Presentation To Denali Commission

2009 Emerging Technology Grant

Second Round Application

SEAWATER HEAT PUMP DEMONSTRATION PROJECT

SEPTEMBER 28, 2009

Presenter: Dr. Ian Dutton, President & CEO

Alaska SeaLife Center, Seward, Alaska

What does the Alaska SeaLife Center Mean to Seward and the State of Alaska?

- $4.77 million in annual payroll + multiplier effect ($12 million activity generated)
- 93 year round employees + multiplier effect (up 30 additional jobs)
- Largest private employer in Seward. 11th Largest on the Kenai Peninsula.
- Year round tourism draw card for South Central Alaska. 160,000 visitors (70% first timers)
- Approximately 50,000 of our visitors are Alaskans
- Largest marine non-profit organization in Alaska – unparalleled science capacity
- A vital force in State and national marine science, produced more than 170 significant research papers 1999-2009
- Major marine educator in Alaska. More than 8000 school children in Alaska taught in 2008 and more than 230 distance education classes delivered in 2009.
- The only marine research and public aquarium facility above the 60N <u>in the world!</u>

USING SEAWATER TO HEAT BUILDINGS

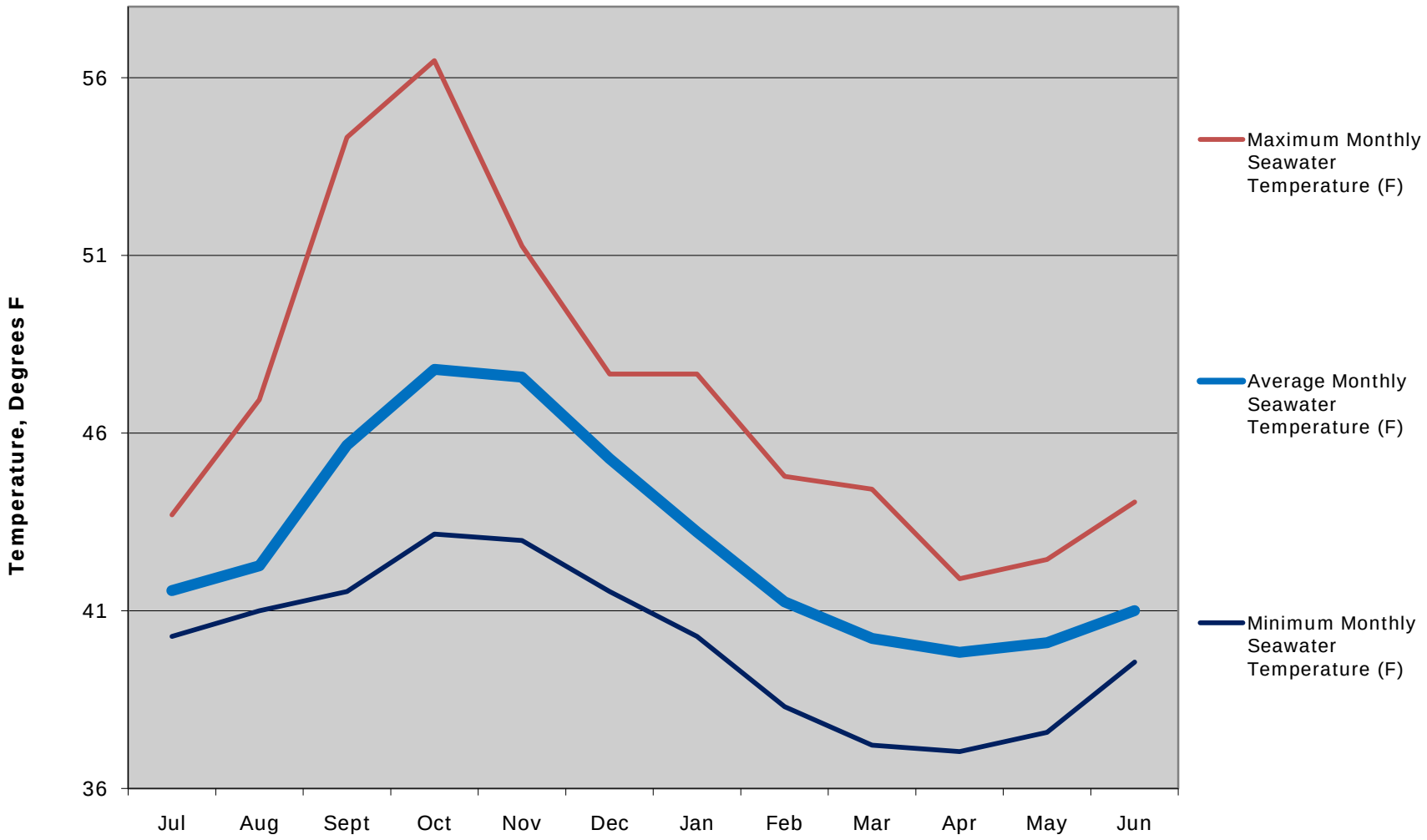
AN EMERGING TECHNOLOGY IN ALASKA

- **Resurrection Bay stores large amounts of solar energy from summer months, this heat is available for buildings in Seward during winter months.**

- **Recent advancements in technology now allow seawater heat to be captured cost effectively.**

- **Using an innovative heat transfer process and the emerging technology of high efficiency heat pumps, a demonstration project at the SeaLife Center can transfer this emerging technology to other coastal communities in Alaska.**

ASLC Raw Seawater Temperatures for 2003-2008



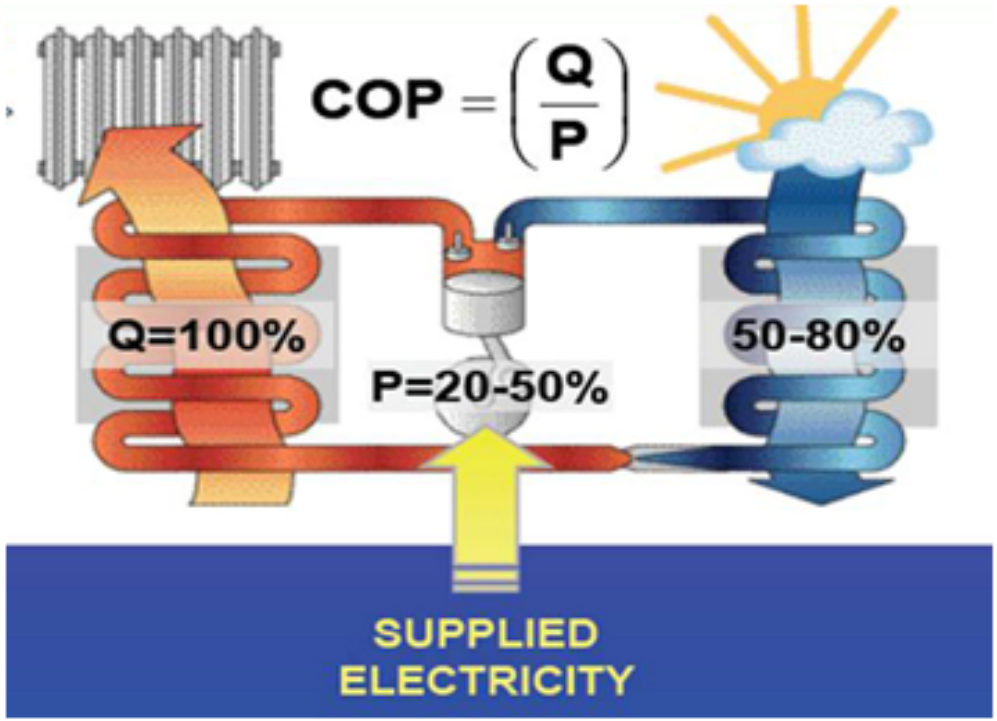
The Seawater Heat Pump

Emerging Technology That Moves Thermal Energy

Heating

- Space Heating
- Hot Water
- Ventilation Air

90 F to 120 F



Source

Alaska Seawater With Temps Ranging From 37 F to 52 F

Q = Quantity of heat produced by heat pump

P = Electrical power used by heat pump

COP (Coefficient of performance) of 3.1 – 3.4 expected from ASLC seawater heat pump

