC), self-funding, and third party financing which are discussed in more detail herein. A unique opportunity exists for WWU to attract third-party financing by acting as an "anchor" customer for heat in a broader district heating network. This network could be developed to serve the WWU main campus, waterfront, and additional downtown Bellingham customers.

Appendix D

- Measure results
  - Prosperous economy
  - Sustainable energy & a clean environment
  - Healthy & safe communities
  - Efficient, effective & accountable government
  - Results Washington: Case studies
  - Legislative reports
- Apply Lean
- Foster performance audits
- Results reviews

Participating agencies/groups

- Department of Agriculture
- Department of Commerce
- Department of Ecology
- Office of Financial Management
- Department of Fish and Wildlife
- Department of Health
- Department of Natural Resources
- Parks and Recreation Commission
- Pollution Liability Insurance Agency
- Puget Sound Partnership
- Recreation and Conservation Office
- State Conservation Commission
- Utilities and Transportation Commission

Download the PDF version

Goal 3: Sustainable energy & a clean environment - Goal map

Click on any numbered box below for more information.

Sustainable & Clean Environment | Healthy Fish & Wildlife | Clean & Restored Environment | Working & Natural Lands

SUSTAINABLE AND CLEAN ENERGY

Reduce our greenhouse gas emissions

CLEAN TRANSPORTATION	CLEAN ELECTRICITY	EFFICIENT BUILDINGS & INDUSTRIAL PROCESSES
1.1: Reduce transportation related greenhouse gas emissions from 44.9 mmt/year (projected 2020) to 37.5 mmt/year(1990) by 2020	1.2: Reduce greenhouse gas emissions from electrical energy consumption from 18.4 mmt/year (projected 2020) to 16.9 mmt/year (1990) by 2020	1.3: Improve non-electrical energy efficiency of buildings and industrial processes to reduce greenhouse gas emissions from 21.7 mmt/year (projected 2020) per year to 18.6 mmt/year (1990) by 2020
1.1.a: Reduce the average emissions of greenhouse gases for each vehicle mile traveled in Washington by 25% from 1.15 pounds (lbs.) in 2010 to 0.85 pounds (lbs.) by 2020	1.2.a: Increase electric load served by renewable energy from 3% to 9% by 2016 and 15% by 2020	1.3.a: Decrease non-electric fossil fuel consumption associated with residential and commercial end users from the 2010 three year average of 165.9 trillion Btu to 140 trillion Btu in 2020
1.1.b: Increase the average miles traveled per gallon of fuel for Washington's overall passenger and light duty truck fleet (private and public) from 19.2 MPG in 2010 to 23 MPG in 2020	1.2.b: Increase electrical load growth replaced by conservation from 112.5 average megawatts per year to 155 average megawatts per year by 2020	1.3.b: Maintain non-electric fossil fuel consumption associated with industrial buildings and industrial processes at or below the 2010 three year average level of 163.7 trillion Btu by 2016
1.1.c: Increase the number of plug-in electric vehicles registered in Washington from approximately 8,000 in 2013 to 50,000 by 2020		

mmt: million metric tons

Appendix E

Mission Statement and Strategic Plan

Mission

Western Washington University serves the people of the State of Washington, the nation, and the world by bringing together individuals of diverse backgrounds and perspectives in an inclusive, student-centered university that develops the potential of learners and the well-being of communities.

Vision

Western will build a stronger Washington by being an international leader in active learning, critical thinking, and societal problem solving.

Strategic Goals

- Build upon Western's strengths to address critical needs in the State of Washington.
- Expand student access to rigorous and engaging baccalaureate and graduate education.
- Foster and promote life-long learning and success in an ever-changing world.
- Apply Western's expertise and collaborative approach to scholarship, creativity, and research in ways that strengthen communities beyond the campus.
- Serve as a model for institutional effectiveness, innovation, diversity, and sustainability.

Appendix F

Western Washington University

Climate Action Plan

June 2010

The Western Washington University Climate Action Plan is a collaboration of faculty, administration, staff and students working to reduce greenhouse gas emissions at Western Washington University

Website: http://www.wwu.edu/sustain/

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ACKNOWLEDGEMENTS

Western Washington University Climate Action Plan (WWUCAP) working group is indebted to the Sustainability Committee Co-Chairs, Dean Brad Smith and Assistant to the President for Sustainability George Pierce, and to members of the committee for their guidance and their contributions to this document. WWUCAP also received valuable support from members of the various departments that reviewed this document for accuracy in their area of specialty.

