Sea Water Heat Pump Project

Alaska SeaLife Center, Seward, Alaska

Presenters:

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&

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ACEP EET Public Forum – Centennial Hall – Juneau - Feb 14, 2011

Alaska SeaLife Center

- **Mission:** The Alaska SeaLife Center generates and shares scientific knowledge to promote understanding and stewardship of Alaska's marine ecosystems.

- We achieve our mission through:

- **Research**
- **Education**
- **Rehabilitation**
- **Exhibits**

Alaska SeaLife Center

Economic Profile

- **$4.77 million in annual payroll + multiplier effect ($12 million)**
- **93 year round employees + multiplier effect (30 additional jobs)**
- **Largest private employer in Seward. 11th Largest on Kenai Peninsula.**
- **Year round tourism for South Central Alaska: 160,000 visitors/yr**

Sea Water Heat Pump Project

SUMMARY OF PARTNERSHIPS WITH STRONG SUPPORT

- **City Of Seward –** looking to reduce future cost of heating for downtown district
- **Kenai Fjords National Park –** looking to reduce cost of heating for future visitor center & administration building
- **Alutiiq Pride Shellfish Hatchery –** also has an existing seawater intake available
- **UAF School Of Fisheries & Ocean Sciences - Seward Marine Center –** also has existing seawater intake available

Goals = Reduce Energy Cost & Carbon Emmissions

- **Energy Use Profile For The 115,000 sq ft SeaLife Center:**

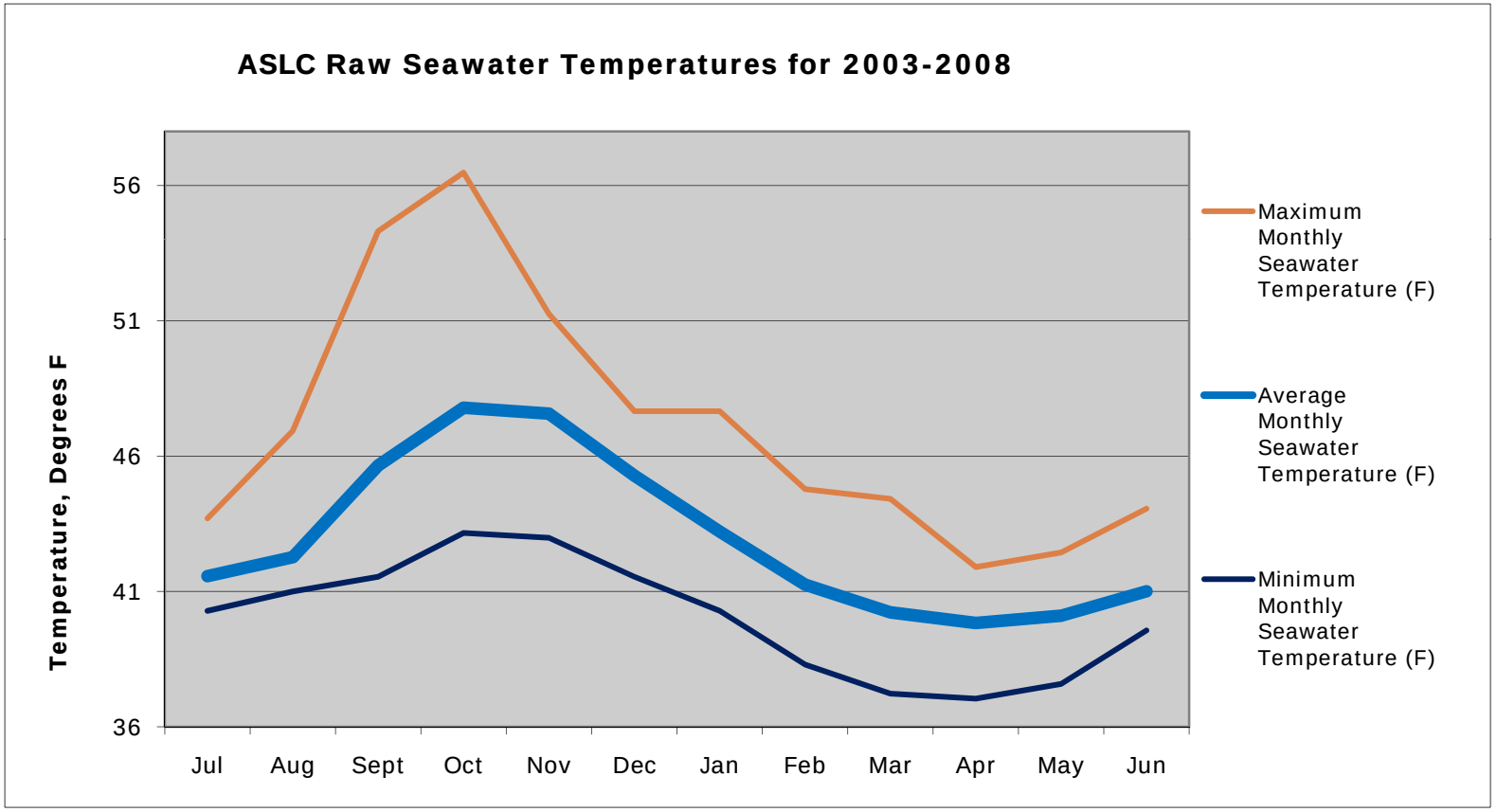
- **Heating loads are large = air handlers, baseboards, duct coils, pavement heating, domestic hot water**
- **Two oil fired boilers plus one electric boiler in plant**
- **Heating oil demand can exceed 500 gallons per day in winter and up to 132,000 gallons per year.**
- **In 2008 with $5/gallon pricing, annual heating costs reached $463,000.**

