



# Keeping the Athletes Warm with Sewer Heat: How did the System Perform?



**John Hart, P.Eng.**

**Kerr Wood Leidal Associates**

# Acknowledgements

- **Resort Municipality of Whistler**
  - James Hallisey
  - Andrew Tucker
  - Joe Paul
  - John Nelson
- **Whistler 2020 Development Corporation**
  - Neil Godfrey
  - Keith McIvor

- **DEC Design Mechanical Consultants Ltd.**



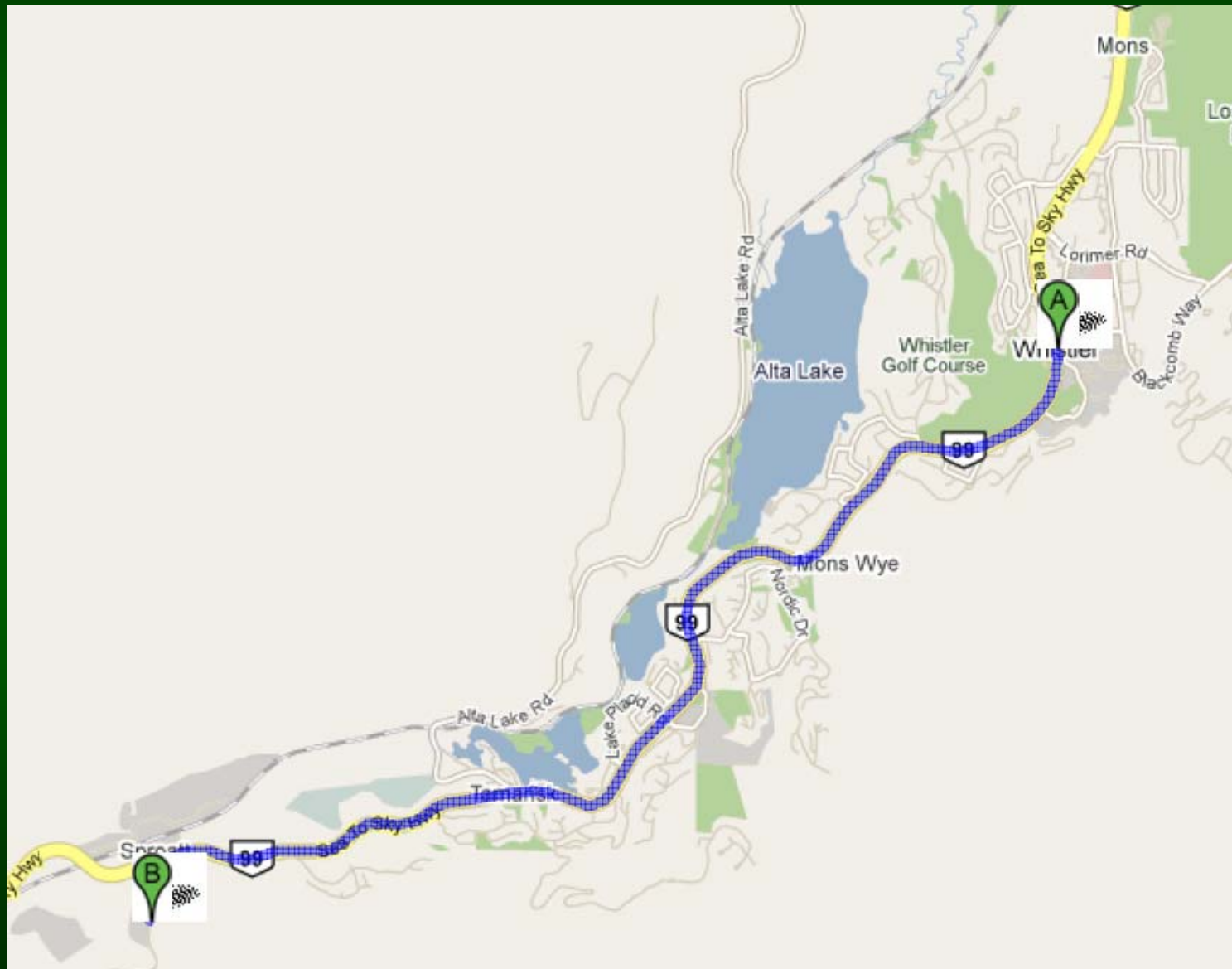
- **EMPAC Engineering Ltd. (Electrical)**



# Presentation Overview

- **Overview of District Energy System (DES)**
- **System Design Parameters**
- **System Performance: Commissioning & the Games**
- **Lessons Learned**

# Location Plan



# Whistler Athletes' Village



## *Whistler Athletes' Village* Low-Temperature District Energy-Sharing System

### EXTRACTING CLEAN HEAT FROM SEWAGE EFFLUENT

District energy systems are normally designed to circulate high temperature water through their distribution loops, limiting their use and responsiveness.

The Whistler system is unique in that it uses low-temperature ambient heat, making it flexible enough to provide both heating *and* cooling for the Athletes' Village.

Using recovered sewer heat, it is one of the first closed-looped, heating and cooling district energy system in the world.

Its use of treated effluent advances the science of reducing greenhouse gas emissions by replacing natural gas with a previously wasted energy source.

