

**AMERICAN WATER RESOURCES ASSOCIATION
(AWRA) MEETING - ALASKA SECTION
SEPTEMBER 17, 2019**



Can anyone name something that has a reverse impact to ocean warming, ocean acidification, or sea level rise?

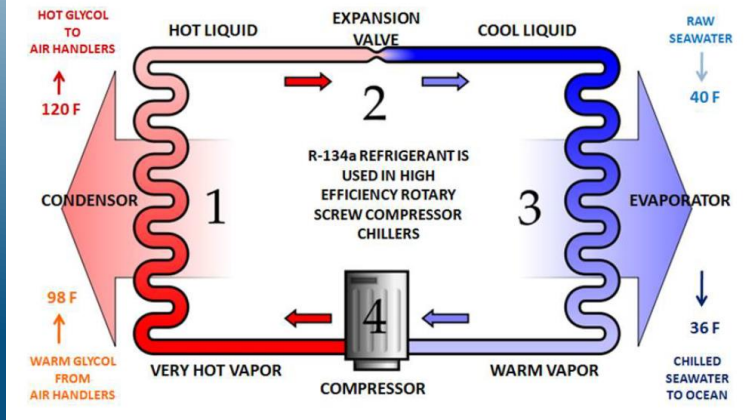


Heating Buildings with Warmed Seawater

1. The First Seawater Heat Pump District Heating in America – Juneau, Alaska

Well, one reverse impact is using long-standing heat pump technology to extract heat from the warming ocean for the purpose of heating or cooling buildings. This is a mini-scale ocean cooling, and if deployed in more coastal communities around the world, we can make a dent in cooling the ocean!

Inside the Heat Pump - Flow Diagram



Juneau Waters are 38° to 54° F year round.

Heat pump is the only heating/cooling system that transfers heat from one place to another given small electric energy input to run the compressor. All other heating systems--oil, natural gas, biomass, and even electric resistance heating--convert one form energy into thermal energy—heat. Hence heat pump is the most efficient method of heating.

HEAT PUMPS ARE SUPER 300% EFFICIENT = EFFECTIVE LOWER COST HEAT AND ZERO EMISSIONS

Type	Heat Demand (kWh)	Heat Output	Efficiency (%)	Input Energy (kWh)	Specific CO ₂ emissions (kg CO ₂ /kWh)	Annual CO ₂ emissions (kg)
Oil-Fired boiler		15,000	80	18,750	0.274	5,138
Natural Gas fired boiler		15,000	95	15,790	0.202	3,189
Electric boiler (renewable source)		15,000	95	15,970	0	0
Electric Heat Pump (renewable source)		15,000	300	5,000	0	0

Source Heat Pump Centre, Borås, Sweden



Hydropower + Seawater Heat Pumps
= "Value Added Renewable Energy"

In the case of seawater heat pump, it is rated at 300% efficiency: each kWh electricity we put, we get 3 kWh equivalent heat energy. And another huge benefit is that heat pumps produce no emission while using electric energy super efficiently.

Current Status: Diesel Heating
Fuel-

**High Carbon & \$\$\$
Expensive**



Future Status: Hydropower based
Seawater Heat Pump District
Heating-

Zero Carbon & Lower Cost



**JUNEAU DISTRICT HEATING = LOWER
COST HEATING**



This is a zero emission heating because the plant will be powered by electricity from the new Sweetheart Lake hydroelectric facility (permitted and under construction).