The WWUCAP working group would like to thank the following organizations and individuals for their ongoing involvement with the project:

In the Greater Community

- City of Bellingham
- Washington State Department of Ecology
- The Northwest Clean Air Agency
- Recycling Services Incorporated
- Association for the Advancement of Sustainability in Higher Education
- Clean Air Cool Planet

At Western Washington University

- Office of the President: Karen Morse, Bruce Shepard
- Business and Financial Affairs Office: Kathy Wetherell
- Facilities Management: Tim Wynn, Ron Bailey
- Assistant to the President for Sustainability: George Pierce
- Huxley Department of Environmental Studies: Gene Myers
- Woodring College of Education: Victor Nolet
- Associated Students Recycle Center: Rich Neyer
- University Residence Hall Sustainability Committee

We are grateful to graduate student researcher Joseph Hayes and undergraduate work study student Corey Havens for their contributions to this study and to the Office of Sustainability.

The WWUCAP team looks forward to working together with these and many other dedicated sustainability-minded colleagues in 2010-2011 and beyond!

Seth Vidaña, Campus Sustainability Coordinator
Irene Hinkle, Project Coordinator
Office of Sustainability
Visit us at: http://www.wwu.edu/sustain/

Background to the Climate Action Plan (CAP)

About the Western Washington University CAP Working Group

The WWUCAP working group was created under the auspices of the Office of Sustainability and at the behest of Facilities Management in June 2008 in response to the need to create a Climate Action Plan as part of the President's Climate Commitment endorsed by President Shepard and signed by former WWU president, Karen Morse, in January 2007.

The working group is officially composed of staff and student workers from the Office of Sustainability and personnel from Facilities Management. Unofficially, it is comprised of many constituents across campus and in the greater community.

Why Western Washington University Should Take Action

Anthropogenic climate change is the most significant problem of our time (IPCC, 2009). Recognizing this, almost all developed countries are taking action to reduce greenhouse gas emissions, with both the Kyoto Protocol increasing its influence and the European Union implementing its recent Emissions Trading Scheme.

Global warming is now recognized as one of the most important threats to ecological sustainability and human civilization. Global surface temperatures are on course to increase by between 2.5ºF and 10.5ºF by the year 2100, with regions in the northern parts of North America and Asia heating by 40 percent above the mean increase. Locally, rising temperatures are compromising the snow packs that supply water, increasing the incidence of floods and forest fires in the region, and threatening to cause Bellingham Bay to rise (NWF 2009). Beyond the geographic borders of our **bioregion**, studies are rolling in at an alarming rate that confirms the global nature of the threat of climate change such as the below from the Royal Society for the Protection of Birds:

> "We hear a lot about climate change, but our paper shows that its effects are being felt right now. The results show the number of species being badly affected outnumbers the species that might benefit by three to one. Although we have only had a very small actual rise in global average temperature, it is staggering to realise how much change we are noticing in wildlife populations. If we don't take our foot off the gas now, our indicator shows there will be many much worse effects to come. We must keep global temperature rise below the two degree ceiling; anything above this will create global havoc." (RSPB 2009)

A changing climate is not only an environmental threat. It also has implications on social equity, our public health, and our local economy. The World Health Organization(WHO) has this detail to add:

> "Modest global warming since the 1970s was already causing over 150,000 excess deaths every year by 2000, according to a study by the World Health Organisation. This assessment was based on studies on the impact of climate-sensitive illnesses like diarrhoeal disease, which is the second leading infectious cause of childhood mortality, and accounts for a total of around 1.8 million deaths each year. "(RSPB 2009)

The goal of a sustainable future will require a paradigm shift. This is described by foremost scientists in the field of societal change as reported in the Proceedings of the National Academy of Science:

> "A high and sustainable quality of life is a central goal for humanity. Our current socio-ecological regime and its set of interconnected worldviews, institutions, and technologies all support the goal of unlimited growth of material production and consumption as a proxy for quality of life. However, abundant evidence shows that, beyond a certain threshold, further material growth no longer significantly contributes to improvement in quality of life. Not only does further material growth not meet humanity's central goal, there is mounting evidence that it creates significant roadblocks to sustainability through increasing resource constraints (i.e., peak oil, water limitations) and sink constraints (i.e., climate disruption). Overcoming these roadblocks and creating a sustainable and desirable future will require an integrated, systems level redesign of our socio-ecological regime focused explicitly and directly on the goal of sustainable quality of life rather than the proxy of unlimited material growth." (PNAS 2009)

Reaching our goal will require significant changes in our community – in our infrastructure, in our technology, and in the decisions we make as residents, business owners, academics, educators, etc. In addition, the strategies included in Western's Climate Action Plan must not only reduce greenhouse gas emissions, but also meet the needs of low-income communities. Part of sustainability is consideration of economic equity and social justice. Historically, we have seen poor people throughout the world and in our community suffer the most from both the impacts and the suggested mitigations of environmental threats and catastrophes. Our plan must make social justice a priority.

As such, the solutions our community proposes and implements must be sensitive to a broader set of societal concerns. Addressing climate change locally is not only an opportunity to reduce greenhouse gas emissions, but also an opportunity to build a positive, community-based movement which results in increased empowerment, civic pride and improved quality of life.