Sea Water Heat – Sweden & Norway

The concept of using heat from seawater for building demands has been employed for nearly 20 years in fjords along the coast of Scandanavia:

- Stockholm, Sweden = Vartan Ropsten = largest seawater heat pumps on the planet
- Bodo Norway, pop 41,000, district heating w/44.6F seawater – on military base
- STATOIL Research Centre, Trondheim, Norway, district heating with seawater

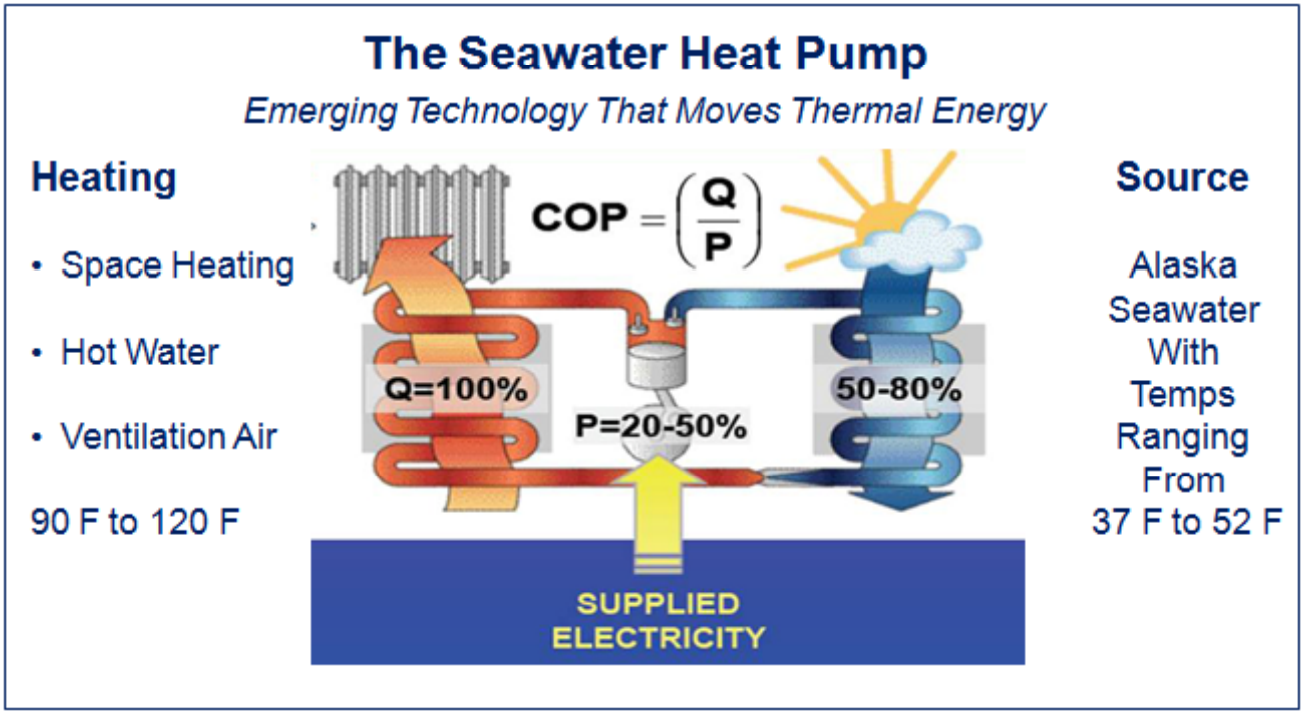
Seward Sea Water Heat Resource



Storage of solar heat in Resurrection Bay = year round usable heat resource

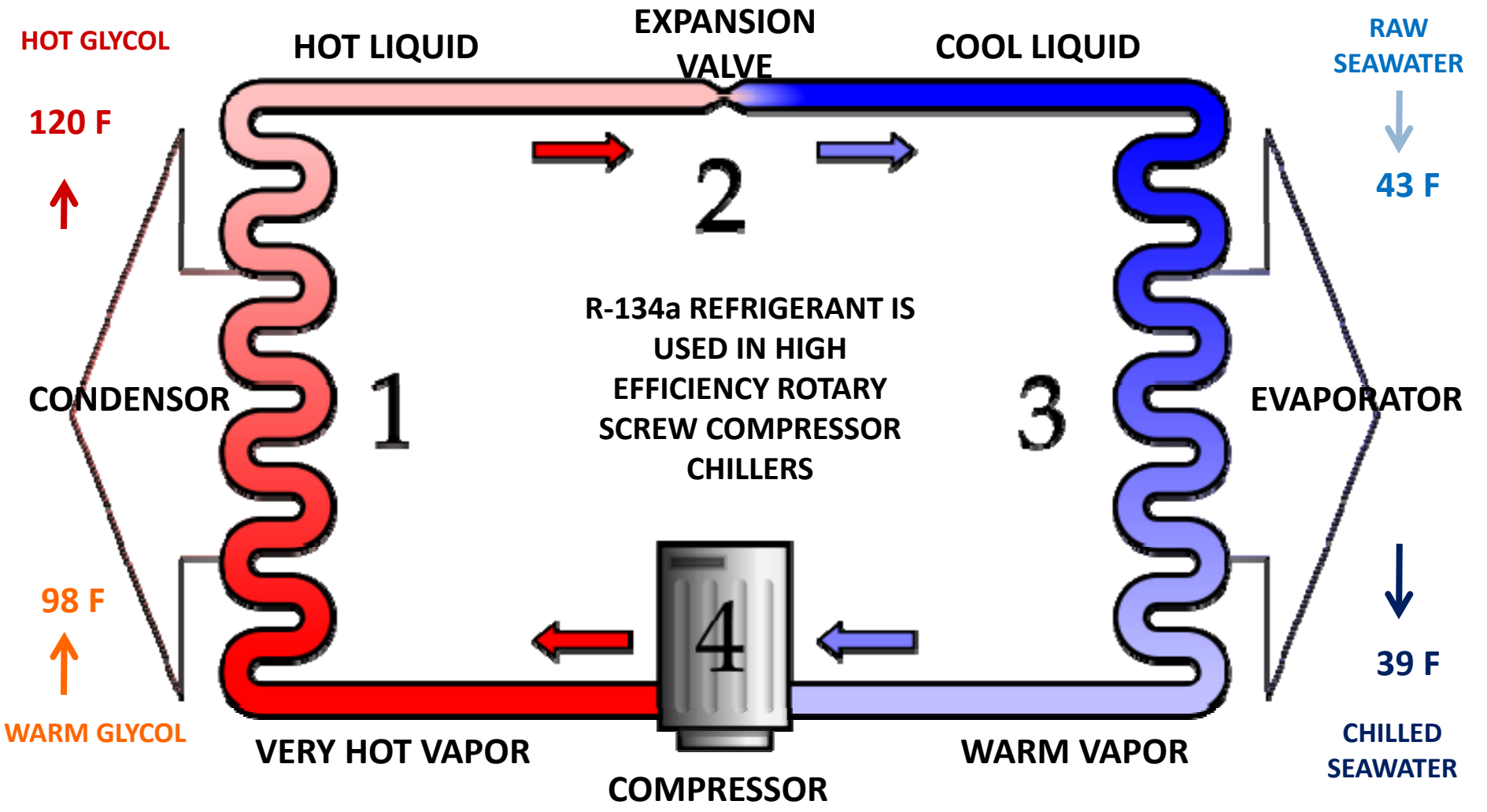
Icy Heat - KTVA Channel 11 – CBS News - Anchorage

