Forum day 2

**Brent Goering**

 Comfort humidify – frost door closure – 30% is comfort for business settings

UFC mentions moisture, but need to be moisture aware

No back up anything if we lose heat a 2 billion dollar day

2 smaller heat sources sized at 60% of load

Hoar frost is an issue

Inherent hardening strategies – use different types of pipes to allow control of freezing

Radiant slabs minimize thermal decay

**Emily Winfield and Robin Rader Design Alaska**

Radiant heating systems

Commercial building challenges – extra heat in entry way

Struggle with delivery temp – oversize entry unit heaters

Also struggle with glass – need supplement heat to radiant heat

Remodel of commercial building – radiant components can lock down walls, have had to abandon radiant system in remodels – maybe put in box on floor more expensive but …

Hybrid approach – heat exposure at temp vs. different temp cool with air

Manifolds high pressure drop – valves proprietary – wax filled actuators

Don’t do slabs on permafrost

Writing on board – air curtains do not work – pressure allows cold air to bypass

Get photo of drawings – bad example of automatic doors – put fan in room aimed straight up – pulling cold air up to second floor for mixing

All entry needs is doors and sprinkler heads from freezing

In tall building no way to pressurize the entry – stack effect is too much,

Can you do a cold trap with a entry ramp?

**Mark Frame – PDC How Alaskan design and live**

2 of everything so we don’t breakdown

Resiliency is more than redundancy but redundancy is a key for Alaska

Hydronic heat use 60% glycol

Flight Simulator at Eielson

60% glycol and 2 of everything in building – no generator though

2 heat exchangers, 2 of all pumps, 2 chillers, 3 dry coolers, fan walls with 2 fans, 2 AC in each space, 2 crac units, ro systems (RH 40% for equipment)

2 base outages – crac units and humidifiers assuming low quality water – flush at restart RO system cannot keep up with flushing

Design to -60 (San Antonio said the design temp too low) big change in design - what data are we going to design to

LNG storage and vaporization facility in NP – video

N+1 redundancy – NG is trucked and stored, must be refrigerator

2 SCADA systems, everything redundant

Permafrost Tunnel

Analyzing refrigeration system to know if they meet future expansion – very old compressor

Tiny budget and not made to design

Refrigerate about 3 feet of dirt – a lot of thermal storage

Amount needed with free cooling in winter

Compressor runs better in cold

One compressor will keep whole thing cold

**Tom Adams – Air Force Civil Engineer Center**

The -42 F guy messing with Eielson UFC mandates 1% design

Satisfy mission first then energy savings

Exterior insulation correlated to facility type – lots of military buildings have less fenestration and less insulation

Cogen Elmendorf – demo and replaced with decentralized system – difficult to maintain direct bury pipe – cheaper to buy local power and have decentralized boilers – save energy base efficiency went up 20%

Always want utilidors

Eielson cogen plant in midst of upgrade – utilidor system – fairly efficient for coal plant – decentralizing would push up cost 300%

Coal is not very homogenous for models maybe – does have capacity for F35 roll out

New EPA rules will make new power plant – claims they are not working well in cold climates with clogging

Traditional heat plants – Clear has new one – too much capacity run one of 3 boilers – 2 people in plant continually

GSHP with 33 DeF water in deep well – installed shallow wells, do not work, installed boiler to pre heat water – water temps need to agree with equipment

Is Elmendorf more resilient with decentralization?

**Steven Taylor WARE – company with mobile boilers –** rental boiler contingency planning

Trailer mounted boilers just below 100 mil btu – need something quick can put on plane overnight

Superheated steam can turn turbines

Can stack multiple units

Mobile boiler room – everything in a trailer

Mobile hot water units -

Get contingency plan in place, get hookup in place

None on stand by in Alaska

Army has self built 2 in Alaska

125 units in fleet, has 5 or 6 not rented – multi year contracts for lots of them

Option instead of redundancy in boilers

Can put inside and duct combustion air etc..

