3 Techniques to Reduce HVAC Energy Waste for Immediate Savings

Application Note

*Figure 1: Checking pressure drop across the air filter with **Fluke 922 Airflow Meter/ Micro-manometer***

The HVAC system is often among the largest consumer of energy within a facility. Air ventilation volumes and outside air percentages should always align to ASHRAE standards, however system settings stray over time. Many systems over-ventilate, either because of discrepancies within the system or because of waste inefficiencies in the distribution process. That over-ventilation represents excess energy being used to condition and distribute air unnecessarily. The larger loads in a facility are often found in the HVAC system: chillers, compressors, air handlers, fans, motors, and pumps.

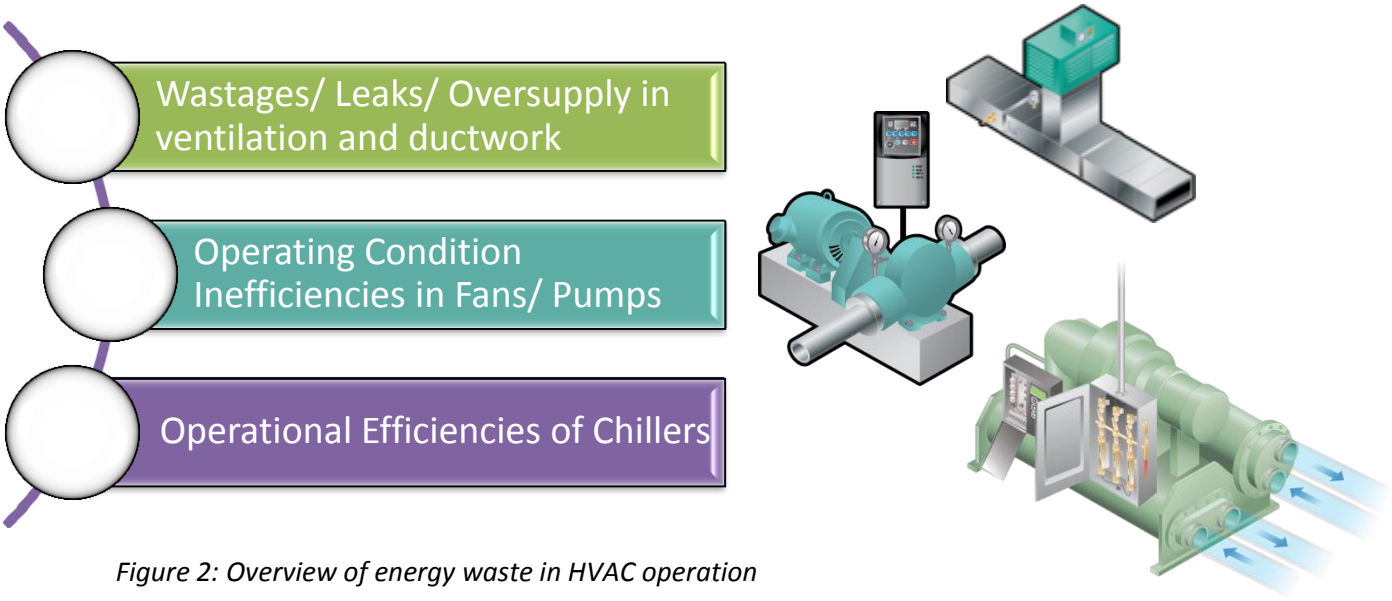

Figure 2: Overview of energy waste in HVAC operation

Reduce HVAC Waste from Oversupply & Leaks in Ventilation and Ductwork

The biggest savings potential for the **Fluke 922 Micro-manometer** is measuring what's called pressure drop across a filter. The pressure drop could determine whether the filter is clogged. For example, take a pressure measurement on either side of the filter – the more clogged the filter is, the greater the difference will be in pressure. Clogged filters and dirty fans will make the HVAC system work far harder than it should, thus wasting energy. You can also use this tool to verify whether dampers are fully opening and closing, based on pressure measurements on either side of the damper. The **Fluke 922 Micro-manometer** also measures air velocity and air flow readings and can be used as a secondary tool to evaluate overall ventilation performance.

The **Fluke 922 Micro-manometer** provides differential and static pressure, air velocity and air flow readings to assess the condition of the pipes. This enables analysis of filter condition, working pressure, and airflow. Understanding and optimizing the conditions of these areas can lead to significant savings – for instance, high airflow resistance from clogged filter can force the fans to consume 15-20% more energy. The rule of thumb is to check if pressure drop across filter is less than 25% of rated maximum static pressure of the fan.

