

Technology Deep-Dive on Geoexchange

Moderator and Presenter:
Mark Spurr, FVB Energy Inc.

Panelists:
Jeff Urlaub, CEO, MEP Associates, LLC
Tom Nyquist, Princeton University
Daniel Dixon, Lincoln District Energy Corporation

**International District Energy Association
Annual Conference
June 24, 2019**



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Local Solutions*

45 Years of Experience in Sustainable District Energy Systems

Agenda

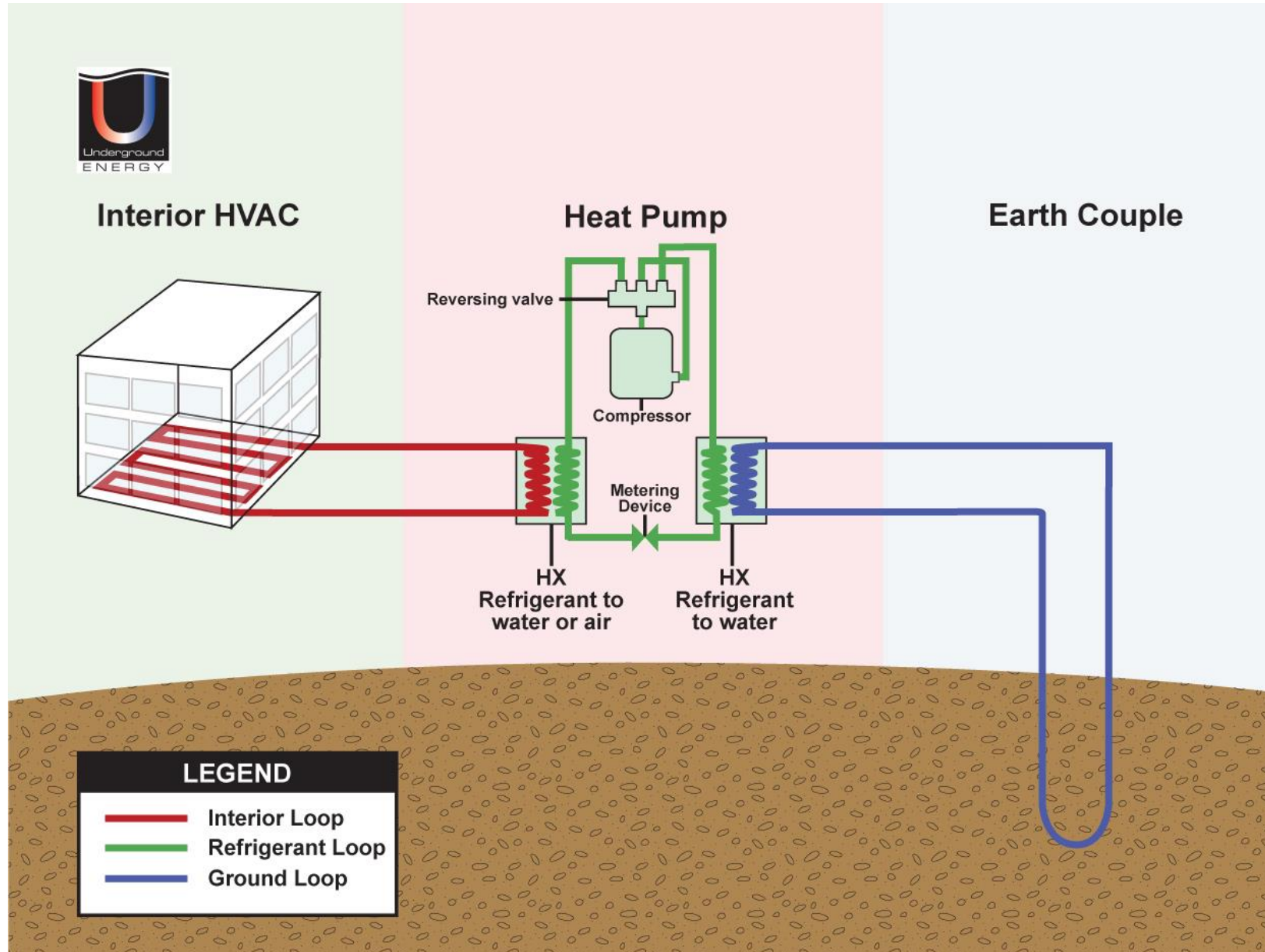
1. Opening presentation

- Basics of geoexchange
- Questions to ask if you are thinking about implementing a geoexchange system

