During the quarter ending June 30, 2010 a Professional Services Contract was executed on May 21, 2010 between the University of Alaska Fairbanks and the Seward Association for the Advancement of Marine Sciences, dba, Alaska SeaLife Center followed by UAF Purchase Order No. FP02826 with an effective date of June 6, 2010. Following receipt of the Contract and Purchase Order, the Project schedule was modified as follows:

**ASLC HEAT PUMP PROJECT TIMELINE**

*Revised July 1, 2010*

**June 6, 2010 – July 7, 2010:** Procure and contract mechanical/electrical engineering services

**July 8 – November 15, 2010:** Complete design (Drawings, Specifications, Final Cost Estimate)

**November 16 – December 15, 2010:** Procure and contract mechanical/electrical contractor

**November 16, 2010 – April 30, 2011:** Equipment procurement (including instrumentation), installation and commissioning, and final reporting:

a. Shop drawing/manufacture submittals and review – 3 weeks
b. Manufacture and ship heat pumps, heat exchangers and instrumentation to Seattle – 8 weeks
c. Ship heat exchangers, heat pumps, instrumentation from Seattle to Anchorage to Seward – 2 weeks
d. Installation of all mechanical, electrical and instrumentation components – 6 weeks
e. Start-up and commissioning – 2 weeks

**May 1, 2011 – June 30, 2012:** Project monitoring and reporting to ACEP

**EXHIBIT TIMELINE**

**November 1 – February 28, 2011:** Exhibit design and procurement

**March 1- April 15, 2011:** Exhibit fabrication

**April 15 - 30, 2011:** Exhibit installation and evaluation
YourCleanEnergy, LLC submitted its written design proposal on June 29, 2010 and a contract has been negotiated for engaging the design and construction management services. It is anticipated that the contract will be signed on or before July 7, 2010.

The second heat pump has been funded in Round 3 of the Alaska Renewable Energy Fund was approved by Governor Parnell on June 3, 2010. It is anticipated that the AREF award documents for the second heat pump will be received by the City of Seward on or before September 1, 2001. The total project budget is as follows:

<table>
<thead>
<tr>
<th>Phase 0</th>
<th>Phase 1 Heat Pump #1</th>
<th>Phase 2 Heat Pump #2</th>
<th>Total Development Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feasibility Study</td>
<td>$ 9,280</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Contracted Construction</td>
<td>$ -</td>
<td>$ 304,800</td>
<td>$ 204,700</td>
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<tr>
<td>Final Design and Procurement Services</td>
<td>$ -</td>
<td>$ 45,720</td>
<td>$ 30,705</td>
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<tr>
<td>Construction Inspection Services</td>
<td>$ -</td>
<td>$ 15,240</td>
<td>$ 10,235</td>
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<tr>
<td>Project Management and Consultation</td>
<td>$ -</td>
<td>$ 12,400</td>
<td>$ 12,400</td>
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<tr>
<td>Contingency</td>
<td>$ -</td>
<td>$ 48,560</td>
<td>$ 28,540</td>
</tr>
<tr>
<td><strong>Total Project Cost</strong></td>
<td><strong>$ 9,280</strong></td>
<td><strong>$ 426,720</strong></td>
<td><strong>$ 286,580</strong></td>
</tr>
</tbody>
</table>

The following is the proposed schedule for executing the design work. The understanding is that ASLC will wait until the Final Design is completed before procuring and/or installing any equipment specified in the system design. Completing the Final Design by November, 2010 may allow opportunity for ASLC to procure and install equipment for the sea water heat pump demonstration project by end of March, 2011. Mid-March through mid-May is the time of year when sea water temperatures are the lowest and the system can be tested in the most challenging operating conditions when chiller efficiency is lowest.
Phase   | Description                               | YCE Presents to ASLC | ASLC Comments By
---      | ------------------------------------------|----------------------|------------------
Phase I  | Project Scoping Meeting At ASLC           | July 8, 2010         | July 15, 2010    
Phase I  | Design Narrative & Cost Estimate          | July 29, 2010        | Aug  5, 2010     
Phase II | 35% Drawings, Specs & Cost Estimate       | August 27, 2010      | Sept 3, 2010     
Phase II | 65% Drawings, Specs, & Cost Estimate      | Sept 30, 2010        | Oct 6, 2010      
Phase IV | Final Drawings, Specs, & Cost Estimate    | October 28, 2010     | Nov 4, 2010      

Project personnel assigned to the design phase are as follows:

Darryl Schaefermeyer, ASLC Operations Manager
John Underwood, ASLC Facilities and Life Support Supervisor
Andy Baker, P.E., ([www.yourcleanenergy.us](http://www.yourcleanenergy.us))
Lee Bolling, EIT, ([www.yourcleanenergy.us](http://www.yourcleanenergy.us))
John Faschan, P.E. ([www.edc-alaska.com](http://www.edc-alaska.com))
Kevin Hansen, P.E. ([www.edc-alaska.com](http://www.edc-alaska.com))

The project is on schedule and budget to meet the Contract completion date of January 15, 2012.

Attachments: (1) YCE Professional Services Agreement (unsigned)
During the quarter ending September 30, 2010 the Alaska Energy Authority Renewable Energy Grant Agreement was executed by the City of Seward with a period of performance July 1, 2010 to December 31, 2011.

Key Activities Completed:

2. 35% Design Documents and Cost Estimate completed on September 30, 2010.
3. Demolition and removal of Culligan system water tanks and related piping to make space for the heat pumps; removal of retired salmon research PVC piping to make space for the condenser and evaporator loop piping; and removal of retired salmon project heat exchangers to make space for the second heat exchange between the condenser loop and 40% PG AHU loop.

Existing or Potential Problems Addressed:

1. During design development a decision was made to utilized existing cooling coils in AHU’s 1, 2A/2B, 4, 5, and 6 as these same cooling coils can receive 120F glycol from the new heat pump condenser loop and function effectively as pre-heat coils. This concept makes use of the existing coils, 3-way valves, shut off valves and copper piping adjacent to the coils; however the Schedule 40 PVC piping that transports glycol from the basement level to roof level must be replaced with steel or Type L copper to accommodate 120F during the heating season. The design and budget has been developed to incorporate the installation of grooved steel piping for the condenser and heating loop to the air handlers.

2. The ASLC has prevented freezing of the AHU coils by keeping 40% propylene glycol (PG) in the AHU coil loops. The design narrative and 35%
design drawings suggested that a continuous circulation of 25% PG would be appropriate in the AHU coil loops; however, this circulation could be interrupted by pump failure, power failure, 3-way valve failure, heat pump shutdown, etc., - the worst case being system interruption/failures late at night on a holiday weekend for example when it below zero outside. Because of this risk, the design has been modified to retain 40% PG in the AHU coil loops and add a second large heat exchanger between the condenser loop piping (treated water) and AHU piping (40% PG) that will exchange heat from the condenser loop of water with no PG to the 40% PG AHU coil loop. The second heat exchanger is added at a cost of $21,000 and will guarantee freeze protection of the coils no matter what happened with heat pumps, circulation pumps, controls, 3-way valves, thermostats, or air handling units.