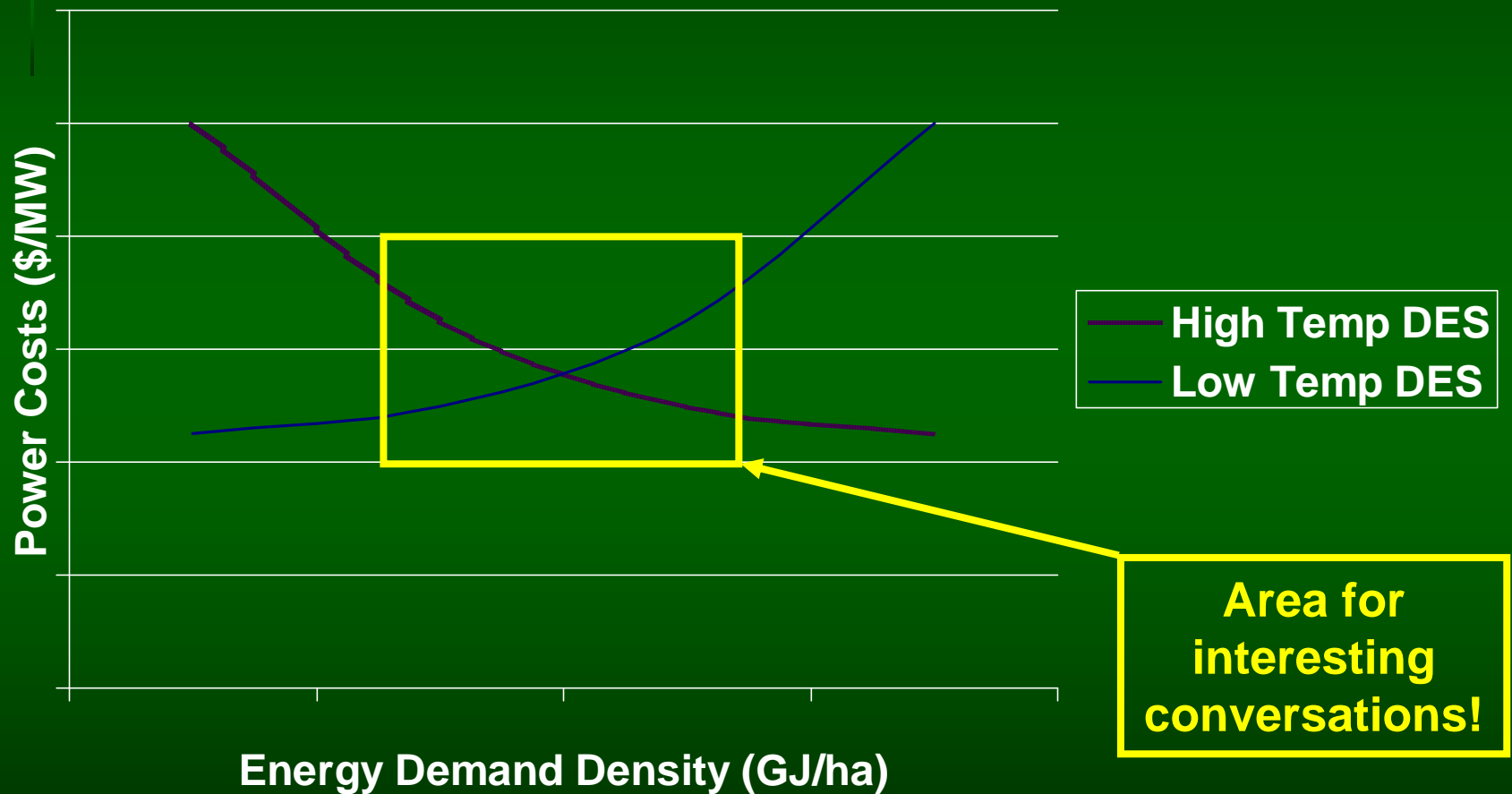
#### Whistler DES Size and Performance

- Reduction in natural gas heating: 97%
- Tonnes of CO<sub>2</sub> saved annually: 1,500
- Ultimate population served: 2,200