2. Panel Discussion

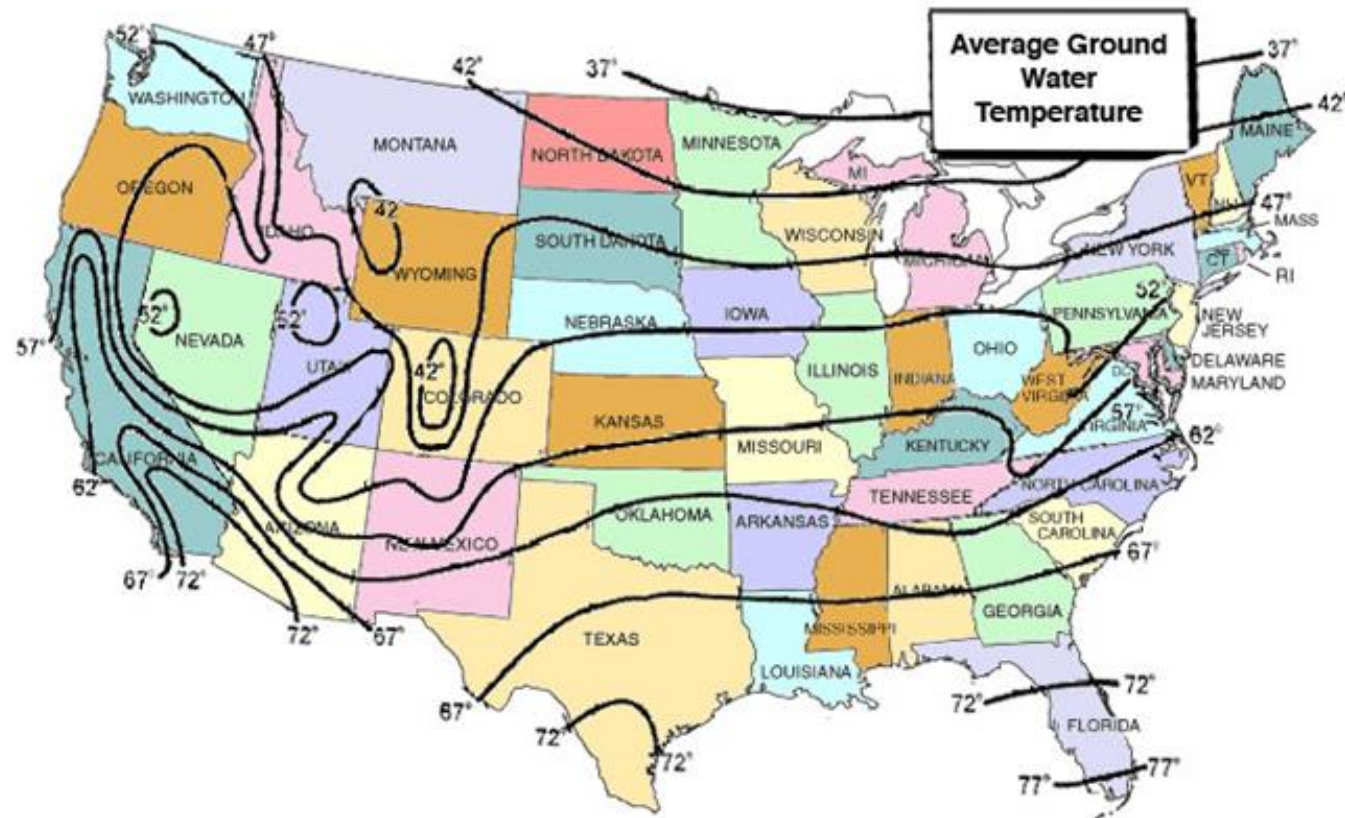
3. Q&A

Basics of Geoexchange

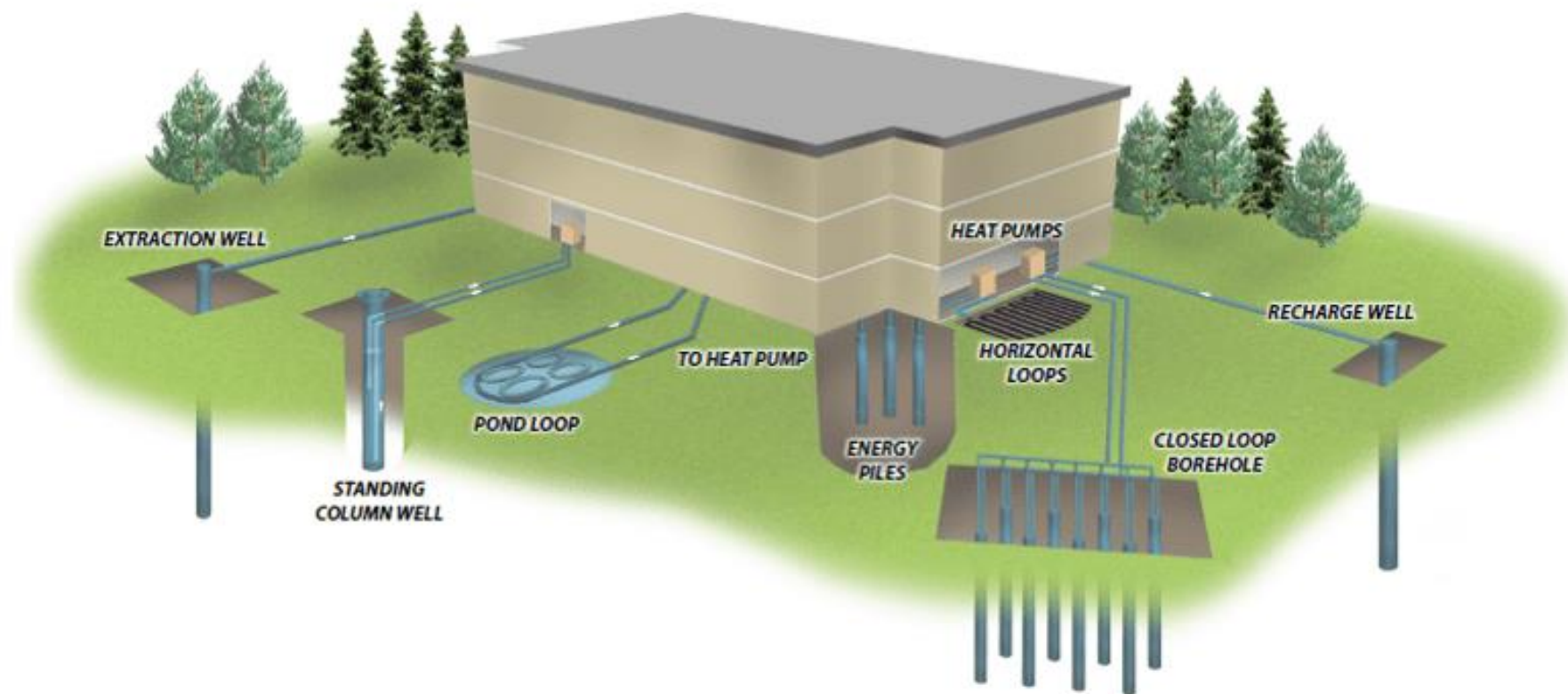


Basics of Georexchange

- Shallow earth temperatures vary depending on location & season
- Mean earth temperature contours across the U.S. (water temperature measured in groundwater wells 30 to 50 feet deep):



Basics of Geoexchange

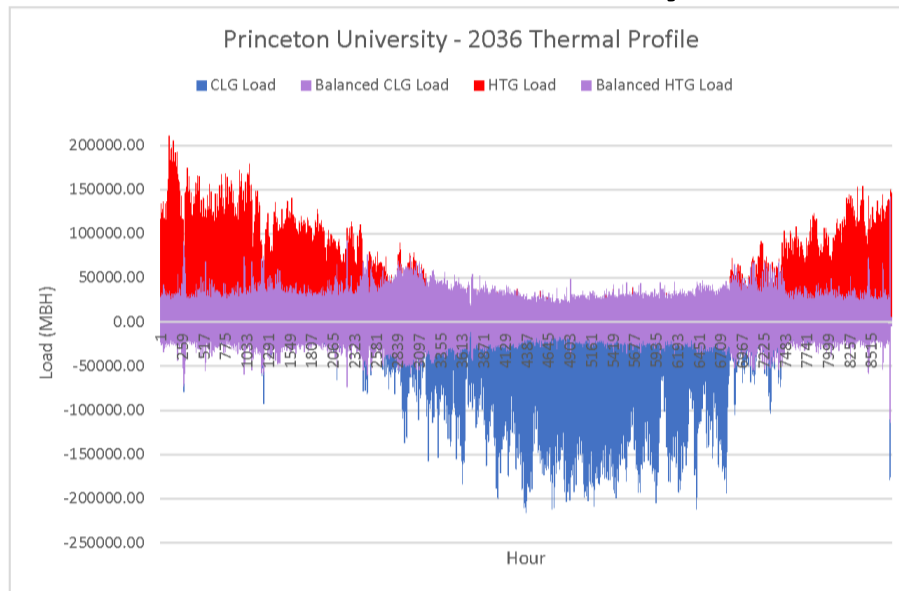


What is the annual balance between heating & cooling energy?

