



Performance Audit of Harborview Energy Conversion

Phase I: Impact of Courthouse and Jail Energy Conversion Projects on Costs and Greenhouse Gas Emissions

**Larry Brubaker
Ben Thompson
Bob Thomas**

**July 9, 2013
Report No. 2013-05**

Executive Summary

This report assesses the cost and greenhouse gas impacts of converting the source of heat and hot water for the King County Courthouse and King County Correctional Facility from steam purchased from Seattle Steam Company to natural gas boilers. We found that the county has achieved significant savings of both costs and greenhouse gas emissions as a result of the conversion.



King County

Metropolitan King County Council

King County Auditor's Office

Bob Thomas, *Interim King County Auditor*

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MEMORANDUM

DATE: July 9, 2013

TO: Metropolitan King County Councilmembers

FROM: *Bob Thomas*
Bob Thomas, Interim County Auditor

SUBJECT: Performance Audit of Harborview Energy Conversion (Phase I)

Attached for your review is the Performance Audit of Harborview Energy Conversion (Phase I). The primary objective of the audit was to assess the cost and greenhouse gas impacts of converting the King County Courthouse and King County Correctional Facility heating and hot water from steam provided by Seattle Steam Company to county-owned and operated natural gas boilers.

The general audit conclusion was that the courthouse and jail conversion projects resulted in significant saving of both costs and greenhouse gas emissions. We noted some implementation issues with these projects and recommend that the Facilities Management Division apply lessons learned from the implementation issues to potential future energy conversion projects.

The County Executive's response to the audit concurred with the audit findings and recommendations and is contained in the appendices of the report.

Larry Brubaker, Senior Principal Management Auditor, and Ben Thompson, Principal Management Auditor, conducted this audit under the supervision of Bob Thomas, Interim County Auditor. Please contact Larry Brubaker at 206-477-1034 or Bob Thomas at 206-477-1042 if you have any questions about this audit.

The Auditor's Office sincerely appreciates the assistance and cooperation received from the Facilities Management Division management and staff, as well as assistance provided by Seattle Steam Company.



Performance Audit of Harborview Energy Conversion Phase I

Report Highlights

July 9, 2013

Report No. 2013-05

Purpose The purpose of Phase I of the audit is to assess the impact of the courthouse and jail energy conversion projects on costs and greenhouse gas. This information will inform future decisions about future potential energy conversions at Harborview Medical Center. Phase II of the audit will review proposals for energy conversion at Harborview.

Key Audit Findings The audit found that the County has achieved significant savings of both costs and greenhouse gas emissions as a result of converting the source of energy for heating and hot water at the county courthouse and jail from steam provided by Seattle Steam Company to county owned and operated natural gas boilers. However, some implementation issues have resulted in the natural gas boilers not operating at full efficiency.

What We Recommend We recommend that the Facilities Management Division apply lessons learned from the implementation issues to potential future energy conversion projects.

King County Auditor's Office

Bob Thomas, Interim King County Auditor



King County

Harborview Energy Conversion Audit, Phase I

Impact of Courthouse and Jail Energy Conversion
Projects on Costs and Greenhouse Gas Emissions

July 9, 2013

Report No. 2013-05

Harborview Energy Conversion Audit Background

- Harborview currently purchases steam from Seattle Steam for heating and hot water
- Issues with current energy source:
 - Lack of redundancy
 - Cost
- Options currently being considered for conversion to different energy source:
 - City of Seattle “District Energy” planning
 - FMD studying various alternatives for energy at Harborview

Audit Proviso and Report Scope

- 2013 budget proviso, Auditor's Office review:
 - County's past energy conversion projects impacts on cost and greenhouse gas emissions (Phase I)
 - Proposals to reduce energy costs and greenhouse gas emissions on Harborview Campus (Phase II)
- This report covers the cost and greenhouse gas impacts of converting the courthouse and jail from Seattle Steam to natural gas boilers (Phase I)

