Recommended Practice for Energy Efficiency improvement

A General observation and inspection made in support with Grundfos, KSA

Inspected by:

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Date:	**Location:**	**Areas of Inspection**:
7.11.2024	Building 105	1. Rooftop Chiller plant 2. Water pumping station

Summary of Inspection:

This is a recommended practice report for energy efficiency improvement suggested with the support of Grundfos engineers and it identifies some operational inefficiencies and proposes strategies to enhance energy efficiency in Building 105 at Prince Sultan University. Key findings include issues with the rooftop chiller plant, underground water pumping control rooms, and improper use of Variable Frequency Drives (VFDs). Immediate actions based on standard operating procedures (SOPs) are recommended to optimize energy use without additional investment.

Scope and Methodology

Scope:

1. Rooftop Chiller Plant
2. Chiller Plant Control Room
3. Air Evaporators
4. Underground Water Pumping Control Rooms

Methodology:

1. Physical inspection of equipment and facilities
2. Analysis of operating standards and maintenance logs
3. Monitoring energy consumption patterns and equipment performance
4. Identification of inefficiencies and potential risks

General Inspection Findings

Chiller Plant (Rooftop)

1. **Setpoint Issues**: Suboptimal chiller temperature setpoints leading to excess energy consumption.
2. **Pump Operations**: Only two chiller pumps were operating, causing uneven load distribution and potential wear. – Chillers might suffer from Low Delta T Syndrome (LDT should be investigated).
3. **Regular Maintenance**: It is observed that the pump used in the chiller plant require regular maintenance. (leakage at mechanical seal at CHW pump).

Underground Pumping Stations

1. **VFDs Not Operational**: Pumps operated directly from supply, bypassing VFDs, leading to inefficient energy usage.
2. **Pump Operation**: Pumps run at full load and abruptly switch off, increasing energy waste and mechanical stress. Also, frequent start and stop of the pump may reduce motor's lifetime and may trip the motor because of overheating.
3. **Pipeline Vibrations**: Significant vibration during pump startup/shutdown, risking pipeline leakage and water hammer effects.

General Maintenance Issues

1. Lack of adherence to operating standards.
2. Insufficient routine maintenance causes inefficiencies and equipment degradation.

Recommendations

Optimize Chiller Plant Operations

1. **Reset Temperature Setpoints:** Align chiller setpoints with cooling load requirements to avoid overcooling and energy wastage.

2. **Distribute Pump Load:** Ensure all pumps are operational with balanced load distribution to improve efficiency and extend equipment life.

Restore and Utilize VFDs in Pumping Stations

1. **Repair/Reactivate VFDs**: Reinstate VFD functionality to allow variable speed operation, reducing energy demand during low-load conditions.
2. **Adjust Pump Operations**: Implement soft start/stop sequences to minimize mechanical stress and vibration.

Address Pipeline Vibrations

1. **Install Dampers or Expansion Joints**: Reduce vibration and protect pipelines from potential leakage.
2. **Regular Inspections**: Schedule periodic checks for pipeline integrity and promptly address wear and tear.

Establish Standard Operating Procedures (SOPs)

1. **Maintenance Logs**: Develop a routine maintenance schedule and document all actions for accountability.
2. **Energy Monitoring**: Introduce an energy tracking system to identify anomalies in real time and adjust operations accordingly.
3. **Training Programs**: Train facility staff on energy-efficient practices and equipment handling.

Enhance Equipment Utilization Without Investment

1. Optimize the sequence of pump and chiller operations based on actual demand.
2. Leverage existing automation systems to implement night setbacks and partial load conditions during off-peak hours.
3. Reduce lighting and HVAC loads during non-operational hours were feasible.

Expected Benefits

1. **Energy Savings**: Lower operational energy costs by optimizing equipment usage.
2. **Extended Equipment Life**: Reduced mechanical stress and wear due to improved operations.
3. **Risk Mitigation**: Prevent pipe leakage and water hammering through vibration management.
4. **Sustainability**: Support the university's alignment with energy efficiency goals such as SDG 6, 7, and 13.

Conclusion

The energy inefficiencies identified in Building 105 present significant opportunities for improvement without requiring additional investment. By implementing

the above recommendations and adhering to SOPs, Prince Sultan University can achieve substantial energy savings, operational reliability, and sustainability. This report also recommends to implement the strategy all other buildings in PSU through proper channel.