Case Study: Yakutat Energy Efficiency Upgrade

2013 Village Energy Efficiency Program (VEEP)

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Buildings Selected

Elementary School

Courthouse

High School

City Offices

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Unique Aspects

- 2 schools, wood shop, PSO building, power plant and adjacent residence all use recovered heat (RH) from power plant
- 20-30 year old heat recovery system
- No heat plant backup in schools, wood shop or PSO building
- Insufficient heat for coldest days
- High School at end of RH loop
- Severe design deficiencies
  - No isolation heat exchangers in PSO (forced air and sub-floor) or wood shop (AHU and fintube)
  - Reversed piping to PSO
- 2 decades of deferred maintenance in schools

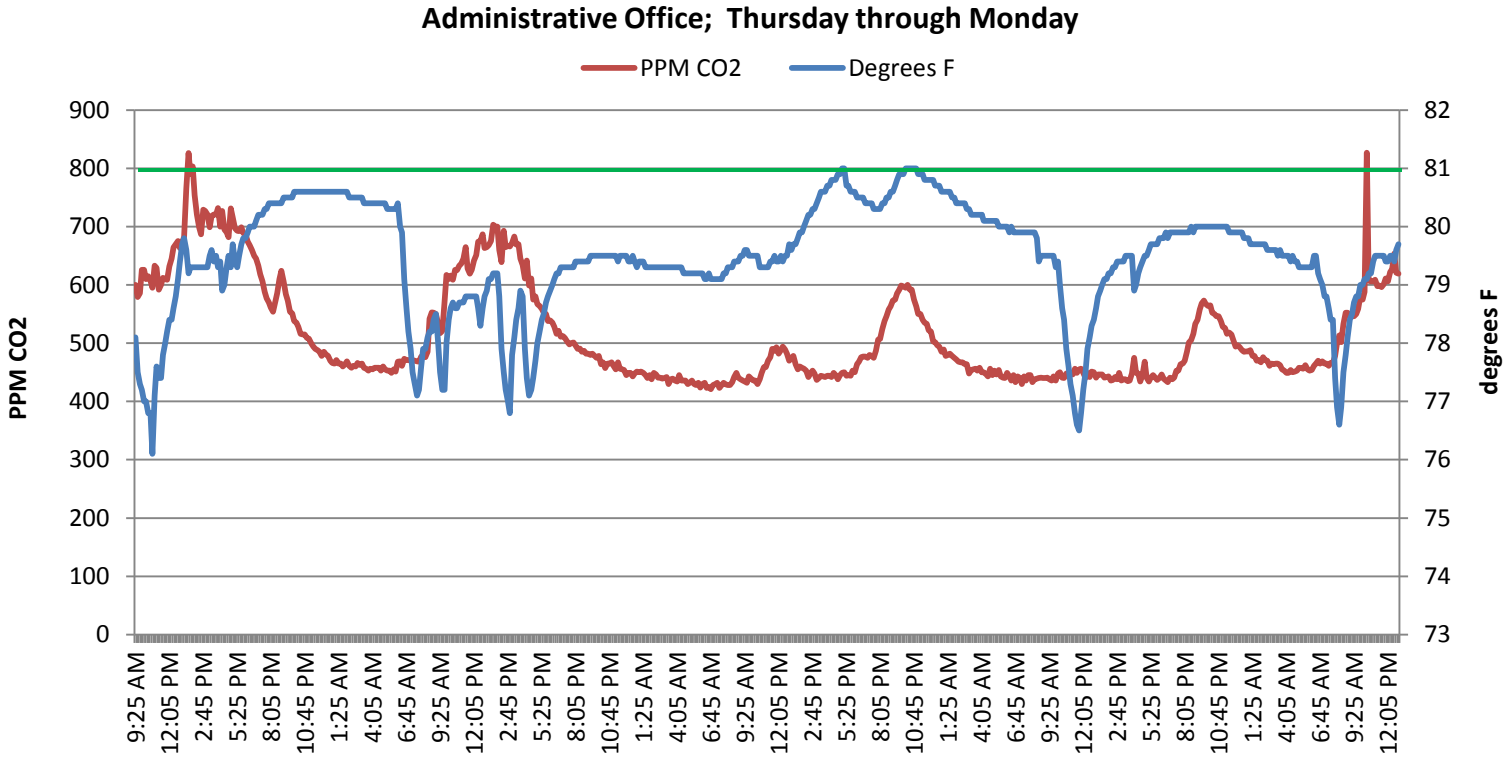
Existing Conditions

Deferred Maintenance

High School

- was pneumatic; now no controls, no pneumatics
- 1 AHU running backwards
- OSA dampers locked closed
- Relief dampers non-functional
- Local ball valves used to control zone temperatures
- On/off to control ventilation