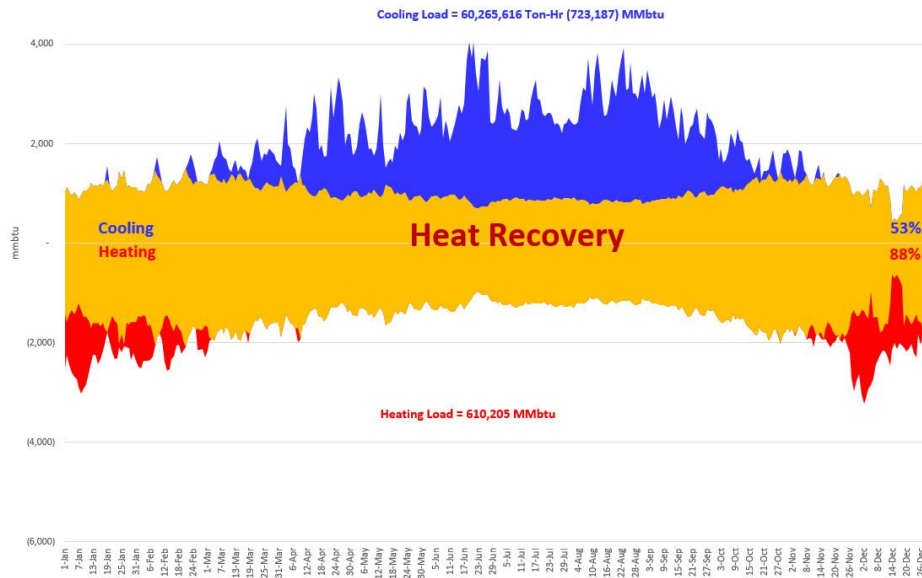
How much simultaneous heating and cooling is expected?

Thermal load balance varies widely!