3. The design has identified feasibility of heat recovery from existing building sources; however, this project is currently outside of the budget. We are currently evaluating how much of the piping installation work could be accomplished by ASLC personnel. During 35% design document review, the potential to save approximately $94,000 in outside contractor cost by ASLC staff installation of seawater supply loop, evaporator loop, condenser loop, and heat/cooling loop piping was identified. This could free up enough of the grant funds budget to pay for the heat recovery project which has a forecast return on investment payback of 2.2 years by boosting the available heat to the heat pump evaporator loop by 1.5 to 3 degrees F. We are currently determining feasibility of ASLC staff installation as a component of the 65% design documents and cost estimate.

4. The 35% design cost estimate includes the $23,000 purchase of a very robust control package with the heat pumps. During the 65% design phase, we will be evaluating if this control package is necessary given the built-in controls on the heat pumps along with existing ASLC building automation controls.

Activities Targeted for Next Quarter

1. Completion of Final Design
2. Procure Major Equipment
3. Procure Outside Contractor Services
4. Begin installation of condenser loop, evaporator loop, heat loop, and seawater supply loop piping
5. Commence Exhibit Design

ASLC HEAT PUMP PROJECT TIMELINE
Revised October 1, 2010

June 6, 2010 – July 7, 2010: Procure and contract mechanical/electrical engineering services

July 8 – November 15, 2010: Complete design (Drawings, Specifications, Final Cost Estimate)

November 16 – December 15, 2010: Procure and contract mechanical/electrical contractor

November 16, 2010 – April 30, 2011: Equipment procurement (including instrumentation), installation and commissioning, and final reporting:
   a. Shop drawing/manufacture submittals and review – 3 weeks
   b. Manufacture and ship heat pumps, heat exchangers and instrumentation to Seattle – 10 weeks
   c. Ship heat exchangers, heat pumps, instrumentation from Seattle to Anchorage to Seward – 2 weeks
   d. Installation of all mechanical, electrical and instrumentation components – 6 weeks, including piping and seawater supply pump
   e. Start-up and commissioning – 2 weeks

May 1, 2011 – June 30, 2012: Project monitoring and reporting to ACEP

EXHIBIT TIMELINE

November 1 – February 28, 2011: Exhibit design and procurement

March 1- April 15, 2011: Exhibit fabrication

April 15 - 30, 2011: Exhibit installation and evaluation

The following is the revised schedule for executing the design work. The ASLC anticipates commencing major equipment procurement upon the completion of 65% design and cost estimate. Completing the Final Design by early December, 2010 will allow the opportunity for ASLC to procure and install the equipment for the sea water heat pump demonstration project by end of March, 2011. Mid-March through mid-May is the time of year when sea water temperatures are the lowest and the system can be tested in the most challenging operating conditions when chiller efficiency is lowest.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Description</th>
<th>YCE Presents to ASLC</th>
<th>ASLC Comments By</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase I</td>
<td>Project Scoping Meeting At ASLC</td>
<td>July 8, 2010</td>
<td>July 15, 2010</td>
</tr>
<tr>
<td>Phase I</td>
<td>Design Narrative &amp; Cost Estimate</td>
<td>August 6, 2010</td>
<td>Aug 12, 2010</td>
</tr>
</tbody>
</table>
Phase II  35% Drawings, Specs & Cost Estimate  September 21, 2010  Sept 28, 2010
Phase II  65% Drawings, Specs, & Cost Estimate  October 28, 2010  Nov 5, 2010
Phase IV  Final Drawings, Specs, & Cost Estimate  November 30, 2010  Dec 6, 2010

Project personnel assigned to the design phase are as follows:

Steven Carrick, Director of Visitor Services & Facilities  Project Executive
Daryl Schaefermeyer, ASLC Operations Manager  Project Manager
John Underwood, ASLC Facilities and Life Support Supervisor  Project Engineer
Andy Baker, P.E., (www.yourcleanenergy.us)  Consulting Engineer
Lee Bolling, EIT, (www.yourcleanenergy.us)  Engineering Technician
John Faschan, P.E. (www.edc-alaska.com)  Electrical Engineer
Kevin Hansen, P.E. (www.edc-alaska.com)  Mechanical Engineer

The project is on schedule and budget to meet the Contract completion date of January 15, 2012.

Attachments:  (1) Agenda, July 8, 2010 Design Scoping Meeting
(2) Design Scoping Meeting Minutes
(3) Design Narrative
(4) 35% Design Documents
(5) Financial Reports
(6) Photos
Figure 1 Removing Culligan System Tanks
Figure 2 Heat Pump Location

Figure 3 Removal of Salmon Project HX - Location of Seawater HP HX 6
Figure 4 Pipe Corridor for Condenser and Evaporator Loop Piping

Figure 5 Corridor for Condenser and Evaporator Loop Piping
Figure 6 Corridor for Condenser and Evaporator Loop Piping

Figure 7 Location for Titanium Plate Heat Exchanger - HX 3
Figure 8 Location for Heat Pump Seawater Supply Pump

Figure 9 Domestic Hot Water Tank
Figure 10 Pavement Heating Heat Exchanger
Key Activities Completed:

1. 95% Design Review meeting held in Anchorage on November 18, 2010, including budget revision review meeting with ACEP and AEA.
2. 100% design documents completed on November 30, 2010.
3. Demolition and removal of cooling loop PVC piping completed in preparation for installing Schedule 40 steel piping to Fan Rooms 1 and 2 that will connect the heat pump system heating loads to AHU-1, AHU-2A/2B, AHU-4, AHU-5 and AHU-6.
4. Ordered heat pumps from Trane and released for manufacturer on December 20, 2010 following engineer review and approval of shop drawings.
5. Issued RFP for equipment bids for heat exchangers, closed loop circulation pumps, air separators, expansion tanks, control valves, non-motorized valves, motor control center, and PVC and steel piping/fittings.
6. Issued request for proposal to several control contractors for furnishing, installation and commissioning of heat pump system controls and instrumentation.
7. Reviewed electrical specifications and plans with proposed electrical contractor.

Existing or Potential Problems Addressed:

1. ASLC met with AEA and ACEP/Denali Commission representatives on November 18, 2010 to review the grant budget formats and to request that the budget formats be modified to better facilitate the allocation of costs between the two grants. AEA has informed ASLC that the format presented by ASLC at the meeting was acceptable and requested ASLC to prepare and submit an amendment to the schedule, milestone table and budget. ASLC submitted revised schedule, milestone table and budget to AEA on December 16, 2010.
and AEA made some formatting revisions which were acceptable to ASLC. Revisions are being incorporated in a grant agreement amendment by AEA.