# Selecting a DES Technology?

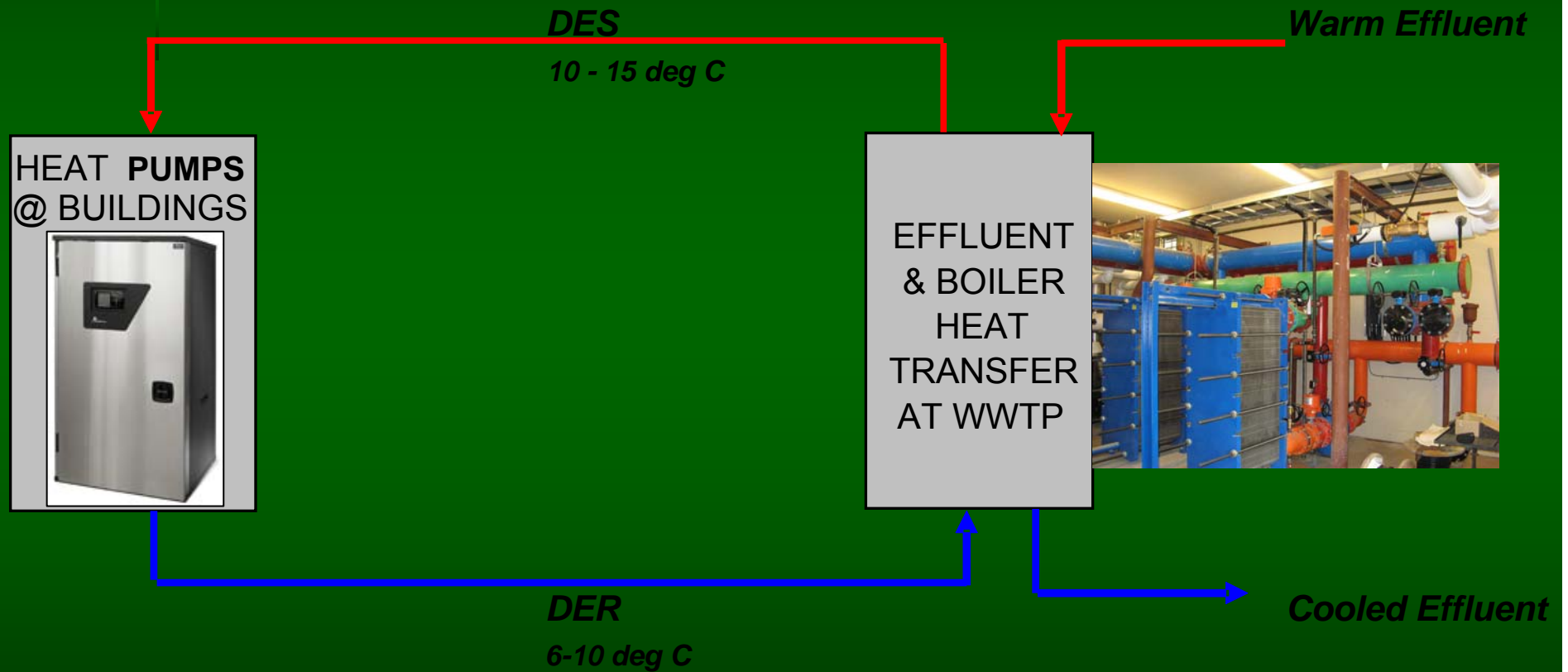
*(...over-simplified for illustrative purposes!)*



# Whistler Athletes' Village - DES

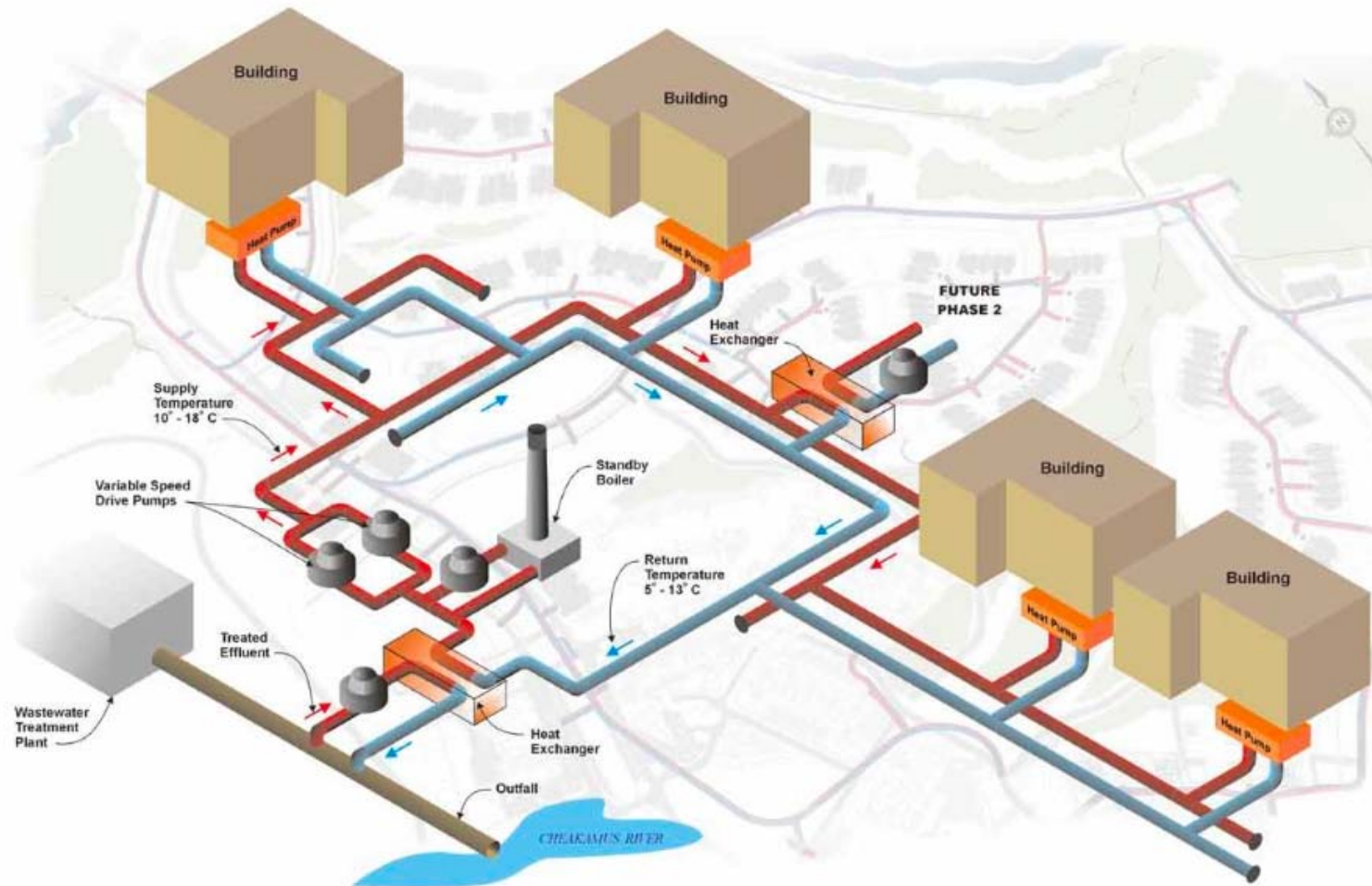
- **Low temperature District Energy System (DES)**
- **Primary heat source: WWTP treated effluent**
- **Secondary heat source: natural gas boilers**
- **Load-side ETS: heat pumps & heat exchangers**
- **Heat sharing: MURBs/Institutional cooling – shed heat to supply loop**
- **Phase 1 (current): 300 units; Phase 2: 600 units**

