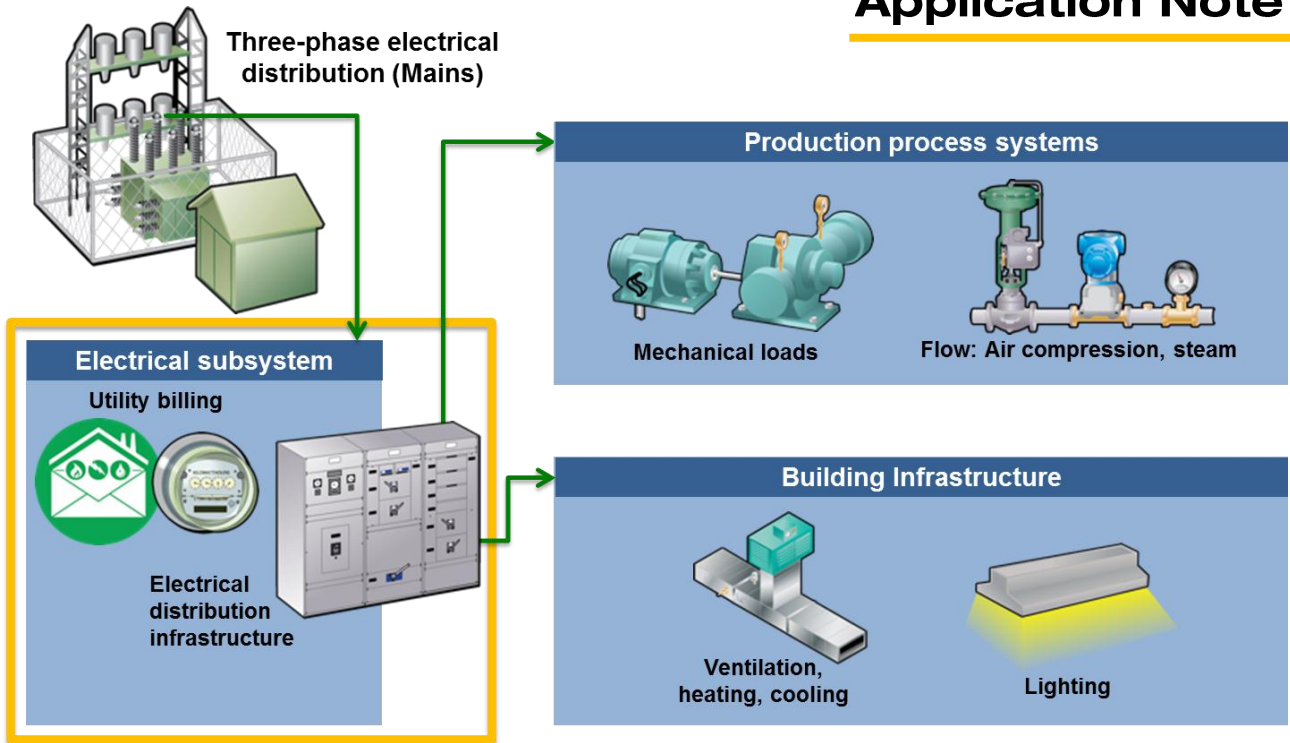


HOW MUCH DOES WASTED ENERGY COST YOU EVERY YEAR ?

FLUKE®

Application Note



If you do not know the number, it is time to find out.

Companies have been trying ways to bring down their manufacturing costs. Exploring advance automation technologies to reduce labor, to improvise their manufacturing process and more but their biggest cost is still from the energy consumption.

Test & Measurement tools have been evolving in the recent years that enable companies to see more details and understand their energy waste electrically, mechanically as well as to detect significant energy wastage from their HVAC System in their production facilities.

Energy management is a growing trend globally, where companies are exploring the better approach to achieve energy consumption optimization. Energy Management process involves energy consumption monitoring, managing and conserving the energy used in the production floor or building. Energy management helps to identify and eliminate unnecessary energy waste, thereby increasing the overall energy efficiency of the manufacturing plants.

