Optimising Energy Consumption in Pumping Systems

Buyer's Guide

Produced by **The Energy Managers Association (EMA)**

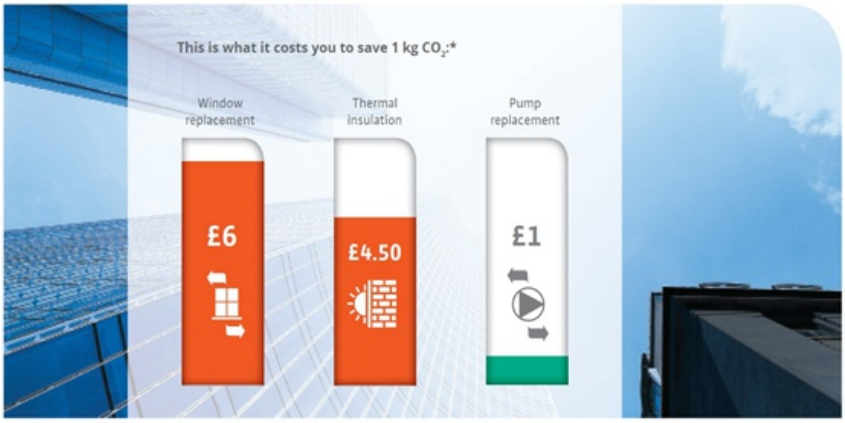
Optimising Energy Consumption in Pumping Systems - EMA Buyers' guide

Introduction

Summary

Pumping systems account for nearly 20% of the worlds electrical energy demand and between 25% -50% of the electrical energy usage in certain applications . Pumps are the single largest user of electricity in Industry in the European Union, consuming over 300 TWhpa of electricity, accounting for over 65 Mton CO2.

It is also well documented that rotodynamic pumps which account for 80% of the installed base are between 20-30% oversized. There is therefore a major potential to save energy if rotodynamic pumps are properly sized and operated. This EMA buyer's guide is designed to give you some basic information and guidance on purchasing, maintaining and design of pump systems.



* Basis for calculation is an "Office and administration building" example project in accordance with DIN V 18599.

British Pump Manufacturers Association Ltd

Established in 1941, and incorporated as a company limited by guarantee in 2009 the British Pump manufacturers' Association Limited (BPMA) is a not for profit trade association representing the interests of UK and Irish suppliers of liquid pumps and pumping equipment.

This Buyers guide was written by Steve Schofield Director & Chief Executive of the BPMA with help from its members. For further information please visit our website www.bpma.org.uk or contact the BPMA via enquiry@bpma.org.uk

Where to start

Assess the potential for savings

Understand your pumping system

To identify if a pumping system is sized correctly make the following checks;

- Are you wasting liquid flow?
- Are you creating additional pressure?
- What is the control philosophy
- Is there excessive noise in the system?
- Proactive equipment replacement to current EU legislation

Available Technology

Choosing the right equipment

Understanding Drive Technology

Use latest EU regulation to achieve best possible drive efficiency, i.e.;

- Variable speed drive
- Integrated control and monitoring
- Permanent Magnet technology

Choose your supplier

Making the right choice

Which company

This document does not suggest or promote any single supplier or technology. It does however recommend that you choose a supplier that is a member of the BPMA, see www.bpma.org.uk

BPMA Membership

Companies that are part of the BPMA are able to use the BPMA logo. By ensuring your pump supplier is a member of BPMA, your supplier will operate within the agreed standards and Code of Practice

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Background

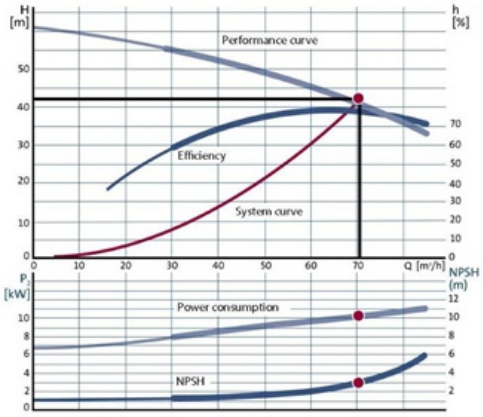
The great majority of pump systems are not designed with energy conservation as a major consideration. If pump systems are initially designed on an energy efficient basis and pumps are correctly applied and sized the energy savings will often be in excess of 50%.

To design an energy efficient pump system all of the following criteria should be taken into account:

- Basic plant layout
- Pipe work configuration and restrictions
- Liquid velocity in pipe work
- System characteristics and pump selection
- Pump/System control

Low energy costs are a direct result of selecting the correct pump and matching it to the system

When selecting a pump it is important to determine the required flow and pressure to be generated by the pump. The flow may be determined by a process requirement, by the heating or cooling required in the system or by the peak water demand for utilities. The pressure required may be to elevate the liquid within the system or to overcome the pressure losses in the system created as liquid passes through it.