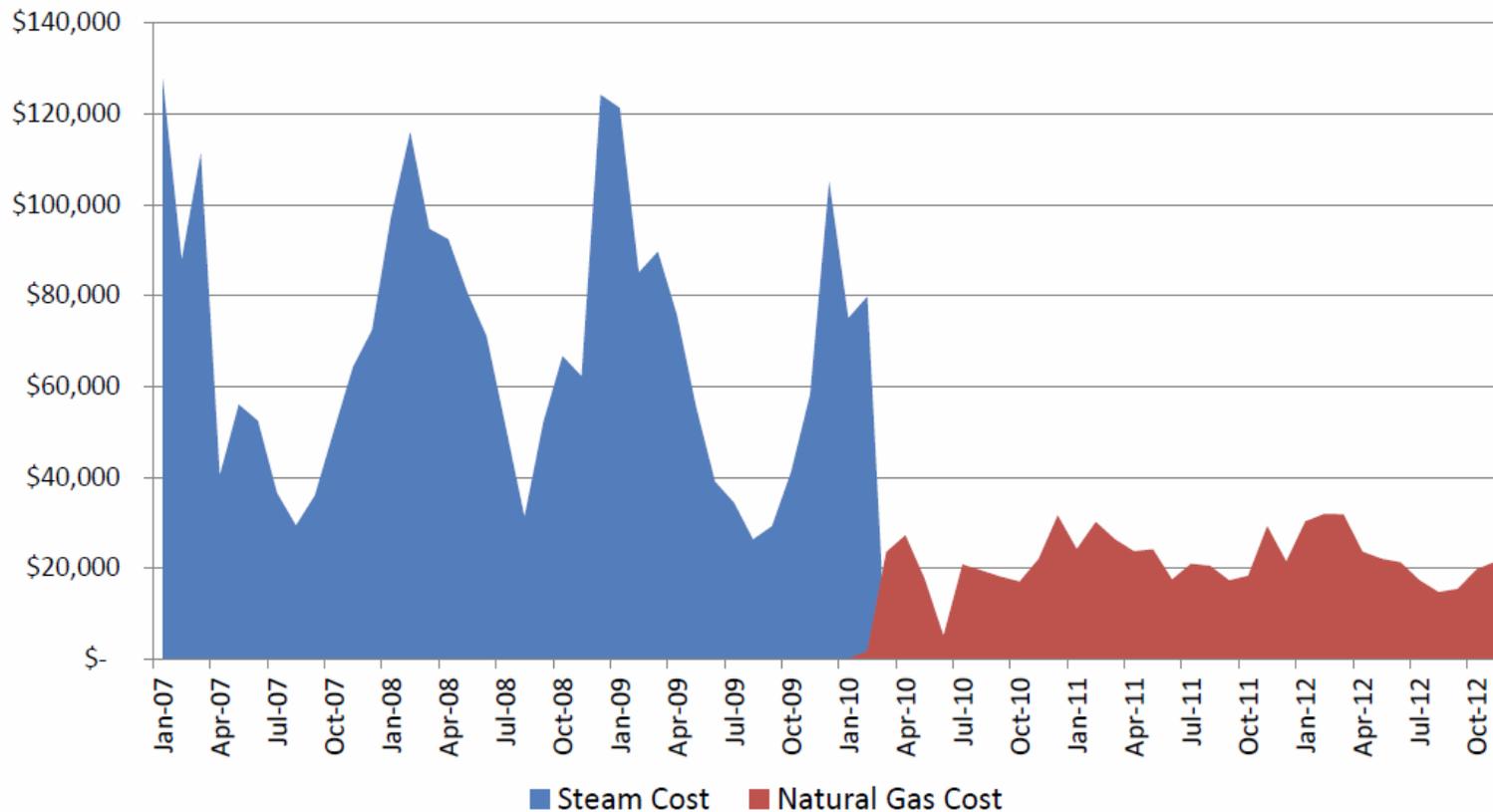
Background: Courthouse & Jail Conversion

- In 2009, the County Council approved expenditure of \$6.3 million to convert the courthouse and jail from Seattle Steam to natural gas boilers
- Purpose was to save money and reduce greenhouse gas emissions. FMD projected:
 - The conversion project would save \$5.3 million over the 25-year life of the boilers
 - The conversion project would save 1,700 metric tonnes of CO₂ per year
- Conversion project completed in 2010

Impact of the Courthouse/Jail Conversion – Costs

- Auditor's Office analysis:
 - Compared actual costs before and after the conversion
 - Compared actual costs with what costs would have been had the county remained on Seattle Steam
 - Extrapolated actual two-year cost savings over the 25-year life of the boilers
- Projected 25-year cost savings NPV = \$6.5 million

