Alaska SeaLife Center®

windows to the sea

Alaska SeaLife Center Seawater Heat Pump Project

Denali Commission Emerging Energy Technology Grant

UAF 10-0069

Alaska Energy Authority Renewable Energy Grant

AEA Grant Agreement No. 7030017

Quarterly & Monthly Report ending June 30, 2012

A. Narrative

Summary

During the Quarter ending June 30, 2012 system commissioning was completed, including Tracer operating system training. The automated data monitoring system is fully functional allowing the energy operating parameters to be viewed on-line, Performance for the months of May and June is shown on the Performance sheet of the report. To improve on system COP during the warm summer months, the Heat Pump output temperature has been lowered to 105F. To reduce heating operating cost during the warm summer months, the boiler heating loop has been set to 130F. During the next quarter, the evaporator loop will be connected to the heating system boiler loop, allowing the heat pumps to supply all the building heat. Design is complete for the slab heat and heat recovery project and installation will be performed during the next quarter. This project is being funded by a grant from the M.J. Murdock Foundation. A short video on the seawater heat pump system has been completed which will allow presentation of the system to ASLC visitors and the Center is planning to add the heat pump system to it's behind the scenes tour.

Sea Water Supply Pump & Heat Exchanger

The sea water supply pump loop has performed exceptionally well to date, including the submerged turbine pump, in-line strainer, and titanium plate heat exchanger. No evidence of fouling has been detected, and the heat exchanger is delivering approach temperatures that are consistently less than

the design specification of 2 degrees F. There have not been local flood events that have in the past introduced fine siltation particles into the raw sea water, this may could be a source of strainer fouling in future.

Heat Pumps And Loop Pumps

The Trane RTWD heat pumps appear to be performing per specifications, however until the automated data login system is fully functional, and the performance cannot be fully evaluated. The heat pump capacity has been adequate to satisfy heating loads of the five air handlers and intermittent domestic hot water loads. The duplex loop pump stations for evaporator, condenser, and AHU loops have performed well and are operating at design efficiency.

Air Hander Pre-Heat Coil Performance

The design called for use of existing cooling coils in five air handlers as pre-heat coils with the heat pump system. These coils have worked well to deliver low temperature heat (98F to106F) in to the outside air and return air flow streams. As the outside air temperature drops, the coils become more efficient in delivering the low temperature heat and these results in improved savings.

B. Performance

	Electricity Consumed		Thermal Energy Delivered				Ratio SWHP/Electric Boiler
	Sea Water HP System Total kWh Consumed	Electric Boiler Total Kwh Consumed	SWHP Thermal MMBTU	Electric Boiler Thermal MMBTU	Electricity saved (Kwh)	Coefficient of Performance (293.1*SWHP Thermal MMBTU/Total kWh Consumed)	
Jan							
Feb							
Mar							
Apr							
May	76,369	112,062	600	382	175,734	2.30	1.57
June	52,976	70,479	444	240	130,037	2.45	1.85
July							
Aug							
Sept							
Oct							
Nov							
Dec							
Total	129,345	182,541	1,043	623	305,771		
Average						2.38	1.71

ELECTRIC CONSUMPTION BY HEAT PUMP SYSTEM - from Tracer System Performance screen for Period May 1-June 30, 2012

Kw	Cost Kw	Energy Cost
129,345	$0.088	$11,382

ELECTRIC CONSUMPTION BY ELECTRIC BOILER - from Electric Boiler power meter for Period May 1-June 30, 2012

Kw	Cost Kw	Energy Cost
182,541	$0.088	$16,064

ENERGY COST SAVINGS

Electricity Saved (Kw)	Cost Of Electricity Saved	Electricity Used (Kw)	Cost of Electricity Used	Net Energy Cost Savings
305,771	$26,908	129,245	$11,382	$15,525

C02 AVOIDED

Electricity # CO2 Avoided*	NG burned (cf)	# of C02 per 1,000 cf NG	# of NG C02 Produced**	# C02 Avoided	# of C02 produced by electric boiler	Net # C02 Generated
123,935	1,445,105	122	52,426	71,509	73,988	2,479

*305,771 Kw X 3,412 / 1,027 = 1,015,382 cf natural gas. 1,000 CF natural gas burned to generate electricity emits 122 lbs C02. 1,015,862/1000 = 1,016 X 122 =123,935 lbs C02.

**129,345 Kw X 3,412 / 1,027 = 429,723 cf natural gas. 1,000 CF natural gas burned to generate electricity emits 122 lbs C02. 429,723/1000 = 430 X 122 = 52,426 lbs C02.