



# The Implementation of Low Temperature District Energy Systems using GeoExchange Technology

IDEA 2018

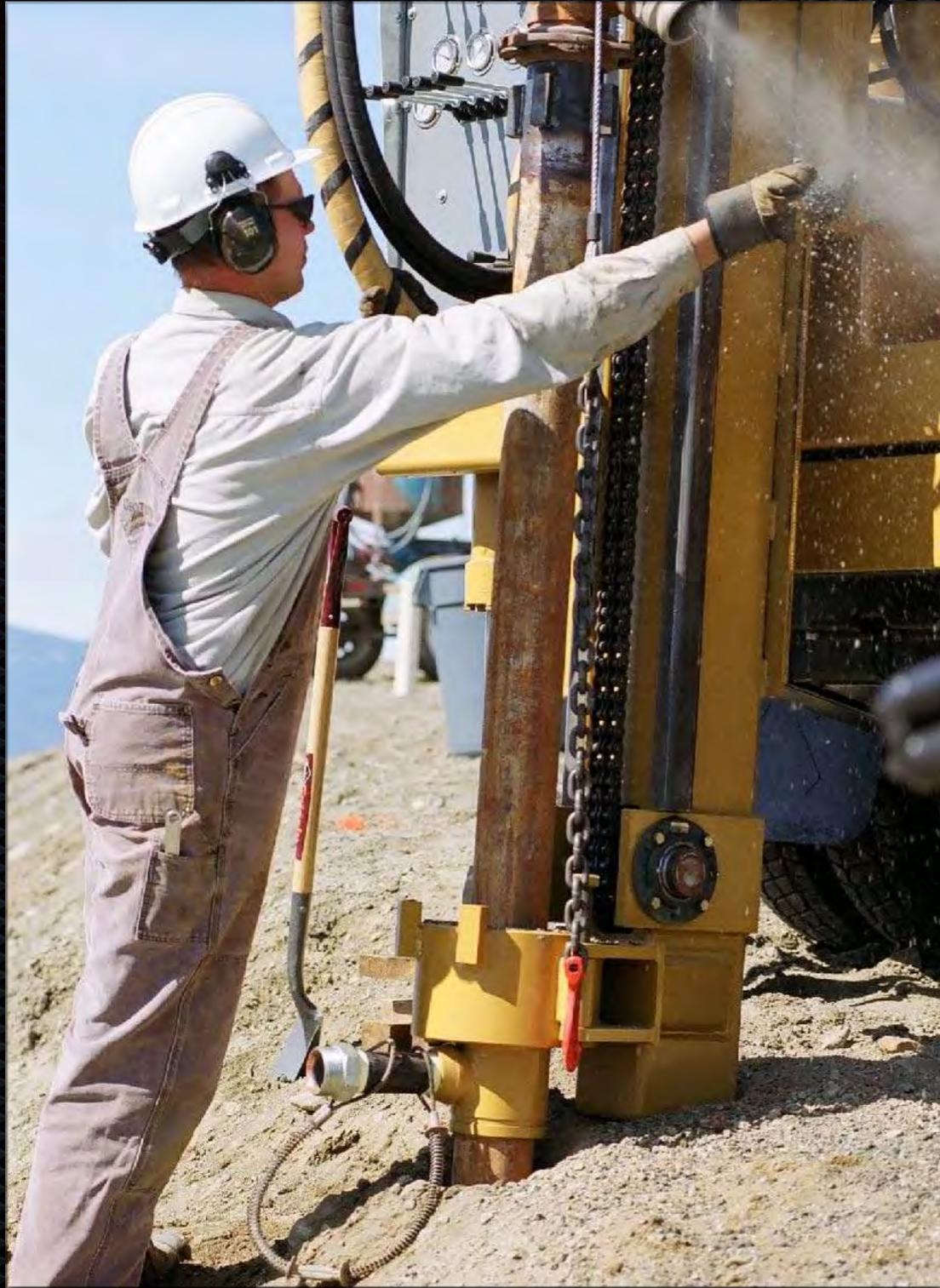
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# Experience

- Commercial GeoExchange Design, Installation & Financing
- District Energy System Design and Installation
- DE System Rate Design and Contract Negotiations