# WAV DES Design



# DES System Schematic

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# Whistler Athletes' Village (or now, Cheakamus Crossing)



# DES Effluent Heat Recovery System



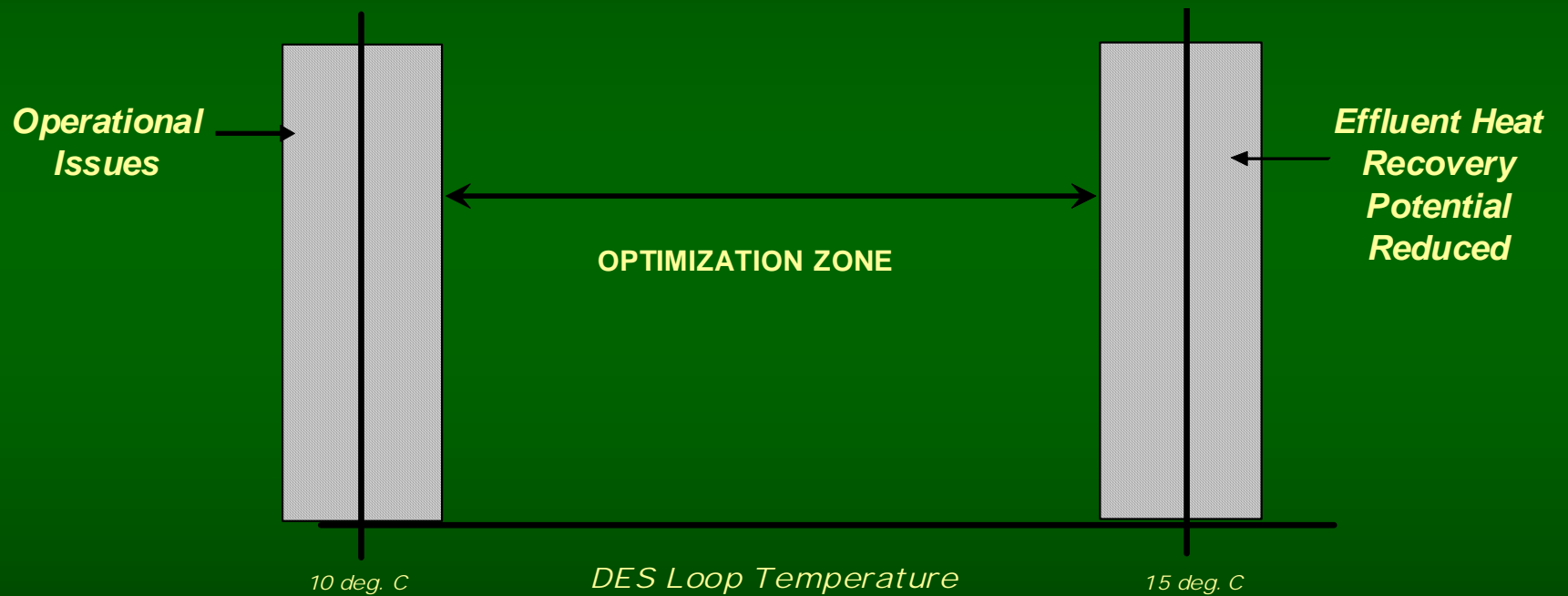
# WAV DES Key Variables

- Whistler Population ( $\approx$ WWTP Effluent Flow and Temperature)
- Weather Conditions; Rain-on-Snow ( $\approx$ WWTP Effluent Temperature)
- Outside Temperature ( $\approx$ Village Heat Demand)
- DES Supply Temperature ( $\approx$ DES Efficiency): Controllable Variable