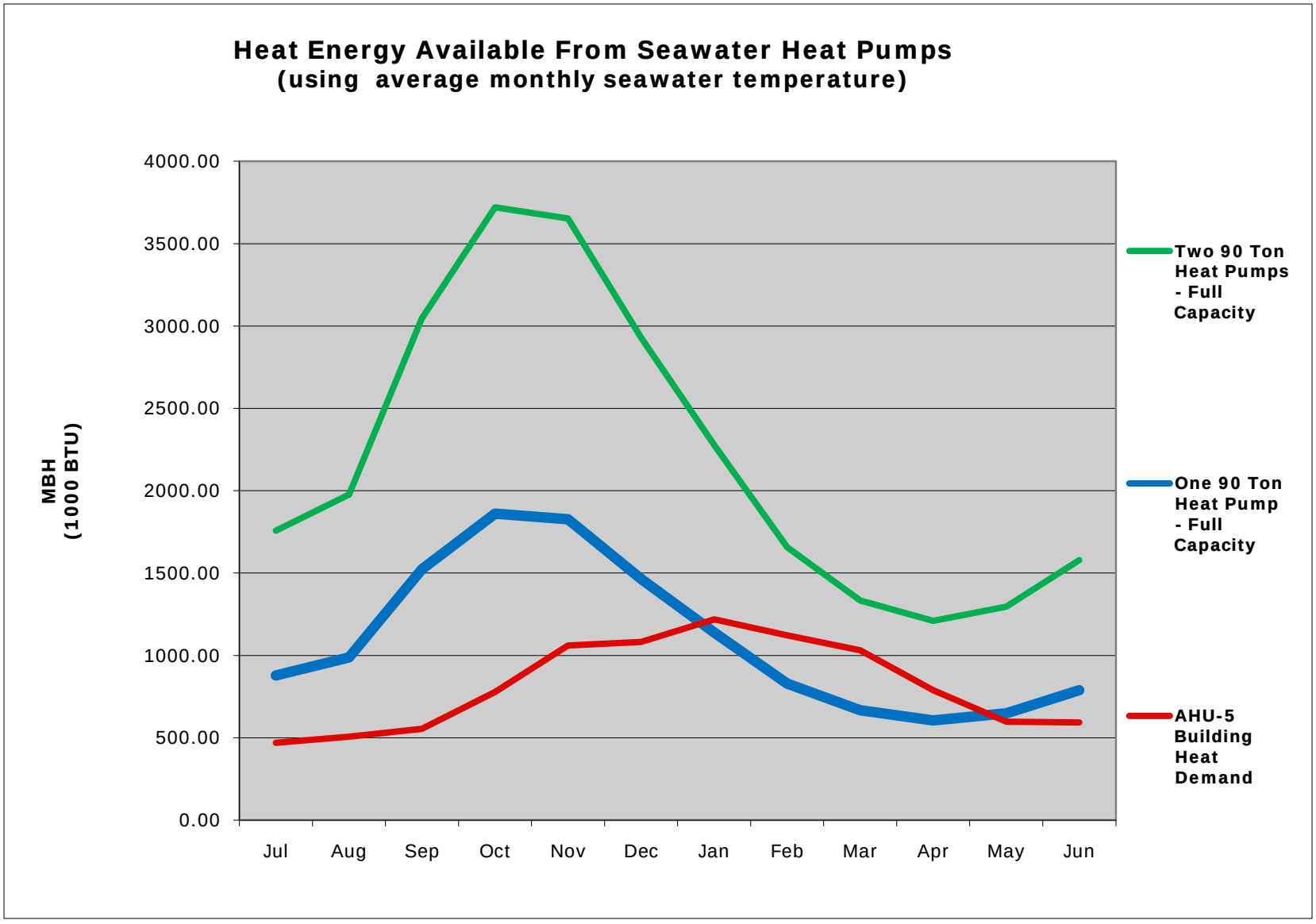
The concept of using heat from seawater for building demands has been employed for nearly 20 years in northern Europe:

- Stockholm, Sweden = Vartan Ropsten = largest seawater heat pumps on the planet

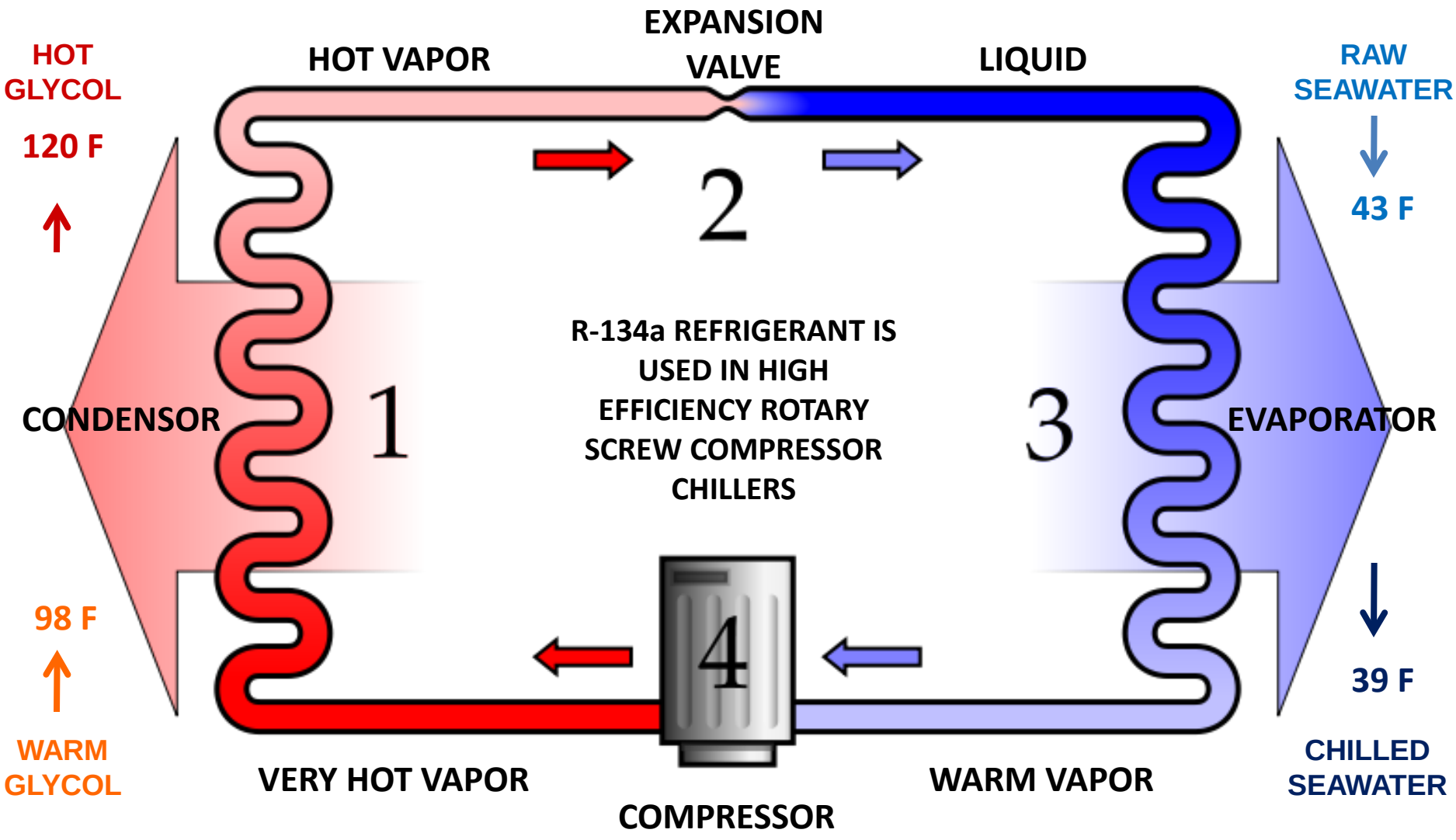
- Bodo Norway, pop 41,000, district heating w/44.6F seawater – on military base