Activities Targeted for Next Quarter

1. Procure remaining project equipment and materials (heat exchangers (3), circulation pumps (6), air separators and expansion tanks, motor control center, motorized valves, non-motorized valves, and PVC and steel piping and fittings).
2. Select control (including control system package) and electrical contractors.
3. Complete grant agreement amendment to the schedule, milestone table and budget amendment with AEA.
4. Commence and complete installation of system piping, valves, heat exchangers, pumps, air separators, expansion tanks, motor control center and electrical work in preparation for delivery and installation of heat pumps in April 2011.

ASLC HEAT PUMP PROJECT TIMELINE

Revised December 31, 2010

June 6, 2010 – July 7, 2010:  Procure and contract mechanical/electrical engineering services

July 8 – November 30, 2010:  Complete design (Drawings, Specifications, Final Cost Estimate)


December 1, 2010 – May 30, 2011: Equipment procurement (including instrumentation), installation and commissioning, and final reporting:
   a. Shop drawing/manufacture submittals and review – 3 weeks
   b. Manufacture and ship heat pumps, heat exchangers and instrumentation to Seward – 12 weeks
   c. Ship heat exchangers, heat pumps, instrumentation from Seattle to Anchorage to Seward – 2 weeks
   d. Installation of all mechanical, electrical and instrumentation components – 6 weeks, including piping and seawater supply pump
   e. Start-up and commissioning – 2 weeks

May 31, 2011 – June 30, 2012:  Project monitoring and reporting to ACEP

EXHIBIT TIMELINE
November 1 – February 28, 2011: Exhibit design and procurement

March 1- May 1, 2011: Exhibit fabrication

May 1 - 30, 2011: Exhibit installation and evaluation

Project personnel assigned to the design phase are as follows:

Steven Carrick, Director of Visitor Services & Facilities   Project Executive
Darryl Schaefermeyer, ASLC Operations Manager   Project Manager
John Underwood, ASLC Facilities and Life Support Supervisor Project Engineer
Andy Baker, P.E., (www.yourcleanenergy.us)    Consulting Engineer
Lee Bolling, EIT, (www.yourcleanenergy.us) Engineering Technician
John Faschan, P.E. (www.edc-alaska.com) Electrical Engineer
Kevin Hansen, P.E. (www.edc-alaska.com) Mechanical Engineer

The project is on schedule and budget to meet the Contract completion date of January 15, 2012.

Financial report will be submitted separately on January 6, 2011.

Attachments: (1) Revised AEA schedule, milestone table, and budget
Key Activities Completed:

1. Issued Purchase Orders for heat exchangers, closed loop circulation pumps, air separators, expansion tanks, control valves, non-motorized valves, motor control center, and PVC and steel piping/fittings.
2. Received proposals from three control contractors for furnishing, installation and commissioning of heat pump system controls and instrumentation.
3. Received quotations from two electrical contractors for installing line voltage power to motor control center, heat pumps, and circulation pumps.
4. Issued Purchase Order for circulation pumps.
5. Issued Purchase Order for heat exchangers.
6. Selected Trane as the most responsive, responsible controls supplier and contractor from the three proposals received. Proceeded to finalize scope of work and draft contract which will be signed in March 2011.
7. Issued contract and purchase order to Service Electric on February 2, 2011 for electrical power installation.
8. Issued contract and purchase order to Jaffa Construction on March 3, 2011 for rigging and installation of Trane heat pumps.
9. Received delivery of Trane heat pumps on March 14, 2011.
10. Received delivery of steel and copper pipe and related materials on March 14, 2011.
11. Poured housekeeping pad for MCC.
12. Received delivery of loaned steel pipe grooving machine and training by Victaulic representative.
13. Received delivery of expansion tanks, air separators, and HX-5.
15. Issued contract and purchase order to Trane for controls and instrumentation.
17. Issued purchase order to Fluidtrol on March 22, 2001 for flushable salt water supply strainer.
18. Issued revised invitation to Johnson Control on March 30, 2011 to quote Metasys control modifications.
19. Issued purchase order to VAF Filtration Systems on April 4, 2011 for salt water supply strainer control and valve.
20. ASLC Life Support and Facilities staff commenced Victaulic pipe installation in public gallery area on April 4, 2011 for HP system heating loop.

Existing or Potential Problems Addressed:

1. Addressed with design engineers the manufactured specifications and performance of the various quoted heat exchangers. ASLC has ordered Bell & Gossett heat exchangers; however, have not yet released to manufacture pending additional review of the heat exchangers' heat transfer rates. ASLC has requested Bell & Gossett to verify and certify the heat transfer rates of the units proposed or to alternatively provide units that will meet the design specification heat transfer rates. Order of Bell and Gossett heat exchangers cancelled due to heat transfer rates not meeting design requirement. Ordered Alfa Laval heat exchangers.

2. ASLC informed AEA Grant Manager that it was withdrawing its request for an amendment to the budget milestones following a review by ASLC and City of Seward accounting personnel that the existing budget appropriately met and could be managed within the ASLC accounting program. Resolved concerns regarding heat exchanger transfer rates by procuring Alfa Laval heat exchangers.

3. Resolved concerns regarding circulation pump curves by procuring Paco pumps.

4. With Steve Carrick's departure on February 18, 2011 to take the Superintendent of Engineering position at the Philadelphia Zoo, the project exhibit schedule has had to be modified to allow his replacement to become oriented to the project. See revised exhibit schedule below.

5. Resolved design questions regarding salt water supply flushable strainer.

Activities Targeted for Next Quarter

1. Receive remaining equipment (heat exchangers (2), motorized valves, circulation pumps (6), motor control center, flushable strainer, 20-inch PVC wye saddle, and control instruments.

2. Complete installation of steel, PVC and copper pipe for seawater loop, evaporation loop, condenser loop and heating supply loop; heat exchangers; air separators; expansion tanks; circulation pumps; motorized and non-motorized control and check valves; motor control center; electrical power supply; HP controls and instrumentation; and commissioning/startup.
ASLC HEAT PUMP PROJECT TIMELINE

Updated February 28, 2011

June 6, 2010 – July 7, 2010: Procure and contract mechanical/electrical engineering services

July 8 – November 30, 2010: Complete design (Drawings, Specifications, Final Cost Estimate)


December 1, 2010 – June 8, 2011: Equipment procurement (including instrumentation), installation and commissioning, and final reporting:
   a. Shop drawing/manufacture submittals and review – 3 weeks
   b. Manufacture and ship heat pumps, heat exchangers and instrumentation to Seward – 12 weeks
   c. Ship heat exchangers, heat pumps, instrumentation from Seattle to Anchorage to Seward – 2 weeks
   d. Installation of all mechanical, electrical and instrumentation components – 6 weeks, including piping and seawater supply pump
   e. Start-up, commissioning, and training – 2 weeks

June 8, 2011 – June 30, 2012: Project monitoring and reporting to ACEP

EXHIBIT TIMELINE

April 1, 2011– August 30, 2011: Exhibit design and procurement

September 1– October 30, 2011: Exhibit fabrication

November 1 – 30, 2011: Exhibit installation and evaluation

Project personnel assigned to the project are as follows:

Daryl Schaefermeyer, ASLC Operations Manager Project Executive
Randy Stauffer, ASLC Project Engineer Project Manager
John Underwood, ASLC Facilities and Life Support Supervisor Project Superintendent
The project is on schedule and budget to meet the Contract completion date of January 15, 2012.

