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December 3, 2010

Harry Schnofinlotz

Project Manager

A Really Big University Project Management, Capital Projects

6391 University Ave., Top Floor

Waddle, Pennsylvania 16870

Re: Really Old Historic Building Energy Conservation Meas

Dear Harry,

As you know, our MBCx efforts in The Really Old Historic Building in 2009 led to the identification of a number of Energy Conservation Measures (ECMs) that have been targeted for implementation in 2011. The purpose of this letter is to provide a proposal for moving forward from the current assessment phase of the project into full implementation.

Initially, 6 ECMs were targeted and assessed.

1. ECM 01 - AHU2 CHW Valve Optimization
2. ECM 02 - CHW System Flywheel
3. ECM 03 - AHU1 Scheduling
4. ECM 04 - Zone Optimization
5. ECM 05 - Condenser Heat Recovery
6. ECM 06 - 208v System Optimization

Over the course of this year, we have assessed the savings potential for all of the targeted measures and developed implementation budgets. The measures are somewhat interactive with each other and in working through our initial savings and implementation budgets we realized that the ECM 04 and 05 both target savings in the same area (reheat energy) as one of their elements and that if ECM 04 was successful, it may make ECM 05 less attractive financially since ECM 04 has the potential to harvest much of the reheat savings. Thus, we eliminated it from the list for implementation in the current program cycle resulting in a project with the characteristics illustrated in Table 1.

We have reviewed our savings projections with the MBCx program administrators and generally they are in agreement with our projections and targets. We still need to finalize our discussions with regard to ECM04, and that effort will follow our final development of the logic associated with the strategy. This is because finalizing the logic will also firm up the basis for our projections, which are currently based on past experience in other facilities applied to the The Really Old Historic Building statistics vs. ECM specific calculations.

As we moved forward with the assessment phase for the The Really Old Historic Building ECMs, we also initiated a scoping phase for the MBCx effort in adjacent Birge Hall. In doing that, we identified savings opportunities that involve integrating the chilled, condenser and hot water systems between the buildings, thereby delivering savings and improved performance to both facilities.

Energy Conservation Measure	Total Savings, \$ Simple Payback, years			Implementation Cost, \$		Incentive, \$		Net Cost, \$	
	Energy	Everything				Energy Only	Everything		
ECM 01 - AHU2 CHW Valve Optimization	\$6,997	\$6,997	\$26,157	\$14,919	\$11,238	1.6	1.6		
ECM 02 - CHW System Flywheel	\$3,759	\$19,735	\$4,240	\$9,021	(\$4,781)	(1.3)	(0.2)		
ECM 03 - AHU1 Scheduling	\$33,473	\$33,473	\$38,893	\$65,345	(\$26,452)	(0.8)	(0.8)		
ECM 04 - Zone Optimization	\$21,806	\$27,856	\$165,000	\$32,672	\$132,328	6.1	4.8		
ECM 05 - Condenser Heat Recovery	\$0	\$0	\$0	\$0	\$0	N/A	N/A		
ECM 06 - 208v System Optimization	\$2,422	\$2,422	\$12,111	\$5,813	\$6,298	2.6	2.6		
SUBTOTAL	\$68,457	\$90,484	\$246,401	\$127,770	\$144,359	2.1	1.6		
UCB Support			\$36,960		\$36,960				
FDE Implementation contract detailed estimate			\$98,553	40%	\$98,553				
TOTAL			\$381,913		\$279,872	4.1	3.1		

Table 1 – LeConte Hall Proposed 2011 ECM Summary

These concepts are likely to affect The Really Old Historic Building ECM 01, 02, and 05. Thus, the projects become interactive from the standpoint of budget, savings, and implementation time lines. Thus, we anticipate that the saving and implementation costs may be modified from what is presented in Table 1 as we develop the integration aspects of the measures. Given that the University will entertain projects with a simple payback of 5 years or less after incentives, we feel comfortable with this contingency since the over-all project simple-payback currently is a bit over 4 years and thus, we have some room for movement within the window created by the University's payback target.

The UCB support budget is based on a percentage of the implementation cost that was derived from our experience last year. The FDE support budget is based on the detailed estimate that was prepared to support this proposal, but falls within the percentage of implementation cost range that we have seen for other MBCx and ECM efforts on the campus (35-40% of the implementation cost budget).

Note also that if considered individually, some of the ECMs have a negative implementation cost because the savings are quite significant relative to the cost to achieve them. Thus, we have elected to consider and present the project as one project rather than 5 separate projects, which allows us to leverage the savings and related incentives to maximum benefit. While this works out mathematically, it would be desirable to verify that this approach is satisfactory from the perspective of the program and the University accounting department.

In addition, the Birge Hall effort is dependent upon the completion of the renovation project to establish a baseline. This currently is anticipated to happen in early 2011. The bottom line is that we elected to delay our implementation efforts in The Really Old Historic Building for everything except the valve modification aspect of ECM 01 so they could be fully coordinated with the Birge effort. The implementation timeline still remains in 2011, but we simply deferred some of our development effort, which allowed us to focus our field staff on other projects with the potential to deliver savings in 2010.