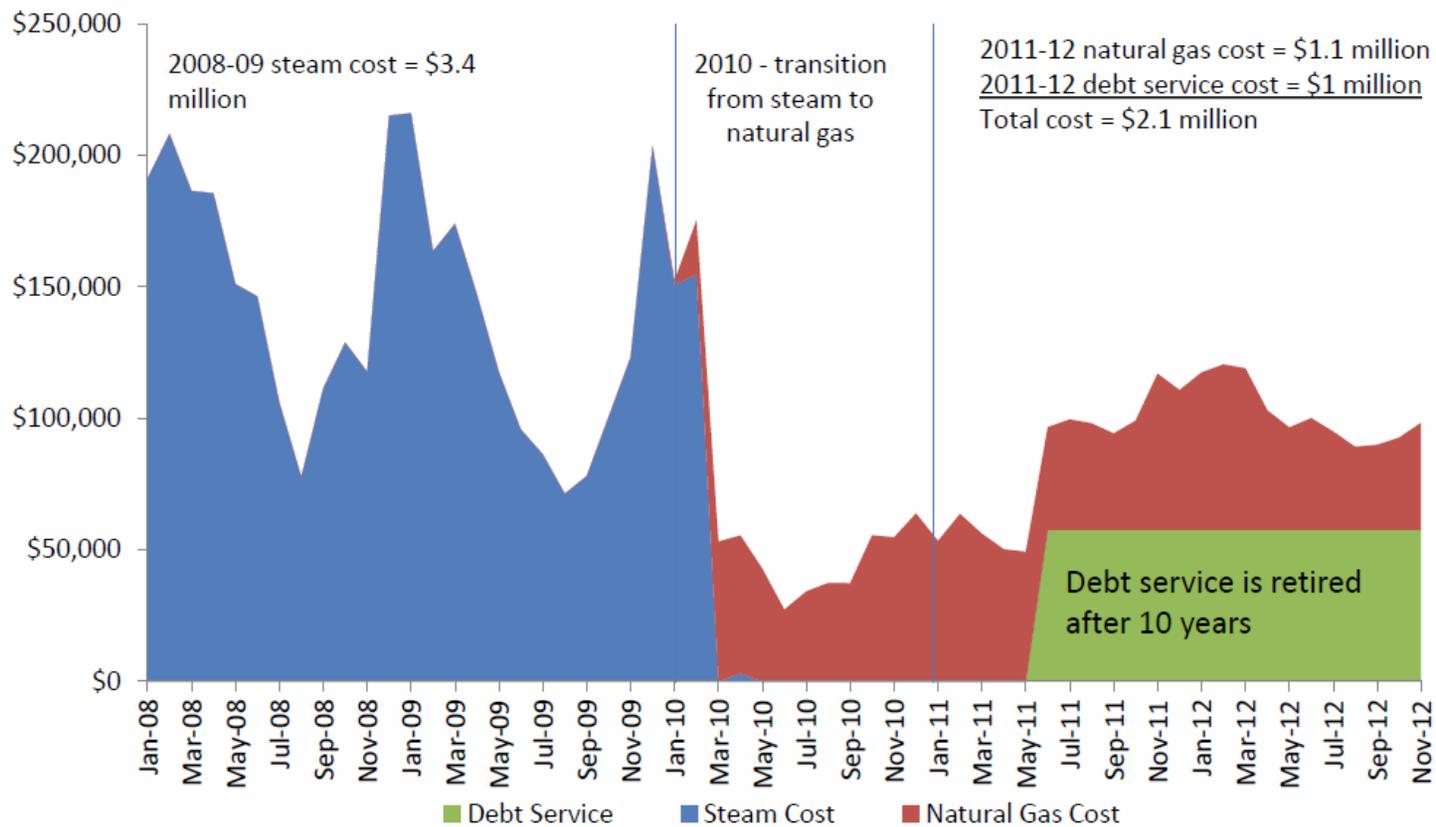
Courthouse Fuel Costs Pre- and Post-Conversion