Princeton University



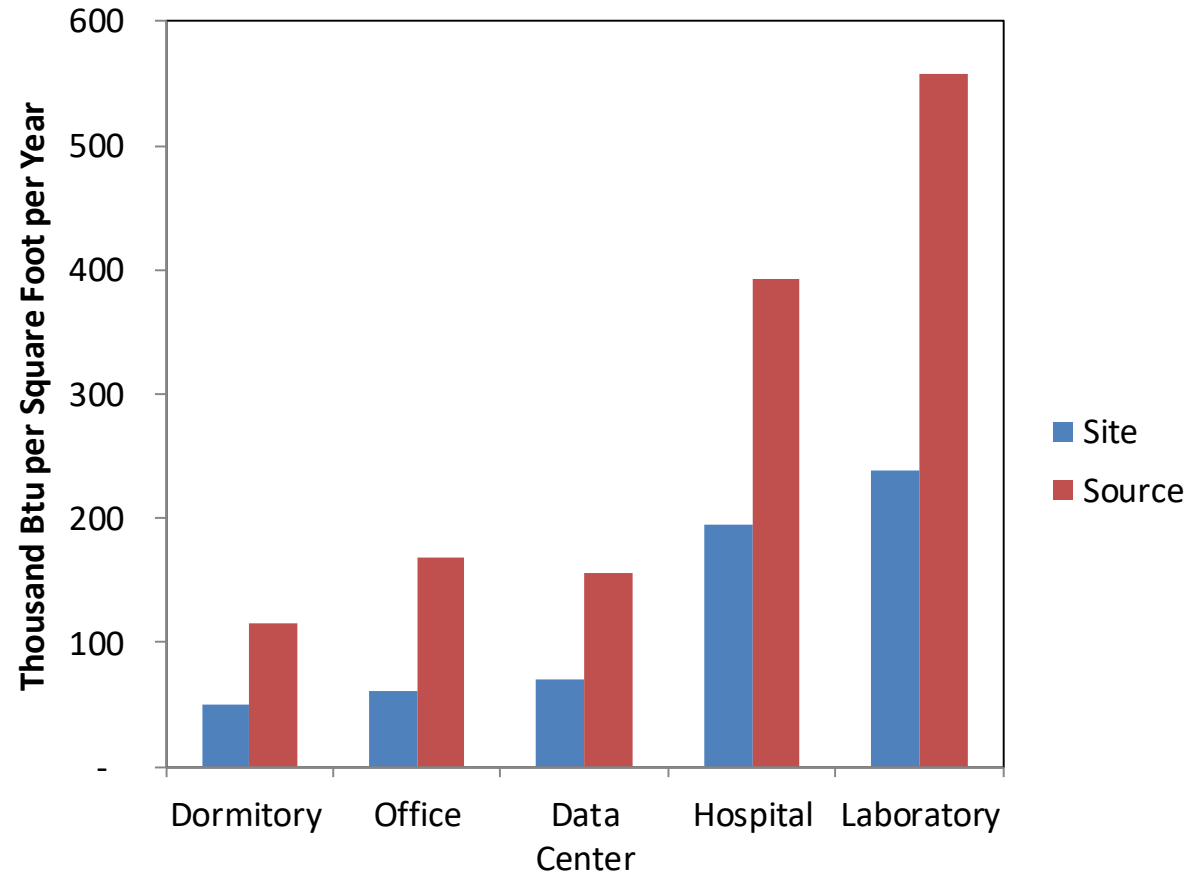
Stanford University



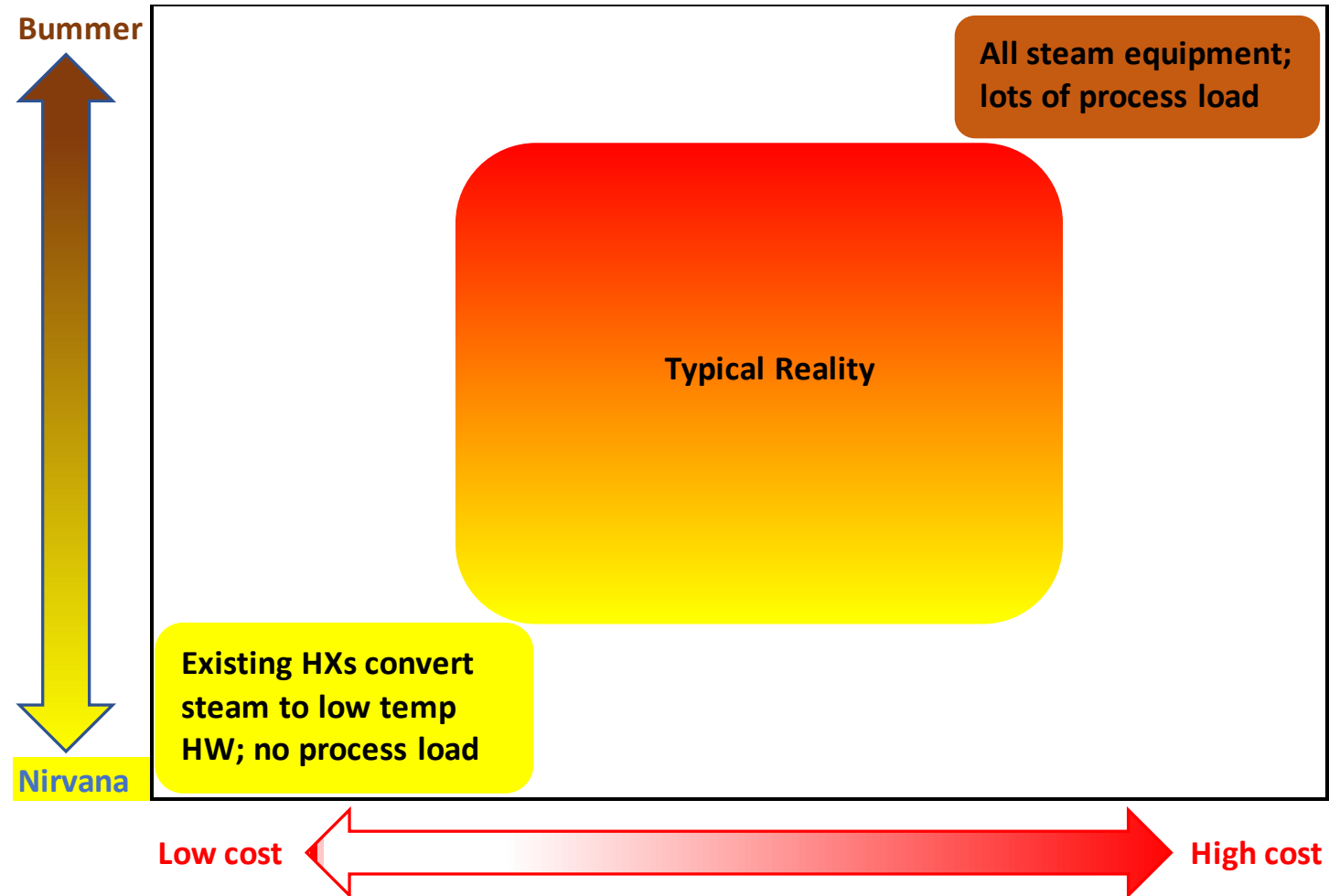
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What are the characteristics of the building space?

- Mix of end uses
- Retrofit vs new
- Demand/supply design trade-offs



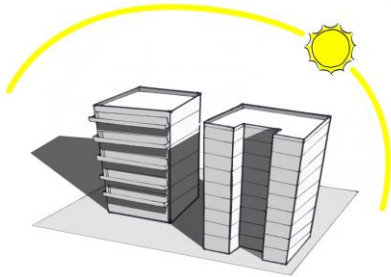
What is the mix of new vs. existing building space?
What are the characteristics of the existing HVAC systems?



For new buildings, have you assessed trade-offs between demand side and supply side?

Passive

- Building massing & orientation
- Improved envelope
- Daylighting
- Natural ventilation