Financial report will be submitted separately on January 6, 2011.

Attachments: (1) Schedule & Milestone Overview as of 3/10/11
               (2) Summary of Material, Equipment & Contract Purchase Orders as of 4/5/2011
               (4) Financial Reports
               (3) Photos

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Sea Water Heat Pump Project
Schedule & Milestone Overview
As of 4/1/11

1. Heat Pumps Ordered (1) Nov. 12, 2010
2. Complete System Engineering Nov 30, 2010
5. Receive System Components Mar. 7 – May 6, 2011
7. Install Piping in 2nd Floor Gallery April 4 - 7, 2011
8. Install Components & Piping in Basement April 11 – May 13, 2011

11. Complete System Training   Jun. 6 - 8, 2011

Notes:
(1) Heat Pumps pre-ordered due to long lead time & to obtain price discount.
(2) Power wiring & control wiring to be completed concurrently.
(3) Due to warming sea water temperatures, complete system verification may not be possible at this time of year.

### Sea Water Heat Pump Project

**Project No. V0201 & V0202**

**Material, Equipment & Contract Purchase Orders**

<table>
<thead>
<tr>
<th>Item</th>
<th>Manufacturer</th>
<th>Supplier</th>
<th>P/O #</th>
<th>P/O $</th>
<th>P/O Date</th>
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<td>Bell &amp; Gossett</td>
<td>Keller Supply</td>
<td>8517</td>
<td>*****</td>
<td>12/5/11</td>
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<td>HX-4</td>
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<td>2/8/11</td>
<td>2/15/11</td>
<td>2/25/11</td>
<td>3/25/11</td>
<td>AFF</td>
<td>4/15/11</td>
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<tr>
<td>HX-3</td>
<td>Alta Laval</td>
<td>Stinebaugh &amp; Co.</td>
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<td>2/25/11</td>
<td>2/15/11</td>
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<td>Trane</td>
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<td>ACEP</td>
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</tbody>
</table>

**Total Project P/O Value** = $580,714

**Total Project Budget** = $713,300

**Remaining Budget** = $132,586

**T&M Not To Exceed (NTE) Contract Signed 2/18/2011**
Figure 1 Installing first Trane heat pump into ASLC boiler room – March 17, 2011
Figure 2 Installing first Trane heat pump in ASLC boiler room - March 17, 2011
Figure 3 Installing second Trane heat pump in ASLC boiler room - March 17, 2011
Figure 5  Trane heat pumps installed in ASLC boiler plant room - March 18, 2011
Figure 6  ASLC Facilities Technician Dan Rice installing Victaulic heating loop piping - April 4, 2011
Figure 7 ASLC Building Maintenance staff installing Victaulic heat loop piping - April 4, 2011
Figure 8 ASLC LSS Group Manager John Underwood and LSS Technician Isaac London installing Victaulic heating loop piping - April 5, 2011
Figure 9 ASLC LSS Technician Isaac London preparing Victaulic couplers for installation - April 5, 2011
Key Activities Completed:

1. Completed the pre-commissioning punch list.
2. All mechanical and electrical completed.
3. Heat pump and MCC commissioning and training completed.
4. Completed commissioning of refrigerant alarm system.
5. System commissioning and training in progress.

Existing or Potential Problems Addressed:

1. There are no unresolved problems.

Activities Targeted for Next Month/Quarter:

1. Complete full system commissioning and training.
2. Install pipe insulation.
3. Complete project exhibit design.
4. Finalize project reporting and monitoring requirements with ACEP/AEA.
ASLC HEAT PUMP PROJECT TIMELINE

Updated July 1, 2011

June 6, 2010 – July 7, 2010: Procure and contract mechanical/electrical engineering services

July 8 – November 30, 2010: Complete design (Drawings, Specifications, Final Cost Estimate)


December 1, 2010 – July 1, 2011: Equipment procurement (including instrumentation), installation and commissioning, and final reporting:
  a. Shop drawing/manufacture submittals and review – 3 weeks
  b. Manufacture and ship heat pumps, heat exchangers and instrumentation to Seward – 12 weeks
  c. Ship heat exchangers, heat pumps, instrumentation from Seattle to Anchorage to Seward – 2 weeks
  d. Installation of all mechanical, electrical and instrumentation components – 6 weeks, including piping and seawater supply pump
  e. Start-up, commissioning, and training – 2 weeks

July 15, 2011 – June 30, 2012: Project monitoring and reporting to ACEP

EXHIBIT TIMELINE

April 1, 2011– August 30, 2011: Exhibit design

September 1- October 30, 2011: Exhibit procurement & fabrication

November 1 – 30, 2011: Exhibit installation and evaluation
Project personnel assigned to the project are as follows:

Darryl Schaefermeyer, ASLC Operations Manager   Project Executive
Randy Stauffer, ASLC Project Engineer     Project Manager
John Underwood, ASLC Facilities and Life Support Supervisor Project Superintendent
Douglas (Ricky) Deel, ASLC Exhibits Manager     Exhibit Development
Andy Baker, P.E., (www.yourcleanenergy.us)     Consulting Engineer
Lee Bolling, EIT, (www.yourcleanenergy.us) Engineering Technician
John Faschan, P.E. (www.edc-alaska.com)    Mechanical Engineer
Kevin Hansen, P.E. (www.edc-alaska.com)     Electrical Engineer

The project is on schedule and budget to meet the Contract completion date of January 15, 2012.