July 9, 2013

Government Accountability and Oversight Committee

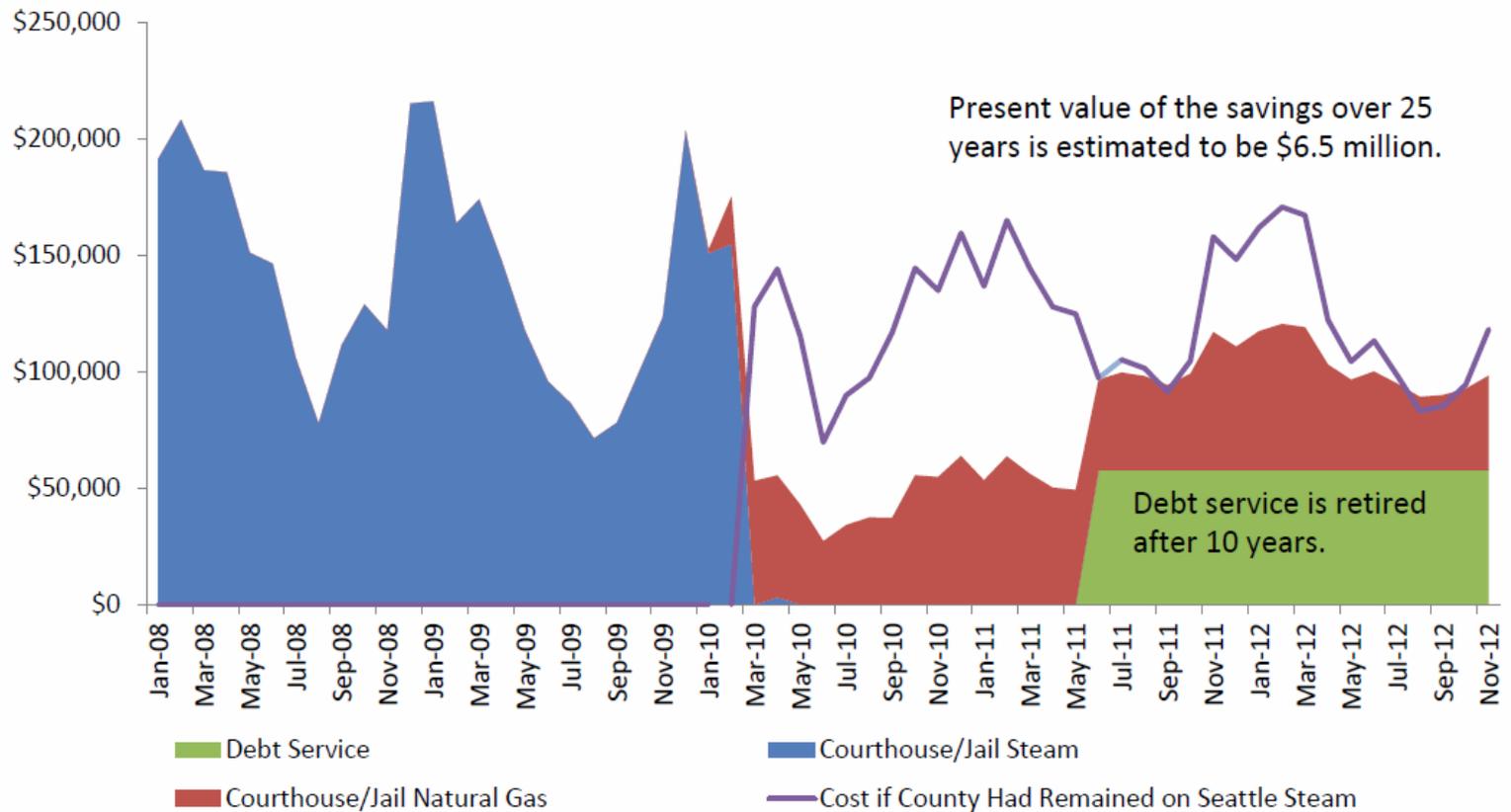
Actual Costs for Fuel and Debt Service



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Actual Costs Pre- and Post-Conversion



July 9, 2013

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Impact on Greenhouse Gas Emissions

- Auditor's Office analysis:
 - Compared actual emissions from on-site natural gas boilers after conversion to estimated emissions had the County remained on Seattle Steam
- Projected annual emissions savings about 2,000 metric tonnes

Calculating Estimated Emissions

- Used the Climate Registry Protocol to calculate estimated emissions had the County remained on Seattle Steam
- Calculated estimated emissions based on factors provided by Seattle Steam and on estimates we made of the total system efficiency