High School CO2 & Temperatures



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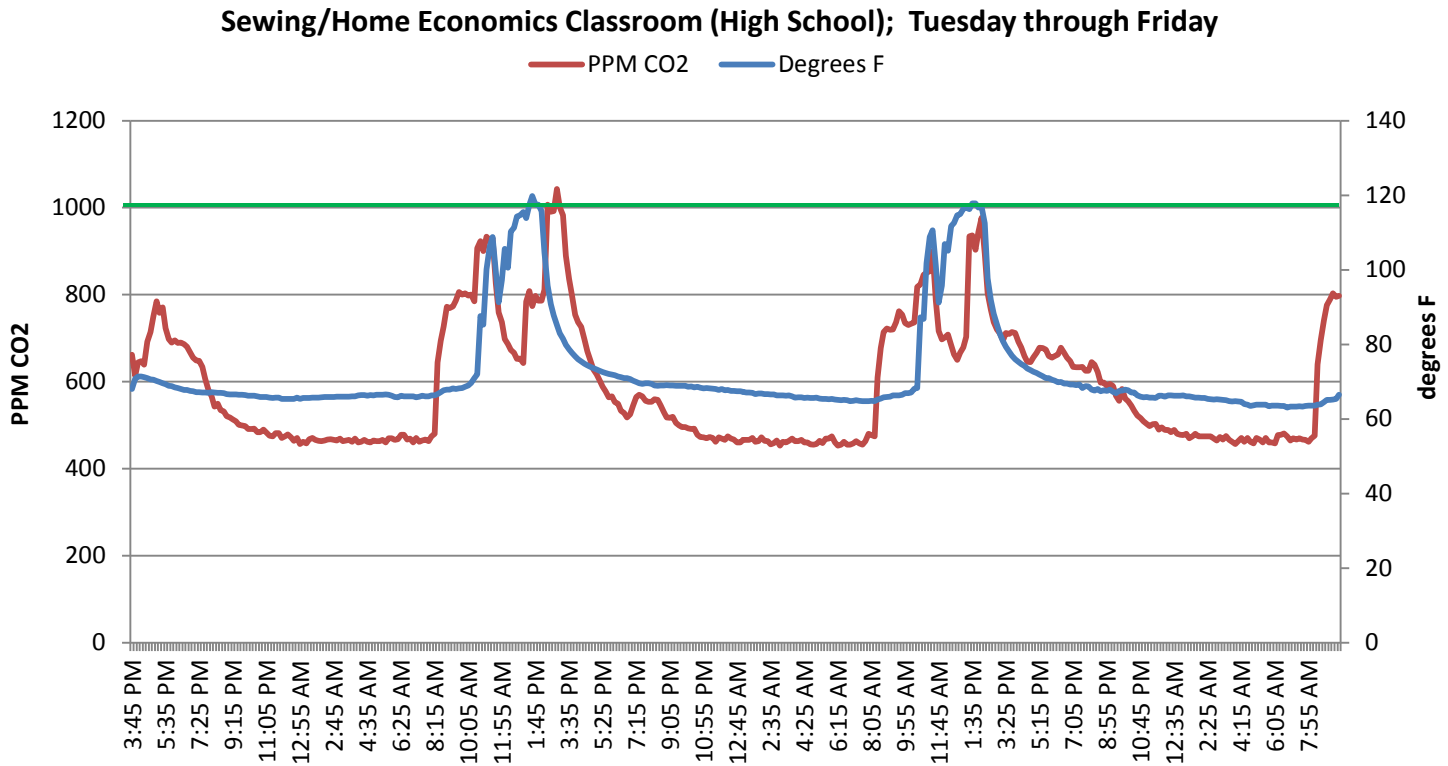
High School CO2 & Temperatures



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Deferred Maintenance

Elementary School

- Pneumatic, no controls, severe overheating
- Logged 8 hrs/day pneumatic compressor
- All AHU's running backwards (phase problem)
- Kitchen MAU disabled
- DHW running into cold water, back-feeding lav's & WC's