Description of Services

Having said that, we are now at the point in time where we need to move forward and develop the RFPs, and other documents associated with the The Really Old Historic Building ECM implementations. Towards that end, Facility Dynamics Engineering proposes to provide engineering and commissioning services to support the implementation effort as follows.

Task 1 – ECM 01 - AHU2 CHW System Optimization

This ECM involves modifying the AHU2 chilled water valve to allow it to move through its full stroke without causing cavitation and then optimizing the pumping energy requirement of the system to reflect the reduction in head associated with the valve optimization. Initially, we thought the pump energy optimization would be achieved by modifications to the The Really Old Historic Building pump. However, this is one area where integration with the systems in Birge Hall may achieve the intent while yielding other benefits, thus, it is possible that the implementation approach originally anticipated will be modified as we move forward.

For this task, FDE will:

1. Coordinate with the University to have the valve modified (currently in progress).
2. Coordinate with the University to modify the ALC software as necessary to take advantage of the valve modification once it is completed.

3. Coordinate with the University to commission the modified system and re-establish design flow rates and identify the optimized system operating point.
4. Coordinate with the University to determine the best optimization technique for reducing the pump energy required by the system.
5. Modify savings projections, budgets, and implementation plans based on the optimization analysis.
6. Coordinate this effort with the Birge Hall MBCx effort if the optimization strategy ends up involving integration of the Birge system with the The Really Old Historic Building System.

It is possible that the integration effort with Birge, if selected as the best strategy, will require additional engineering or commissioning support from FDE, beyond the scope of this proposal or the Birge MBCx proposal which is already in place. If that turns out to be the case, FDE will prepare a separate cost proposal to cover the added scope.

Task 2 – ECM 02 - CHW System Flywheel

This ECM targets a software modification that will save energy by minimizing or eliminating the operation of the The Really Old Historic Building chiller on hot gas bypass. It is another ECM with the potential to benefit from integration with the Birge Hall chilled water plant in terms of savings and performance. It is also interactive with ECM 01. Thus, it is possible that the implementation approach originally anticipated will be modified as we move forward.

For this task, FDE will:

1. Perform engineering assessments, tests, and calculations to determine the best implementation strategy, including the option of coordinating with the Birge Hall MBCx effort and integrating the chilled water plants in both buildings.
2. Develop the programming logic necessary to provide the chilled water flywheel cycle in The Really Old Historic Building Hall.
3. Coordinate with the University to make any chiller control modifications necessary to accommodate the flywheel strategy.
4. Coordinate with the University to commission the modified system to verify performance.

It is possible that the integration effort with Birge, if selected as the best strategy, will require additional engineering or commissioning support from FDE, beyond the scope of this proposal or the Birge MBCx proposal which is already in place. If that turns out to be the case, FDE will prepare a separate cost proposal to cover the added scope.

Task 3 – ECM 03 - AHU 1 Scheduling

This ECM provides zone level scheduling for areas that are served by AHU1 but are not continuously occupied and/or do not require continuous air circulation. It will be achieved by a combination of zone control modification, two position isolation dampers, and conversion of the existing constant speed exhaust fan to variable speed.

For this task, FDE will:

1. Coordinate with the University to obtain a VFD for the primary exhaust fan associated with AHU1.
2. Coordinate with the University to obtain zone control dampers where required to shut down air flow for unoccupied hours.

3. Coordinate with the University to obtain software modifications for the AHU1 control system as required to accommodate the zone control scheduling strategy.
4. Coordinate with the University to commission the modified system and verify performance, including assessments of the air change rates and pressure relationship in critical areas impacted by the modifications.

Task 4 – ECM 04 - Zone Optimization

This task targets a significant reduction in fan and reheat energy by implementing a control strategy that allows the constant volume systems in the facility to operate as large, single zone VAV/reheat systems. It will fully develop a control strategy we identified during the initial phase of the ECM effort that will allow the savings to be achieved using conventional control software and elements vs. implementing a proprietary strategy like the Federspiel strategy utilized elsewhere on campus. The effort will be pilot tested on AHU2 and then expanded to AHU1 based on the results of the AHU2 pilot test.

Note that this project also involves upgrading the existing zone controls in the building, making them fully integrated with the ALC system that was installed on the central systems as a part of last year's MBCx effort.

For this task, FDE will:

1. Develop the new control logic in the form of a logic diagram and narrative sequence.
2. Coordinate with the University to implement the new logic in AHU2 and then AHU1 after the AHU2 pilot phase.
3. Coordinate with the University to obtain and ALC zone control upgrade for all zones in the building to support the zone optimization control logic and make the building control system fully ALC compatible.
4. Coordinate with the University to commission the modified system and verify performance, including assessments of the air change rates and pressure relationship in critical areas impacted by the modifications.