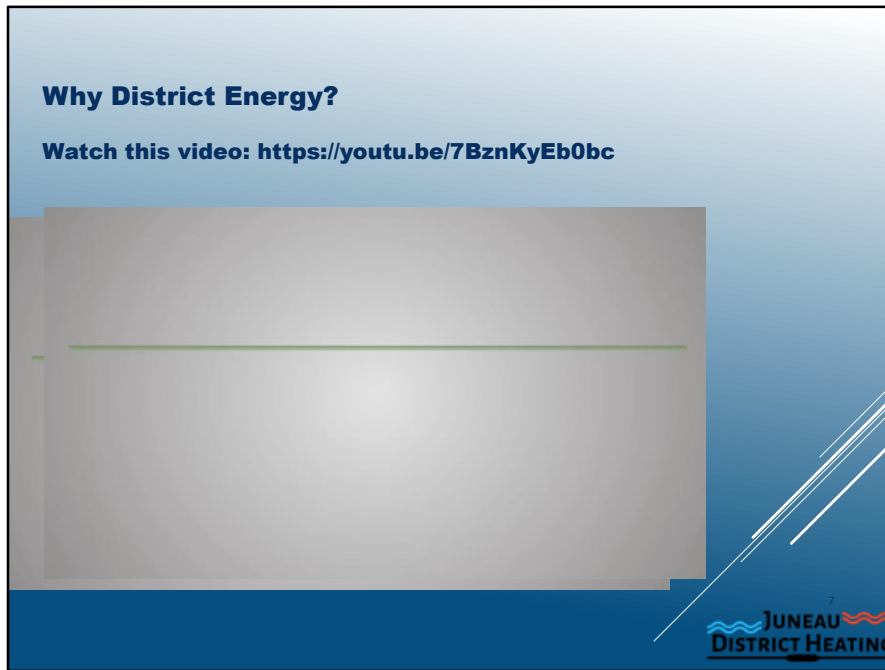


In addition, it prevents environmental contaminations from oil spill and mitigates fire hazards.

It was very challenging to put a legend without blocking contamination sites. Just so you know, this legend is blocking two contamination sites by Juneau-Douglas bridge.

Why District Energy?

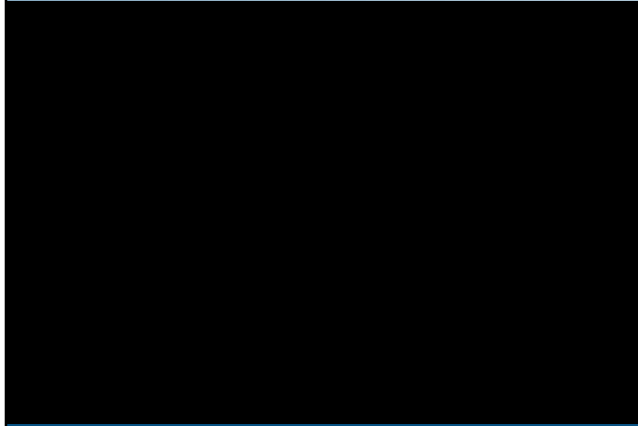
Watch this video: <https://youtu.be/7BznKyEb0bc>



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City and Borough of Juneau (CBJ) is a member of ICLEI - International Council for Local Environmental Initiatives which is an international organization for local governments and sustainability.

Watch this video to learn the plans and benefits of
Juneau District Heating: [https://youtu.be/-
GWuVXLxMJM](https://youtu.be/-GWuVXLxMJM)



<https://youtu.be/-GWuVXLxMJM>

WHY IS DISTRICT HEATING IDEAL FOR JUNEAU?

- ▶ District Heating is a component of “**local**” community planning for over a decade:
Comprehensive Plan, Climate Action Plan, Willoughby Plan, Sealaska/Federal study, etc.
- ▶ **High urban heat load density**
- ▶ **High space heating costs based on fossil fuels**
- ▶ **Lower operation and maintenance costs for building owners**
- ▶ **Low conversion costs-redundancy of existing heating systems**
- ▶ **Available Local Renewable Energy Resources**
- ▶ **Sustainable**

TEAM EFFORT-CBJ, JEDC, Emerson Juneau Hydropower, Ever-Green,
Denmark-District Energy Alliance

Downtown Juneau, Alaska is well-suited for District Heating



Low conversion cost because it doesn't require a new heat distribution system. Hot water from the distribution pipes will NOT enter the buildings, rather only the heat from the water will be transferred via a heat transfer station and will be distributed in the buildings with existing hydronic systems.



