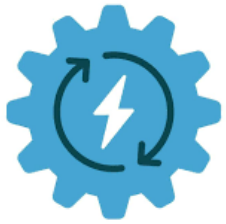
Energy Management System

In today’s industrial environment, energy efficiency become a pivotal factor for manufacturing facilities aiming to curb operational costs and bolster competitiveness. With the industrial sector marked by significant energy demands, the adoption of energy-efficient tips mitigates environmental impact and unveils substantial economic and operational benefits.



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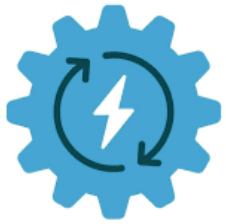
Efficiently lowering the total energy usage across a company necessitates both strategic planning and a commitment that spans the entire organization. Take, for instance, the process involving a product that goes through various stages of drying and coating, starting in a natural gas-fired dryer, followed by curing, additional drying in an electric dryer, and finally being coated. If a manager, to heed a directive to conserve energy, decides to cut down on the gas usage in the initial drying phase, this decision could unintentionally disrupt the subsequent curing stage. Additionally, it might escalate the workload on the electric dryer, which typically incurs higher operating costs compared to its gas counterpart. Such a singular approach not only risks boosting the overall energy consumption and production expenses but might also compromise product quality.



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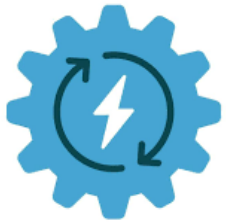
To steer clear of such pitfalls, establishing an Energy Management Program is crucial. This program aims to achieve a consistent reduction in energy consumption across all facets of a business. It integrates two key elements:

1.Comprehensive Strategy: A well-structured plan that encompasses all areas of operation, ensuring that energy-saving efforts are aligned and do not adversely affect one stage of production due to changes made in another.

2.Organizational Commitment: A unified approach where the energy-saving objectives are embraced company-wide, fostering a culture of sustainability and efficiency at every level of the organization.

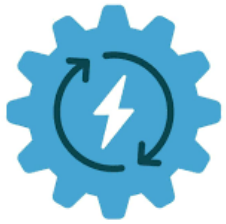
By focusing on these components, a business can successfully decrease its energy use in a manner that is both sustainable and conducive to maintaining high standards of production efficiency and product quality.



Energy Management System

Best Practices for Energy Management in Manufacturing Industry:

1. Detect and Repair Steam Leaks
2. Use Variable Speed Drives
3. Recover Heat From Boiler
4. Optimize Compress Air Piping Network
5. Improve Boiler Efficiency
6. Recover Steam Condensate
7. Perform HVAC Maintenance
8. Implement High Efficiency Lighting
9. Reduce Compress Air Pressure
10. Upgrade Pipe Insulation
11. Evaluate Processes Set Point
12. Implement Employee Awareness Program



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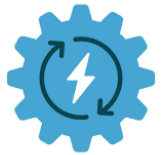

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1. Detect and Repair Steam Leaks :

Steam leaks are inevitable as day-to-day wear and tear on pipes and valves (and various other equipment/parts) occur due to the pressures and temperature by which steam is distributed. These steam leaks form part of operating costs that are not easily visible, and they reduce the efficiency of steam distribution to the source equipment. Thus, looking at ways to reduce steam leaks may be attractive to reduce operating costs, which in turn contribute to higher profits.

WHY implement?

A small leak may represent significant energy losses over a year making it very expensive to accommodate. Having steam leaks in your facility could lead to:

- Higher temperatures in the boiler room and surrounding distribution lines. This causes an increase in ambient temperature in the workplace and may lead to an uncomfortable working environment and higher air conditioning costs.
- A drop in system pressure can cause equipment to operate less efficiently by reducing the amount of heat delivered.
- Higher operational costs, a steam leak can lose 10 kg steam/hr.

Energy Management

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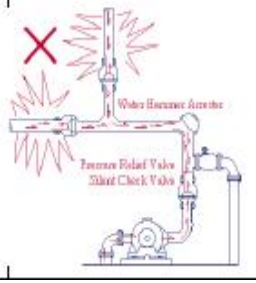
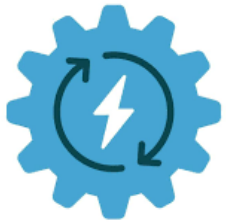
1. Detect and Repair Steam Leaks :

What Are the Major Causes of Steam Leaks?