Note that the current implementation budget funds the zone modifications for all zones as a part of this task. However, since some of the other ECMs require zone data, we may spend some of the implementation budget associated with this task when other ECMs are implemented if the implementations do not end up being concurrent. We do not anticipate that this will impact FDE's cost nor do we anticipate that it will impact the total project bottom line based on our current projections.

Task 5 – ECM 06 - 208 v System Optimization

This task targets optimizing the 208 volt system energy consumption, primarily by optimizing the way that lighting is controlled. Note that the savings projections currently are based on new measures vs. making existing measures work. In other words, there are areas where we think we can add controls and save energy that currently are not covered by the existing lighting control system.

However, we also believe that we will find things that can be done with the existing system that will further optimize the savings that it is delivering. Since the program will not allow us to claim these savings as a part of the ECM, we have not included them in our projections at this point in time. However, we believe they exist and anticipate that the over-all savings that result from this effort will be higher than the projections we have made currently. The savings will be real and will show up at the meter; we just will not be able to claim them as savings generated by this ECM.

For this task, FDE will:

1. Review existing drawings for building lighting loads and controls (completed under the assessment phase budget).
2. Identify one or two lighting panels serving the areas of greatest savings potential (completed under the assessment phase budget).
3. Install data-loggers to baseline three weeks of lighting load energy usage (completed under the assessment phase budget).
4. Develop revised lighting control specifications to include, daylight harvesting, occupancy sensors, timers, photocells, and lamp/fixture replacement.
5. Coordinate with the University to modify and expand the lighting control system as necessary to capture the targeted savings.
6. Coordinate with the University to commission the modified system and verify performance.

Task 6 – Training and Miscellaneous Engineering Support

This task provides the budget for general engineering support tasks that are common to all of the targeted ECMs.

For this task, FDE will:

1. Coordinate with the University to provide training specific to the The Really Old Historic Building Hall ECMs and also the MBCx work that occurred last year.
2. Provide a system manual documenting the systems that have been targeted by the measures associated with this proposal that includes system diagrams and a description of the intended operation of the system.
3. Provide informal reports of progress through-out the process and any final reports required by the program to capture incentives.

Cost Proposal

FDE proposes to perform the work as described above for a fee of \$83,699 plus expenses which are projected to be \$14,854 . The fee will be billed on a time and materials basis using the attached rate schedule. Expenses will be passed on at cost with documentation.

Table 2 indicates approximately how the fee will be spent over the tasks outlined above.

Task	Fee	Expenses	Total	Approximate hours per task
Task 1 - AHU2 CHW System Optimization	\$7,645	\$1,357	\$9,002	53
Task 2 - CHW System Flywheel	\$11,220	\$1,991	\$13,211	77
Task 3 - AHU 1 Scheduling	\$9,368	\$1,662	\$11,030	65
Task 4 - Zone Optimization	\$23,240	\$4,124	\$27,364	160
Task 5 - 208 v System Optimization	\$9,920	\$1,761	\$11,681	68
Task 6 - Training and Misc. Engineering Support	\$22,306	\$3,959	\$26,265	154
TOTAL	\$83,699	\$14,854	\$98,553	577

Table 2 – Approximate Fee Break-down By Task

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December 3, 2010

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We anticipate performing this work over the course of the rest of 2010 and being substantially complete by the end of 2011. The latest schedule targeted a July completion date but that was based on the Birge Hall baseline being established by this past July, which did not happen due to complications with the renovation project.

That said, we believe we can still have significant savings in place by July of 2011 since ECMs 01 and 03 will deliver significant savings with relatively easy to install measures and are not dependent on the work in Birge. Significant portions of the ECM04 and ECM06 savings should also be in place by July, barring delays on the part of any contractors that are involved. FDE will develop a revised schedule reflecting the current strategy as a first step in moving forward from this point.

Thank you for this opportunity to continue working with you and the UCB team to improve energy efficiency and performance on the campus. Please call if you have questions or comments regarding this proposal.

Sincerely,



Senior Engineer – Facility Dynamics Engineering

DAS/tbm

cc Michelle Matthews, Jay Santos, Kim Parson, Ron Simens, Gary Kawabuchi, Mark Porter, Mark Arney, Larry Luskay, Darren Goody; FDE (all via e-mail)



2010 Professional Rate Schedule

<u>Category</u>	<u>Rate</u>
Principal	\$155/hr
Senior Mechanical Engineer	\$145/hr
Senior Electrical Engineer	\$135/hr
Field Mechanical Engineer	\$135/hr
Field Engineer	\$125/hr
Field Technician	\$115/hr
Administrative Support	\$50/hr

2011 Professional Rate Schedule

<u>Category</u>	<u>Rate</u>
Principal	\$165/hr
Senior Mechanical Engineer	\$155/hr
Senior Electrical Engineer	\$145/hr
Field Mechanical Engineer	\$145/hr
Field Engineer	\$135/hr
Field Technician	\$115/hr
Administrative Support	\$55/hr