Measureable energy formats:

- Heat
- Electrical
- Pressure (steam, air, water)
- Mechanical force (rotating/centrifugal)



Why does measuring energy matter?

Measurement data supports the decisions and actions that reduce energy consumption and cost.

Electrical Waste

Power consumption will be the key area we will start with. Without knowing how much we have consumed, we will not be able to justify how much we have wasted. We can use Energy Analyzer like Fluke 1730 to log and understand the amount of energy we have consumed.



Fluke 1730

This will help to visualize the amount of energy we will need for each production line and it's processes. These are important data that can help the companies to make wise decision to manage their manufacturing processes to avoid getting penalized for exceeding the peak demand contracted power with the Utilities company.

Fluke 1730 Energy Analyzer can also use for load studies and minimizing detect electrical energy waste from machine in idling mode, e.g compression air leakage.

This will enable you to identify some critical electrical wastes, but not all. In the modern automation era, there are a lot of modern electrical noise in our power system that has created a lot of new electrical waste but has gone unknown. To save more, we need to be able to detect these non-linear loads' noises with the right tools.

Fluke 435 Series II Power Quality and Energy Analyzer will be able to help to detect all these risks and also quantify the impact of your energy waste, in term of watts and dollars.

ENERGY LOSS CALCULATOR				
DEMO	0:02:13			
	Total	Loss	Cost	
Effective kJ	187	kJ 15.6	Eur 2.39	/hr
Reactive kvar	25	kJ 0.3	Eur 0.04	/hr
Unbalance kVA	22	kJ 0.4	Eur 0.07	/hr
Distortion kVA	35	kJ 1.6	Eur 0.24	/hr
Neutral A	38.0	kJ 0.1	Eur 0.01	/hr
Total			kEur 23.64	/hr
10/28/12 13:41:00	230V 50Hz 3Ø WYE	EM50160		
LENGTH 200 m	DIAMETER 50 mm2	METER	RATE 0.15	

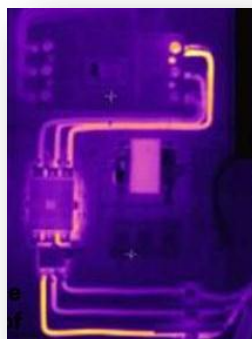
Fluke 435 II



To make electrical energy waste detection more efficient, we can also leverage on advance IR technology to sniff out the "HOT SPOT" for good saving from electrical waste using *Fluke Ti 400 Laser -Sharp Focus Thermal Imager*.



Fluke TI 400



Energy Waste in Production Process System

In the production process system, you can find many energy waste, especially those in electro-mechanical systems. Widely publicized estimates show that systems driven by electric motors consume more than half of the electricity produced in the U.S. and more than 70% of the electricity used in many industrial plants.

There are two primary ways to decrease the amount of energy consumed by motors and other similar large mechanical loads:

1. Apply a control device to modulate operation and manual or automated shut-off when process is not required. Some studies shows that by reducing a motor speed to half by using a variable frequency drive can reduce energy consumption to an eighth of that compared to running at full speed
2. Improve maintenance/efficiency of device operation

Many facilities find that it makes sense to divide their motor efficiency strategy into three phases:

- Overall energy consumption and efficiency assessment
- Immediate improvements
- Long-term maintenance strategy changes

Top inspection points for identifying energy waste in electro-mechanical systems

• Electrical issues

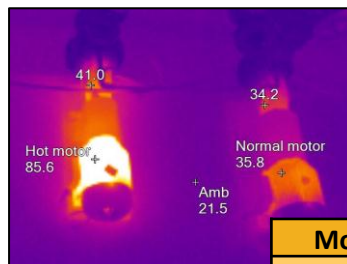
- Current Overload
- Phase Imbalance
- 3rd or 5th harmonics on the line (overheating)
- High-resistance connections: Too loose, too tight, or corroded