Causes	Picture
Threaded pipe connections	
Packing problems	
Carbonic Acid	
Water hammer	



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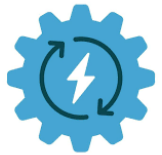

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2. Use Variable Speed Drives :

A VFD works by converting the incoming electrical supply of fixed frequency into a variable frequency output. This variation in frequency allows the drive to control the way in which the motor operates — a low frequency for a slow speed, and a higher frequency for a faster speed. The output can also be changed to enable the motor to generate more or less torque as required. So, the motor and drive combination might be used for turning a large load at fairly slow speeds, or turning a lighter load at high speeds, maximizing efficiency.

How do you size a VSD drive for an application and feel confident it's going to work?

For that you must understand the requirements of the load. It helps also if you understand the difference between horsepower and torque.

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2. Use Variable Speed Drives :

Torque: Torque is an applied force that tends to produce rotation and is measured in lb-ft (pound-force foot) or Nm (Newton meter). 1 lb-ft = 1.35582 Nm. All loads have a torque requirement that must be met by the motor. The purpose of the motor is to develop enough torque to meet the requirements of the load.

Horsepower: Horsepower (hp), or power (kW) is the time rate at which work is being done. One hp is the force required to lift 33,000 lbs, 1 ft in 1 min. And 1kW = 0.746 hp. If you want to get the work done in less time, get yourself more horses!

Here are some basic equations that will help you understand the relationship between hp, torque, and speed.

hp = (Torque x Speed)/5250

Torque = (hp x 5250)/Speed

As an example, a 1-hp motor operating at 1800 rpm will develop 2.92 lb-ft of torque.

Know your load torque requirements:

Every load has distinct torque requirements that vary with the load's operation; this torques must be supplied by the motor via the VFD. You should have a clear understanding of the torque load for each application a VFD is being considered. Data can be retrieved from the pump or fan vendor and the VSD vendor can assist with determining VFD requirements for the load.

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2. Use Variable Speed Drives :

Break-away torque: torque required to start a load in motion (typically greater than the torque required to maintain motion).
Accelerating torque: torque required to bring the load to operating speed within a given time.
Running torque: torque required to keep the load moving at all speeds.
Peak torque: occasional peak torque required by the load, such as a load
being dropped on a conveyor.
Holding torque: torque required by the motor when operating as a brake, such as downhill loads and high inertia machines.
Together with your supplier you will be able to pick the right sized VSD.

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2. Use Variable Speed Drives :

The speed of an induction motor is proportional to the frequency of the AC voltage applied to it, as well as the number of poles in the motor stator. This is expressed by the equation:

RPM = (f x 120) / p

Where f is the frequency in Hz, and p is the number of poles in any multiple of 2.

Therefore, if the frequency applied to the motor is changed, the motor speed changes in direct proportion to the frequency change. The control of frequency applied to the motor is the job given to the VSD.

The VSD's basic principle of operation is to convert the electrical system frequency and voltage to the frequency and voltage required to drive a motor at a speed other than its rated speed. The two most basic functions of a VSD are to provide power conversion from one frequency to another, and to enable control of the output frequency.

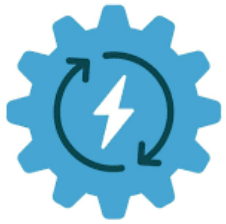
Only a small reduction in the rotational speed can significantly reduce the energy consumed by the motor. Let's assume that the rotational speed, N_1, of an industrial pump is reduced by 20%. This should mea[illegible] **0.8*N₁.**

Also $\frac{P1}{P2} = \left(\frac{N1}{N2}\right)^3$

Where:

N is the shaft rotational speed (rpm)

P is the shaft power (W).



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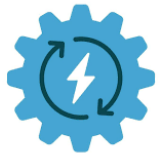

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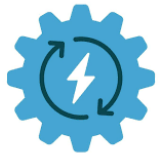
3. Recover Heat From Boiler:

Provides information on control techniques and measures that are available to mitigate energy costs and greenhouse gas (GHG) emissions from industrial and commercial boilers. It provides basic information on reduction measures in order to assist industry in their efforts to achieve the sustainability goals of "Grow the business not the Carbon" initiative.

Industrial equipment and facilities such as boilers, incinerators, and process plants generate heat when used. Some heat is discharged and thus wasted. Waste heat is heat discharged from this process into the environment even though the heat can be tapped for useful purposes. It presents great opportunities for heat recovery and fuel savings is the most obvious benefit of waste heat recovery. This is a key motivating factor for plants to consider given the significant opportunity in cost and energy savings.



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