- STATOIL Research Centre, Trondheim, Norway, district heating with seawater

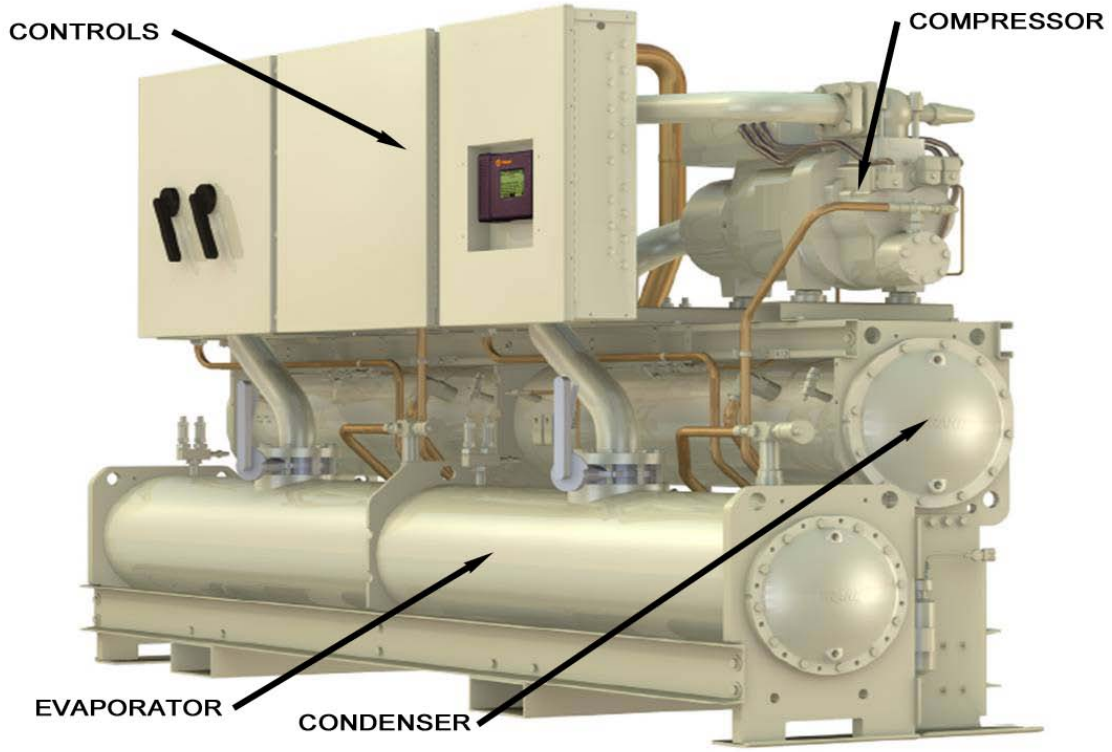
ASLC'S CONTRIBUTION INCLUDES SEAWATER INTAKE/PUMPING SYSTEM


Heat Energy Available From Seawater Heat Pumps
(using average monthly seawater temperature)
MBH
(1000 BTU)
4000.00
3500.00
3000.00
2500.00
2000.00
1500.00
1000.00
500.00
0.00
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Two 90 Ton Heat Pumps - Full Capacity
One 90 Ton Heat Pump - Full Capacity
AHU-5 Building Heat Demand