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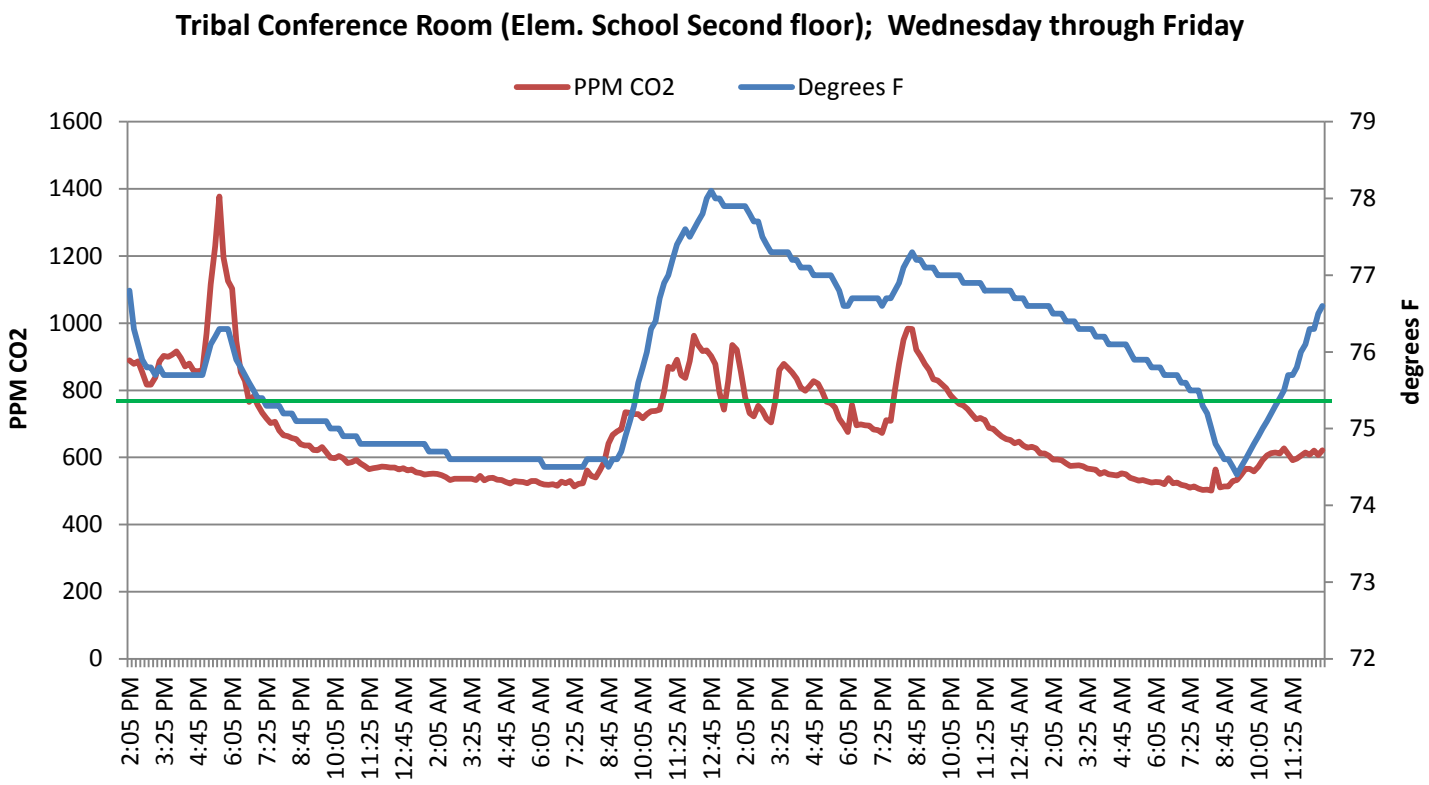
Elementary School CO2 & Temperatures



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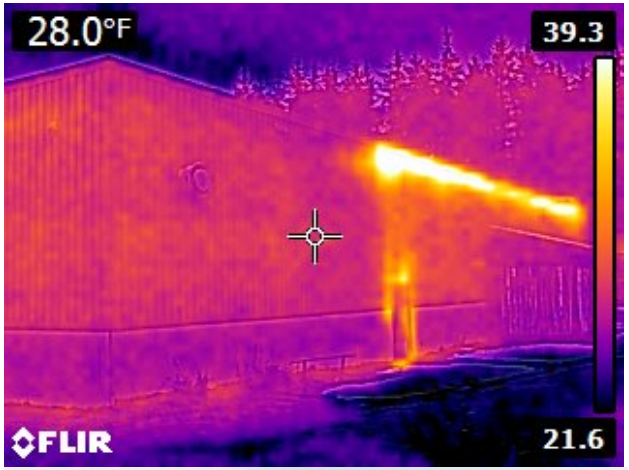
Deferred Maintenance

Natatorium

- 100% OSA de-humidification
- 2500 cfm EF removed
- Positive static pressure
- 89.5°F water temp, 88.5°F air temp, 65% RH
- corrosion



