Facility Overview

NWSC-2 Vendor Day

February 24, 2015
NWSC Overview

- Construction completed in 2011 at a cost of approximately $70M; focus on energy efficiency
- 153,000 square feet; 12,000 square feet of raised computer floor (Module B)
- Operations began on October 2012; Yellowstone in production on December 20, 2012
- NWSC-2 system slated for Module A; currently reviewing design/build proposals for the facilities work
- All work that is independent of specific NWSC-2 design will be completed by March 2016; system-specific fit-up will be completed by June 2016.
NWSC Operations

• NWSC is located approximately 7 miles west of the city of Cheyenne, northwest of the intersection of Interstates 80 and 25 in the North Range Business Park
• City of Cheyenne Population as of 2012 – 61.5K
• NWSC Operations are 7x24x365; three teams in the building at all times
  • CASG – Cheyenne Administration Support Group – Computer Room Operators
  • ISGC – Infrastructure Support Group Cheyenne – Power Plant Operators
  • G4S Security (contract)
• Excellent receiving and staging areas
• Vendor office space
NWSC AWARD WINNING DESIGN

- Uptime Institute – Green Enterprise IT Award 2013
- Data Center Dynamics – Green Data Center of the Year 2013
- 2015 ASHRAE Technology Award – Honorable Mention – Category IV – Industrial Facilities or Processes - New
Big Picture Focus On Energy Efficiency

- Utilize the region's cool, dry climate to minimize energy use
  - Very low pressure drop
    - Minimize bends
    - Oversized pipe
  - Elevated chilled water temp
    - 65 degree
- Utilize liquid cooled computer solutions where practical
  - HPC Systems
- Utilize hot aisle containment for commodity equipment
- Focus on the biggest losses
  - Compressor based cooling
  - Transformer losses

Typical* Modern Data Center

- Lights: 15.0%
- Cooling: 13.0%
- Fans: 6.0%
- Electrical Losses: 0.1%
- IT Load: 65.9%

* Conventional variable primary, evaporative cooling based Tier II data center with traditional 45°F water

NWSC Design

- Lights
- Cooling
- Fans
- Electrical Losses
- IT Load

91.9%
Innovative Sustainable Design Elements Abound throughout the Facility

• **Indirect evaporative cooling** provides low-energy economizer (free-cooling) cycle-based cooling system to provide chilled water for liquid- or air-cooled computing.

• **Implementation of broader ASHRAE indoor conditions** allow extended operating hours on economizer cycles for all but 300 hours per year, limiting mechanical refrigeration needs and lowering required refrigerant volume.

• **Large-capacity energy recovery heat pumps** cool computer systems and transfer waste heat to occupied areas.

• **Fan-wall technology** provides large air volume movement at very low pressure drop.

• **Duct-less air-based computer cooling system** further reduces pressure drop.

• **Low-energy, high-pressure fogging system** efficiently maintains humidification levels in critical spaces.

• **Envelope commissioning** ensures thermal and humidity control in critical IT spaces and occupant comfort in administrative areas.

• **Chilled water piping network with a very low pressure drop** is achieved with oversized piping, use of 45° turns instead of 90° elbows, and elimination of balance valves and other pressure-restricting devices in the mains.

• **Daylighting** in visitor and office areas reduces overall lighting power density.

• **Continuous insulation** on steel and precast concrete panel systems.

• **High-efficiency electrical components** configured into computing infrastructure to reduce electrical losses.

• **Direct connection of supercomputer processing nodes to utility power limits power transformation and UPS losses.**

• **Office HVAC systems design philosophy of limiting transport energy** using water-based cooling instead of air. Chilled beams used for cooling and radiant slab/baseboard radiation for heating.

• **Zero water blow-down** technology in the cooling towers significantly reduces water consumption in the cooling process.
Electrical Overview

Base NWSC Configuration

Module B
12,000 Sq. Ft.
(About 1MW UPS power available)

Module A
12,000 Sq. Ft.

CLF&P

Gen-1

Gen-2

2 MW EACH

USH-1
3MW

USU-1
3MW

USU-2
3MW

UPS-1
750KW

UPS-2
750KW

UPS Output / Static Switch

UPS Output / Static Switch

USH-2
NWSC2

Gens

Gens
The following energy efficiency strategies were implemented into the facility design to further reduce the PUE and EUI.

- Implementation of broader ASHRAE TC 9.9-2008 thermal indoor conditions allow extended operating hours on economizer cycles for all but 121 hours per year, limiting mechanical refrigeration needs and lowering required refrigerant volume. A psychrometric chart showing Cheyenne's outdoor weather (scatter plot) and resulting indoor conditions in relation to ASHRAE TC 9.9-2008 is provided in Figure 3.

- Large-capacity energy recovery heat pumps cool computer systems and transfer waste heat from the computer equipment to occupied areas of the building. Waste heat from the supercomputers is captured and reused to heat administrative areas of the building and to melt snow and ice on exterior walkways and loading docks.

- Fan-wall technology provides large air volume movement at very low pressure drop. Ductless air-based computer cooling systems further reduce pressure drop.

- Low-energy, high-pressure fogging system maintains humidification levels in critical IT spaces. Fogging systems are significantly lower energy than ultrasonic, steam, or electrical resistance type humidifiers.
65°F (18.3°C) Degree Chilled Water Evaporative Cooling Solution
IBM Equipment Layout

NWSC-2 Disc Storage Area

NWSC-2 Installation Area
NWSC LEED Gold Facility Preferences

Electrical
• Prefer 480V, 3 Phase-balanced loads
• Other voltages achievable

Mechanical
• Prefer liquid cooling: direct or heat exchanger doors
• Air cooling capacity ~ 2MW

Clean Room
* Restricted access; maintain clean environment