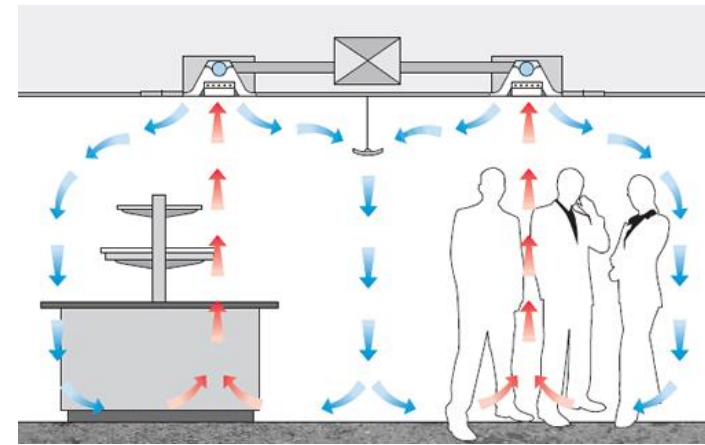


Culture & Operation

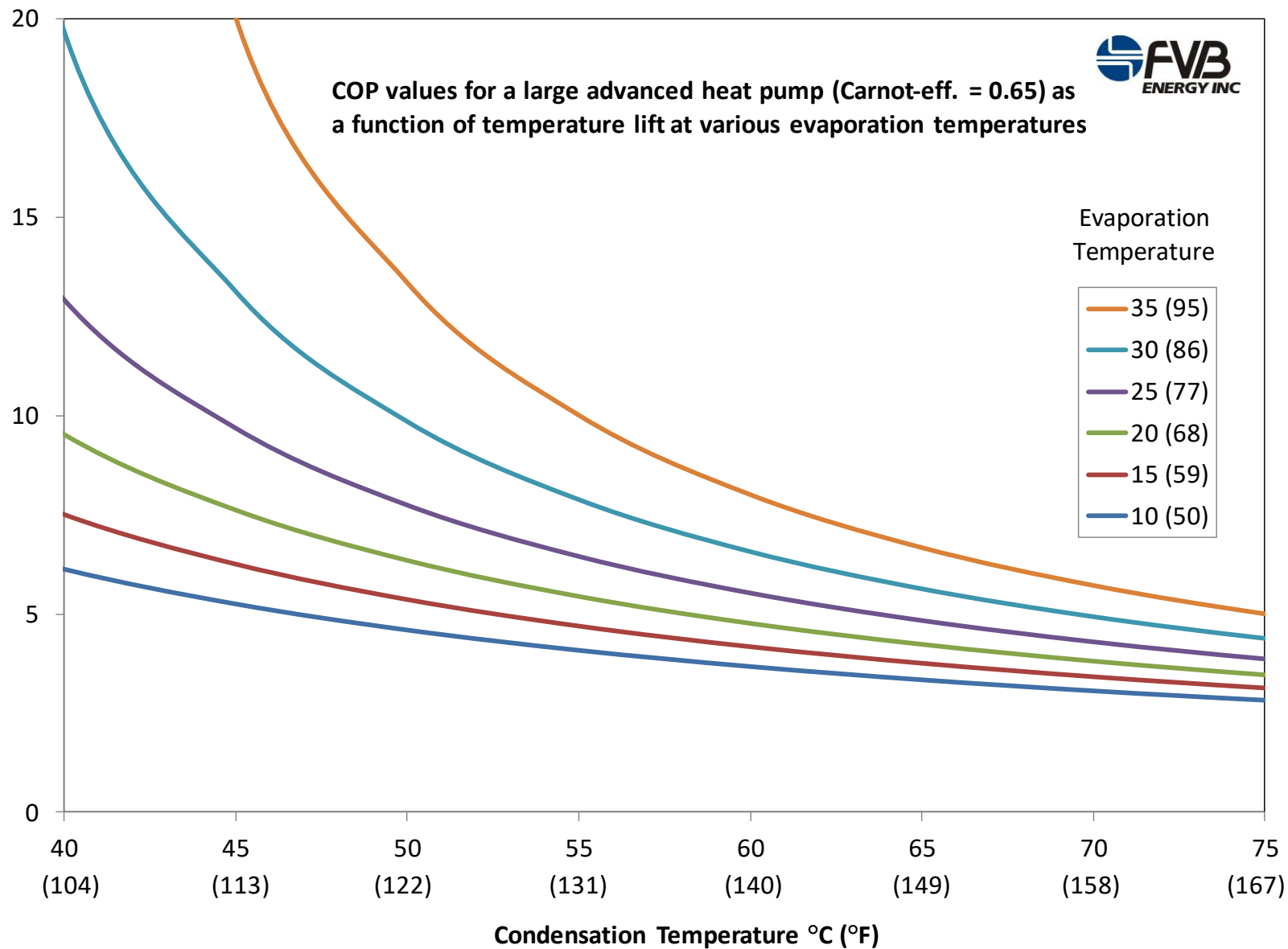


Engineered systems

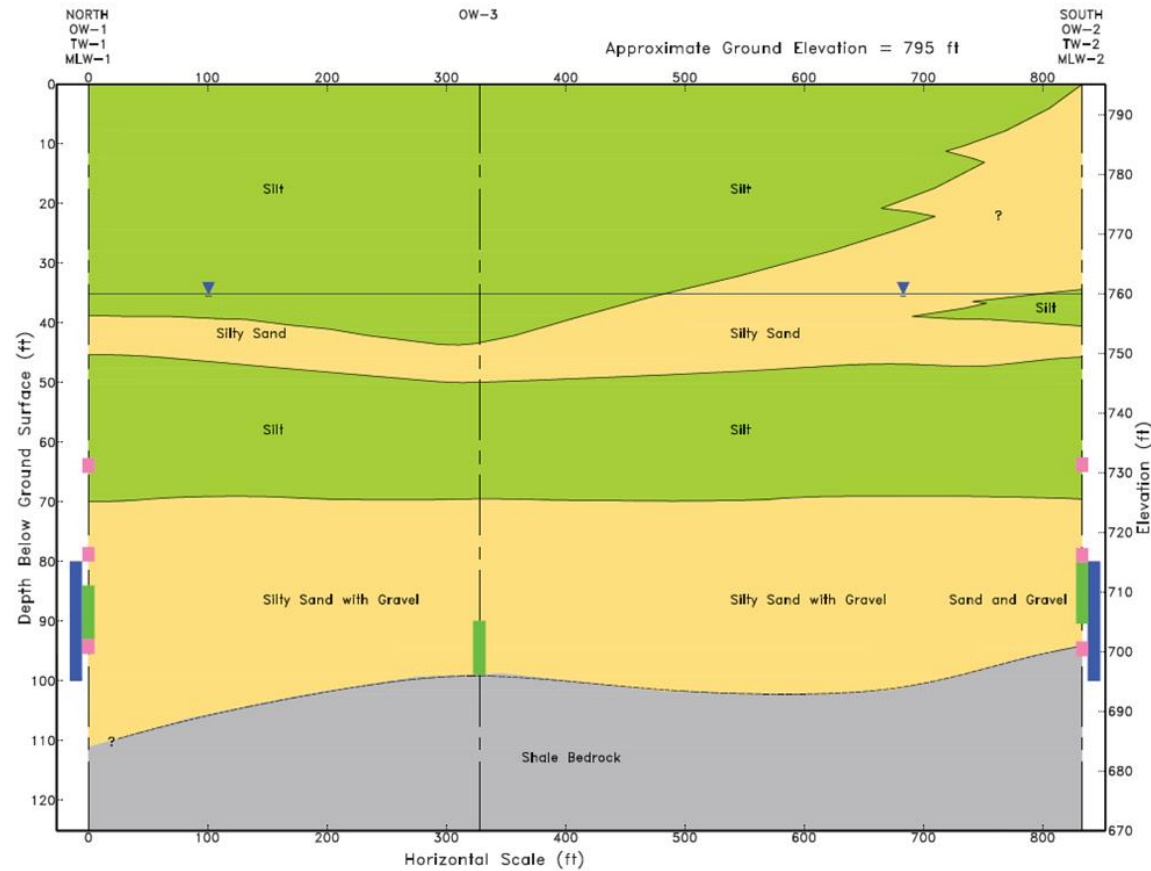
- Low temp space heating systems
- Heat recovery for ventilation air
- Radiant floor heating
- Higher temp cooling systems
- Chilled beams and slabs
- Smart HVAC controls
- LED lighting



What temperatures are required for thermal service?



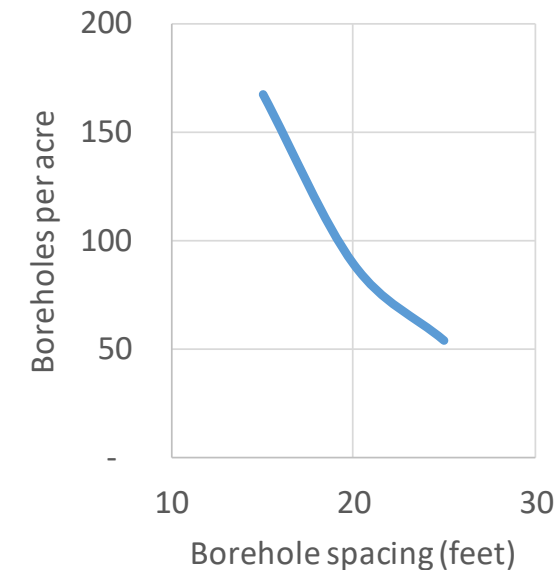
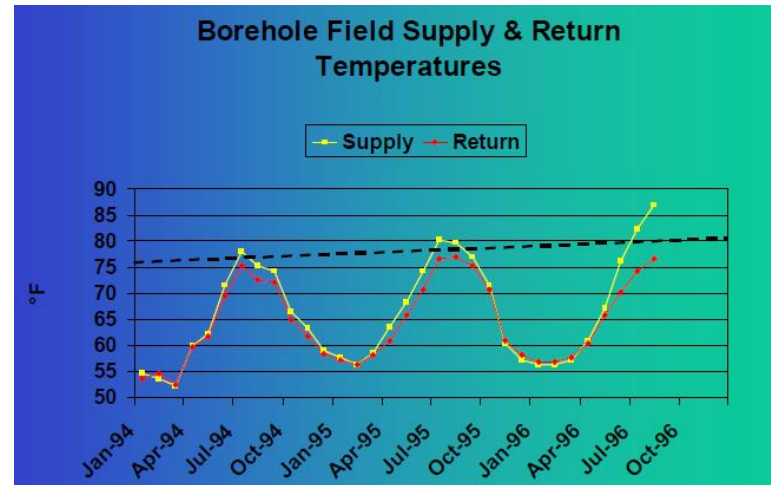
What are the underground conditions?



