

Skagway Public Safety Building

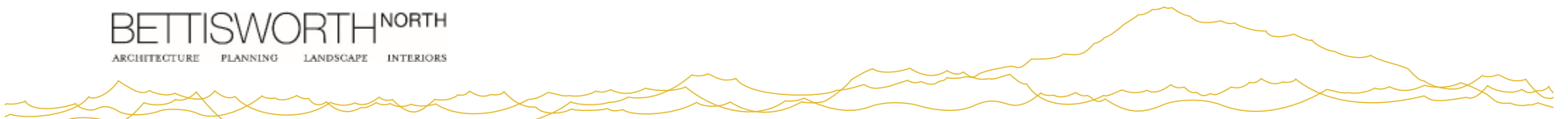
Dena Strait

Energy Programs Manager

Bettisworth North Architects and Planners

March 29, 2017

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Who is Bettisworth North



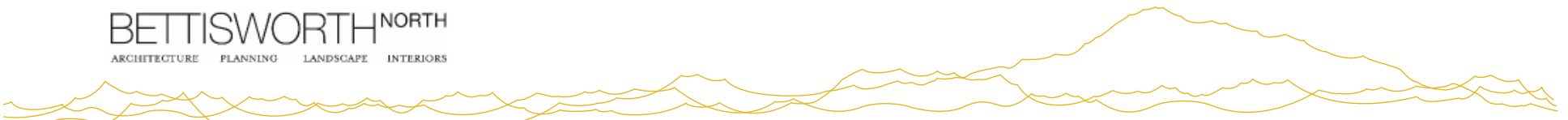
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Existing Buildings



Basic Stats

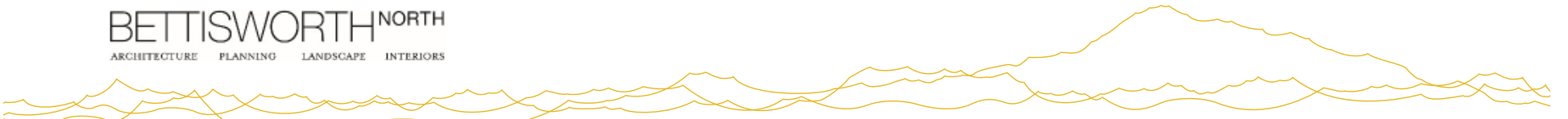
- Police Department with holding cells
- Emergency Dispatch
- Administration of both police and fire dept.
- Fire Department, includes sleeping/living
- Animal Control
- 28,730sf
- General Contract/Construction Manager
Delivery Method



Rendering/Design Process

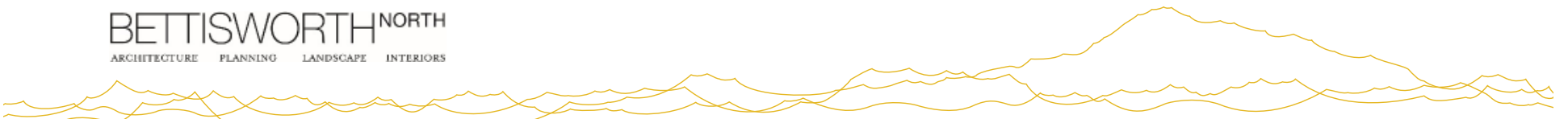


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Original Energy Use Analysis

- Eliminated electric boilers
- Eliminated Ground Source Heat pump
- Incorporated Lighting upgrade and controls
- Air Source Heat Pump needed further analysis



Energy Rates

Diesel [Details](#)

Retail \$4.16 per gallon – No. 1, AHFC/DCRA Aug 2014 [History](#)
\$4.06 per gallon – No. 2, AHFC/DCRA Aug 2014

Power Sector \$3.85 per gallon – PCE Jun 2013

Electricity

Utility

Utility Alaska Power & Telephone Company

PCE status PCE Eligible Active

Service area Covenant Life, Haines, Skagway

Note: The data in the Electricity section are for the entire state of Alaska.