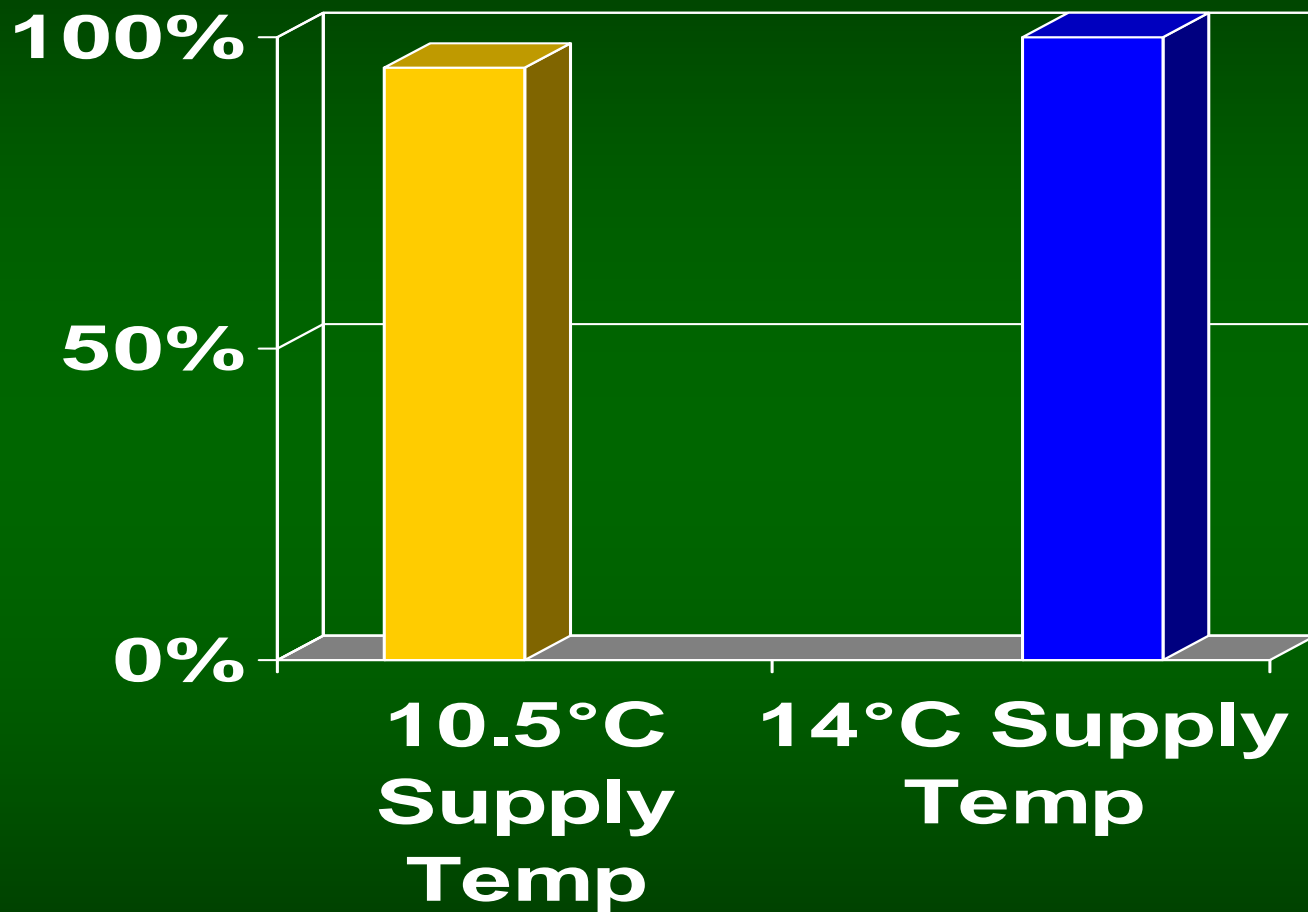
# WAV DES Design Parameters

- Flow rate: 1 to 4 m<sup>3</sup>/min (Phase 1)
- Supply Temperature: 10°C to 15°C
- Return Temperature: 6°C to 10°C

