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How Maintenance is Essential to Energy Saving

Objectives

- **Identify chilling and refrigeration equipment maintenance (Benchmark)**
- **Identify 4-8 companies for in-depth investigation into:**
  - **Maintenance strategy development**
  - **availability (actual operating time),**
  - **efficiency (running temperatures)**
- **Identify barriers to development and implementation of new maintenance strategy**
- **Examine case study evidence to support the need for a new maintenance strategy**
- **Produce report to outline the link between inappropriate maintenance and energy consumption.**

Results from data collection and analysis

- Predominantly reactive maintenance
- Little or no planned maintenance activities
- Costs of maintenance (planned or unplanned) not recorded
- Energy consumption not recorded
- Space utilisation is poor (increased running costs including maintenance costs)

Barriers to maintenance strategy development

- Lack of finance
- Lack of time to develop and implement new initiatives
- Lack of skilled engineers and equipment operators

- NEW cost effective strategy required

Energy Efficiency in Refrigeration

- **Role of Maintenance**
  - Cost savings of 50% or more can be achieved by ensuring that your refrigeration plant is well maintained. Improved reliability also reduces the chance of systems breaking down. (Carbon Trust)
- **Reduce costs**
- **Reduce energy consumption**
- **Improved Health and Safety**

Maintenance Issues

- The major efficiency problem is loss of coolant
- This has other environmental side effects:
  - Many refrigerants are greenhouse gases, some are far more potent than Carbon dioxide.

Condition Monitoring Technologies

- **Thermal camera**
  - **For observing heat loss**
- **Vibration sensors**
  - **For monitoring the condition of bearings etc**
- **Temperature sensors**
  - **For measuring whether the system is operating within its optimal parameters**

Case Study

- Carried out at an indoor skating arena in Madison, Wisconsin.
- Loss of refrigerant in one of the two banks led to a drop in performance of approximately 33%

Case Study – solution

- Add a monitoring system to record:
  - Refrigerant pressure
  - Operation of the relief valves
- Total cost of proposed system in case study system would be $420
- The installation cost is assumed to be approximately $2000
- Net savings with the system based on the problems which occurred were estimated at $7439

Case Study 2

- Stonyfield Farms Yogurt.
- A controller regulates the set points of the compressor based on load.
- This resulted in annual cost savings in the region of $2000.

Other factors affecting performance

- Compressor Performance
- Condenser Performance
- Evaporator Performance

Compressor Performance

- Compressor power consumption can be affected by:
  - Refrigerant temperature
  - Condensing pressure
- Monitoring the refrigerant temperature and pressure provides a picture of the current operating condition of the compressor.

Condenser Performance

- The key issue in condenser efficiency is selecting the correct specification for the task
- Efficiency can, however, be maintained by keeping condensers free of hard water and bacterial build up

Evaporator Performance

- **Evaporator efficiency can be maintained by keeping fin blocks and tubes clean and adequately defrosted.**
- **Optimising the frequency and timing of defrost cycles can achieved substantial energy savings.**

Summary

- **Better monitoring and maintenance planning can reap substantial benefits:**
  - Energy efficiency
  - **Better reliability**
  - **Less leakage of greenhouse gasses**