# GeoExchange Intro

## Ground Heat Exchanger (GHX):

- Transfers heat to and from the earth
- Typically consists of an array of HDPE piping in the ground
- Fluid pumped through the GHX transfers heat to / from building



# GeoExchange Intro

GHX's can be:

- Vertically drilled
- Horizontally drilled or  
trenched
- Located in lakes or  
ocean
- Other misc formats

Vertically drilled most  
common configuration due  
to space constraints



# GeoExchange Intro

## GHX Operating Temps:

- Ground loops like to operate between ~ 32F and 100F (water temperature returning from the GHX)



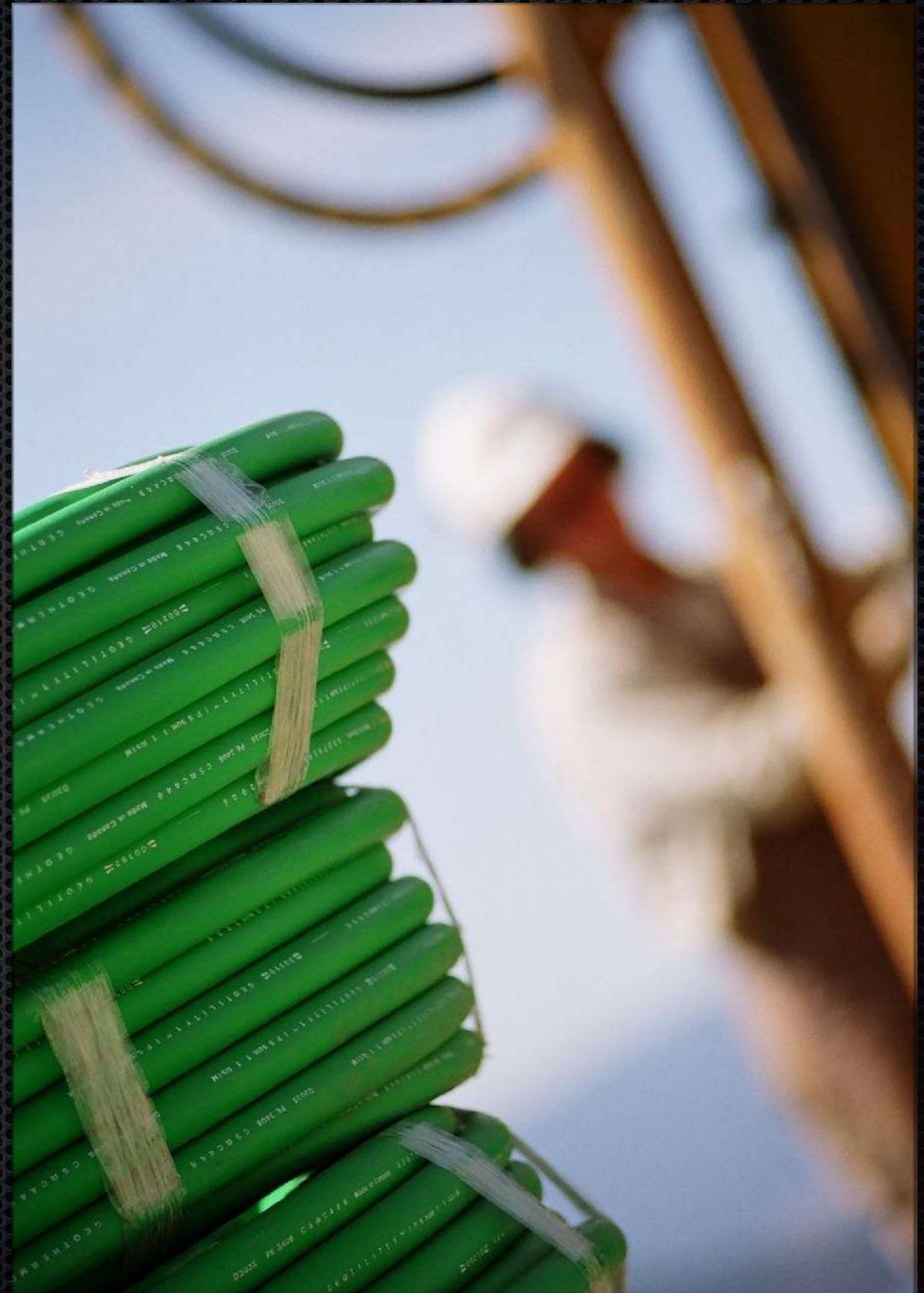
# Key Options When Integrating Geo into DE Systems