Technology Overview

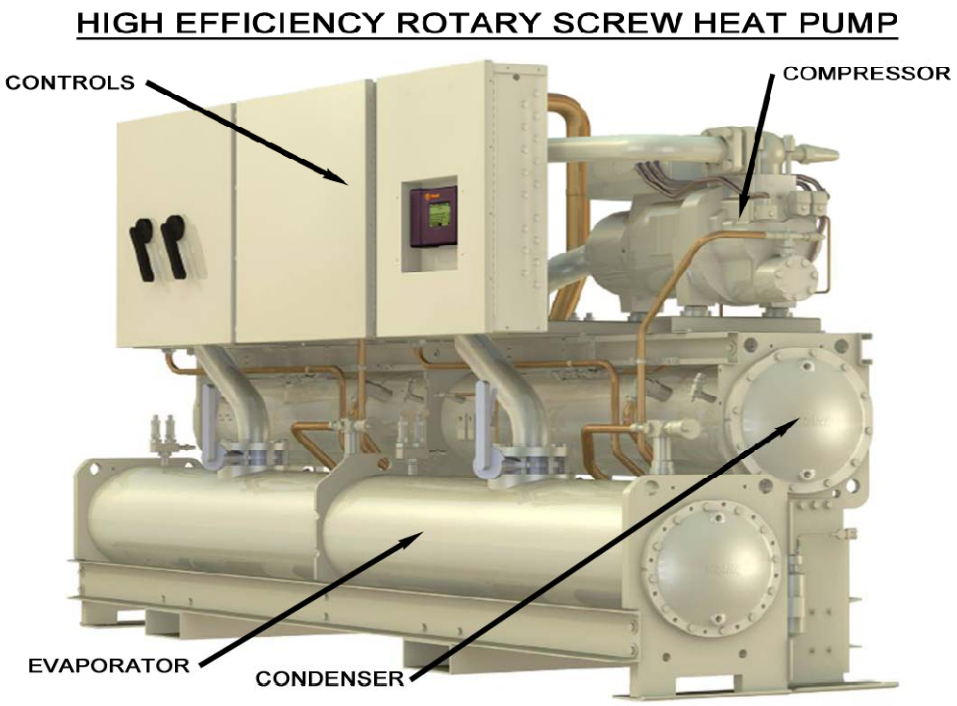


- **Q = Quantity of heat produced by heat pump**
- **P = Electrical power used by heat pump**
- **COP (Coefficient of performance) of 3.1 – 3.6 expected from ASLC seawater heat pump**