14 MW, 90°C, District heating
3 x 2 stage 4.6 MW Systems



DRAMMEN
FJERNVARME

COP_{heating} = 3.0

Evaporating temp. 2°C	Condensing temp. 89°C
Sea water 8 to 4°C	District heating water 60 – 90°C

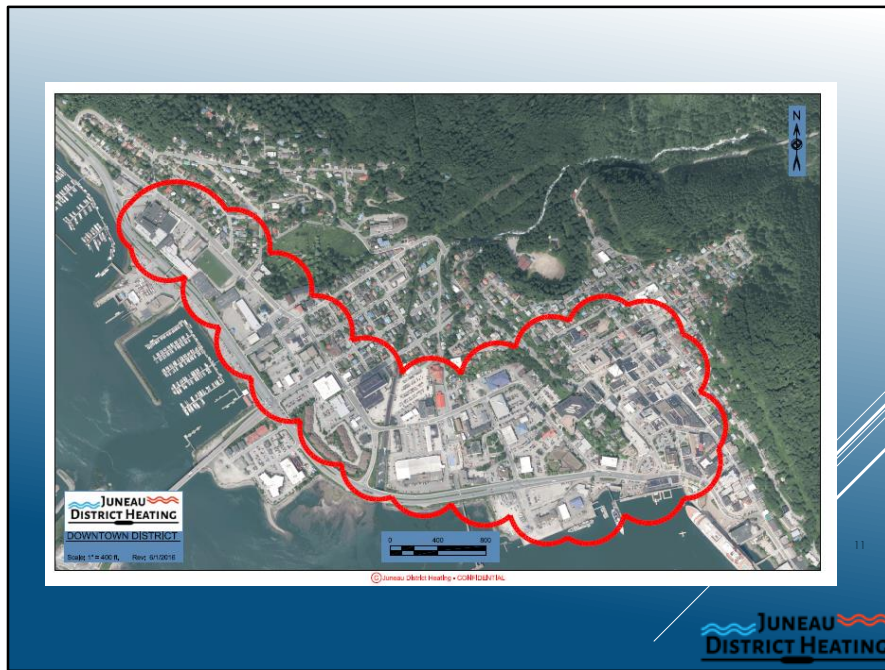


TRIED AND PROVEN SEA WATER HEAT PUMP DISTRICT HEATING SYSTEM

Operating flawlessly since 2011

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Drammen, Norway is at higher latitude than Juneau with three times more population. We are working with people and companies who worked on Drammen project, so we have their lessons learned.



Initial Phase Project Area



JUNEAU DISTRICT HEATING INTAKE

12

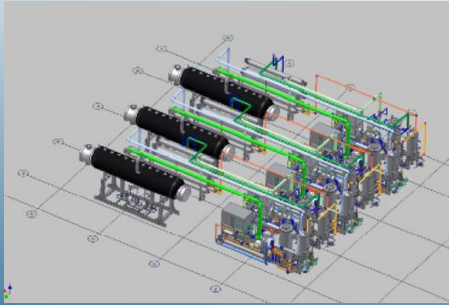







The plant is designed with wide big glass walls so that the tourists can see how we heat our buildings.