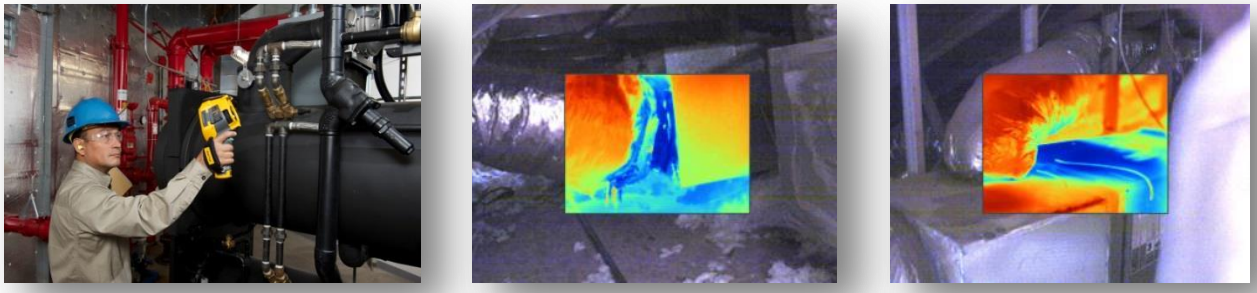

*Figure 3: Using **Fluke Ti400 Thermal Imager** to inspect HVAC equipment & ductwork*

In addition to poor condition of ductwork, joints, insulation and other ventilation infrastructure components also lead to over-work by the conditioning and distribution system, where using a **Fluke Thermal Imager** can:

- detect temperature differences at duct joints indicating sealing problems, insulation leaks and other air leaks
- spot check temperature at air vents, for sensor correction

Look for non-uniform temperature patterns detected in HVAC equipment and ductwork as they indicate excessive heat transfer or thermal leakages. **Fluke Thermal Imagers** are used to:

- inspect compressors, heat exchangers, cooling fans, electrical circuits, belts, motors, bearings, electrical components, and ductwork
- verify the temperature, operation, and balance of air diffusers
- quickly verify thermostats and wall sensors

Reduce HVAC Waste from Operating Condition Inefficiencies

Over time, your fans and pumps develop inefficiencies due to increased heat or friction. In the worst case, faulty fans in inaccessible locations would even overload electrical conductors and increase risk of fire in commercial buildings.

Overheated equipment would in fact convert a considerable amount of consumed energy into unused heat loss. It is recommended by many regulatory bodies to perform thermal scanning on electro-mechanical equipment to reduce fire risk and ensure effective operating condition.

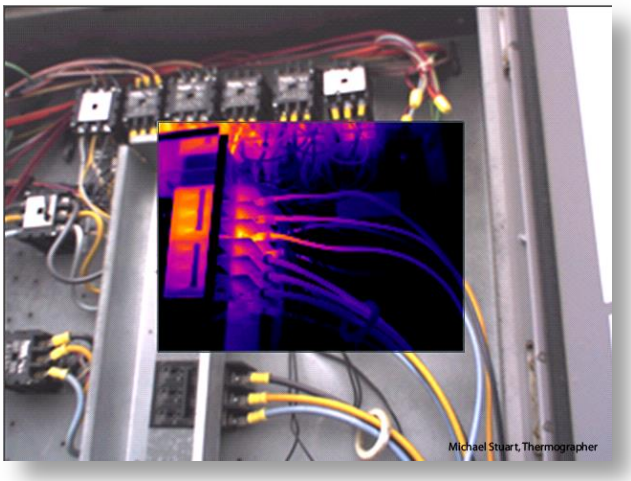

Figure 4: Overheated, high-resistance electrical connection in the supply panel to the HVAC rooftop system

Fluke Ti400 Thermal Imager is an effective tool for thermal scanning of fans, pumps, HVAC system, electro-mechanical system and many more. With the unique LaserSharp™ Auto Focus feature, consistently in-focus images are guaranteed. Missing problems due to blur, out-of-focus images can no longer lurk in your system.

Vibration, which creates stress as well as wear and tear, causes system inefficiencies. Friction in moving components generates heat which drives components will need to compensate for. Thus, another popular technique to identify inefficiencies in HVAC machineries is to use vibration testing.

Any engineer or technician, even with minimum training in vibration technology, can use **Fluke 810 Vibration Tester** to identify root causes of excessive vibration and friction in HVAC machineries. Fluke 810 diagnoses vibration signatures and gives clear and actionable answers to mechanical condition:

- What the problem is: bearing problem, misalignment, imbalance or looseness
- Where the problem is: on the motor, on the load, on which bearing or on the shaft
- How bad the problem is: can be flagged in a vivid traffic light color indication

One of the key advantages of **Fluke 810 Vibration Tester** is the ability to diagnose without prior measurement history. In most cases for HVAC vibration testing, you cannot afford to collect data and trend 6-9 months data before having your results. Fluke 810 will thus be the fastest way to jumpstart a vibration maintenance program to identify problems and start saving from the get-go. Read more on HVAC vibration testing in the application note here.

Besides identifying problems, you can also use **Fluke 830 Laser Alignment Tool** to correct misalignment problem. Precise alignment can protect mechanical components from damaging vibration and excessive friction, thus reducing energy consumption.