• Overheating Issues

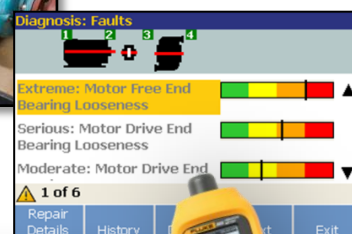
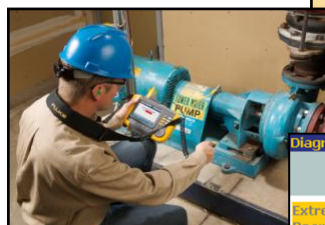
- Internal motor winding problems
- Cooling and airflow problems

• Bearing issues

- Under-lubrication
- Over-lubrication
- Misalignment
- Bearing failure



Motor Overheating Cost	
Increase over Maximum Temperature Rating	Insulation Life Reduced by
+10°C (18°F)	-50%
+20°C (36°F)	-75%
+30°C (54°F)	-88%



For most of the issues above, you can leverage on **Fluke Ti 400 Thermal Imager** to detect the “HOT SPOTS” effectively. You can use the **Fluke 435 Series II Power Quality & Energy Analyzer** to sniff out all the PQ energy waste in the electro-mechanical machines and determine the root causes of the issues. For mechanical energy waste, you can detect via **Fluke 810 Vibration Tester** and solve most of mechanical issues in the system thus achieve savings in your overall utilities bills.

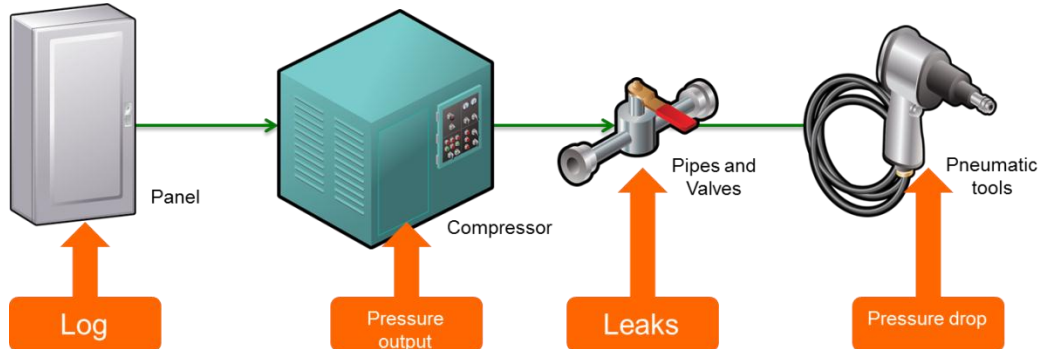


Fluke 810

Fluke 805

Energy Waste in Production Process System (cont'd)

In the production process system, another area of high potential energy waste is at the compressed air system.



Primary waste sources:

Over production due to inefficient distribution (leaks) and usage

Common inefficiencies:

- Leaks, blockages, failures
- Sensor misalignment
- Consumption patterns

Primary sources of leaks:

- Leaks in hoses, connections, tools, etc.
- Mechanical failure of valves, cylinders, etc.
- Condensate collection systems and pressure regulators
- Drainage and purge points



Fluke 289 Logging DMM + PV 350 Pressure Module:

Measure & log pressure differential and drop in compressed air systems.