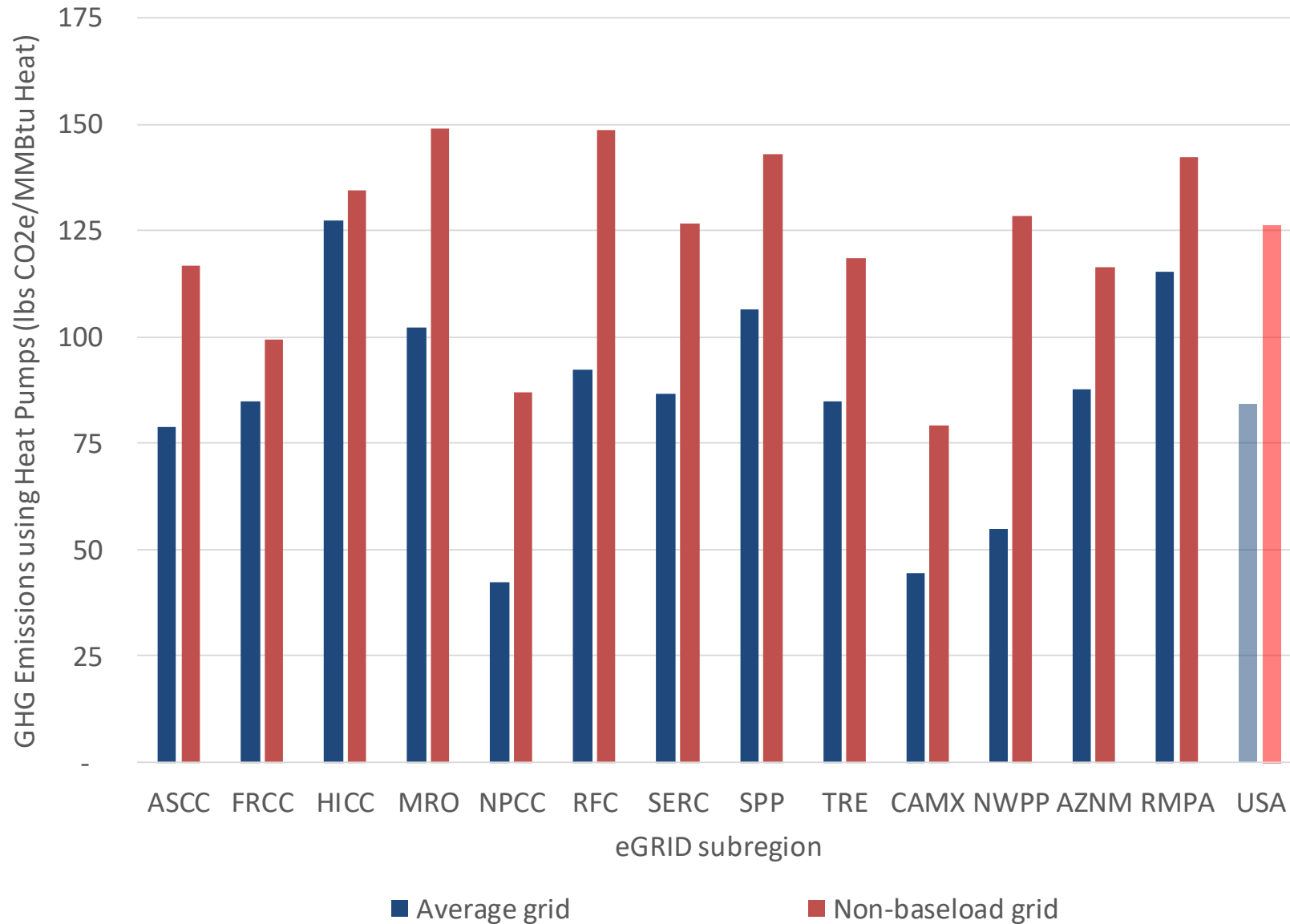
How much space is available for bore fields?



- Depth vs area
- Geologic factors
- Avoid long-term cooling or heating of ground



How will you power the heat pumps? What is the carbon footprint of that power?



Do you want the heat pumps in the central plant or buildings?

“Ambient” district energy

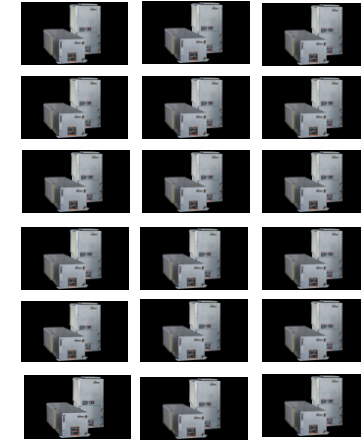
- Two pipe (supply and return) circulates low temperature water to buildings
- Heat pumps located in buildings

District heating and cooling

- Four pipe (hot water & chilled water supply and return)
- Heat pumps located in central plant

Consider

- Efficiencies and service life of larger central plant heat pumps vs many small units
- Benefits of load diversity in reducing investment in heat pump capacity
- Cost-effective peaking and back-up
- Comparative pumping energy
- Total life-cycle capital, maintenance, replacement and electricity costs