Figure 5: ***Fluke 810 Vibration Tester*** *to identify problems and* ***Fluke 830 Laser Alignment Tool*** *to align shaft precisely*

Reduce HVAC Waste from Operational Efficiencies of Chillers and HVAC Machineries

Significant savings can be achieved by managing peak demand. First, log power consumption for 1 operation cycle – usually at least 1 week – to understand demand profile. **Fluke 1730 Energy Logger** or **Fluke 435-II Power Quality Analyzer** is the tool of choice for many energy managers and maintenance team due to best-in-class safety ratings, ease of use and reliable measurement.

Peak demand usually falls on a particular day of the week. Figure 6 shows a typical demand graph. Different bars in the graph are power demand in each day: Monday, Tuesday, Wednesday, Thursday, Friday (usually higher bars on work day), Saturday and Sunday (lower bars on weekend). In the graph, the peak demand 7600kW happens on one Monday morning.

Next, prepare a list of loads or equipment running on that particular day, and arrange them by 'size' from large to small. Chiller is an example of a large equipment. Lightning circuitry can be another. Now you can log the major HVAC loads on the particular day (Monday in this case) to understand what was happening. From demand profiles of major loads, you will understand the causes of peak demand. It could be because many HVAC loads start to operate at maximum power in a same time frame.

Review the operation of your facility and find a way to stage the operation of HVAC equipment in an earlier or later time to avoid cumulative demand turning into a costly penalized peak demand.

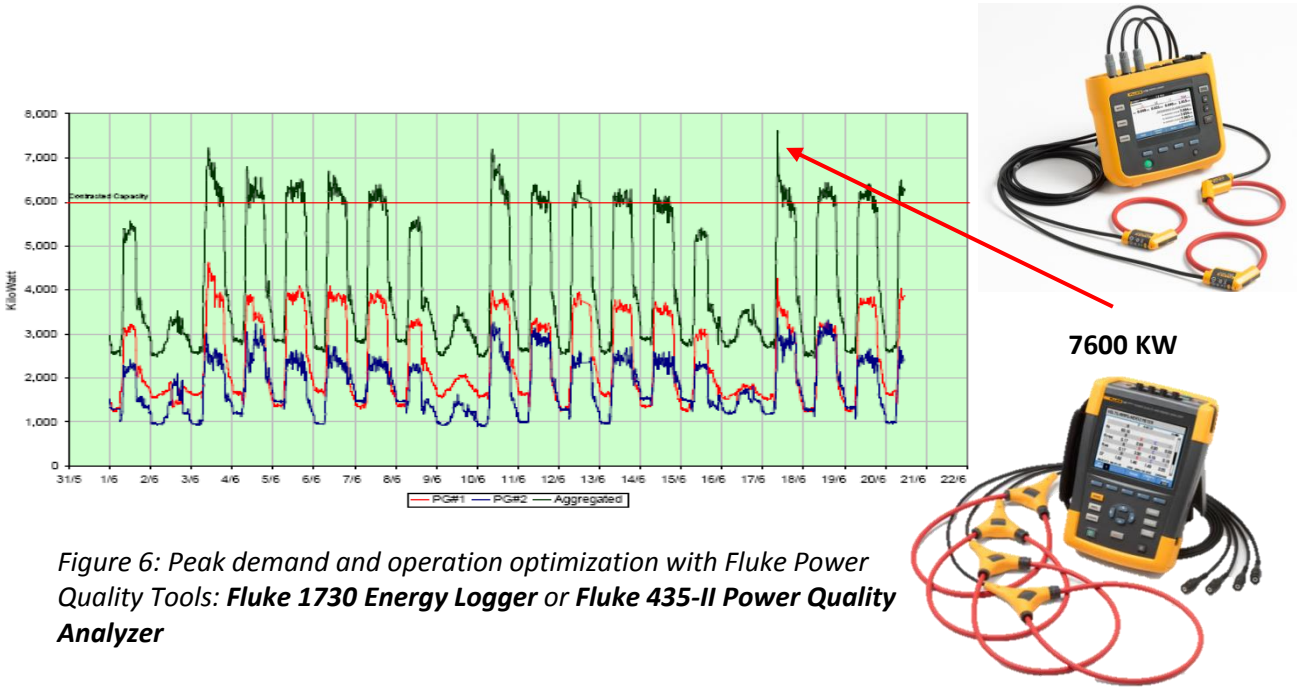

Figure 6: Peak demand and operation optimization with Fluke Power Quality Tools: ***Fluke 1730 Energy Logger*** *or* ***Fluke 435-II Power Quality Analyzer***

Peak demand management and operation optimization is easy to implement if you have the data to back your decision.

In conclusion, avoiding guesswork is a key to successful energy management. Use and share the 3 techniques in this article to stay ahead of competition and achieve your energy saving goal with confidence.

Fluke. *Keeping Your World Up and Running.*

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