Amprobe ULD-300 Ultrasonic leak detector

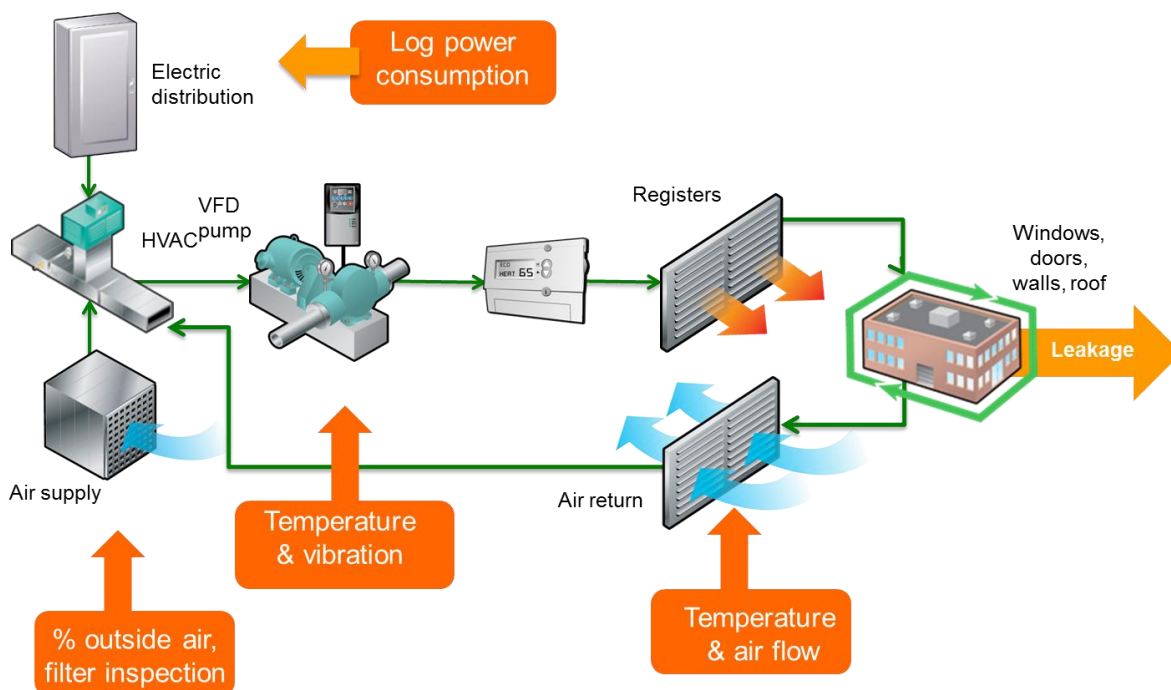
Entry-level tool for conducting leak tests on pressurized pipes

Use the PV350 Pressure Module in tandem with the **Amprobe ULD-300 Ultrasonic Leak Detector** to evaluate your compressed air system. This accessory plugs into your digital multimeter and measures air pressure at test points installed along your system. With these measurements you will be able verify the system pressure at each critical location and optimize the system typically resulting in the reduction of demand on the compressors once leaks have been addressed.

Energy Waste in Building Infrastructure (HVAC SYSTEM)

HVAC system is often among the largest consumers 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 largest loads in a facility are often found in the HVAC system: chillers, compressors, air handlers, fans, motors, and pumps.

While the HVAC system is commonly one of the biggest energy consumers in a facility, the steps to increase its efficiency are not necessarily easy and often involves capital expense. The biggest opportunities often lie in updating to high-efficiency equipment (especially chillers), adding controls to hard-start systems, and optimizing the ventilation system, which requires a professional HVAC technician and possibly a building engineer. Similarly, if a facility has not updated its lighting system in the last ten year, changing to a high efficiency system with controls offer substantial savings, but it also involves expense and a professional contractor.



This methodology is designed to provide the end-user with the data and system awareness necessary to correctly determine the energy ROI of improving building ventilation and lighting.

Energy Waste in Building Infrastructure (HVAC System) (cont'd)

Understand your energy consumption with Fluke 1735 Power Logger

The 1735 Power Logger is a three-phase tool that measures and logs all of the same power components that your utility does. This tool gives you a very accurate picture, over time, of your real power consumption on three-phase circuits and loads. The biggest power savings with this tool come from determining when your power usage peaks, evaluating your power factor, evaluating your overall power consumption compared to utility invoices, and possibly, re-balancing your loads or changing equipment and team operational schedules.