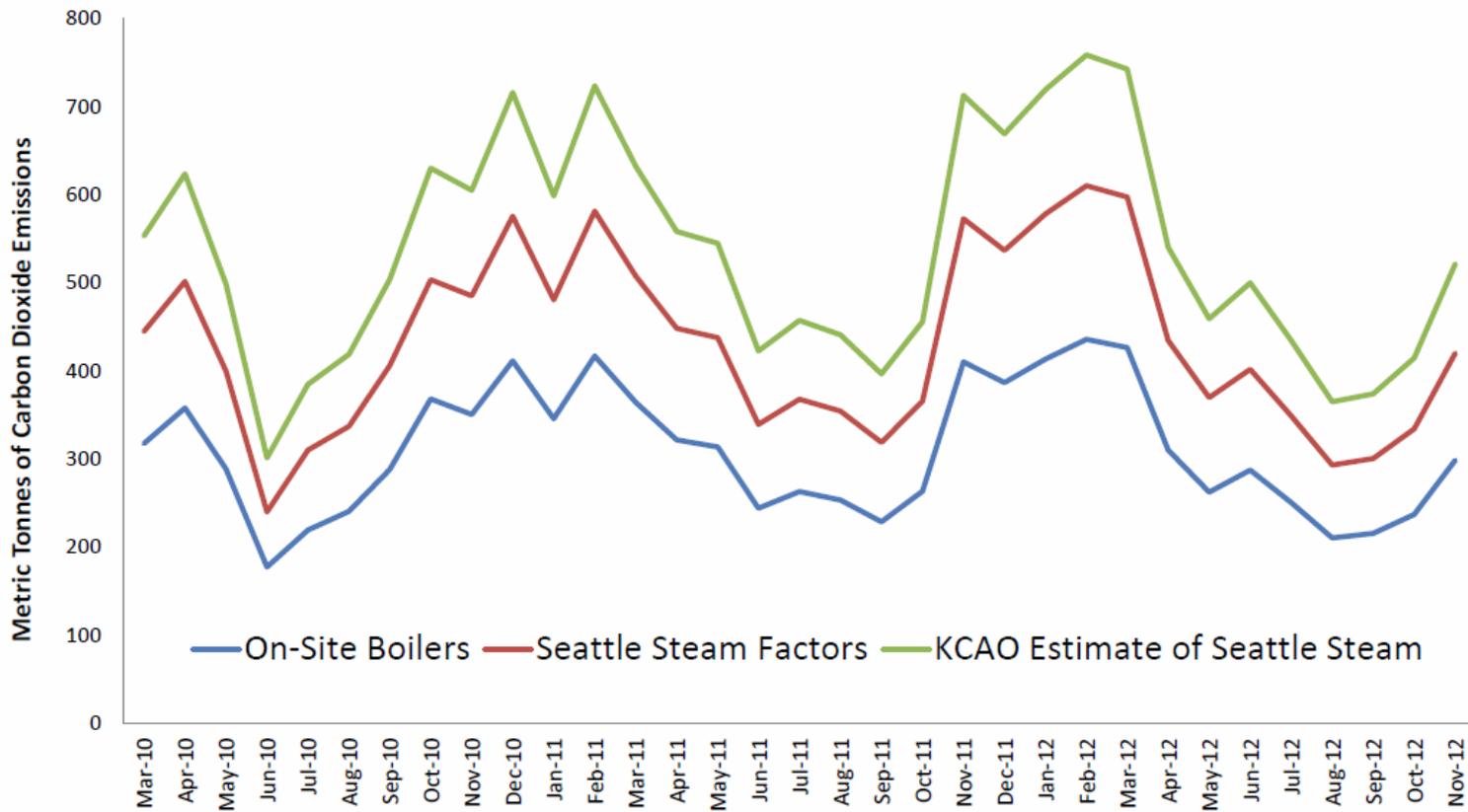
Greenhouse Gas Impact of Burning Wood

- Seattle Steam currently burns both natural gas and wood to produce steam
- Although burning wood produces greater emissions than burning natural gas, the Environmental Protection Agency currently considers burning wood to be greenhouse gas neutral
- Our analysis did not include emissions from Seattle Steam's wood combustion based on 2012 usage
- Future emissions from Seattle Steam could change based on the quantity of wood burned and whether burning wood continues to be considered greenhouse gas neutral

July 9, 2013

Government Accountability and Oversight Committee

CO₂ from On-Site Boilers Less Than Estimated CO₂ from Seattle Steam



July 9, 2013

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Issues With Implementation of County Boiler System

- According to FMD:
 - Boilers are not operating as a unit as efficiently as originally planned
 - Problems are attributed to the operation and functionality of controls, the boilers, and other installed equipment. Follow-up review is underway
 - Some anticipated energy savings have not yet been realized
 - Cost of addressing problems to date are shared by contractor, control system manufacturer, and County
 - County's share is \$160,000
 - FMD is working with original contractor to identify and resolve any other ongoing problems

