FINAL TECHNICAL REPORT

1. DOE award number: DE-EE0003897

Name of the recipient: King County Housing and Community Development

Project title: Issaquah Highlands Zero Energy Affordable Housing (WA) - YWCA

Project director/principal investigator: Vincent Tom followed by Wendy DeRobbio of King County

Consortium/Team Members: Linda Hall, YWCA

2. No patentable material or protected data being provided. Final system designs subject to contracts in place with the architect, general contractor and subcontractors.

3. Executive Summary

The YWCA Family Village at Issaquah, Net Zero Energy Approach Project provides a compelling model for how the nation can seriously respond to the critical need for affordable housing while advancing environmental standards and reducing economic inequities. Affordable housing developments for vulnerable members of the community and in today's workforce cannot overlook issues, such as climate impact, energy security and water conservation. This project's advanced building design was based on the goal of creating a 100 year building that could achieve net zero energy usage if funding had been available to support the final pieces of energy generation. The team worked closely with community stakeholders to ensure the baseline components of high quality and efficient building envelopes along with efficient systems were in place to set the stage for future incorporation of energy generating systems such as solar panels.

As built, these 146 homes, large child care center and community services areas are proving the value of investing upfront for the benefit of future generations by reducing ongoing utility and maintenance costs with an eye toward environmental stewardship and community/resident education.

The DOE award helped fund two critical energy conservation features for the YWCA Family Village at Issaquah campus: 1) super-insulated roof assembly with a continuous air barrier and 2) domestic hot water preheat system.

The roof system at the YWCA Family Village at Issaquah project was built to include 6" of Polyiso rigid insulation (R-38) on top of the roof sheathing to provide a super-insulated roof in line with the other green features of the project. Placing the rigid insulation on top of the roof sheathing allows the building to have a continuous layer of insulation and provides a continuous air barrier.

The domestic hot water preheat system includes flat panel arrays on roofs of the buildings that heat the water using solar power, which reduces the amount of heating needed from the gas-fired boilers. The flat-plate panels on the roof of the building heats the water using solar power. A heat exchanger transfers heat from water warmed by the

panels to potable water for the units. The warmed potable water mixes with the tap water supply to create hot water for the buildings. This boost of water warmed by the solar panels reduces the heating costs for the project by reducing the need to heat the water via gas-fired boilers.

Both of these energy upgrades were chosen because they significantly improve the energy efficiency for the life of the building and are reducing monthly utility costs for both the residents and the owners. Since the owner is a not-for-profit dedicated to long-term ownership and serving households with very-low and low-incomes, the costs savings will ultimately benefit current and future residents as the dollars saved will either be realized directly by the resident or be invested in the project.

Technically, the design of these systems is easily understood and the principles could be applied to other projects. The incremental costs depend largely on the existing market rate of the components—none of which are considered “cutting edge” so a market does currently exist.

4. Projected to Actual Goals and Objectives

OBJECTIVES	ACTUAL RESULTS
<p>Task 1.0 Installation of Components</p> <p>1.1 Super Insulated Roof Install 6” of Polyiso rigid insulation (R-38) on top of roof sheathing.</p> <p>1.2 Pre-heated Domestic Water Supply</p>	<p>Completed insulation on buildings as planned</p> <p>Completed design and installation of system as planned</p>
<p>Task 2.0 Project Management and Reporting</p> <p>2.1 Ongoing monitoring</p> <p>2.2 sustainability education</p>	<p>Submitting required reports; ongoing energy tracking systems for various components of the project have been established once stabilized occupancy reached summer 2012.</p> <p>Sustainability education for residents is an ongoing process which includes verbal and written instruction during the leasing of units as well as various customized resident trainings throughout the year. The YWCA has hosted numerous tours and trainings focused on the sustainability aspects of this project.</p>

5. Project Activities

The project activities closely followed the original scope of work. A final report from the General Contractor along with photos is attached. The adjustments and lessons learned throughout are summarized below:

Super-Insulated Roof: At the raised roof areas, there was not quite enough room to easily install the 6" of rigid insulation on the lower roof. We were able to get the insulation in but it involved a small amount of rework. At the other buildings, we raised up the roof areas by a few inches to allow the insulation to be installed underneath the overhang on the lower roof more easily. Further, during construction, we had an unusually rainy and cold winter so it was a challenge to find days where weather permitted the roofing to be installed. The roof system is made up of multiple layers and no part of the roof can be installed during wet weather, lest moisture get trapped between the roofing layers. We used every available dry day to get the roof system on the last building installed correctly. Overall, the installation of the roof system went very well and we don't have any other specific changes that were made.