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Deferred Maintenance

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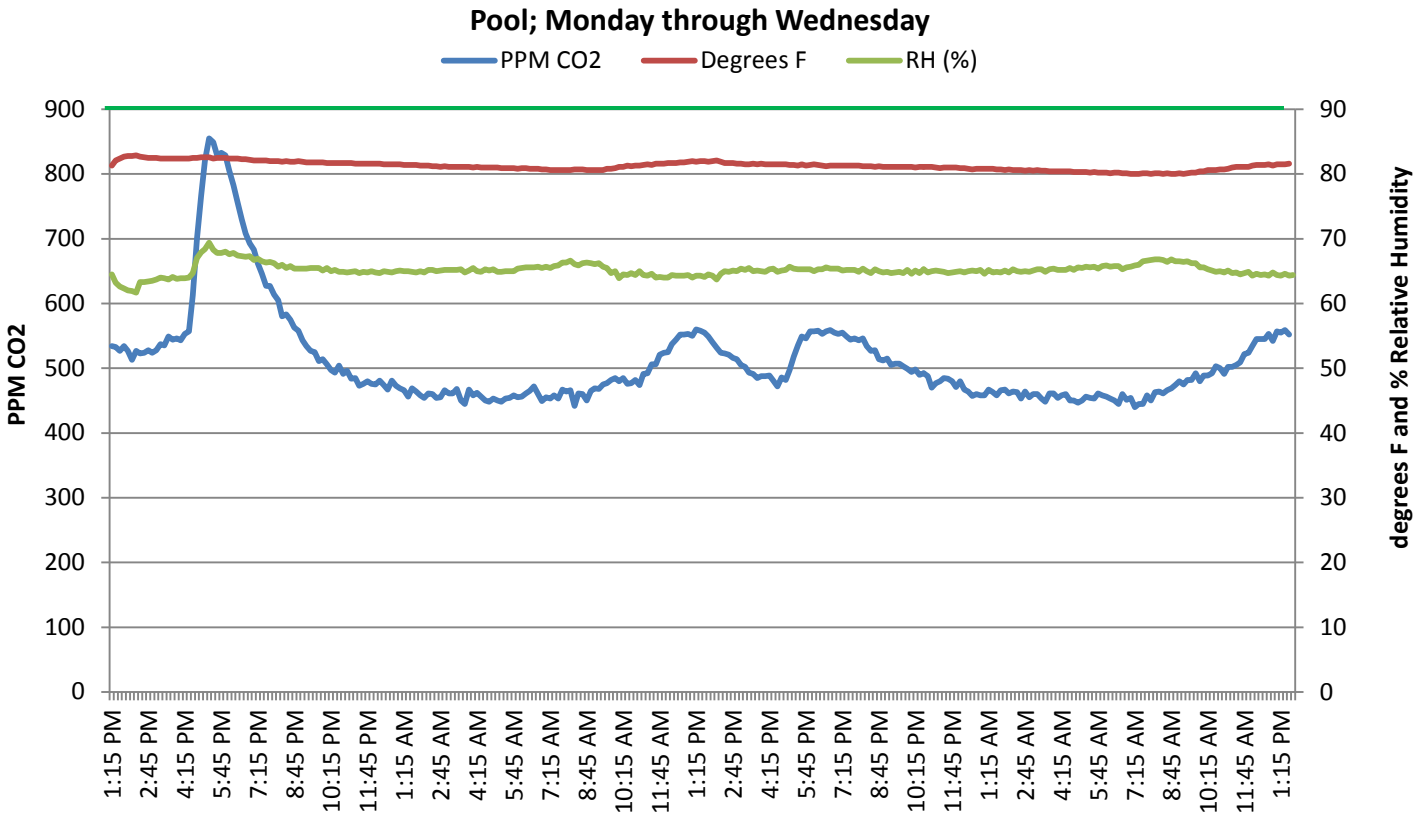
Natatorium CO2 & Temperatures