Comments and Recommendation Regarding Implementation Issues

- We included the County's additional cost in our cost analysis
- Despite the issues, savings are still greater than original projection
- Resolution of the issues may increase savings in the future
- FMD has identified lessons learned from the implementation issues

Recommendation: FMD should apply lessons learned to similar projects in the future

Audit Scope and Methodology

Audit Scope and Objectives

- This audit evaluated the impacts in terms of cost and greenhouse gas emissions of King County's conversion of the County Courthouse and King County Correctional Facility from Seattle Steam to on-site natural gas boilers.
- It also described the current options for energy at Harborview Medical Center.

Methodology

- In conducting this performance audit we interviewed staff at the Department of Executive Services' Facilities Management Division (FMD), the Department of Natural Resources, Seattle Steam, and Harborview Medical Center.
- In conducting our analyses, we relied primarily on documentation and data provided by FMD, supplemented by data from other sources including Seattle Steam.
- To calculate the cost impact of the conversion, we used utility bills to compare fuel costs before and after the conversion, we used rate sheets provided by Seattle Steam to compare the County's costs of operating the boilers with what costs would have been had the County remained on Seattle Steam, and we estimated the present value of the conversion savings by extrapolating savings from 2011-12 through the 25-year useful life of the boilers, using a 7-percent real discount rate.
- To calculate estimated carbon emissions had these two buildings stayed on Seattle Steam, we used two methods. The first relied on an emission factor provided by Seattle Steam. However, since we could not verify this factor, we also calculated emissions based on estimates we made of Seattle Steam's total system efficiency. We based our estimates on information provided by Seattle Steam and its 2013 rate explanation form.

Audit Methodology and Standards

Internal Controls

- We evaluated internal controls relevant to the audit objectives. This included a review of relevant policies and procedures relating to data system management controls and reporting.

External Impairment

- Seattle Steam did not provide all of the information requested about its current operations. It did provide some of the data we requested, however, because it is not a regulated utility, it was under no obligation to provide this information. This impairment did not affect our ability to form independent, objective analysis, findings and conclusions regarding the topics covered in this report.

Audit Standards

- The work performed in this audit was carried out in conformance with generally accepted government auditing standards.

July 9, 2013

Government Accountability and Oversight Committee

Executive Response



King County

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KING COUNTY AUDITOR

JUN 21 2013

RECEIVED

June 21, 2013

Bob Thomas
Interim King County Auditor
Room 1033
C O U R T H O U S E

Dear Mr. Thomas:

Thank you for the opportunity to review and comment on the proposed final report – Harborview Energy Conservation Project Phase I. We appreciate the auditor's thorough review and my staff and I agree with the findings. Your recommendation is quite timely as we continue to assess the issues surrounding the installation and operation of the new boilers provided through the Steam Conversion Project.

As demonstrated by your review, the decision to move forward with the Energy Services Contract (ESCO) project to move from high pressure steam to gas fired boilers in the Courthouse and the King County Correctional Facility has proven to be an excellent policy choice. By switching from the old, off-site steam system to on-site gas fired boilers, King County has reduced greenhouse gases by 2000 metric tons a year as compared to original estimates of 1700 metric tons. Furthermore, post conversion experience shows that the Facilities Management Division (FMD) has cut energy costs by to roughly 1/3 of our previous experience with externally provided high pressure steam. As noted in your report, the 25-year present value of cost savings is exceeding the original \$5.3 million projections by \$1.2 million.

FMD is already applying the lessons learned in the Steam Conversion project and we plan to apply our lessons learned to future energy projects. FMD has developed a work program to address the installation and operational issues and fully expects that further efficiencies will be achieved.



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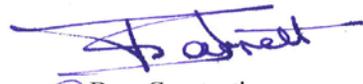
Bob Thomas
June 21, 2013
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I fully **concur** with the following recommendation and provide the following specific comments below:

Recommendation	Agency Position	Schedule for Implementation	Comments
FMD Should Apply Lessons Learned to Similar Projects In the Future	Concur	On-going	The FMD intends to formally debrief on lessons learned and then apply those lessons to future similar projects. These efforts will be continuing. The first major change was to implement an "owner managed" ESCO process which has will be used in place of the State ESCO Program.

If you have any questions regarding our audit response, please contact Carol Basile, Deputy Director, Finance and Business Operations Division, at 206-263-9255.