It is important to know as much about the pump system as possible and to create a pressure/flow profile for the system. The energy required to drive the pump is directly related to the flow and pressure required. To generate high pressures generally leads to designs which may be inefficient and therefore it is important that neither the flow nor pressure are over specified.

Variable Speed Drives can save energy

It is estimated that significant energy savings have already been made by using Variable Speed Drive and High Efficiency motors. Generally Variable speed drives are used to continually adjust the speed of the pump to the demand.

The savings can be determined by the affinity laws:
Q= Flow , H= Head , P = Power and n = Rotational Speed

$$\frac{Q_2}{Q_1} = \frac{n_2}{n_1} \quad \frac{H_2}{H_1} = \left(\frac{n_2}{n_1}\right)^2 \quad \frac{P_2}{P_1} = \left(\frac{n_2}{n_1}\right)^3$$

When building a new pumping system, most Pumps are selected with a "safety factor" for potential future uprates or to allow for wear in the pump or fouling of the system. Often there are many different parties involved in specifying and building a system and the safety factor can grow exponentially. This results in the pump delivering much higher flows than required. There may also be the need to vary the flow due to process conditions or varying heating and cooling needs within buildings.

Traditionally, throttling is used to regulate flow in a pumping system. While throttling reduces the flow, the motor is still running at full speed and works even harder as it has to work against a restriction. By reducing the speed of the motor, the variable speed drive ensures no more energy than necessary is used to achieve the required flow. A centrifugal pump running at half speed consumes only one-eighth of the energy compared to one running at full speed. Utilising an Electrical variable speed drive is the simplest and most economical way of controlling the pump and matching it to the pump system.

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Questions for Engineers, Project Managers and Buyers

Has an alternative configuration been considered ?

In some case moving from an existing pump layout to an alternative can offer energy saving possibilities

Is the Pump Performance Monitored ?

By looking for early signs of pump wear which can include increased noise, vibration or power consumption major energy and maintenance savings can be achieved

Has ease of maintenance been allowed for?

When designing or replacing pumps ease of future maintenance requirements should be considered

Variable Speed Drive Considerations

When fitting VSD to a pumping system output and input filters should be considered and insulated motor bearings

Maintenance

When maintaining pumping systems it is recommended to use original manufacturers recommendations and parts

Reliability / Security

Efficient , well maintained pumps are more likely to be reliable and unlikely to fail prematurely causing loss of production or services

Valves

Valves are considered to waste energy within a pumping system , however if installed they should be checked for correct operation.

Pumps not in use

Stand by pump units or pumps with no –demand should be switched off to save energy

Is the pump working most of the time close to its best efficiency point

Rotodynamic pumps operating away from BEP not only waste energy also reduce the life expectancy of the pump

System Alterations

When upgrading , changing or expanding a pumping system the demand may have changed and existing pumps may not be the most efficient solution

Purchasing the correct pumpset

When purchasing a pumpset, price should not be the deciding factor. If a pump is sized correctly the return on investment is shorter, likewise if a pump is oversized and is wasting energy going forward you will have this additional cost for the anticipated life of the pumpset

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Has energy check been done on existing system?

Under UK ESOS regulation all non SME organizations are mandated to carry out energy audits. Pumping Systems can offer substantial energy savings.

When specifying a new pump, ask for a high efficiency motor to be fitted. If you are replacing or rewinding a motor then evaluate the cost of fitting a High Efficiency motor remembering to factor in the running savings which will pay back any increase in cost. Invest in carrying out an energy audit. Review your utility bills and understand the energy you are using. Carry out an audit if:

- Your energy bills are high
- You have continuously operating pumps
- You have many pumps in the system
- You have processes with varying flows
- You have throttled pumps
- You have pumps which are on bypass
- You have noisy valves or pipework
- You have critical systems which have been subject to breakdowns
- Often you can take simple action like just turning a pump off

The purpose of an energy audit is to reduce operating costs by reducing energy consumption and the government has estimated that most companies can reduce their energy consumption by 10% to 20%. Energy audits carried out by BPMA members have shown that savings from 30 to 50% are not unusual. When deciding whether or not to carry out an energy audit a good starting point is to assume that you will save at least 10% of your current energy consumption. By reviewing Utility bills you can get an indication of the savings to be made and investment that you should be prepared to put into the auditing process.

In most industrial sites about two-thirds of the energy is consumed by electric motors. In its lifetime the cost of energy consumed by an electric motor may be 100 times its purchase cost. So the reduction of losses in the motor itself is very important and modern electric motor design can reduce the energy loss in the motor by up to 30%. Many pumps and motors are operated at full power constantly, irrespective of process needs, and in some sites this offers the potential of large cost reductions.