Rates [Details](#)

Residential Rate \$0.26 per kWh, Jun 2013

PCE Rate \$0.08 per kWh, Jun 2013

Effective Rate \$0.18 per kWh, Jun 2013

AHFC/DCRA Survey: No. 1 Fuel Oil

Year	Month	Price
2014	Aug	4.16
2014	Jan	4.25
2013	Aug	4.16
2013	Jan	4.48
2012	Jul	4.23
2012	Jan	4.45
2011	Dec	4.35
2011	Aug	4.35
2011	Jun	3.96
2011	Feb	3.96
2010	Sep	3.96
2010	Jun	3.19
2010	Mar	3.19
2009	Sep	2.96
2009	Jul	2.96
2008	Dec	4.60
2008	Jun	4.60
2008	Jan	3.50
2006	Dec	3.08
2005	Dec	2.81

- \$0.23/kWh
- \$4.30/gallon
- Electrical Escalation rate – 1.8%
- Fuel Escalation – 2.7%

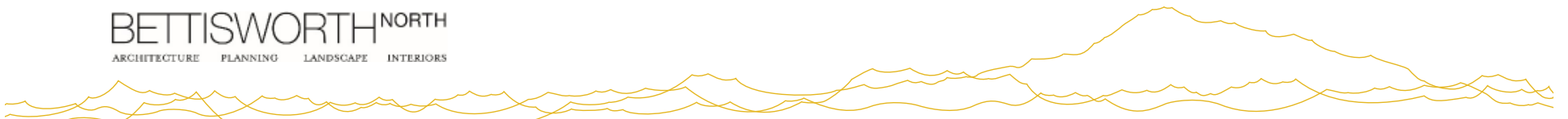
ASHP/Financial Analysis

- Completed in August of 2015
- Fuel prices falling
- Modeled the building in Equest
- HZA Engineers were Engineers of Record and energy modelers



ECMs

- ECM-A1 – Increased wall insulation (R-19 batt with 1.5” IMP to R-19 with 4” IMP or R-32)
- ECM-A2 – Improved Glazing
- ECM-A3 – Increased roof insulation (R-20 to R-50)
- ECM-M1 – Heat Recovery
- ECM-M2 – ASHP - 2.17 COP



Analysis Results

TABLE 9 YEARLY ENERGY AND COST SAVINGS PER ECM

Architectural											
ECM	Description	Annual Elect Use kWh	Annual Peak Demand kW	Annual Fuel Oil Mbtu	Annual Total kBtuh	Annual Electric Cost (\$)	Annual Fuel Oil Cost (\$)	Annual Total Cost (\$)	Annual Total Savings (\$)	% Energy Savings	% \$ Savings
0	Base Design	127,033	34	2,661	3,094,364	\$28,803	\$82,491	\$111,294			
A1	0+Increase Wall Insulation	126,821	34	2,589	3,021,940	\$28,757	\$80,268	\$109,025	\$2,269	2%	2%
A2	0+Improved Glazing U-0.36	126,979	34	2,617	3,050,479	\$28,795	\$81,136	\$109,931	\$1,363	1%	1%
A3	0+Increase Roof Insulation	126,809	33	2,553	2,985,899	\$28,752	\$79,152	\$107,904	\$3,390	4%	3%

Mechanical											
ECM	Description	Annual Elect Use kWh	Annual Peak Demand kW	Annual Fuel Oil Mbtu	Annual Total kBtuh	Annual Electric Cost (\$)	Annual Fuel Oil Cost (\$)	Annual Total Cost (\$)	Annual Total Savings (\$)	% Energy Savings	% \$ Savings
1	Base+Arch	126,557	33	2,434	2,865,639	\$28,710	\$75,450	\$104,159			
M1	1+Heat Recovery	130,818	34	1,631	2,077,482	\$29,607	\$50,564	\$80,171	\$23,988	28%	23%
M2	1+Heat Pump	453,241	99	412	1,959,312	\$92,407	\$12,785	\$105,192	(\$1,033)	32%	-1%