Sincerely,



Dow Constantine
King County Executive

cc: Fred Jarrett, Deputy County Executive, King County Executive Office (KCEO)
Rhonda Berry, Assistant Deputy County Executive, KCEO
Caroline Whalen, County Administrative Officer, Department of Executive Services (DES)
Kathy Brown, Director, Facilities Management Division (FMD)
Ameer Faquir, Deputy Director, FMD
Ken Guy, Director, Finance and Business Operations Division (FBOD), DES
Carol Basile, Deputy Director, FBOD, DES

List of Recommendations & Implementation Schedule

Recommendation 1: FMD should apply lessons learned to similar projects in the future.

Implementation Date: Ongoing

Estimate of Impact: Avoid implementation problems for future energy conversion projects.



Analysis of Energy Options at Harborview Medical Center

**Larry Brubaker
Ben Thompson
Bob Thomas**

July 22, 2014

Executive Summary

The proposed redevelopment of Harborview Hall provides King County the opportunity to assess its energy options for the Harborview Medical Center with a focus on providing on-site redundancy while decreasing both costs and greenhouse gas emissions. Our analysis found that while the option to provide an on-site central utility plant meets these three objectives, Seattle Steam's recent rate proposal presents challenges.

King County Auditor's Office

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Harborview Energy Conversion Study, Phase 2

Analysis of Energy Options at
Harborview Medical Center

July 22, 2014

Summary of findings

- Advantages to both remain on Seattle Steam and have on-site utility plant
- Risks of continuing to purchase energy from current provider
- Infrastructure could be built to provide future flexibility

Why we did this work

- 2013 budget proviso, Auditor's Office to review:
 - County's past energy conversion projects (Phase I)
 - Proposals for Harborview Campus (Phase II)

Harborview energy conversion audit background

- Harborview currently purchases steam from Seattle Steam
 - Lack of on-site redundancy
 - Cost
- FMD proposed renovation of Harborview Hall includes option for local utility plant

Status of Harborview Hall project

- Sabey selected as prime contractor and McKinstry was subcontractor
- Project design is nearly complete
- Legislation for County Council review should be transmitted soon

Options reviewed

- Options we reviewed were:
 - Sabey/McKinstry proposal to build on-site central utility plant
 - Seattle Steam proposal