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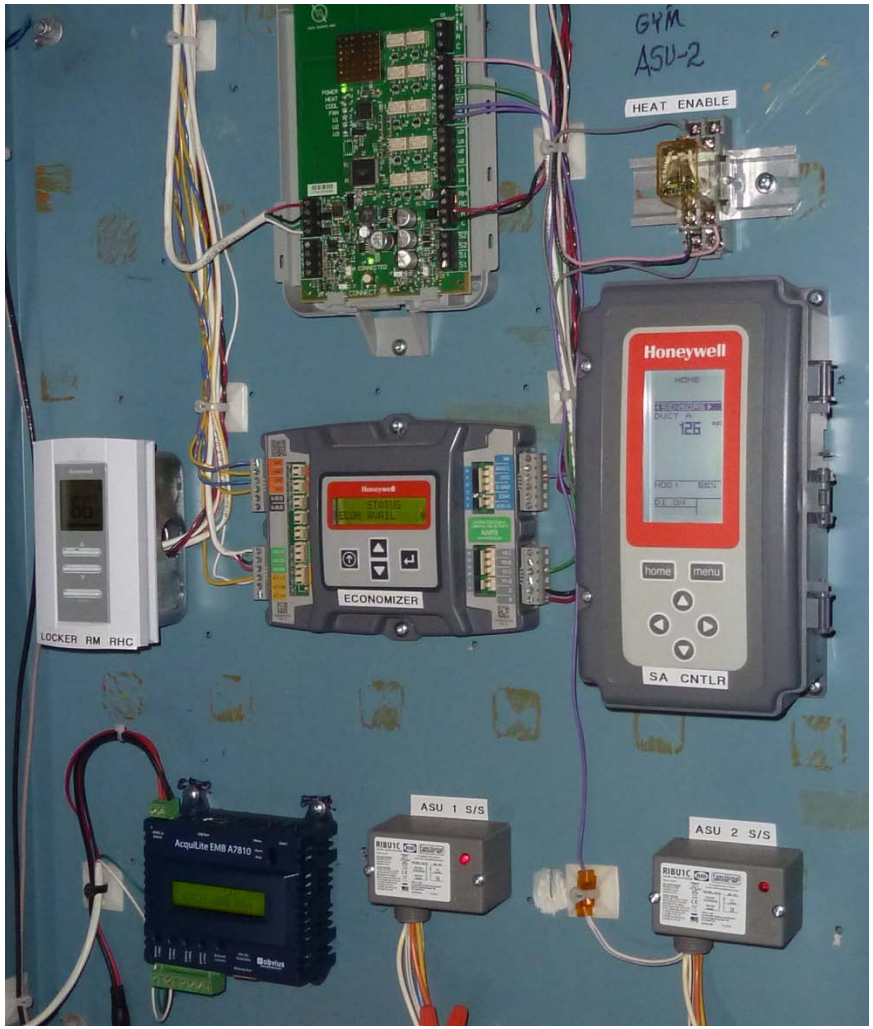
Proposed Conditions

High School

- Demo remaining pneumatics
- Simple Electronic Controls on 6 AHU's
  - Prestige IAQ Controller
  - JADE Economizer Control
  - Honeywell T755 Analog Output Controller
- Combination of Wi-Fi & standard tstats
- New electronic actuators
- 3-way valves to 2-way
- VFD circulation pumps
- CO2 based demand controlled ventilation
- Re-pipe boiler room, remove boiler

High School



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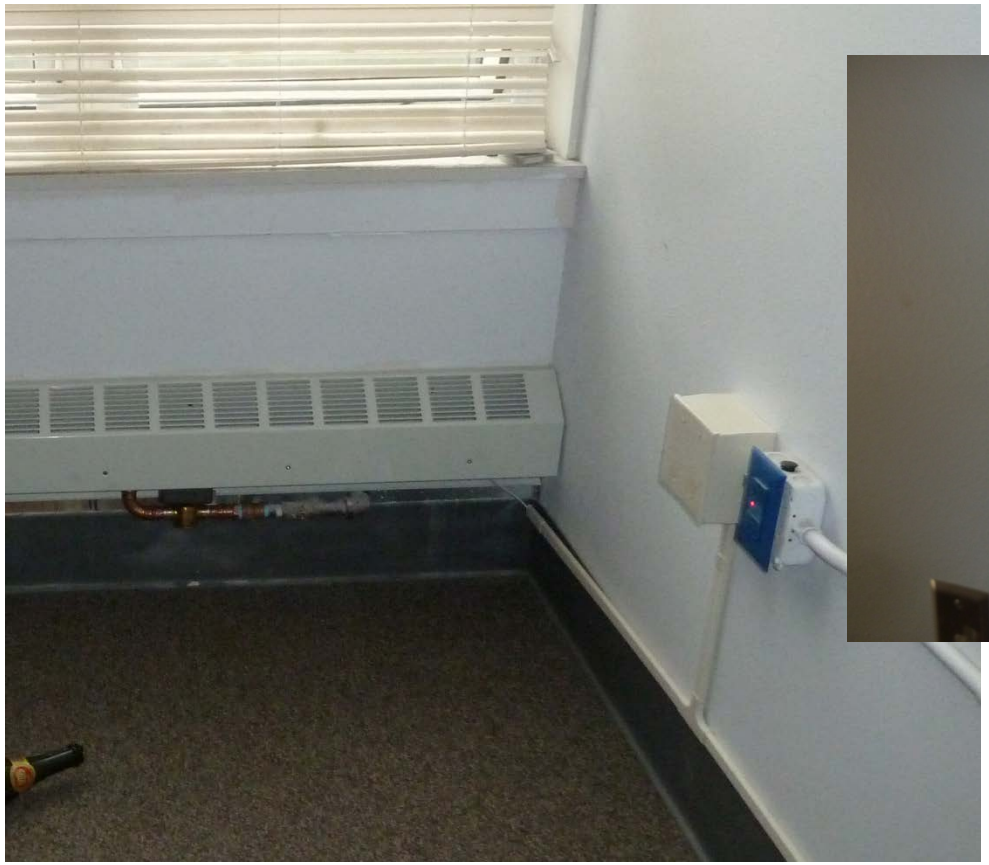
High School