Heat Pump Units




Typical Energy Transfer Station


Large building/ Large Hotel



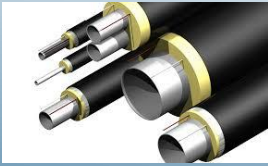

12 Unit apartment building




Single Family Home



District heating rigid and flex pipe

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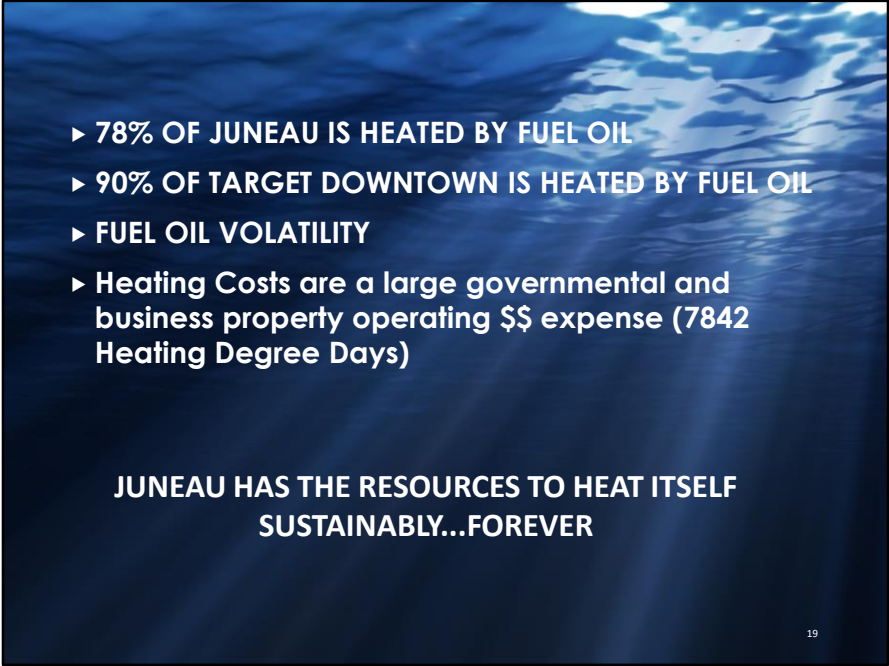
Energy Transfer Stations extract heat from the district energy system to the building heating system.



Pipes in Drammen, Norway. Stakeholders of Juneau District Heating, including project leaders, local assembly members, and investors visited Drammen, Norway and took these pictures.



What happens if there is a leak in the pipes? Just water

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- ▶ 78% OF JUNEAU IS HEATED BY FUEL OIL
 - ▶ 90% OF TARGET DOWNTOWN IS HEATED BY FUEL OIL
 - ▶ FUEL OIL VOLATILITY
 - ▶ Heating Costs are a large governmental and business property operating \$\$ expense (7842 Heating Degree Days)

**JUNEAU HAS THE RESOURCES TO HEAT ITSELF
SUSTAINABLY...FOREVER**

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- ▶ Juneau District Heating Facility property secured on Egan Drive
- ▶ Received ADEC approval for pipe distribution system
- ▶ Working with CBJ Engineering, Lands and Community Development for easements and right of ways
- ▶ CBJ Ordinance introduced to establish Juneau District Heating as a CBJ franchised Utility.
- ▶ Feasibility, Pre-construction Engineering, and initial financing complete
- ▶ Working Relationship with Emerson, US DOE, Royal Danish Government.

JUNEAU DISTRICT HEATING UPDATE



CLEAN, SUSTAINABLE, SMART

- ▶ Harvest passive solar heat from Gastineau Channel (Juneau)
- ▶ Convert Seawater Heat to produce 3 units of heat energy for every 1 unit of electrical energy input
- ▶ Circulate heat energy (180°F to 190°F) to heating district via pipe distribution network

Juneau, Alaska is already a leader in Heat Pump Technology

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Juneau is a community that is successfully utilizing ground source heat pumps for some of our schools and airport
NOAA Ted Stevens Marine Research Facility Complex successfully uses a low temperature seawater heat pump heating system.



COMMUNITY VALUES, GLOBAL VALUE PROPOSITION

 JUNE²³
DISTRICT HEATING

This is our way of Thinking Globally and Acting Locally!

Thank you!

If you have any questions, please contact the managing director, Duff Mitchell at (907) 723-2481 and Duff.Mitchell@juneauhydro.com
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