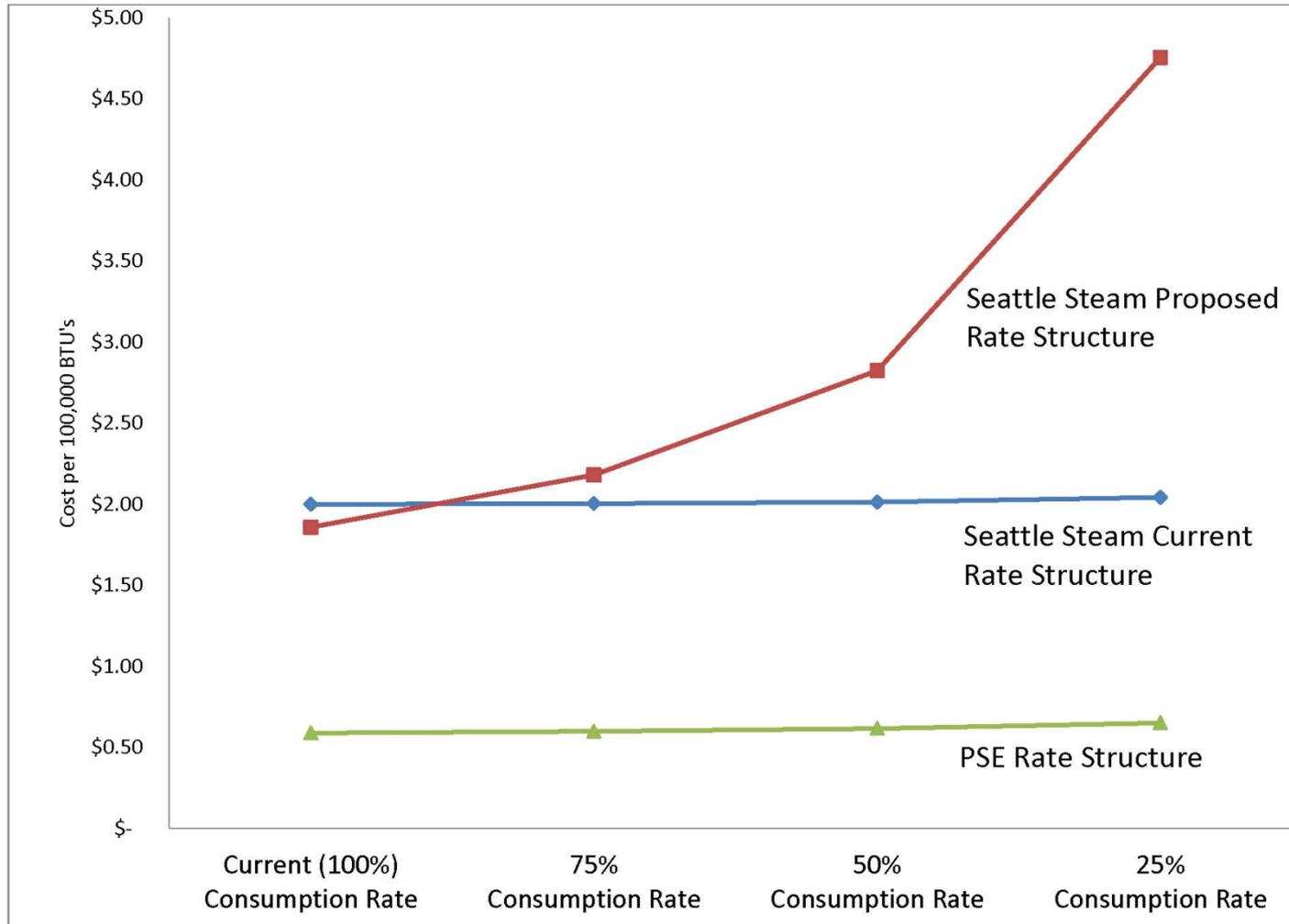
Sabey/McKinstry proposal

- Installation of four 800-horsepower boilers in the basement of redeveloped Harborview Hall
- Provide heat and hot water for 65% of HMC campus
- Capacity to power all critical systems on HMC campus

Sabey/McKinstry: Impact of new rate structure

- Sabey/McKinstry central utility plant would result in Seattle Steam serving 35% of campus
- New rate structure would result in substantially higher costs if Harborview reduces use of Seattle Steam service

Sabey/McKinstry: Impact of new rate structure



Sabey/McKinstry: Impact of new rate structure

- Seattle Steam rates not regulated
- Risks of relying on an unregulated utility

Seattle Steam proposal

- Install, own, and operate a backup boiler
- Redesigned cost structure
- Guarantee reduction in carbon emissions achieved by burning biomass
- County supplies infrastructure to support backup boiler

FMD's evaluation of Seattle Steam proposal

- Unsolicited and outside of competitive process
- No compelling reason to consider
- Multiple vendors
- No flexibility
- FMD alternative – Harborview remains on Seattle Steam, County constructs minimum on-site boiler capacity for redundancy plus infrastructure necessary for future expansion

Impact of alternatives on HMC costs

Sabey/McKinstry central utility plant assuming current steam rate	Sabey/McKinstry central utility plant assuming new steam rate	Minimum redundancy plus infrastructure
Saves Harborview \$1.2 million over 30 years	Costs Harborview \$16.1 million over 30 years	Costs Harborview \$7.3 million over 30 years

Impact on greenhouse gas emissions

Sabey/McKinstry central utility plant	Minimum redundancy plus infrastructure
<p data-bbox="73 596 937 654">6,616 metric tonnes annually</p> <p data-bbox="112 749 898 878">Reduction of more than 1,260 metric tonnes</p>	<p data-bbox="987 596 1850 654">5,753 metric tonnes annually</p> <p data-bbox="1025 749 1812 1035">Reduction of more than 2,120 metric tonnes compared to status quo and 863 from Sabey/McKinstry proposal</p> <p data-bbox="1006 1130 1831 1182">Relies on biomass for reduction</p>

Conclusions

- Advantages for Harborview to both remain on Seattle Steam and have on-site utility plant
- Sabey/McKinstry proposal provides greatest savings, however, offset by Seattle Steam's proposed rate
- Risks of continuing to procure energy from an unregulated utility

Recommendations

- Recommendation 1: The County Executive should ensure that the Harborview energy plant has sufficient infrastructure to support flexibility of energy sources for Harborview.
- Recommendation 2: The County Executive should attempt to negotiate a rate structure with Seattle Steam that allows for flexibility of energy sources at Harborview in an economic manner.