BTU Costs

Comparison of BTU Purchased as Electricity and as Fuel

Electrical: 3,413 BTU/kWh

$$1,000,000\text{BTU}/3,413 \text{ BTU/kWh} = 293 \text{ kWh/MBtu}$$

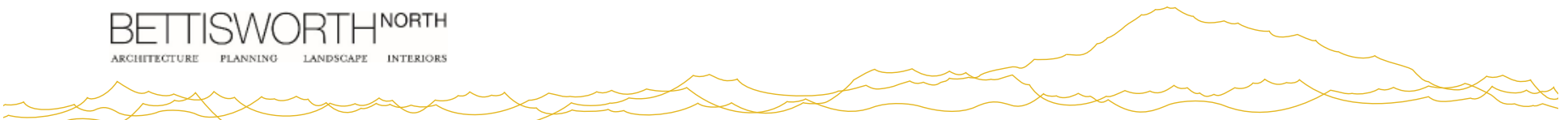
MBtu = million BTUs

$$293 \text{ kWh/MBtu} * \$0.23/\text{kWh} = \mathbf{\$67.39/\text{MBtu}}$$

Fuel Oil: 138,875BTU/Gallon

$$1,000,000\text{BTU}/138,875\text{Btu/Gallon} = 7.2 \text{ gallon/MBTU}$$

$$7.2\text{Gallon/MBTU} * \$4.30/\text{gallon} = \mathbf{\$30.96/\text{MBtu}}$$



Analysis Results

TABLE 1 LIFE CYCLE COST SUMMARY

Architectural

ECM	Description	Investment Cost (\$)	LCC (\$)	LCC Savings (\$)	LCC Savings %
	Base Design	\$ -	\$ 2,678,986		
A1	Increase Wall Insulation	\$ 63,557	\$ 2,591,558	\$ 87,428	3%
A2	Improved Glazing	\$ 22,872	\$ 2,572,604	\$ 106,382	4%
A3	Increase Roof Insulation	\$ 79,106	\$ 2,580,097	\$ 98,889	4%

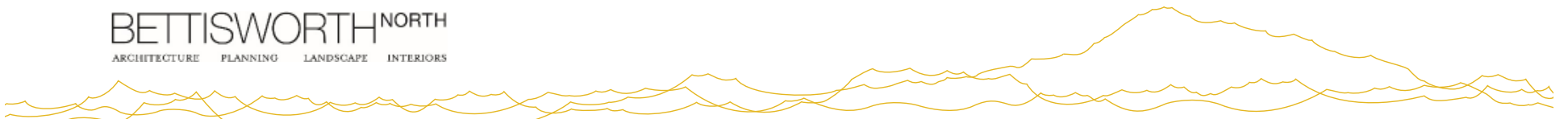
Mechanical

ECM	Description	Investment Cost (\$)	LCC (\$)	LCC Savings (\$)	LCC Savings %
	Base Design + Arch Measures	\$ -	\$ 2,507,524		
M1	Heat Recovery	\$ 28,787	\$ 1,956,447	\$ 551,077	22%
M2	Heat Pump	\$ 136,973	\$ 2,556,333	\$ (48,809)	-2%



ASHP challenges

- Redundant system
- Only works above 20 degrees
- ASHP has COP of 2.17
- Electrical BTUs are 2.17 more expensive than fuel BTUs
- Simplistic view is efficiency gain of ASHP is wiped out in cost difference
- Many other variables



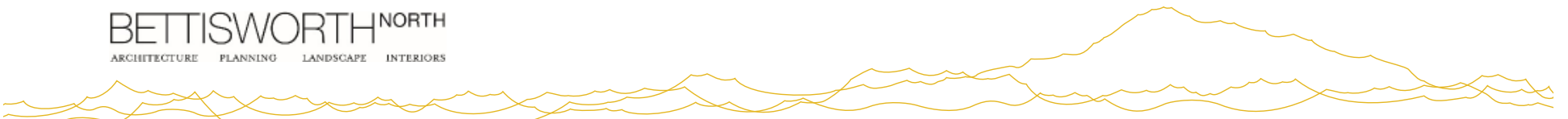
Energy Use Index

Name of Facility	Ave. Gal. Per Year	Ave. Fuel Oil kBTUs Per Year at 138.875 kTBU/Gal.	Ave. kWh Per Year	Ave. Electrical kBTUs Per Year at 3.413 BTU/kWh	Total kBTU Per Year	Building Square Footage	Energy Use Index (kBTU/SF)
Existing Police Station	545	75,663	52,847	180,366	256,028	1,440sf	178
Existing Fire Station	4,088	567,718	50,467	172,245	739,963	6,780sf	109
Baseline Public Safety Building	19,160	2,660,801	127,033	433,563	3,094,364	29,112sf	106
Proposed Public Safety Building	11,759	1,631,000	130,818	446,481	2,077,482	29,112sf	71



Future Renewables

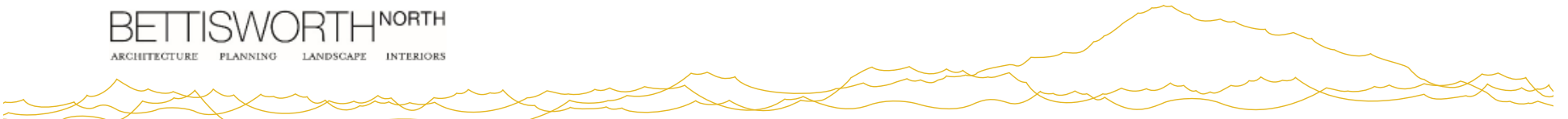
- Used low temp hydronic system for in-floor heat and baseboard
- Left room in mechanical room and planned roof install
- Invested in envelope



Construction



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Completed Building



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Questions/Contact

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