Technology Overview

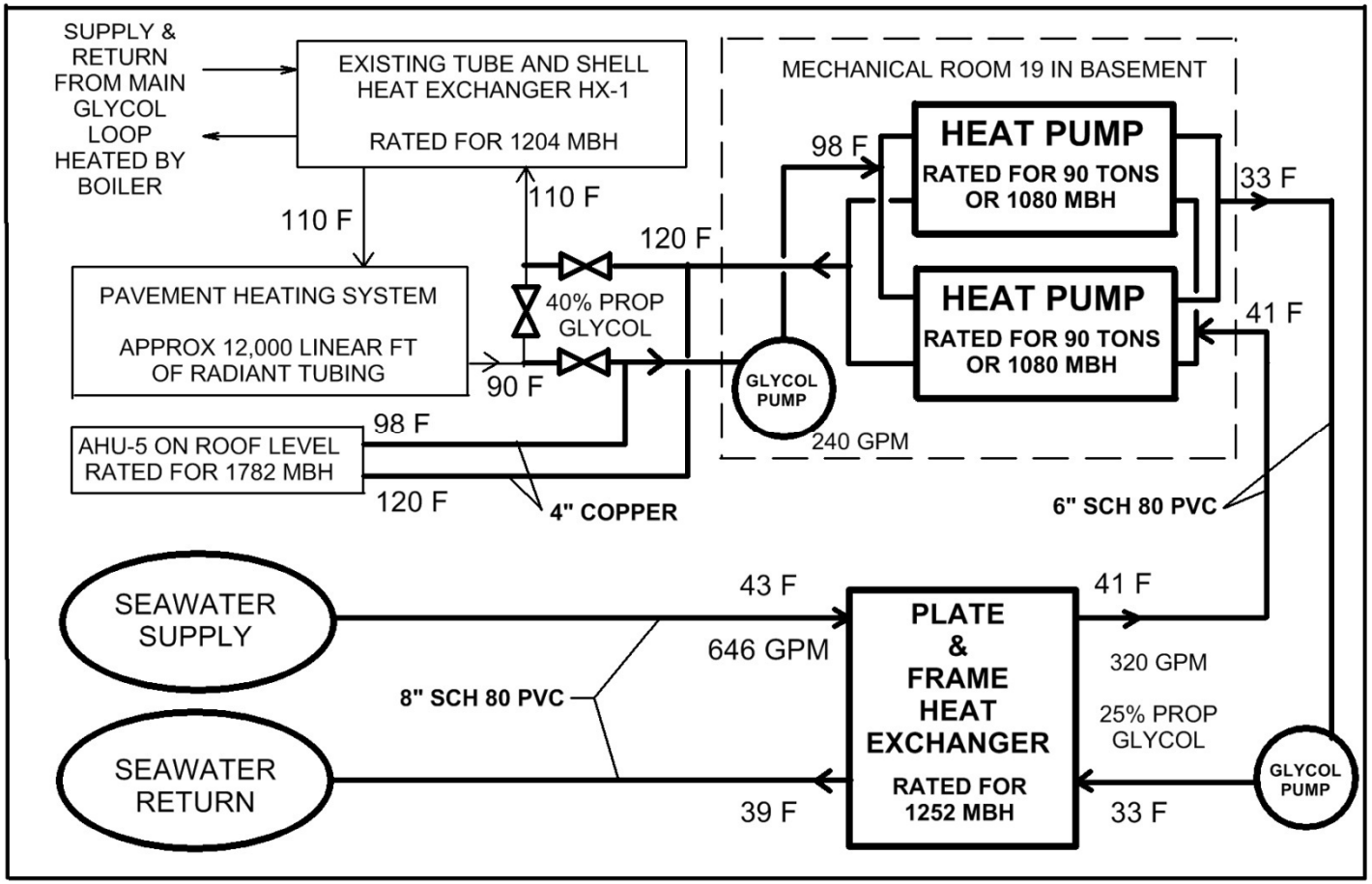


Technology Overview



- **Emerging technology with more efficiency & lower maintenance**
- **Single packaged unit can now perform complex heat pump functions with high reliability and serviceability**
- **Can be operated and supported with automated controls and web based monitoring**

Technology Overview



Two 90 Ton Heat Pumps Will Be Used To Supply Air Handlers & Domestic Hot Water Loads

Technology Overview

Month	Entering Evaporator deg F	Heating MBH	kW	COP
Jan	41.2	955.9	81.94	3.42
Feb	39.3	921.4	81	3.33
March	38.2	901.4	80.46	3.28
April	37.8	894.2	80.26	3.26
May	38.1	899.6	80.41	3.28
June	39	915.9	80.85	3.32
July	39.6	926.8	81.15	3.35
August	40.3	939.5	81.49	3.38
September	43.7	1001.6	83.17	3.53
October	45.8	1040.3	84.21	3.62
November	45.6	1036.8	84.11	3.61
December	43.3	994.2	82.97	3.51
Worst	35	843.7	78.89	3.13

Project Financial Evaluation

CAPITAL COST:	**$ 713,300**
ANNUAL COST FOR GLYCOL PUMPING:	**$ 9,149**
ANNUAL COST FOR HEAT PUMP ELECTRICITY:	**$ 61,300**
ANNUAL COST FOR O&M:	**$ 2,500**
ANNUAL VALUE OF HEATING OIL SAVED:	**$ 140,672**
NET PRESENT WORTH WITH 20 YR LIFE CYCLE:	**$ 850,242**
YEARS TO PAYBACK INVESTMENT:	**10.5 YEARS**
ANNUAL CO2 PRODUCTION AVOIDED:	**1.3 million LBS CO2**

- **Electricity cost = start at $0.10/kwh with 4% per year escalation**
- **Heating oil cost = start at $2.44 /gallon with 6% per year escalation**

Alaska Application

- **Opportunities for use in Alaska:**

  Coastal communities with warm sea water (ice free) and low cost hydro electricity = heating of large buildings + district heating

- **Challenges:**

  Constructing and maintaining sea water intakes, making use of low temperature heat in existing buildings (120F-130F).