Attachments: (1) Schedule & Milestone Overview as of 7/1/11
(2) Summary of Material, Equipment & Contract Purchase Orders as of 7/6/2011
(3) Financial Report
(4) Photos
# Sea Water Heat Pump Project

## Schedule & Milestone Overview

As of 7/1/11

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Heat Pumps Ordered</td>
<td>Nov. 12, 2010</td>
</tr>
<tr>
<td>2. Complete System Engineering</td>
<td>Nov 30, 2010</td>
</tr>
<tr>
<td>5. Receive System Components</td>
<td>Mar. 7 – May 6, 2011</td>
</tr>
<tr>
<td>7. Install Piping in 2nd Floor Gallery</td>
<td>April 4 - 7, 2011</td>
</tr>
<tr>
<td>8. Install Components &amp; Piping in Basement</td>
<td>April 11 – June 6, 2011</td>
</tr>
</tbody>
</table>

Notes:

(1) Due to warming sea water temperatures, complete system verification is not possible at this time of year.
Figure 1 Trane Heat Pumps and HX-5
Figure 2 Evaporator and Condenser Loop Pumps
Figure 3 Trane Heat Pumps
Figure 4 Heat Pump Motor Control Center
Figure 5 Heating Loop Pumps and HX-4
Figure 6 Trane Tracer Controller
Figure 7 Refrigeration Gas Monitor
Figure 8 Trane Tracer Control Screen
Figure 9 Trane Control Module Screen
Figure 10 Refrigeration Monitor Alarm Strobe
Figure 11 Refrigerant Monitor Alarm Strobe
Figure 13 Trane Tracer Control Module
Figure 14 Salt Water Supply Strainer Controller
Figure 15 Heat Pumps showing Refrigerant Relief Vent Header
Key Activities Completed:

1. Completed partial system commissioning and training.

Existing or Potential Problems Addressed:

1. During commissioning it was discovered that the ModBus to LonWorks converter (Smart Server) supplied with the Motor Control Center (MCC) had not been programmed prior to installation in the MCC. The Smart Server has been removed and returned to the MCC supplier, Eaton. Eaton contracted with Echelon Corporation, the supplier of the Smart Server, to perform the programming which has been completed and returned and reinstalled in the MCC. Trane technician will be able onsite October 20th and 21st to complete the Tracer controller programming and screen programming which will allow for completion of commissioning the heat pump system.

2. The five electronic flow meters specified by the design engineers and supplied by SeaMetrics Corporation have proven unreliable in operation with the glycol and temperature ranges of the heat pump system loops. After extensive attempts to calibrate the electronic meters in consultation with the design engineers and SeaMetrics without success, a mechanical paddle wheel meter was tested in the evaporator loop and it is showing readings correlating with the design flows and pump pressure curves. The electronic meters are being replaced with mechanical paddle wheel meters that scheduled to ship from the supplier on October 26th.

3. Last month we reported a “power bump” caused from a weather related fault at the electric utility, was suspected in causing one of the two circuits in Heat Pump No. 1 to trip and not be able to be restarted. A Trane technician came
on-site and determined the fault was caused by low condenser oil which was corrected.
4. Installation of the pipe insulation is approximately 80% complete.

Activities Targeted for Completion:

1. Complete full system commissioning and training.
2. Complete pipe insulation installation.
3. Complete project exhibit design and construct/install exhibit.
4. Finalize project reporting and monitoring requirements with ACEP/AEA.

ASLC HEAT PUMP PROJECT TIMELINE

Updated October 1, 2011

June 6, 2010 – July 7, 2010: Procure and contract mechanical/electrical engineering services

July 8 – November 30, 2010: Complete design (Drawings, Specifications, Final Cost Estimate)


December 1, 2010 – November 15, 2011: Equipment procurement (including instrumentation), installation and commissioning, and final reporting:
   a. Shop drawing/manufacture submittals and review – 3 weeks
   b. Manufacture and ship heat pumps, heat exchangers and instrumentation to Seward – 12 weeks
   c. Ship heat exchangers, heat pumps, instrumentation from Seattle to Anchorage to Seward – 2 weeks
   d. Installation of all mechanical, electrical and instrumentation components – 6 weeks, including piping and seawater supply pump
   e. Start-up, commissioning, and training

November 15, 2011 – June 30, 2012: Project monitoring and reporting to ACEP

EXHIBIT TIMELINE

April 1, 2011 – November 1, 2011: Exhibit design

November 1, 2011 - November 30, 2011: Exhibit procurement & fabrication

December 1 – 30, 2011: Exhibit installation and evaluation
Project personnel assigned to the project are as follows:

Darryl Schaefermeyer, ASLC Operations Manager   Project Executive
Randy Stauffer, ASLC Project Engineer     Project Manager
John Underwood, ASLC Facilities and Life Support Supervisor Project Superintendent
Douglas (Ricky) Deel, ASLC Exhibits Manager     Exhibit Development
Andy Baker, P.E., (www.yourcleanenergy.us)    Consulting Engineer
Lee Bolling, EIT, (www.yourcleanenergy.us) Engineering Technician
John Faschan, P.E. (www.edc-alaska.com)    Electrical Engineer
Kevin Hansen, P.E. (www.edc-alaska.com) Mechanical Engineer

The project is on schedule and budget to meet the Contract completion date of January 15, 2012.

Attachments:  (1) Schedule & Milestone Overview as of 9/1/11
(2) Financial Report
(3) Photos
<table>
<thead>
<tr>
<th></th>
<th>Task Description</th>
<th>Date Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Heat Pumps Ordered</td>
<td>Nov. 12, 2010</td>
</tr>
<tr>
<td>2.</td>
<td>Complete System Engineering</td>
<td>Nov 30, 2010</td>
</tr>
<tr>
<td>5.</td>
<td>Receive System Components</td>
<td>Mar. 7 – May 6, 2011</td>
</tr>
<tr>
<td>7.</td>
<td>Install Piping in 2nd Floor Gallery</td>
<td>April 4 - 7, 2011</td>
</tr>
<tr>
<td>8.</td>
<td>Install Components &amp; Piping in Basement</td>
<td>April 11 – June 6, 2011</td>
</tr>
</tbody>
</table>
Figure 1 Installing pipe insulation
Figure 4 Installing pipe insulation
Key Activities Completed:

1. Completed installation of piping insulation.
2. The five electronic flow meters were replaced with mechanical paddle wheel meters and all loops are showing readings correlating with the design flows and pump pressure curves.
3. The paddle flow switches supplied by Trane with the heat pumps have been replaced with differential switches.
4. Requested and receive from AEA and ACEP 6-month no cost extension until June 30, 2012 to complete the project.
5. ASLC has received a grant from the M.J. Murdock Foundation to fund connecting the Center’s pavement heating to the heat pumps and to recover waste heat from various sources in the building to add to the evaporator loop to keep the glycol temperature entering the heat pump evaporators as high as possible to improve system performance. This work is in design and will be installed in 2012.

Existing or Potential Problems Addressed:

1. As reported in last quarterly report the instrumentation integration and operator screen programming has been delayed by a very challenging detail of getting ModBus power meter data into a LonTalk server. With the power data not coming through the LonTalk server, we have not been able to monitor COP continuously on line. We have not been pleased with rate of progress on resolving this problem by Echelon and Trane; however, they appear close to resolution and Trane should be able to complete the Tracer SC controller programming by January 16, 2012.
2. We have been able to sample one hour time intervals that are fairly typical and the readings we are obtaining are close to those predicted in the modeling. From the time the heat pumps were placed into operation by Trane in July 2011, we operated them with our 500KW electric boiler as the Center’s source of building heating. Effective December 21, 2011, we discontinued the electric boiler operation and went on oil boiler. This was predicated by the high demand placed on the electric boiler to supply building and pavement heating during very cold weather, resulting in high KWH demand. As reported in the attached Seawater Heat Pump Performance Report, for the 19-day period from December 21, 2011 through January 8, 2012, we have achieved a COP of 3.14 with 4,020 gallons of fuel oil saved. Factoring in the cost of the total kWh consumed by the heat pump system, this has meant a cost savings of $11,117 and a reduction of 89,000 pounds of CO2.