Panelists

Daniel Dixon

- Manager, District Energy Corporation, Lincoln NE

Jeff Urlaub

- CEO, MEP Associates, Eau Claire WI

Tom Nyquist

- Executive Director, Engineering & Campus Energy,
Princeton University



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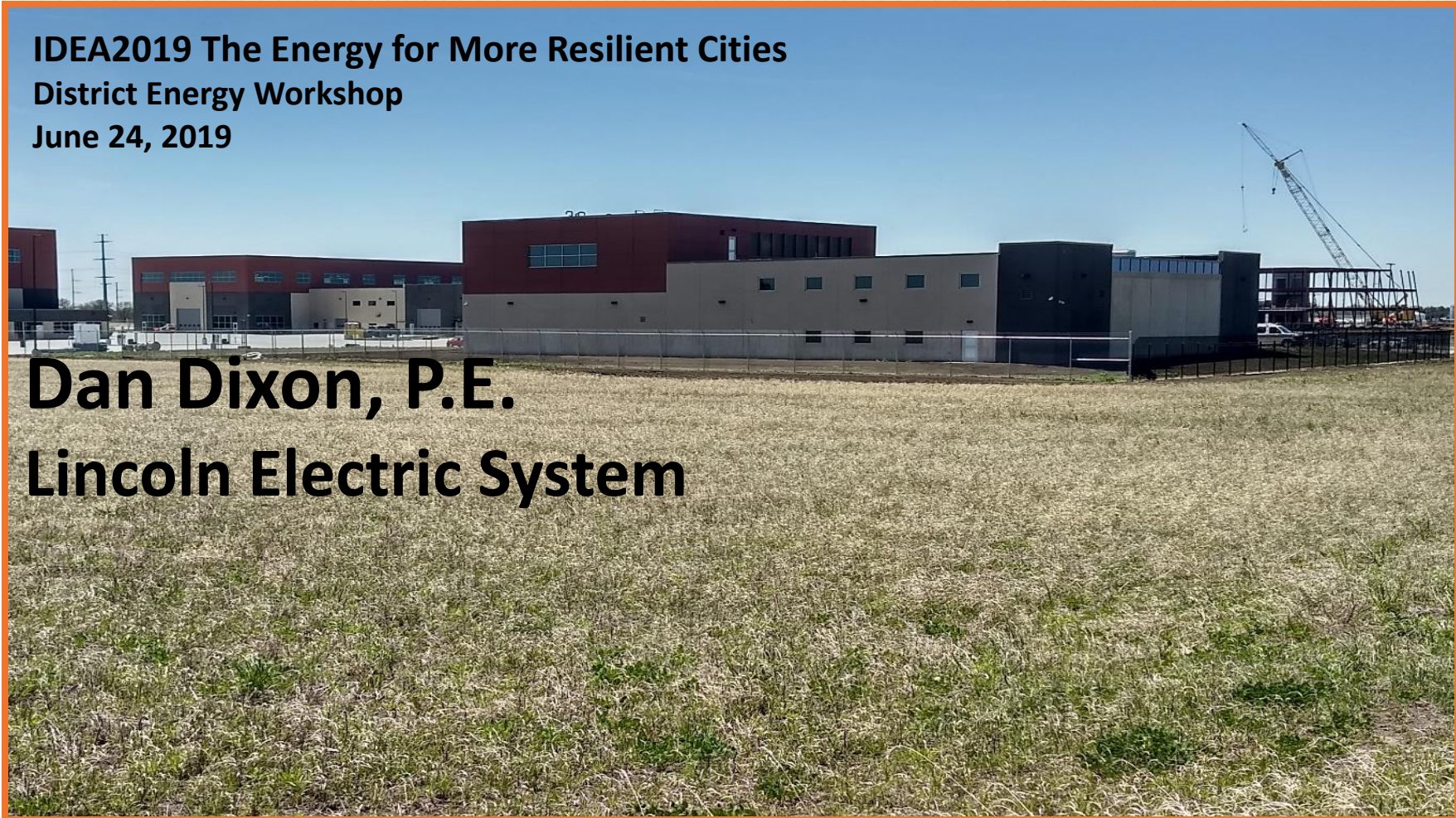
District Energy Corporation

Geothermal Plants

16

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Dan Dixon, P.E.
Lincoln Electric System





Geothermal Plant for Lincoln Electric System's new Operations Center (LOC)