# WAV DES Optimization



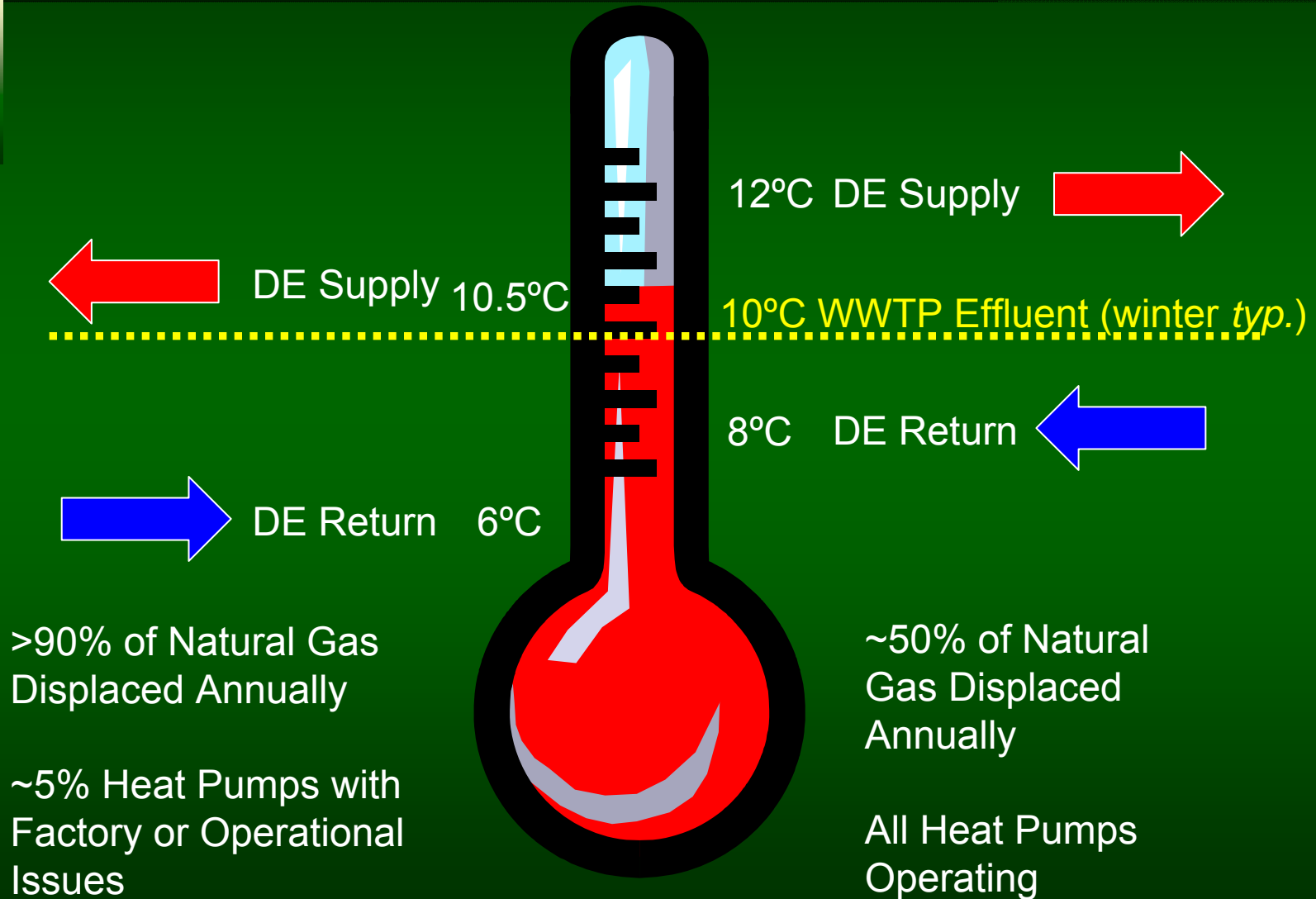
# **% Village Buildings On-Line (Load-Side Operations)**