- Correct improper hydronic piping
- Install BTU Monitor
- Fix hydronic leaks
- Replace defective coils & fintube
- Install freezstats and smoke detectors
- Replace missing locker room EF's, add Occupancy sensors
- Replace expansion tank
- Replace hot water generator
- Replace cabinet unit heater

Elementary School

- Demo pneumatics
- Simple Electronic Controls on 3 AHU's (Natatorium AHU eliminated from program), same as High School
- 14 zone Wi-Fi tstats; add Wi-Fi coverage
- 14 new zone valves
- New electronic actuators
- 3-way valves to 2-way
- VFD circulation pumps
- CO2 based demand controlled ventilation

Elementary School



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Elementary School

- Occupancy sensors on all EF's
- Install freezstats and smoke detectors
- Repair unit ventilator, replace fintube
- Replace oil fired HWH with HWG
- Install BTU meter
- Remove boiler & piping
- Repair hydronic leaks
- Replace pool circulation pump with premium efficiency
- Replace expansion tank

Wood Shop

- Install isolation heat exchanger
- Replace fintube, add control valves, circulation pumps & controls
- Install BTU meter
- Setback tstats

PSO Building

- Install isolation heat exchanger & hydraulic separator
- Add mixing valve for slab heat & controls
- Install BTU meter
- Setback tstats

Heat Recovery Loop

- Consolidate circulation pumps
- Procure back-up main circulation pump
- Correct reversed piping to PSO building

Courthouse & City Offices

- Setback, Wi-Fi tstats
- Upgrade lighting to LED
- Replace missing bathroom EF's
- Add occupancy sensors on bathroom EF's

Project Development & Management

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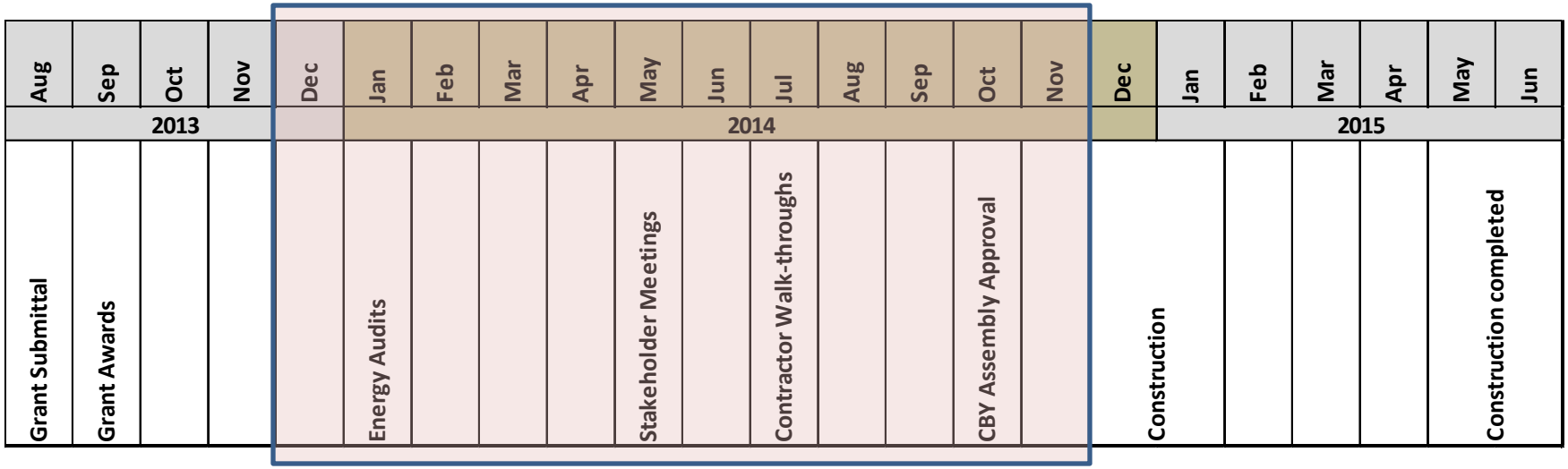
Project Development



12 months in development phase:

- Energy Audits
- Stakeholder meetings, prioritization of EEM's
- 5% design, contractor walk-through & quotes, asbestos inspection
- Stakeholder meetings, round 2
- Council Approval & contracts