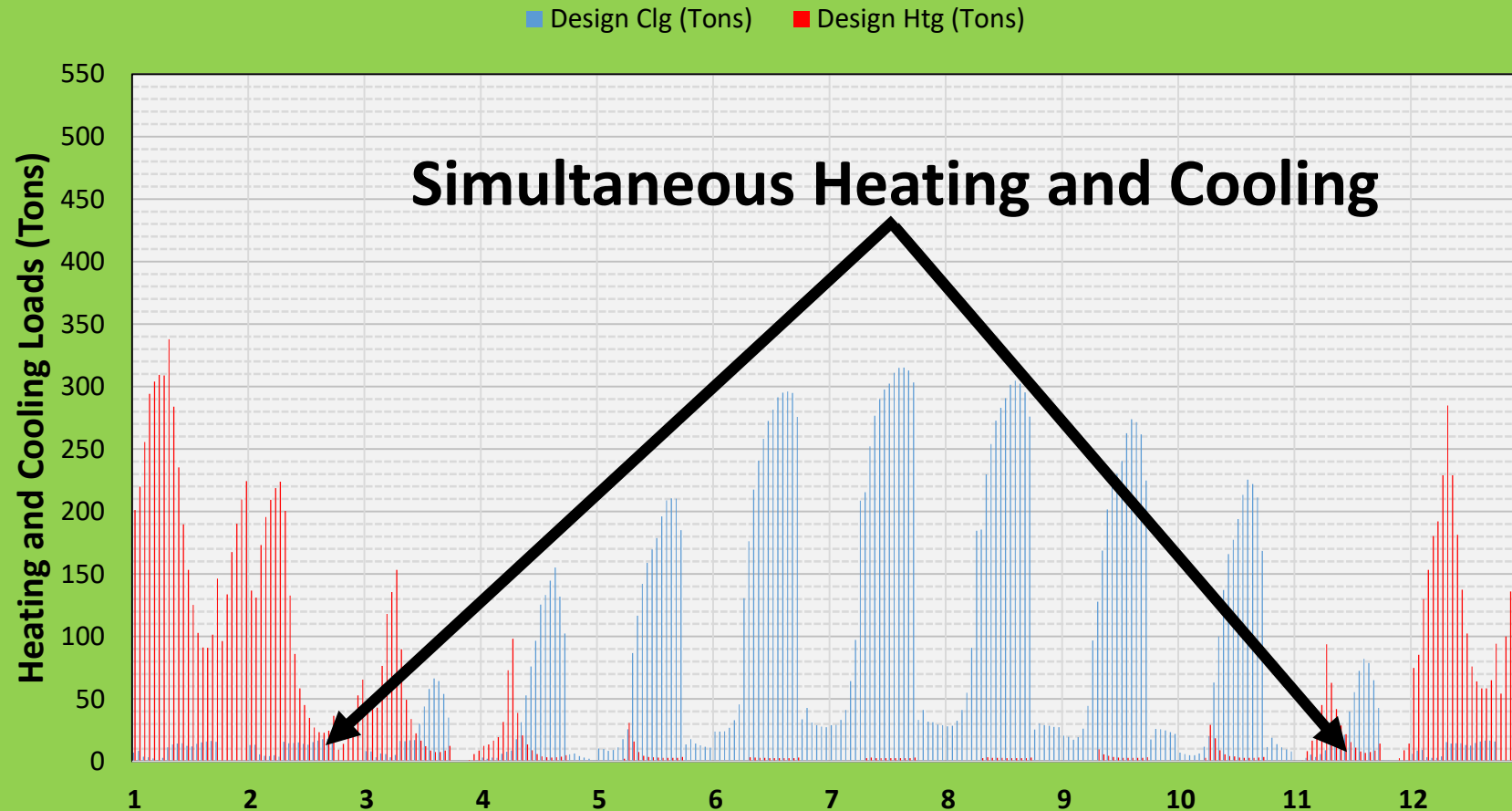
17



LOC Heating & Cooling Load Profile

18

Phase 1 & 2 Heating & Cooling Loads (Typical Design Day for Each Month)





Nominal 200 ton Scroll Heater-Chiller Banks



**Installation of the Geothermal
Well Field: 321 wells at 370 feet
deep**



**Well Field Headers
entering LL of plant
to common
manifold. Note space
for future expansion**



**Chilled, Hot, & Well
Field Water Pumps**

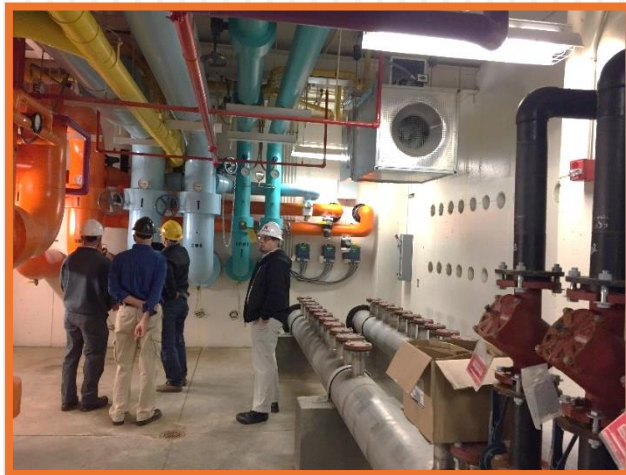
Adult Detention Facility Geothermal Plant



Nominal 300 ton Scroll Heat Pump Banks



**N+1 Back-up Generators for
ADF and Plant – 5.4 MW**



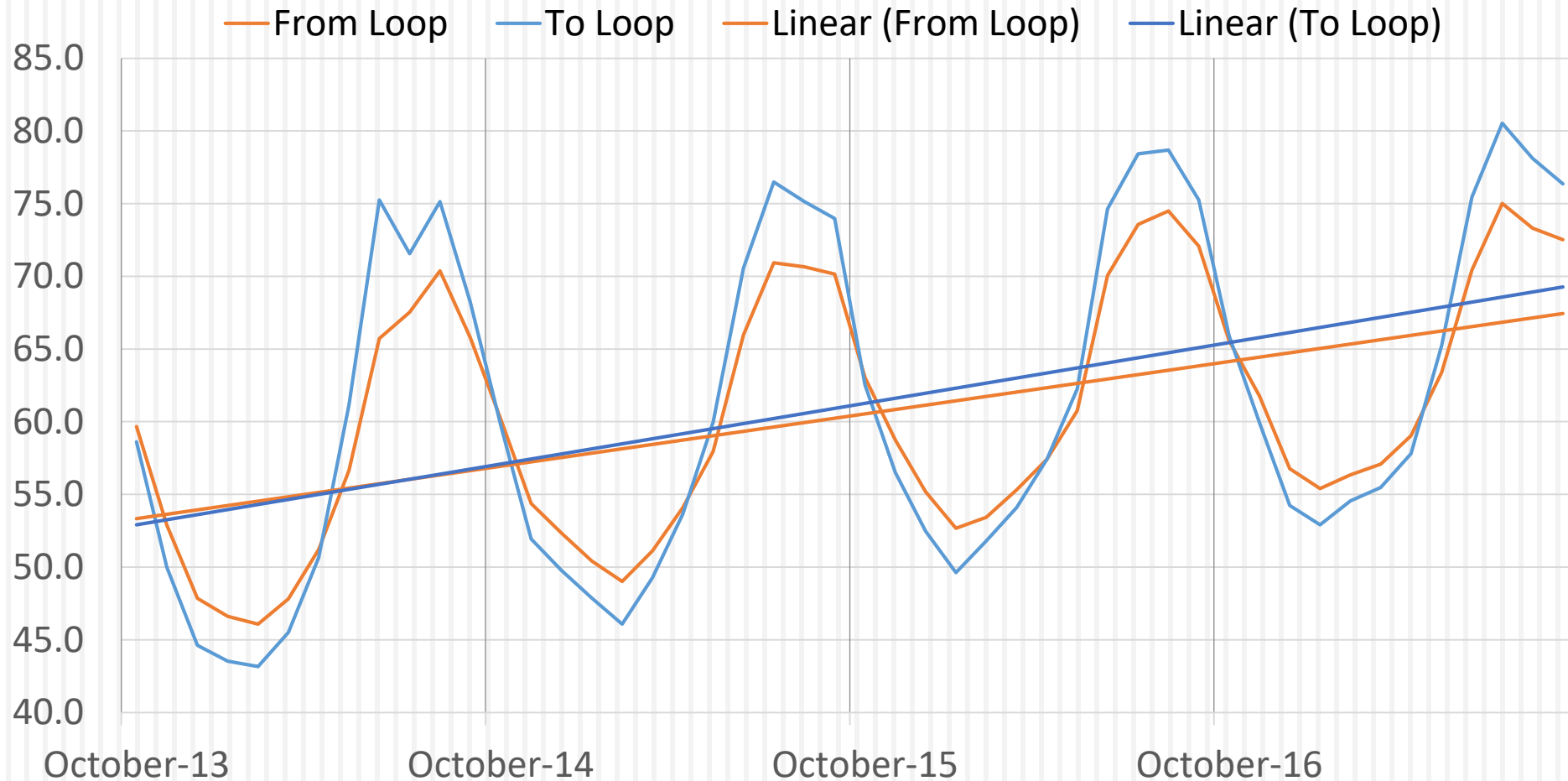


Detention Facility

Thermal Build-up

21

Well Field Temp Trend (F)



Thanks for your attention!

Questions?

Mark Spurr

Phone: 612-607-4544

Email: mspurr@fvbenergy.com



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