**■ Before Games (95%)**

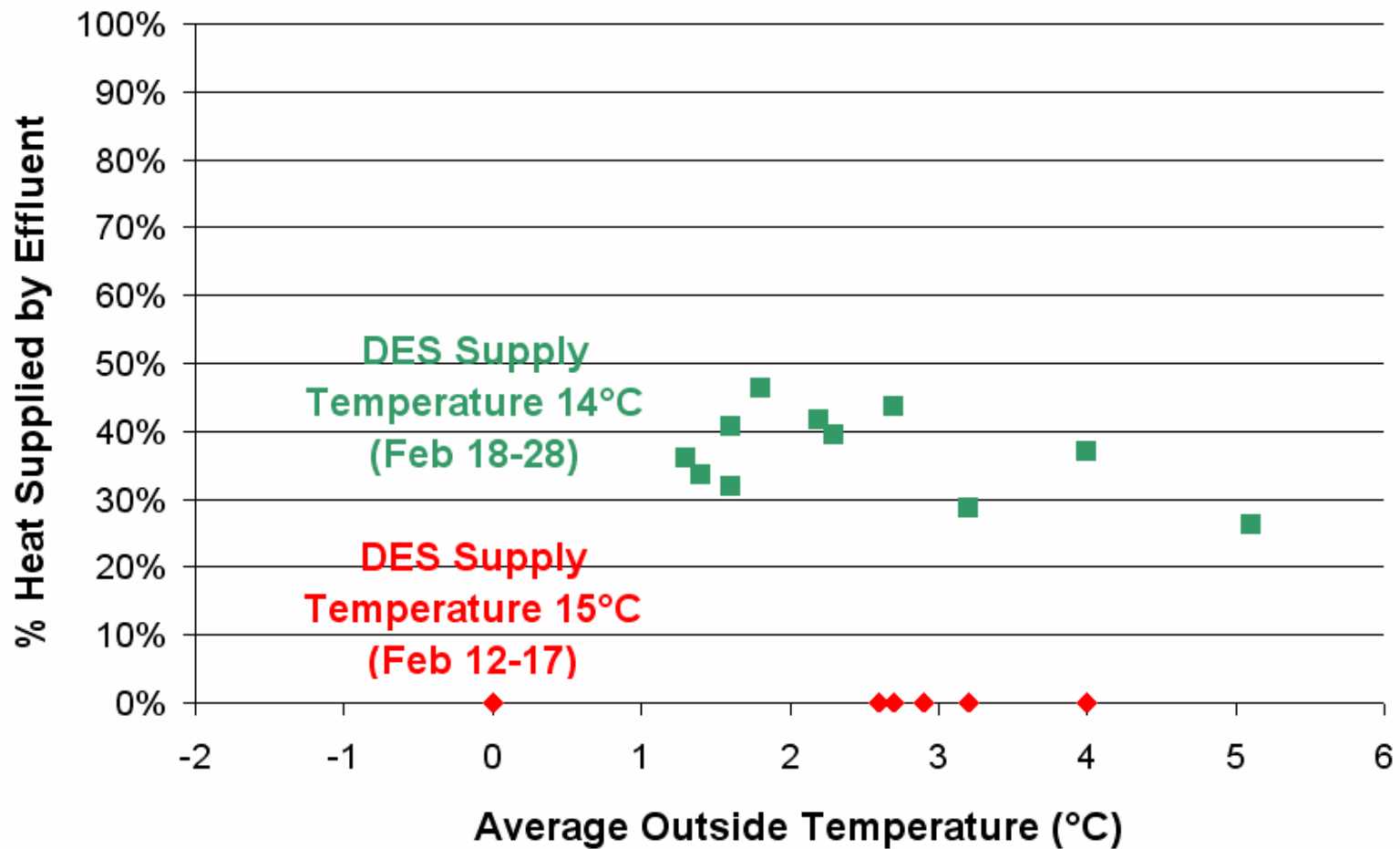
**■ During Games (100%)**

# WAV DES Optimization



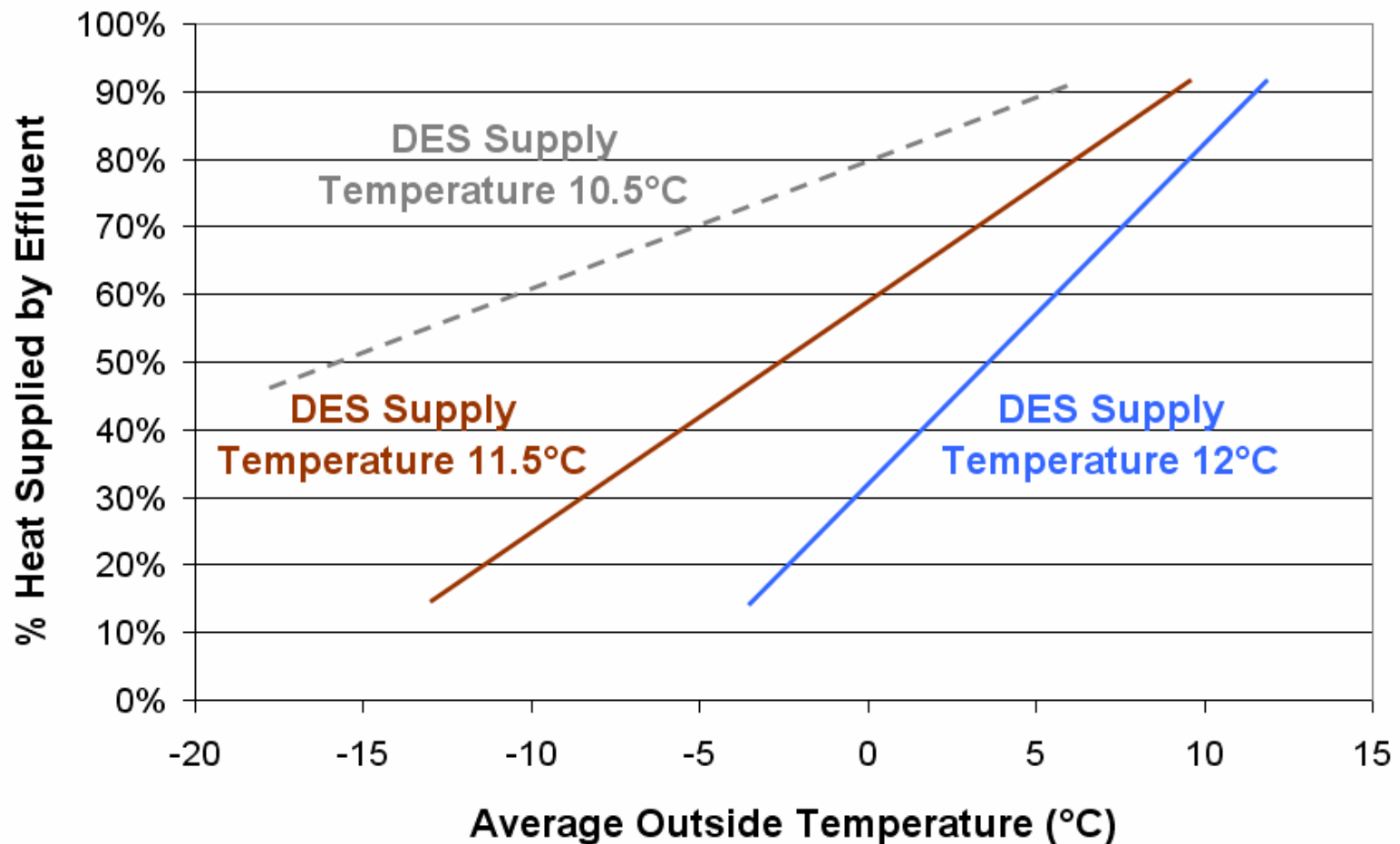
# WAV DES Operation During the Olympic Games