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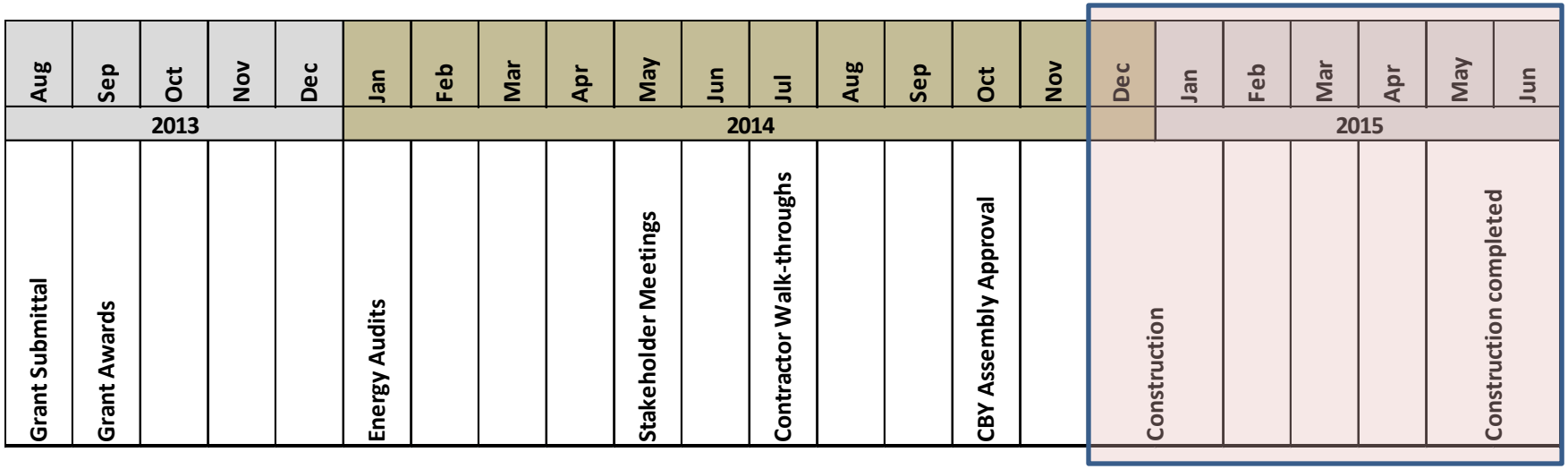
Project Management



7 months in construction phase:

- Construction
- Inspections, (informal) commissioning
- Completed at 99% of budget
- Completed on schedule

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Funding

VEEP Program

- $300,000 VEEP Grant
- $311,540 Tongass Economic Relief Funds (TERF)

Total EE upgrades $778,540

Self Managed

- $167,000 lighting upgrade (TERF funds):
  - All LED in both schools including fixture by fixture occupancy sensors in high bay gym & multi-purpose
  - Electrical contractor performed data logging and energy savings calculations
  - Completed December 2013

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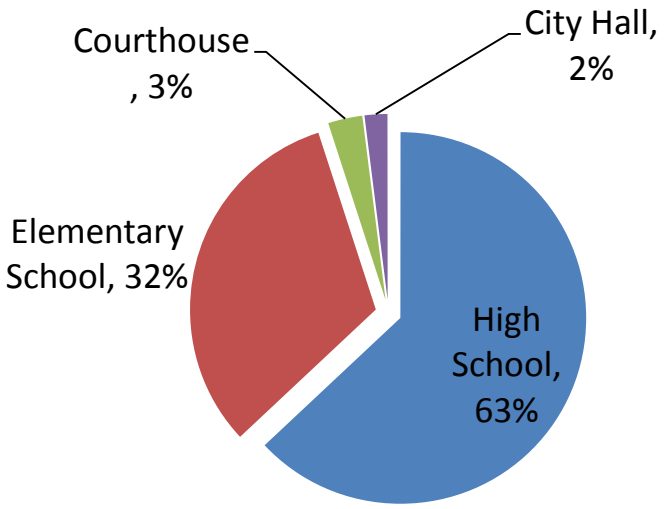
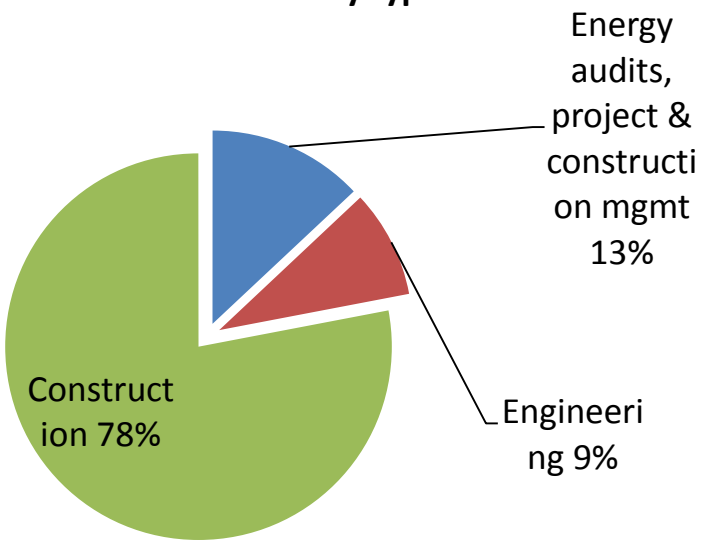
Use of Funds