## GHX:

- Centralized or Distributed GHX

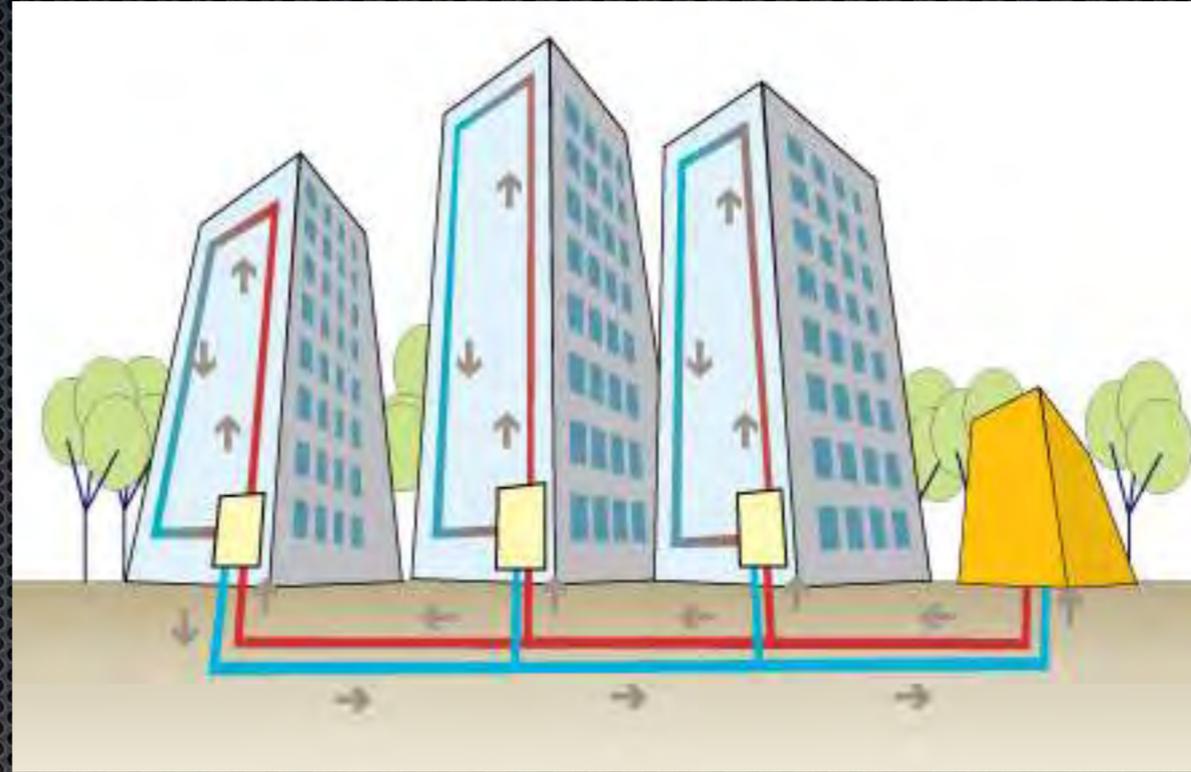
## System Temperature:

- Low Temp vs High Temp

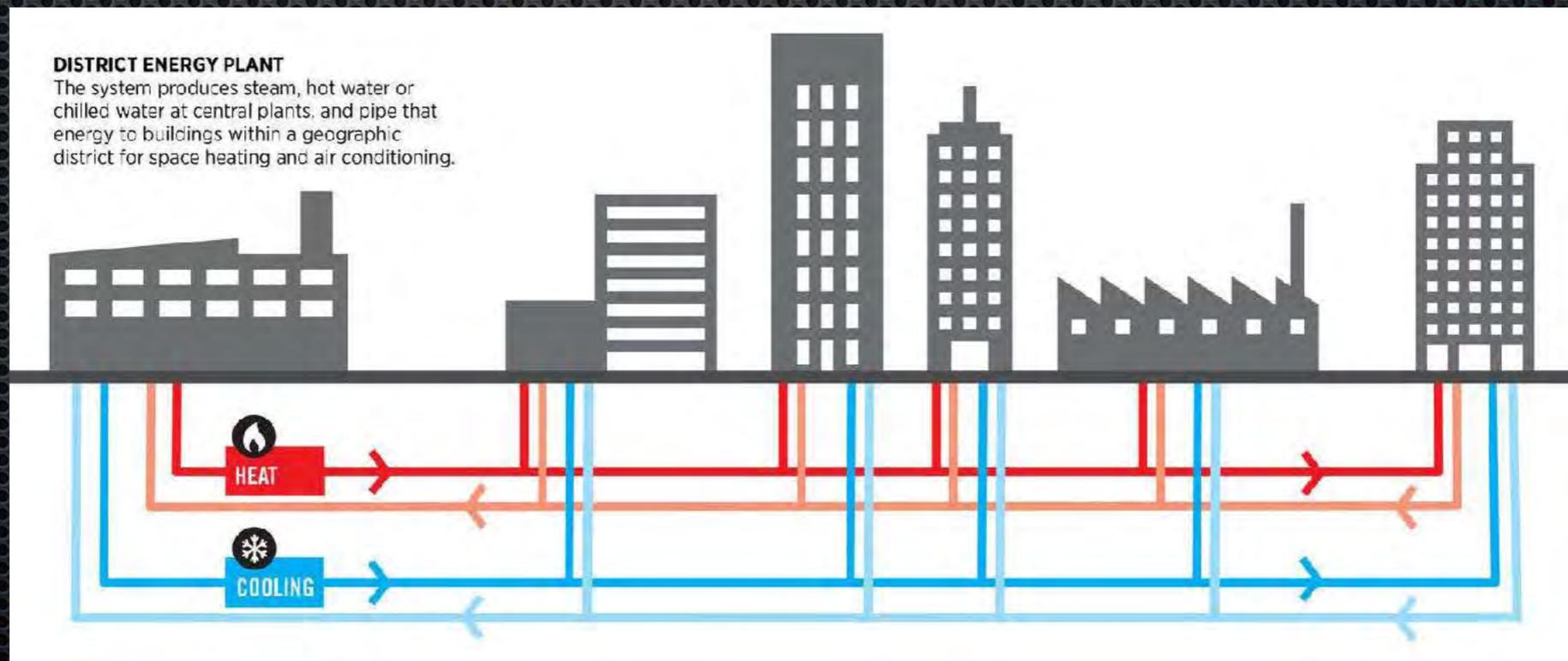


# Low Temp vs. High Temp

Low  
Temp



High  
Temp



# Low Temp vs. High Temp

## Key Factors:

### Geographic Layout

- Condensed site
- Multi-property site

### Utility Company Objectives

- Charging for end use thermal energy

### Installation Costs

- 4 pipe vs 2 pipe, insulated pipe vs non-insulated pipe, less central plant equipment



# Low Temp vs High Temp Comparison

<i>Factor</i>	<i>Low Temperature System</i>	<i>High Temperature System</i>
<i>Plant Design</i>	<i>Chillers / HP's located in individual buildings</i>	<i>Central chillers / HP's located in central plant</i>
<i>DE Piping Options</i>	<i>Typically 2 uninsulated pipe system satisfies both heating and cooling</i>	<i>Typically 2 insulated pipes required for heating and 2 insulated pipes for cooling</i>
<i>Building Mechanical System Options</i>	<i>Can be central plant within the building or distributed heat pumps as well as other options (i.e. VRF)</i>	<i>Typically fan coils or air handlers within the buildings</i>
<i>Utility Billing Options</i>	<i>Substantially less billing revenue as utility is only billing low-grade energy</i>	<i>Opportunity for higher revenue as utility is producing final heating &amp; cooling</i>
<i>Capital Expenditure Required</i>	<i>Same amount for ground heat exchanger, less for distribution piping and central plant</i>	<i>Same amount for ground heat exchanger, more for distribution piping and central plant equipment</i>