3. We have verbally proposed to ACEP that the exhibit match requirement be waived given the significant contributed labor provided to systems installation. We are proposing to develop an a video to exhibit the system to the Center’s visitors rather than a static floor display.

4. We have been invited by the House Resources Committee to make a 10-minute presentation on the project January 27, 2012 in Juneau.

Activities Targeted for Completion:

1. Complete full system commissioning and training. Training is scheduled for January 17-18, 2012 subject to Trane’s completion of the instrumentation integration and operator screen programming.

2. Obtain formal modification of the ACEP agreement regarding the Exhibit requirement.

3. Finalize project reporting and monitoring requirements with ACEP/AEA following commissioning and training.

ASLC HEAT PUMP PROJECT TIMELINE

Updated January 1, 2012

June 6, 2010 – July 7, 2010: Procure and contract mechanical/electrical engineering services

July 8 – November 30, 2010: Complete design (Drawings, Specifications, Final Cost Estimate)


December 1, 2010 – November 15, 2011: Equipment procurement (including instrumentation), installation and commissioning, and final reporting:

a. Shop drawing/manufacture submittals and review – 3 weeks
b. Manufacture and ship heat pumps, heat exchangers and instrumentation to Seward – 12 weeks

c. Ship heat exchangers, heat pumps, instrumentation from Seattle to Anchorage to Seward – 2 weeks

d. Installation of all mechanical, electrical and instrumentation components – 6 weeks, including piping and seawater supply pump

e. Start-up, commissioning, and training

November 15, 2011 – June 30, 2012: Project monitoring and reporting to ACEP/AEA

EXHIBIT TIMELINE

January 1, 2012– March 1, 2012: Exhibit (video) development

March 1, 2012 - June 1, 2011: Exhibit (video) production and evaluation

June 1-30, 2012: Exhibit (video) launch

Project personnel assigned to the project are as follows:

Darryl Schaefermeyer, ASLC Operations Manager   Project Executive
Randy Stauffer, ASLC Project Engineer     Project Manager
John Underwood, ASLC Facilities and Life Support Supervisor Project Superintendent
Douglas (Ricky) Deel, ASLC Exhibits Manager Exhibit Development
Andy Baker, P.E., (www.yourcleanenergy.us) Consulting Engineer
Lee Bolling, EIT, (www.yourcleanenergy.us) Engineering Technician
John Faschan, P.E. (www.edc-alaska.com) Electrical Engineer
Kevin Hansen, P.E. (www.edc-alaska.com) Mechanical Engineer

The project is on schedule and budget to meet the revised Contract completion date of June 30, 2012.

Attachments:  
(1) Schedule & Milestone Overview as of 1/1/12
(2) Seawater Heat Pump Performance Report, 12-21-2011 – 01-09-2012
(3) Financial Report
(4) Photos
Sea Water Heat Pump Project
Schedule & Milestone Overview
As of 1/1/12

1. Heat Pumps Ordered (1) Nov. 12, 2010
2. Complete System Engineering Nov 30, 2010
5. Receive System Components Mar. 7 – May 6, 2011
7. Install Piping in 2nd Floor Gallery April 4 - 7, 2011
8. Install Components & Piping in Basement April 11 – June 6, 2011
Figure 1 Pump 100 - Salt Water Supply
Figure 2 Evaporator Loop HX
Figure 3 Heat Pump MCC

Figure 4 Heat Pumps
Figure 5 Evaporator and Condenser Loop Pumps

Figure 6 AHU Pre-Heat Loop HX and Pumps
Figure 7 DHW Pre-Heat HX
Figure 8 Tracer SC - Overall Screen View
Key Activities Completed:

1. Trane is 98% complete with the Tracer SC programming.
2. Design work is commencing on connecting the Center’s pavement heating to heat pumps and to recover waste heat from various sources in the building to add to the evaporator loop to keep the glycol temperature entering the heat pump evaporators as high as possible to improve system performance. The schedule is have 50% complete design drawings by April 30, 2012 and 100% complete design drawings, specifications and cost estimates by June 1, 2012. This project is being funded by a grant from the M.J. Murdock Foundation.
3. On April 14, 2012 Jason Moore (formerly with KTTU-TV Channel 2) and Scott Jensen (KTVA-TV Channel 11) under contract to the Alaska SeaLife Center and YourCleanEnergy conducted interviews and shot video for preparation of short video presentation on the seawater heat pump system.

Existing or Potential Problems Addressed:

Activities Targeted for Completion:

2. Obtain formal modification of the ACEP agreement regarding the Exhibit requirement.
3. Finalize project reporting and monitoring requirements with ACEP/AEA following commissioning and training.
4. We have been invited to present a poster on the project at the REAP annual Business of Clean Energy Conference scheduled for April 19-20, 2012. A copy of the poster is attached.

5. We are invited to present the seawater heat pump system at the April 23, 2012 Green Star HVAC workshop at 11:00 a.m., Anchorage Crowne Plaza (Borealis Room).

6. We are invited to be the presenter at the May 9, 2012 REAP Forum, 6:00 – 8:00 p.m., Anchorage Museum Auditorium.

ASLC HEAT PUMP PROJECT TIMELINE

Updated January 1, 2012

June 6, 2010 – July 7, 2010: Procure and contract mechanical/electrical engineering services

July 8 – November 30, 2010: Complete design (Drawings, Specifications, Final Cost Estimate)


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November 15, 2011 – June 30, 2012: Project monitoring and reporting to ACEP/AEA

EXHIBIT TIMELINE

January 1, 2012– March 1, 2012: Exhibit (video) development

March 1, 2012 - June 1, 2011: Exhibit (video) production and evaluation

June 1-30, 2012: Exhibit (video) launch

Project personnel assigned to the project are as follows:
Darryl Schaefermeyer, ASLC Operations Manager          Project Executive
Randy Stauffer, ASLC Project Engineer               Project Manager
John Underwood, ASLC Facilities and Life Support Supervisor      Project Superintendent
Douglas (Ricky) Deel, ASLC Exhibits Manager          Exhibit Development
Andy Baker, P.E., (www.yourcleanenergy.us)          Consulting Engineer
John Faschan, P.E. (www.edc-alaska.com)             Electrical Engineer
Kevin Hansen, P.E. (www.edc-alaska.com)              Mechanical Engineer

The project is on schedule and budget to meet the revised Contract completion date of June 30, 2012.