BPMA involvement

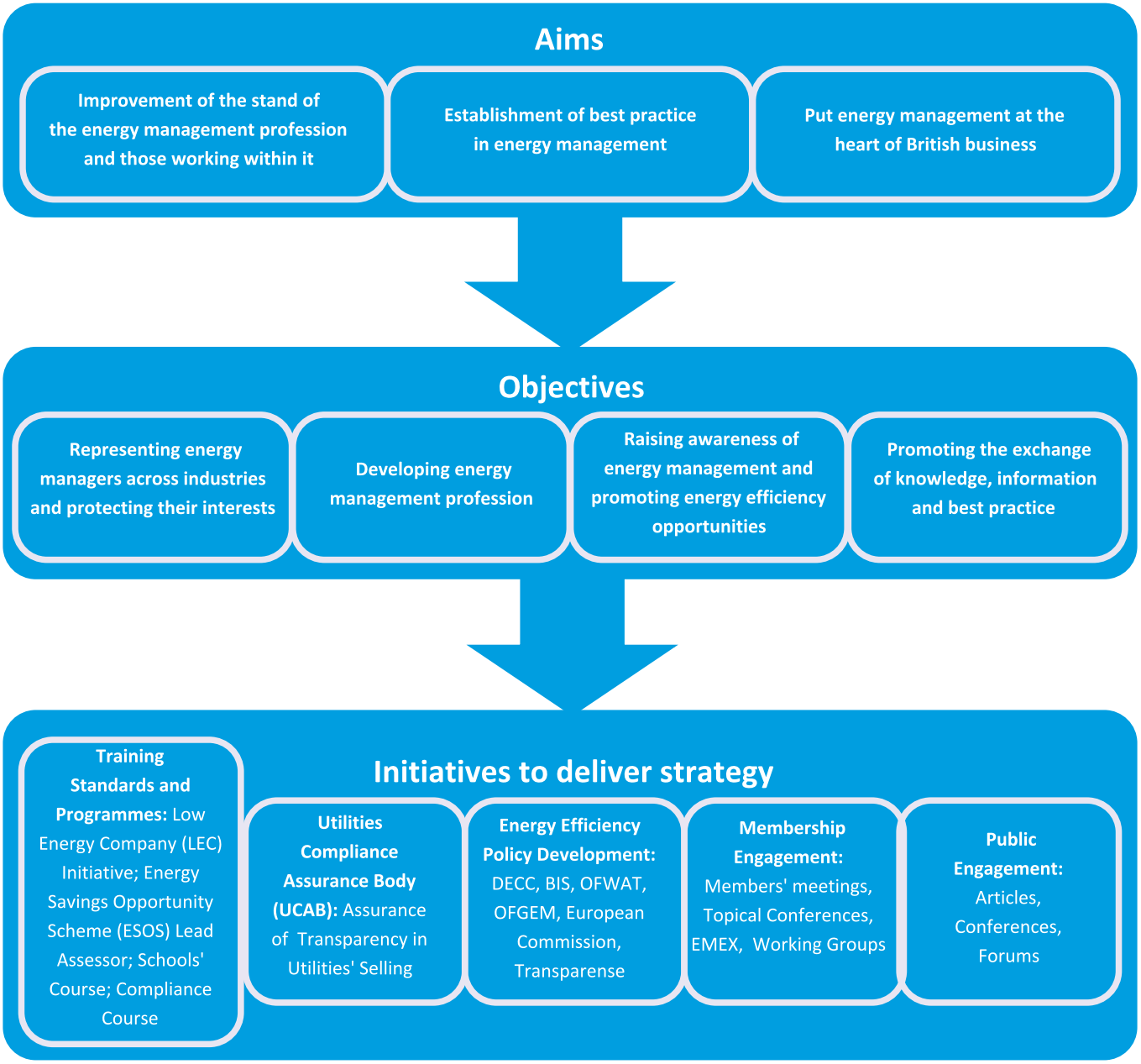
Given the amount of energy consumed by pumps through their normal operation, and the potential for energy efficiency gains within pump systems, the BPMA have worked to develop a Certified Pump System Auditor Scheme (CPSA).

Through the CPSA, pump engineers are being trained to correctly assess the efficiency of pump systems, and to provide appropriate recommendations in order to improve the efficiency of those systems.The CPSA accreditation is achieved by successfully completing a four day residential course, followed by the satisfactory completion of a pump system audit. Only then can ‘Certified Pump System Auditor’ status is achieved.

Within the full ESOS Guidance document, the ISO/14414-Pump System Energy Assessment standard is referenced as an auditing methodology that can be accepted by "Lead Assessors" approved by the Environment Agency. Accordingly it is hoped that CPSA accredited persons (who are trained according to the IS0 14414 standard) will be recommended by Lead Assessors to undertake the pumping system elements of company-wide energy audits.

Web: http://www.bpma-cpsa.co.uk

The Energy Managers Association



Contact information

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