Distribution of costs for $611,540 funds by building



Distribution of costs by type



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Projected Costs, Savings and Payback

Building(s)	Implementation Cost	Savings	Payback (years)
High School, Wood Shop, PPSO building & Waste Heat loop	$386,804	$57,177	6.8
Elementary School	$194,107	$68,126	2.8
Courthouse	$20,261	$2,687	7.5
City Office	$10,368	$3,081	3.4
TOTALS	**$611,540**	**$131,071**	**4.7**

$5.26/gallon @ 80% thermal efficiency equivalency for cost of recovered heat

$ .4583/kWh, no PCE for schools

Natatorium upgrades eliminated due to budget limitations

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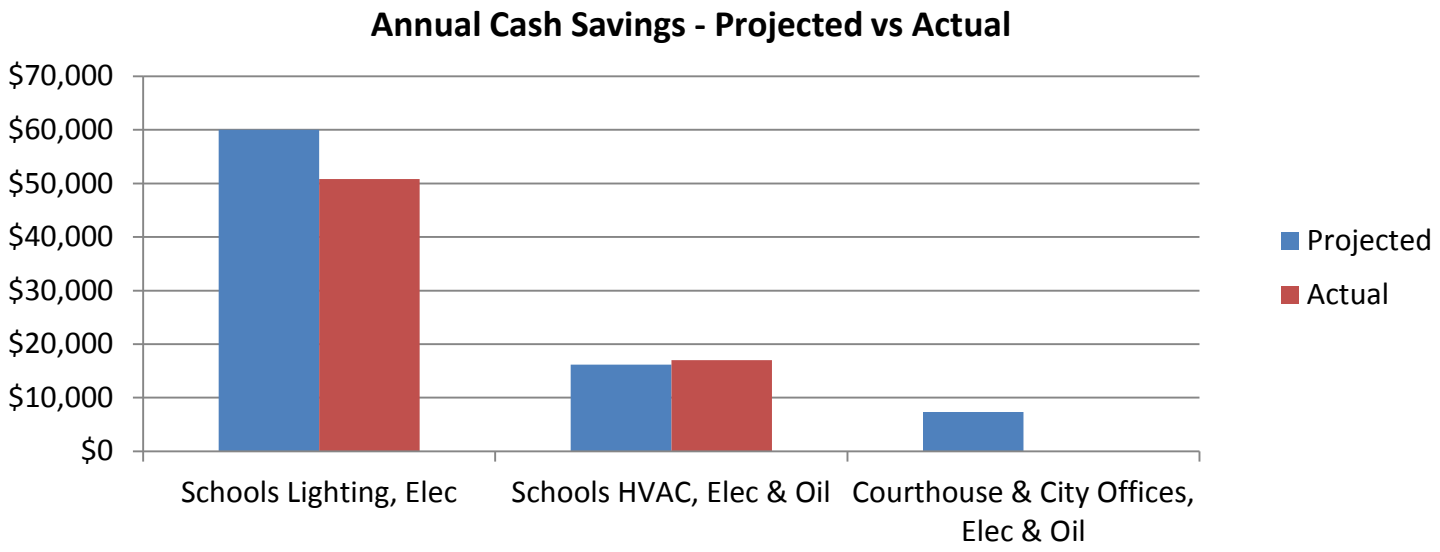
Actual Savings through July 2015



- No heating penalty for lighting upgrade
- No actuals yet for Courthouse & City Office

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Open Issues

- 160°F heat loop supply glycol at power plant down to 146°F at High School
- Insufficient recovered heat to maintain High School supply air temperatures when Temp < 25°F
- No backup heat sources
- Aging heat recovery infrastructure
- Declining school enrollment & budget

Conclusions

- This 4-5 year payback is typical
- In rural villages, energy efficiency upgrades are likely to be 80% maintenance and 20% energy efficiency
- Deferred maintenance programs can be “packaged” with energy efficiency upgrades and financed via savings

- Use experienced, bush-proven contractor resources
- Use a general contractor who is using his own proven subs

- Keep the energy auditor involved for design integrity, perform M & V
- Keep solutions simple & appropriate
- Get stakeholders involved early and often, keep them informed, respond to local input

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