Gotta heat trace and insulate in cold

Natural gas or diesel units – multi fuel units

Need, power, water, fuel

About 35,000 a month – on month minimum – pro rated for longer times

Can lease to buy

**Craig Fredeen Cold Climate Engineering**

O and M

Maintenance need to happen on back up systems

Training is everything

Cold limits time to act

Power grids in Alaska are unreliable

Have good WiFi in mech room and on the standby generator allows Facetime to help technician fix things

Posted diagrams of mech systems with sequence of operation in mech room

ID piping! And valves

Same tag on components in all locations and need to be unique

Design engineers need to talk clients not just architects

Best practices of O and M document will get sent out – cold climate specific – living document

**Panel Q and A**

Dual fuels? What is COA willing to fund? Sonny Turpin wants this at JBER

Micro turbines

**Emmet Leffel from Alaska Thermal Imaging**

“10 years of building enclosure testing on USACE projects”

In 2009 USACE issued a directive that required that all new buildings undergoing renovations to conduct an air leakage test. 30 buildings have been tested, only 4 failed.

Once contractors for renovation and new construction knew they were going to be tested on air tightness, they prepared for it, in most cases leading to successful air leakage tests.

0.25 CFM/Sf @75pa is leaky from Emmett’s perspective. The tightest building on Eielson was rated at 0.054. CMU and Insulated Metal Panel systems are the most prevalent.

Injected foam into roof flutes to fix air leakage

Building size vs. air leakage – building size don’t have much of an effect on air leakage

High air leakage – moisture issues, mold, high condensation, ice damning a lot more problems

Is 0.25 tight enough to prevent problems?

Renovations are improving air leakage to better than new construction in some ways – does still have problems, 0.25 still is a lot of air leakage

Testing arch vs. arch plus – arch only is always tighter, move away from dual testing, just test against louvered dampers don’t worry about sealing off ventilation penetration

Passive house is 0.09 cfm/ft2, ASHRAE 0.4, Military 0.25

Retesting at intervals? Might consider retesting if had troubles with first test or if there is a change in end use – need to have a reason for the testing

Masking can also seal unintentional openings

Alex wants to suggest change to 0.15

**Bill Rose**

In design bid build process how do make all parties meet air barrier – means and methods wall?

Quality assurance process reviews arch details

What topics need to be called out? Corrugated sheet metal flutes a problem at top of wall – example Ventilated attic systems make those corners messy

**Eva Moller DTU Denmark**

Durability of the sealants – good for 10 years?

**Discussion**

It has to be a team effort

Alexander will push to get rid of arch only test, wants to move to 0.15 and see how much resistance there is

Brent says averages are 0.15 but would push for 0.175

Alexander wants detail drawings – there is a 500 page energy retrofit guide.

**Afternoon Session**

Traditional systems

Lon Fiedler

Closed loop geothermal systems – heat imbalance between heating and cooling

Use waste heat like a geothermal system – bury hdpe to send cooling fluid for cogen to run gshps in buildings

 **Oddgeir Gudmundsson – Danforss, Denmark**

District heating not stream, low temperature

Fuel flexibility

Hot water pipelines

Heat transfer stations are factory assembled and tested

Even with power lost can bring generator into plant and keep things going

What is a bio oil peak load boiler?

Hospital can serve as district boiler as well

**Jen Peter Sandemand – Ministry of Defense Denmark**

Small island Large plants for 90 inhabitants – cold place

“remote” for Europe

Gensets operate under 50% capacity much of the time

**Kurt Knitter – UAF Combined Heat and Power Plant**

“Meantime to repair guy”

District heating system 1/3 size of FWW

One buried steam line to West Valley high school – a back up system

Committed to steam

Almost no waste in cogen plant – take every BTU you can no matter of phase

Electricity is a “by-product” – heat is primary

Could sell excess power to GVEA –

9 MW at peak

Utilidors hold everything

Connected to GVEA for electricity

Lot of residual heat in new buildings – have some time

Loss of boilers – 35 took 2 hours for west ridge to steam to reach “0” – took 6 hours to come back