# City of Richmond - ADEU

## Low Temperature System

# The Facts:

- 2 pipe low temperature system (uninsulated HDPE)
- Central plant featuring natural gas boilers and closed circuit fluid coolers for hybrid application
- GHX's installed in multiple phases (currently at approximately 1,000 boreholes installed to 250 ft) in multiple locations around the energy centre
- Buildings have a variety of mechanical systems including distributed heat pumps and central chillers
- Capable of serving both residential and commercial buildings for both heating and cooling



# Senkulmen District Energy System

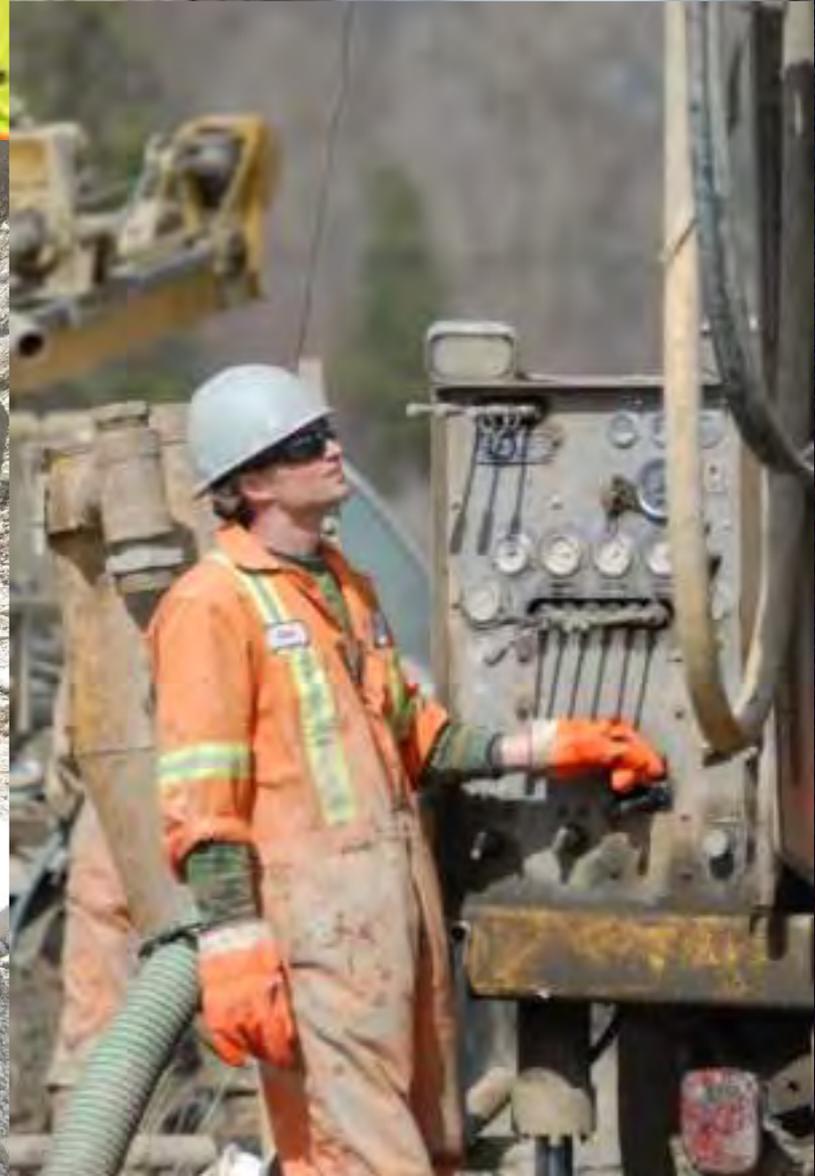
## Low Temperature System



# The Facts:



- 2 pipe low temperature system (uninsulated HDPE)
- Original phase serving only small warehouse building
- Expanded to provide heating and cooling to new provincial penitentiary
- Owned and operated by the Osoyoos Indian Band. Generates significant annual revenue to the First Nation
- Currently GHX serves entire district energy system. Any substantial increase in load could be achieved through the addition of boilers and fluid coolers
- GHX's installed in multiple phases
- Buildings have a variety of mechanical systems including distributed heat pumps and central plant equipment
- Can easily be expanded to serve different future occupancies



# Conclusions

- GeoExchange can be incorporated into both low and high temperature systems
- Low temperature loops provide more flexibility (from installation and design perspective)
- Low temperature is generally a simpler solution



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