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# WAV DES Commissioning: Heat Supplied By Effluent

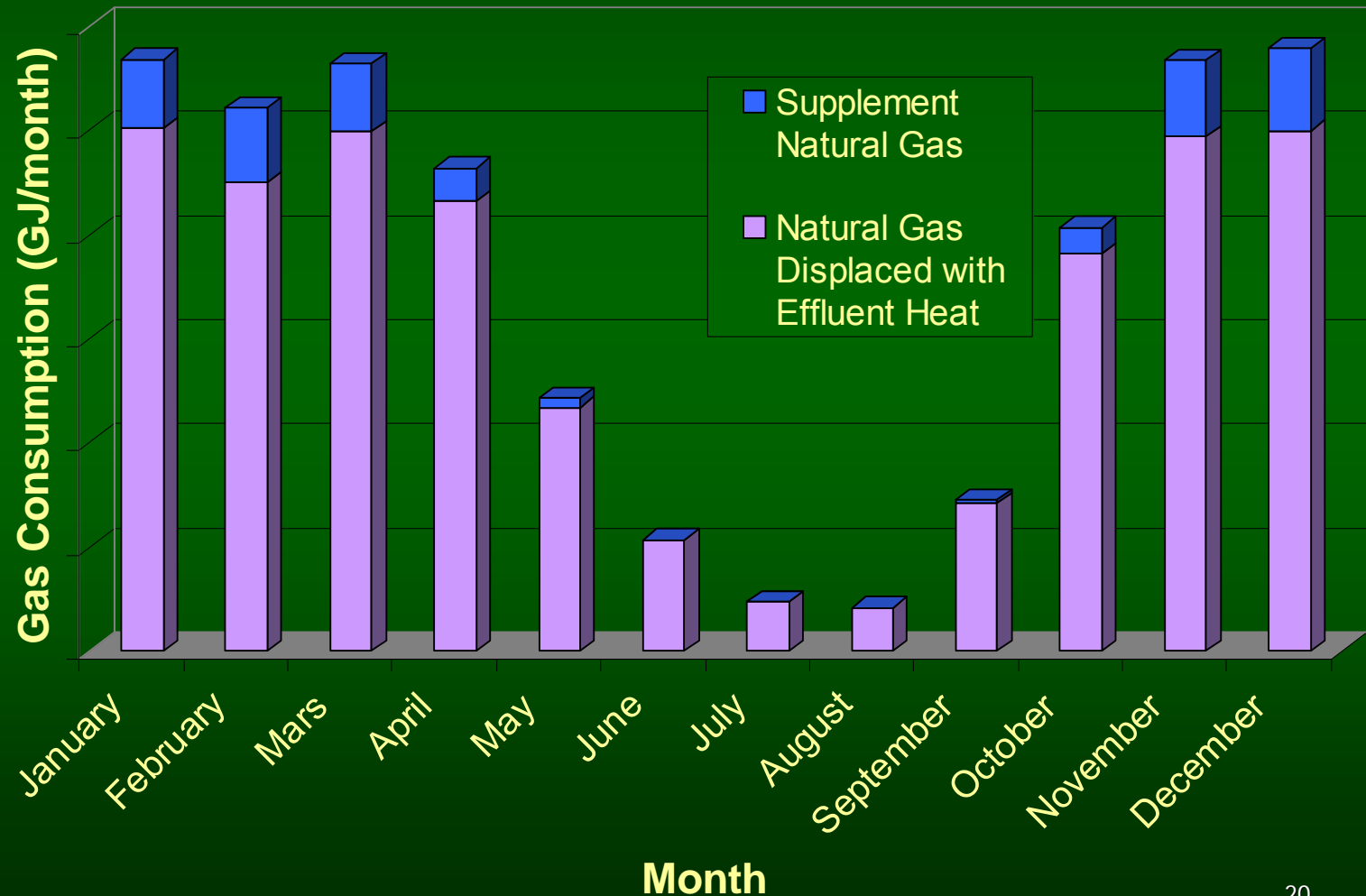
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Notes - solid lines: operational results; dashed line: system design parameters.

# WAV DES – Forecast Performance 10.5 deg C Loop Temperature

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Notes - February 2006 was warmer than average.

# Forecast Heating Energy Cost Savings – Development Phase 1

- 10.5°C DES Supply Temperature:
  - >90% displacement of natural gas
  - Annual saving of ~ \$300K from BAU (@2010 NG prices)
- 12°C DES Supply Temperature:
  - ~50% displacement of natural gas
  - Annual saving of ~ \$170K from BAU (@2010 NG prices)

# Lessons Learned

- The Whistler DES is a robust system; operating parameters are finely tuned
- $\Delta 0.5^{\circ}\text{C}$  in loop supply temperature has large effect on effluent heat recovery
- DES load-side users must understand system configuration, and employ heating equipment congruent with system operation parameters

# Questions?

John Hart, P.Eng.  
Senior Process Engineer  
Kerr Wood Leidal Associates  
604-294-2088; [jhart@kwl.ca](mailto:jhart@kwl.ca)