But we do not start from scratch. Bellingham is known throughout the region as a pioneering green city that is willing to lead social change through innovative and creative strategies – from free energy efficiency assistance to low income residents to record-setting participation in curbside recycling to green business programs and biodiesel production. We have active sustainable businesses and vibrant civic organizations and non-profit entities with which we have already forged long-lasting and mutually-beneficial relationships. We benefit from businesses and residents who care about solving the climate crisis and creating a sustainable, socially just bioregion. This tangible gift to Western Washington University is, in part, financial since the natural beauty of Western Washington University's setting is part of what draws students to attend our institution. Our community is also nourished by the resources and intellectual capital at Western Washington University. The university's commitment and action to address its own climate footprint is an inspiration and provides valuable lessons for the

community as a whole. We have already begun to extend our expertise and intellectual capitol built through the work of addressing our climate footprint into the greater community as consultants to businesses wanting to emulate our example (WWU O of S 2009).

Western Washington University is already demonstrating national and regional leadership in committing to reduce its GHG emissions. On January 12, 2007, Western Washington University's then-President Karen Morse signed the President's Climate Commitment that endorses meeting the goals outlined by the Association for the Advancement of Sustainability in Higher Education (AASHE 2009).

There were three goals for compliance with the commitments inherent in the President's Climate Commitment (See Appendix A: AASHE President's Climate Commitment full text):

1. Create a carbon emissions inventory
2. Assess the feasibility of emissions reduction through campus initiatives
3. Create an institutional model for emissions reduction to move toward carbon neutrality through Climate Action Plan.

This committed Western Washington University to:

- Reduce campus energy use and costs
- Implement GHG reduction technologies developed by campus researchers
- Prepare for future climate regulations and energy price volatility
- Create demand for low-cost renewable energy technologies through purchasing power
- Appeal to a campus community that has a strong culture of environmental ethics
- Collaborate with local communities and the City of Bellingham

Western Washington University Climate Action Plan (WWUCAP)

WWUCAP was formed to develop a strategy for significantly reducing Western Washington University's GHG footprint without compromising its operations. The first of the three goals above was carried out by the Office of Sustainability in 2007-08. The WWUCAP fulfills the second two goals of the President's Climate Commitment as listed above.

How to Read this Action Plan

The primary Climate Action Plan findings and motivations for embracing them are stated in the Executive Summary on page 6. All terms that are in **bold** type are to be found in the Glossary beginning on page 41. Sources cited in the text are found in the References section beginning on page 43. All sources for information in this document are found in the Bibliography section beginning on page 45.

EXECUTIVE SUMMARY – WWU CLIMATE ACTION PLAN 2010

The President's Climate Commitment, signed in January 2007, establishes a plan by which Western would reach climate neutrality in a self established period. "Climate neutrality" refers to reaching net zero carbon emissions through a combination of reducing our carbon output to the barest minimum possible and balancing our remaining carbon production with off-campus options such as University-sponsored carbon reduction and sequestration projects. In 2009, the state of Washington passed legislation to require annual reporting of greenhouse gas emissions and targets for reductions against a 2005 baseline. This Climate Action Plan seeks to make WWU a regional leader in the drive for a stable climate by exceeding state requirements and reaching climate neutrality by 2050.

Final Conclusions of the WWU Climate Action Plan

The Plan concludes that the University may take the following actions to reach climate neutrality:

- **Commit to reducing net greenhouse gas emissions** to 36% below 2005 levels by 2020. This report demonstrates that this target can be met through execution of identified on-campus projects and, if necessary, University-sponsored carbon reduction and sequestration projects. This goal will also allow us to meet the state mandated greenhouse gas emissions reductions targets (RCW 70.235) well within the required timelines.

- **Commit to long-term climate neutrality** by researching system-wide opportunities for energy conservation and efficiency. Through behavior change programs such as the "10 X 12" Program and potential infrastructure changes outlined in Energy Savings Company (ESCO) projects, we forecast a climate neutral campus by 2050. Student leadership in the area of renewable energy has already demonstrated a high level of support for measures to reach this goal.

- **Provide a model** to the campus to incorporate greenhouse gas reduction criteria and sustainability into the institutional decision-making process. This model behavior can help guide decision making by every member of the campus community: administrators, faculty, staff, students and contractors.

- **Support the continuation of the WWUCAP and sustainability initiatives**. Allocate resources for permanent sustainability staff roles and incorporate greenhouse gas reduction criteria and reporting into their mandates. Create CAP Implementation Team to research reduction opportunities and funding opportunities; report progress to the WWU Board of Trustees on a cyclical basis.

Funding

Financial investments in energy conservation and efficiency, on-campus carbon-neutral energy production and University-sponsored carbon reduction projects are contingent on current funding opportunities and will follow standard university budgeting procedures.