3 to 5 days of oil on campus to fire back up boilers

With loss of plant and GVEA they are dead

Critical buildings have oil fired boilers as back up

No onsite storage of coal – can freeze in coal cars

New plant blow offs – create icicles

Spare parts? Are all “odd ball” not many spares and can be weeks out

**Nick Janssen – Doyon Utilities**

FWW

Cogen – 6 boilers

Also connected to GVEA

1953 generation plant

Tried lots of way to check the conditions of the steam pipes

2018 comprehensive study of FWW

Peak demand – 19 MW, 9 MW at base load

350 kpph peak heat load, 100 kpph base load

Resilience benefits of district heating

Decentralized heat on FWW would require more demand to keep utilidors warm

Coal handling equipment must be very old – how to get spares?

**George Roe – ACEP**

Advanced energy source – nuclear micro reactors

1.5 MW smallest in development

Kotzebue one of the leaders of integrating wind into grid

PCE spreadsheet tool

**Stephen Doig – Dartmouth University**

When a mine goes down for a day can lose millions – what can the military learn from mines?

**Viktoria Gisladottir** – ERDC CRREL

Geothermal

Can scale plants

More energy as you go deeper

**John Zarling – Arctic Engineering**

Permafrost in Fairbanks area 31.6 F at Thompson Dr.

**Whit Hicks – Renewable energy solutions education and technology**

Biomass fuel is everywhere

Syngas – wood gas – superheated tar gasses “cracked” to hydrogen, CO and methane

GEK and Wayne Keith Gasifiers - for profits

GEK power cube – 25 kw power?

**Dan Sambor – Stanford University**

Microgrids

design microgrid the “other way around” – start from demand management

some large wind plants tossing 60% of energy due to low demand – can we increase thermal storage for excess electrical energy

**Bernie Karl – Hydrogen Community**

with the renewable energy it makes sense to make hydrogen

natural hydrogen – methane digesters to make hydrogen

Unalaska – has well to make 7 MW power plants at the volcano,

Buried cables – pay now or pay later

150 million dollar project

Online Nov 2023

Chinese? Heat pumps everywhere – avg temp 47 F wants to hire Tom

**Thermal Energy Resilience Study – direct test method**

**Dayne Broderson UAF and Jonathan Goebel ERDC**

Preliminary results – tested 5 structures

Critical locations focused on air temperatures

Focus loss of steam but still have power

FTWW test still air, Greely wind condition

Bldg 4070 basement garage and mech room (open damper) temps degrade quickly

Bldg 3002 – command operating facility – new building- fairly resilient building – need longer period than 8 hours – utility room problem location

Ft. Greely – cold wind chills

Bldg 650 – 17 hour test – quick recovery – most temp drop wind side

Bldg 603 – windows whistling in the wind 17 hours didn’t hit 40 F threshold

**Bill Rose – Ft Riley prison bldg** – temperatures model second method

Has an equation of variables

Robin says what about stack effect?

**Richard Liesen CERL – model method**

Thermal Decay test to feed into models

No set back at FtWW

Bldg 3013 model best guess R-values

Heated floor

Three regions of decay initial, (asymptote) running slope, length of recovery

Bill wants to know how many hours per building

Air leakage important, what is going on with ground connection?, what about ventilation fans?

40 F is a good limit,

**Alexander – Next Steps**

Time to repair for buildings archetypes and outside temp, Can we make a table?

Summary of 2 days

Technical paper from forum? English

Intro - Alexander

Thermal energy resilience concept – Alexander lead, Angela Urban, Bjorn

Specifics of construction in cold climates – Robbin lead, Craig and John Zarling

Major threats and hazards – David Bragg lead, Angela Urban

Typical commercial building archetypes in cold climates – Eva Moeller

Building envelop characteristics – Aaron lead, Lyle, plus Aaron’s list

Typical HVAC systems Robin and Emily lead, Brent, Tom Adams

Advanced energy strategies – Gudmundsson, Bill Kirkener GVEA

Best practices