Attachments:  (1) Schedule & Milestone Overview as of 4/1/12
               (2) REAP Poster
               (3) REAP Forum Announcement
               (3) Financial Report
<table>
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<td>Nov. 12, 2010</td>
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<tr>
<td>2. Complete System Engineering</td>
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</tr>
<tr>
<td>8. Install Components &amp; Piping in Basement</td>
<td>April 11 – June 6, 2011</td>
</tr>
</tbody>
</table>
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 105°F. To reduce heating operating cost during the warm summer months, the boiler heating loop has been set to 130°F. 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 to 106F) 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

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<th>Electricity Consumed</th>
<th>Thermal Energy Delivered</th>
<th>Ratio SWHP/Electric Boiler</th>
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<td>Electrical Boiler Total kWh Consumed</td>
<td>SWHP Thermal MMBtu</td>
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### ELECTRIC CONSUMPTION BY HEAT PUMP SYSTEM - from Tracer System Performance screen for Period May 1 - June 30, 2012

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<th>Kw</th>
<th>Cost Kw</th>
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<tbody>
<tr>
<td>129,343</td>
<td>$0.088</td>
<td>$11,309</td>
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</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Kw</th>
<th>Cost Kw</th>
<th>Energy Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>182,541</td>
<td>$0.088</td>
<td>$16,064</td>
</tr>
</tbody>
</table>

### ENERGY COST SAVINGS

- **Electricity Saved (Kwh):** 305,971
- **Cost of Electricity Saved:** $26,908
- **Electricity Used (Kwh):** 129,245
- **Cost of Electricity Used:** $17,382
- **Net Energy Savings:** $15,526

### CO2 AVOIDED

- **Electricity** 
  - # of CO2 Avoided: 123.935, 1,443.108, 122, 52,426, 71,309, 122
  - # of CO2 Generated: 52,426, 71,309, 122

---

\[ *305,971 \times 3.412 / 1 \times 0.027 = 1,015.382 \text{ cf of natural gas} \]

\[ 1,000 \text{ CF natural gas burned to generate electricity emits 122 lbs CO2} \]

\[ 1,015.382 \times 1000 = 1,015.842 \text{ lbs CO2} \]

\[ 1,015.842 / 122 = 8.393 \text{ lbs CO2/lb of NG burned} \]

\[ 123.935 \times 8.393 = 1,027 \text{ lbs CO2} \]

**123.935 Kw X 3.412 / 1 \times 0.027 = 429,723 \text{ cf of natural gas} \]

**1,000 CF natural gas burned to generate electricity emits 122 lbs CO2.**

**429,723 / 1000 = 430 X 122 = 52,426 lbs CO2.**
Overview

The Alaska SeaLife Center Seawater Heat Pump Project implementation commenced with financial awards in 2010 from the Denali Commission (DC) as an Emerging Energy Technology Grant, administered by the University of Alaska Fairbanks’ Alaska Center for Energy and Power, and the Alaska Energy Authority’s Round II Renewable Energy Program (AEA). The DC award was for $426,720 and the Commission made a Financial Assistance Award to the University of Alaska Fairbanks (UAF) on March 13, 2010 for the purposes of contracting the project to the Seward Association for the Advancement of Marine Science, dba, Alaska SeaLife Center (ASLC). A UAF Professional Services Contract was issued Seward Association for the Advancement of Marine Science, dba, Alaska SeaLife Center on May 21, 2010. The AEA award was for $286,580 and an AEA grant agreement was executed the City of Seward on September 2, 2010. System designed was contracted by the ASLC to YourCleanEnergy and EDC Engineers, with final design being completed on November 30, 2010.

Personnel assigned to the project were as follows:

Steven Carrick, ASLC Director of Facilities and Visitor Services  Project Executive
Darryl Schaefermeyer, ASLC Operations Manager  Project Executive
Randy Stauffer, ASLC Project Engineer  Project Manager
John Underwood, ASLC Facilities and Life Support Supervisor  Project
Noah Hermundson, ASLC Lead Life Support Technician  Superintendent
Procurement and Installation:

The ASLC commenced project competitive procurement in December 2010. The following vendors were utilized on the project:

AIS, Inc.: Pipe Insulation Installation
Alaska Roteq Corporation: Circulation Pumps
Bay Traders – True Value: Miscellaneous Materials
Carlile Transportation: Freight Services
CH20, Inc.: Water Testing and Inhibiters
City Express: Freight Services
Eaton Corporation: VFD’s and Power Meter
EPSCO International: Wye Saddle, Pipe Glue, etc.
Echelon Corporation: Echelon Lon Smart Server
Federal Express: Freight Services
Ferguson Enterprises: Piping, Fittings, and Non-Motorized Valves
Fluidtrol Process Technologies: Flushable Strainer
Grainger: Miscellaneous Tools and Materials
Jaffa Construction: Rigging Heat Pumps into Building
Johnson Controls: Air Handler Coil BAS programming
Keller Supply: HX- 5 and Motorized Valves
Paramount Supply: Air Separators, Expansion Tanks
Polar Supply: Sikaflex Caulking
Resurrection Rentals: Scissorlift and Forklift Rental
Sampson Electric: Control Instrumentation Wiring Installation
Sampson Tug and Barge: Freight Services
Service Electric: Electrical Wiring Installation
Seward Plumbing & Heating: Miscellaneous Plumbing Materials
Seward Ship’s Drydock Inc.: Crane Services
Seward Ships Ace Hardware: Miscellaneous Materials
Spenard Builders Supply: Concrete Mix and Miscellaneous Materials
Stinebaugh & Company: HX-3 and HX-4
Technical Controls, Inc.: Flow Meters
Trane U.S. Inc.: Heat Pumps, Controls and Instrumentation
Two Dogs Trucking, Inc.: Freight Services
Installation commenced in Spring 2011 with initial start-up of the heat pumps in July 2011. Final completion, commissioning and training was delayed until April 2012 due to problems encountered with communication incompatibility between the LonWorks and Modbus systems installed in the MCC. The Modbus and LonWorks converter (gateway) is necessary to allow the devices within the MCC that do not have LonWorks communications capability the ability to communicate on the LonWorks network to the Heat Pump System Controller (Trane Tracer SC). The Modbus devices include the across-the-line motor starters and power monitor. The Gateway specified for the project was an Echelon model 72101R-430i.Lon Smart Server. Considerable work ensued with engineers from Trane (Tracer SC controller), Eaton/Cutler/Hammer (power monitor and motor starters) and Echelon Corporation (i.Lon Smart Server) with the principal involvement of a senior programmer from Echelon to map the Standard Network Variable Type (SNVT) points from the power meter to the Echelon i.Lon Smart Server. This work was completed in March 2012 allowing the Tracer SC screen programming to be completed in April 2012. Training was completed April 25-26, 2012 and system placed in full automatic control operation at that time.