HOW A HEAT PUMP WORKS TO REMOVE HEAT FROM SEAWATER



HIGH EFFICIENCY ROTARY SCREW HEAT PUMP



- 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

Trane RTWD 90 Ton Heat Pump Simulation - COP Range

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

SUMMARY OF PARTNERSHIPS WITH STRONG SUPPORT

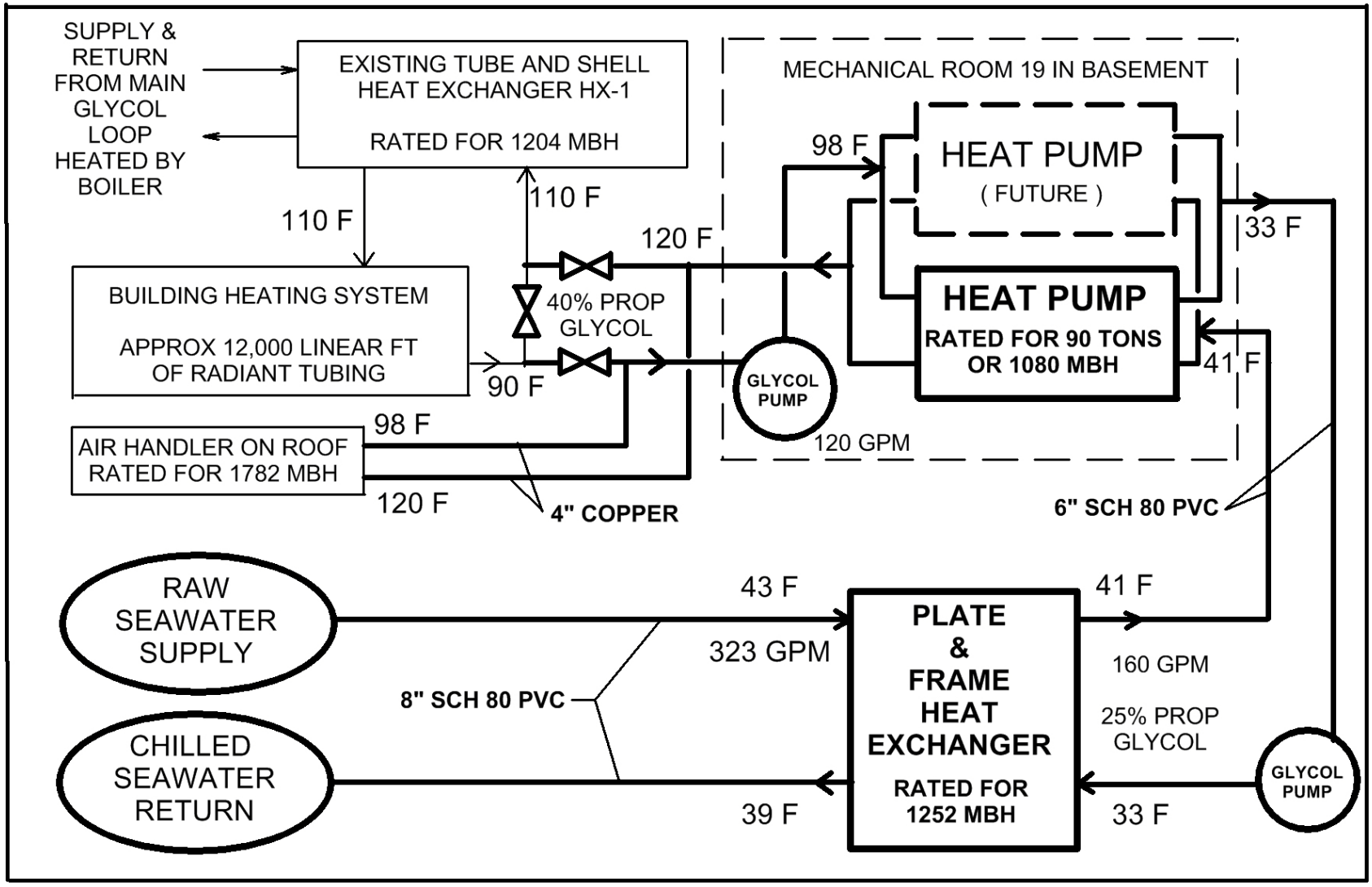
City Of Seward – looking to reduce future cost of heating for downtown district

Kenai Fjords National Park – looking to reduce cost of heating for future visitor center & administration building

Alutiiq Pride Shellfish Hatchery – looking at opportunity to use seawater heat pump technology in production of larvae and algae cultures needed for shellfish production

UAF School Of Fisheries & Ocean Sciences - Seward Marine Center – looking at opportunity to convert its heating system using seawater heat pump technology

ALTERNATIVE B: ONE HEAT PUMP TO SUPPLEMENT BUILDING HEAT DEMAND



ALTERNATIVE B: ONE HEAT PUMP IN MECHANICAL ROOM 19 OF BASEMENT FOR BUILDING HEAT

CAPITAL COST:	**$ 426,720**
ANNUAL COST FOR GLYCOL PUMPING:	**$ 6,535**
ANNUAL COST FOR HEAT PUMP ELECTRICITY:	**$ 27,864**
ANNUAL COST FOR O&M:	**$ 1,200**
ANNUAL VALUE OF HEATING OIL SAVED:	**$ 63,942**
NET PRESENT WORTH WITH 20 YR LIFE CYCLE:	**$ 427,242**
YEARS TO PAYBACK INVESTMENT:	**11.7 YEARS**
ANNUAL CO2 PRODUCTION AVOIDED:	**587,006 LBS**