- **Potential Benefits:**

  Significant cost savings for heating against both heating oil and straight electric heat; large reductions in carbon emmissions compared to equivalent heating oil burn; reduction of demand load on local utility grid (to one third) compared to straight electric resistance heating systems

Project Tasks & Timeline

- Final Design was completed by YourCleanEnergy on November 30, 2010

- Equipment procurement - Dec 2010 thru Feb 2011
- Equipment delivery - March & April 2011
- Equipment installation - March & April 2011
- Commissioning/start up - early May 2011

- Interactive display for visitors to be installed in summer 2011, will provide real time data of system

Project Status

- Project status – currently on schedule, now depending on success of delivery and installation contractors
- Alaska SeaLife Center is currently seeking additional funding to improve the base sea water heat pump system:
  - install heat recovery system that uses waste heat from exhaust fans to pre-heat glycol before entering heat pumps; will increase COP, and the investment will payback in less than 3 years
  - connect the pavement heating system to heat pump system so that further reductions in oil usage will occur in shoulder seasons
- Strong interest expressed in sea water heat pumps by two other construction projects now planned for Seward:
  - new Kenai Fjords National Park Visitor Center
  - new Public Library for City of Seward

Sea Water Heat Pump Project

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Your Questions About This Project ???

Thank you for coming today and please visit the Alaska SeaLife Center this summer of 2011