After initial start-up of the heat pumps in July 2011, problems were encountered with the paddle flow switches supplied with the heat pumps. At the recommendation of Trane, the paddle switches were changed to pressure switches. These two proved to be unreliable and ultimately were replaced with ifm efector, Inc. electronic flow sensors which have performed well.
Performance:

Performance for the period May 1 – September 30, 2012 is summarized in the chart below:

<table>
<thead>
<tr>
<th>Sea Water HP</th>
<th>Electric Boiler</th>
<th>SWHP Thermal</th>
<th>Electric Boiler</th>
<th>Electricity saved (Kwh)</th>
<th>Coefficient of Performance: [293.1*SWHP Thermal MMBTU/Total kWh Consumed]</th>
</tr>
</thead>
<tbody>
<tr>
<td>kWh Consumed</td>
<td>Total Kwh Consumed</td>
<td>MMBTU</td>
<td>MMBTU</td>
<td>kWh</td>
<td></td>
</tr>
<tr>
<td>Jan</td>
<td>76,369</td>
<td>112,062</td>
<td>600</td>
<td>382</td>
<td>175,734</td>
</tr>
<tr>
<td>Feb</td>
<td>52,976</td>
<td>70,479</td>
<td>444</td>
<td>240</td>
<td>130,037</td>
</tr>
<tr>
<td>Mar</td>
<td>38,790</td>
<td>66,990</td>
<td>305</td>
<td>229</td>
<td>89,366</td>
</tr>
<tr>
<td>Apr</td>
<td>64,269</td>
<td>57,316</td>
<td>470</td>
<td>196</td>
<td>137,748</td>
</tr>
<tr>
<td>May</td>
<td>27,767</td>
<td>82,220</td>
<td>189</td>
<td>281</td>
<td>55,334</td>
</tr>
<tr>
<td>June</td>
<td>76,369</td>
<td>112,062</td>
<td>600</td>
<td>382</td>
<td>175,734</td>
</tr>
<tr>
<td>July</td>
<td>52,976</td>
<td>70,479</td>
<td>444</td>
<td>240</td>
<td>130,037</td>
</tr>
<tr>
<td>Aug</td>
<td>38,790</td>
<td>66,990</td>
<td>305</td>
<td>229</td>
<td>89,366</td>
</tr>
<tr>
<td>Sept***</td>
<td>64,269</td>
<td>57,316</td>
<td>470</td>
<td>196</td>
<td>137,748</td>
</tr>
<tr>
<td>Total</td>
<td>260,170</td>
<td>389,067</td>
<td>2,007</td>
<td>1,327</td>
<td>588,219</td>
</tr>
<tr>
<td>Average</td>
<td>2.24</td>
<td>1.56</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Kw</th>
<th>Avg. Cost Kw</th>
<th>Energy Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>250,170</td>
<td>$0.099</td>
<td>$23,808</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Kw</th>
<th>Avg. Cost Kw</th>
<th>Energy Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>389,067</td>
<td>$0.099</td>
<td>$38,594</td>
</tr>
</tbody>
</table>

**ENERGY COST SAVINGS**

<table>
<thead>
<tr>
<th>Electricity Saved (Kw)</th>
<th>Electricity saved (Kwh)</th>
<th>Cost of Electricity saved (Kwh)</th>
<th>Electricity Used (Kw)</th>
<th>Electricity Used (Kwh)</th>
<th>Cost of Electricity used (Kwh)</th>
<th>Cost Savings (Kwh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>588,219</td>
<td>$58,234</td>
<td>260,170</td>
<td>$25,808</td>
<td>32,426</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CO2 AVOIDED**

<table>
<thead>
<tr>
<th>Electricity Saved (Kw)</th>
<th># of C02 Avoided*</th>
<th>NG burned (cf)</th>
<th># of C02 per 1,000 cf NG</th>
<th># of C02 Avoided*</th>
<th># of C02 produced by electric boiler**</th>
<th>Net # C02 generated***</th>
</tr>
</thead>
<tbody>
<tr>
<td>238,417</td>
<td>2,156,960</td>
<td>122</td>
<td>105,452</td>
<td>132,965</td>
<td>157,697</td>
<td>24,732</td>
</tr>
</tbody>
</table>

*588,219 Kw X 3,412 / 1,027 = 1,954,239 cf natural gas. 1,000 CF natural gas burned to generate electricity emits 122 lbs C02. 1,954,239/1000 = 1,954 X 122 = 238,417 lbs C02.

**260,170 Kw X 3,412 / 1,027 = 864,362 cf natural gas. 1,000 CF natural gas burned to generate electricity emits 122 lbs C02. 864,362/1000 = 864 X 122 = 105452 lbs C02.

***Heat Pump System Offline September 16-September 28, 2012 due to extreme seawater silting due to Lowell Creek Diversion Flooding.
Lessons Learned:

- Heat Pumps operate most efficiently when fully loaded;
- Sidewalk snow melt is a large heat load that will be added to the heat pump system;
- Existing oil boilers are now too large and expensive to hybridize with heat pumps;
- Original HVAC controls for air handlers & boilers require upgrades to increase benefit of low temperature heat from heat pumps;
- Heat Pumps have proven to meet or exceed design specification; however, heat pump supplier’s control system has not met reliability expectations and support is remote from Alaska;
- Alaska’s remoteness and distance from equipment manufacturers and service centers makes wide application of this technology a challenge;
- Alaska interest in the heat pump technology remains positive with a private system installed at Summit Lake Lodge in summer 2012 and planning underway for seawater heat pump system at the Sitka Sound Science Center facility;
- Seawater heat pump technology is currently only practical for established coastal Alaskan communities and facilities with lower cost electrical power that have the availability of skilled labor and proximity to technical service and support;
- Seawater heat pump and other commercial heat pump technology application in Alaska will require government sponsored grant funding or low-cost capital financing.

Media Presentations:

- Alaska Legislature House Resources Committee, January 27, 2012,
- REAP Business of Clean Energy Conference, Poster Presentation, April 19-20, 2012
- Green Star Forum, April 23, 2012
- Kenai Peninsula Clarion, Hot Idea, October 3, 2012
Attachments:

1. Detailed project expenditure report
2. Certifications

Photos:

Actual Installation – Heat Pumps

Two 90-Ton Heat Pumps – One or Two Heat Pump Operation
Actual Installation – Sea Water HX

Transfers Heat From Sea Water Into a Glycol Loop That Then Passes Through Heat Pumps

Actual Installation – Loop Pumps

High-Efficiency Circulation Pumps Move Glycol and Water Through the Heat Pumps
Actual Installation – Air Handler HX

Heat Pumps Warm Up Water Loop to 120 F – This Heat is Then Transferred to Air Handler Loop

Actual Install – Domestic Hot Water HX

City Water Entering at 45 F is Pre-Heated Up To 100 F With a Side Loop From Heat Pumps
Actual Installation – Motor Control Center

All Electricity Used For Heat Pumps, Circulation Pumps, and Controls is Supplied by One MCC,
John  John Faschan, EDC, Inc.