Domestic Hot Water Preheat System: We did have trouble identifying the firm(s) that had both the technical expertise and availability to complete the design. This was solved by getting recommendations from green building consultants and project teams who had installed or were installing similar systems. Then, we talked to the firms to understand their previous experience and technical expertise with domestic hot water preheat systems and selected our design firm. Since the framing on this building had begun at the time the funds were authorized, we were stretched to complete all the design coordination prior to framing the roof system. We also struggled with identifying the locations for all system components. Since this system was added to an existing design, adequate space had to be found without detracting significantly from the residential living spaces. We needed to coordinate with the structural engineer and framing subcontractor to identify locations of the added roof-top panels to add blocking and upsize the roof framing to carry the added weight of the panels.

6. No products developed under the award and technology transfer activity which meets specified criteria.
7. This project did not directly involve a computer model.

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October 20, 2011

**Subject: Status update for DOE Items
YWCA Family Village at Issaquah**

YWCA of Seattle, King County, Snohomish County
Attn: Linda Hall
1118 5th Ave S
Seattle, WA 98101

Dear Ms. Hall:

The letter is meant to provide an update on the status of two energy efficiency systems that were installed at the YWCA Family Village at Issaquah project, funded by DOE funds. Please refer to the energy upgrades letter dated 8/10/10 for costs and detailed descriptions of each system.

A. Super Insulated Roof: Install 6" of Polyiso rigid insulation (R-38) on top of roof sheathing:

All work on this item was complete as of February 2011. No new costs have been incurred since then and no additional costs are expected to be incurred.

B. Pre-heated Domestic Water Supply: Install flat panel arrays on the roofs to provide a domestic water preheat system:

All work on this item was complete as of August 2011. No new costs have been incurred since then and no additional costs are expected to be incurred.

Please don't hesitate to contact me if you need any further information.

Thank you,

Elizabeth Rinehart, Project Manager
Walsh Construction Co./WA
(206) 547-4008
erinehart@walshconstructionwa.com

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Photo 1 – Roofing:

View of the last super-insulated roof system installed at the YWCA Family Village project. This is Building F.

The metal poles sticking up from the roofing (marked with an arrow) are the support arms for the Domestic Hot Water Pre-Heat Panels that will be installed later this spring.

Photos 2 & 3 – Domestic Hot Water Pre-Heat:

The super-efficient gas-fired boilers, storage tank and associated piping are fully installed in the L3 boiler room. This equipment supplies hot water to the entire campus and is an integral part of the domestic hot water pre-heat system that was installed for Buildings F and L.

(Below): Solar thermal panels installed on the roof of Building F collect heat from the sun's energy and warm a circulating water loop. This solar heat is transferred to the domestic hot water via a heat exchanger to reduce the amount of hot water

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Project:	YWCA Family Village at Issaquah																			
Item:	DOE Pricing #1					NOTE: All work has been completed														
Description					Quantity	Unit	Subcontractor		Total											
							UP	Total												
Domestic Water Pre-Heat System																		Amount Installed		
																		(as of Sept 30)		
									0	0										
	Boilers, Tanks, Pumps & Piping (Sunrise)				1	ls	365,980.00	365,980	365,980									\$	365,980.00	
	Solar plates, piping & equipment at Bldg F, incl design				1	ls	209,311.00	209,311	209,311									\$	209,311.00	
	Additional blocking & framing for added preheat (ProFrame)				1	ls	5,654.00	5,654	5,654									\$	5,654.00	
	Install flashing & clamps for preheat stanchions (Meyer Bros)				1	ls	6,000.00	6,000	6,000									\$	6,000.00	
	Provide electrical supply for boilers & preheat system (Merit)				1	ls	25,650.00	25,650	25,650									\$	25,650.00	
	Controls, Start-up and Balancing (US Mech)				1	ls	6,500.00	6,500	6,500									\$	6,500.00	
									0	0										
									0	0										
										TOTAL	\$	619,095						\$	619,095.00	
										WSST 9.5%	\$	58,814								
										GRAND TOTAL	\$	677,909								

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