Fluke 1730

Thermal imaging

Fluke TI400 thermal imager was designed for everyday electro-mechanical inspections and building inspections. In ventilation optimization, 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

The Fluke 975 AirMeter is an all-in-one tool that will help you evaluate how efficiently you are conditioning your building. Parameters include temperature, Velocity, flow, Moisture, CO₂, and CO.

- How much outside air are you paying to condition? Too much?
- How much ventilation are you pushing through? Too much or too little?
- How accurate are your temperature and humidity sensors?

Energy inspection applications for the 975:

- Evaluate and adjust ventilation levels
- Verify the operation of HVAC control systems
- Test for carbon monoxide leaks

Temperature, humidity, % outside air, velocity, and flow are all used in combination to evaluate ventilation rates. Temperature and humidity are used to verify whether room sensors are working correctly (and sending the correct signals to heat/cool/dehumidify the air).



Fluke 975

Carbon monoxide and carbon dioxide levels are important if your facility uses forklifts, around boilers and heaters, and other areas where air quality (and appropriate ventilation) may be critical.

The Fluke 922 manometer and air flow meter provides differential and static pressure, air velocity and air flow readings to assess the condition of the pipes.

This enables analysis of:

- condition of filters
- working pressure
- air flow



Fluke 922

Optimizing these areas can lead to significant savings.

Energy Waste in Building Infrastructure (Lighting System)

Unless you have recently upgraded your lighting system, this is a very common opportunity for significant savings. It's also an area where you may best be served having a lighting contractor to analyze your savings potential.

Why should I care?

Lighting is the largest cost component of a commercial building's electricity expenditures that average to about 35% which is a significant portion of the total energy bill. Lighting is also typically the largest source of waste heat, often called "heat gain," inside commercial building. This internal heat gain may be useful when the building requires heating, but it is counterproductive when the building requires cooling.

Lighting also affects the power quality of a building's electrical distribution system. Poor power quality is a concern because it wastes energy, reduces electrical capacity, and can harm equipment and the electrical distribution system itself.

Lighting upgrade projects typically pay for themselves in energy savings within a few years. Leveraging rebates and tax incentives can cut that time by half.

How to measure and quantify your Energy Waste from Lighting System?

- **Power Logging Application:** Log energy consumption in kilowatts (measured at supply panel). Compare consumption to newer systems, and multiply consumption by the kWh cost charged by the utility to calculate current system costs.
- **Thermal Imager Application:** Use a thermal imager or non-contact thermometer to evaluate ballast and breaker contact temperatures.
- **Light Meter Application:** Current foot-candle or lux levels in the room (use a light meter).

The Amprobe LM-120 light meter measures the visible light from fluorescent, metal halide, high-pressure sodium or incandescent sources. It is a portable, easy-to-use digital light meter designed for simple one-hand operation reading in Lumen (lux) or foot candle (fc) units. The LM-120 measures a wide range of light up to 20,000 fc or 200,000 lux with an accurate, high resolution of 0.01 fc/lux. This unit is Auto-ranging plus manual ranging with ability to Zero out the reading before taking a measurement.



**Amprobe LM-120
Light Meter**

Energy Waste in Building Infrastructure (Lighting System) (cont'd)

Use the LM-120 light meter to measure the illumination level in the interior and to switch off or reduce or increase the output level of lighting fixtures. Reduce the energy burden of the building by significantly increasing the efficiency of its lighting system.

One lux is the illumination from a one candela lamp perpendicular to a surface one meter squared at a distance of one meter. One fc is the illumination from a one candela lamp perpendicular to a surface one foot squared at a distance of one foot. 1 foot-candle = 10.764 Lux and 1 lux = 0.09290 foot-candles.

Fluke. *Keeping Your World Up and Running.*

For more information:

Fluke South East Asia Pte Ltd

1 Clementi Loop #06-02/03/04 Singapore 129808

Tel: +65-6799-5566 Fax: +65-6799-5577

Web: <http://www.fluke.com.sg>

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