



## Pump Systems Training Courses and Certification

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Pumps offer a large potential for energy savings. In industrial fluid systems pumps can account for 40% or more of energy usage, and there is a plethora of opportunity for utility custom programs to acquire savings from optimizing pumping systems. The Hydraulic Institute (HI), the trade association for the pump industry, has created an efficiency metric for pumps, called Energy Rating (ER), and released a public database of pumps to support the identification and sale of efficient pumps, motors, and variable frequency drives (VFDs). While increasing the efficiency of the pump, motor, and drive will save energy, many factors impacting the efficiency of a pumping system are independent of the pump model efficiency. For example, properly selecting pumps and controls to meet system requirements improves overall performance. Additionally, other components such as seals, valves, equipment, and overall system design all have a large impact on energy consumption than the component efficiencies.

In addition to establishing the ER label, HI has developed trainings to educate the pump industry and promote efficiency in the design and operation of pump systems. This memo describes the Pumping System Optimization (PSO) and the Pump Systems Assessment Professional (PSAP) trainings and outlines how these trainings might compliment new or existing pump incentive programs, such as a deemed pump incentive programs based on HI's Energy Rating or existing utility custom project opportunities, to allow utilities to provide a comprehensive pump program that addresses all aspects of pump system energy consumption.<sup>1</sup>

### Background

Pumps are a ubiquitous piece of equipment, being everywhere from small commercial buildings to large scale agricultural and municipal installations. Given their widespread presence and large energy end use, pumping systems represent the greatest opportunity for energy conservation in industrial manufacturing and commercial HVAC fluid systems.<sup>2</sup> With this understanding the Hydraulic Institute established its educational foundation, Pump Systems Matter (PSM), with the mission of educating the marketplace and providing tools to understand and reduce the total cost of ownership for pumping systems, with energy efficiency being a primary focus.

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<sup>1</sup> For more information on starting an efficient pump rebate program, visit [www.pumps.org/energyefficiency](http://www.pumps.org/energyefficiency).

<sup>2</sup> [US DOE \(2002\). United States Industrial Electric Motor Systems Market Opportunities Assessment. https://www.energy.gov/sites/prod/files/2014/04/f15/mtrmkt.pdf](https://www.energy.gov/sites/prod/files/2014/04/f15/mtrmkt.pdf).

PSM has developed training courses to address the efficiency of pumping systems. These systems can be complex, and pump energy consumption is influenced more by the design and operation of the system than the efficiency of a certain pump model. Each component of a pumping system influences the performance of the pump, and suboptimal configuration, operation, control, or maintenance can waste energy, increase maintenance costs, and reduce the functional lifetime of a pump.

Addressing issues within the system has historically been a challenge, with pumping systems often achieving overall efficiencies of just 40% or less. The PSO course supports the focus on efficiency by preparing individuals hoping to influence pump performance with the foundational technical concepts to identify issues as opportunities for reducing pump system energy consumption. Meanwhile, the PSAP course and certification ensures that the professionals responsible for assessing systems, modeling energy consumption, and moving forward with upgrades have the highest level of expertise and can produce reliable efficiency improvements and provides an industry credential to identify those professionals with this level of expertise.

## **Pumping System Optimization Course**

PSM designed the PSO course to target individuals that interact with pump systems, but may not be responsible for designing or upgrading them. The course prepares energy efficiency program implementers, pump system owners, pump system operators, and pump sales personnel to collaborate with the broader set of actors in the pump industry to make coherent and actionable recommendations to achieve energy efficiency goals. Utilities can sponsor a PSO course to drive the industry focus on energy efficiency and prepare individuals to better understand pump system energy consumption. Attendees will be able to communicate system efficiency concepts, collaborate with pump professionals, and identify opportunities to implement energy conservation measures.

### **Course Overview**

The PSO course comprehensively educates participants on the variables that impact the performance of a pump system. PSO begins with an overview of the physical principles that govern pressure, flow, and power. Through the basic physics, attendees learn that flow and pressure (Head) are the primary variables that impact power consumption, and so optimizing a system with minimum restriction and proper control strategies so that flow and head are not wasted creates the greatest opportunities for saving energy. When teaching these principles, the course uses real-world examples to illustrate the importance of each knowledge area and invites participants to consider systems with which they have interacted as a part of the optimization assessment.

The course enables attendees to:

### **1) Determine the optimization assessment objective and benefits**

Identify the high-level performance issues that occur during operation and identify improvements to system performance, such as greater energy efficiency, reduced maintenance, or improved output.

### **2) Identify data needs for an assessment and determine data collection strategies**

Understand the physical and engineering concepts that determine system performance, identify the variables and system components that impact the assessment objective, and use measurement tools to collect system data.

### **3) Analyze collected data**

Summarize collected data on the attributes of system, generate meaningful insights into performance, and compare costs of an upgrade to the benefits that accrue over the system lifetime.

### **4) Develop and implement recommended changes or upgrades**

Evaluate optimization alternatives and recommend a preferred option based on assessment objectives and organizational preferences.

### **5) Monitor the results of the upgrades**

Identify data sources that indicate results and analyze to validate upgrades are meeting the expectations of the system operator.

Upon completion of the course, PSO attendees will be capable of making actionable recommendations to improve pumping system performance through changes in operation or system upgrades. The experience will enable them to propose and examine alternative courses of action and collaborate with stakeholders to select the optimal choice. For example, reducing the use of throttle valves to control flow and pressure has a large impact on the energy consumption and lifespan of a pump, but requires an action to reduce flow at the pump such as trimming the impeller or adding a variable frequency drive. PSO attendees will have the tools necessary to make recommendations to optimize a system to solve these and other regularly occurring problems.

### **Target Audiences**

For individuals interested in promoting energy efficiency in pumping systems, the PSO Course functions to provide the fundamentals of the topics necessary to understand pump performance, energy consumption, maintenance costs, and longevity. The following sections describe the target audiences and the specific applications of the PSO Course to their work.

**Utility or energy efficiency program implementation staff** are responsible for the development and management of energy conservation programs. If those programs are to target pumps, staff members must understand and be conversant in the technical aspects of pumping systems in order to effectively communicate the benefits of pump system

improvements to pump end-users. The PSO course's focus on pump optimization enables program staff to communicate with pump users and system designers, promote energy efficiency during retrofits, and design programs to address specific market barriers. For program implementation staff that typically work with units of watts, lumens, or Btu, determining objectives of an upgrade, understanding the data that is likely to be available, and learning how to evaluate more-efficient alternatives is a critical point of education.

This training is also a critical step for building relationships within the pump industry, both in terms of the ability to meaningfully interact with market actors and by introducing program staff members to other attendees from organizations who work with pumps every day and influence decisions on pump purchases. Because launching a pump energy efficiency program requires building relationships with market actors, demonstrating technical credibility is an important first step in establishing common ground.

**Pump system technicians** manage, test, and operate a pumping system and are the individuals closest to day-to-day operation of a pump. Although not responsible for system design or the electric bill incurred, technicians are the individuals responsible for monitoring and optimizing the pump system, and are best placed to make the biggest impact on energy consumption. Providing a technician with the tools to assess pump performance allows a company to move beyond "read-and-react" control tactics and encourages ownership in the system by all who interact with it. This enables a technician to make meaningful cost-saving and performance-improving recommendations or help companies reliant on pump systems to maximize their profits and minimize impact on the environment.

**Distributor Sales Teams** both sell pumps and provide technical assistance to pump specifiers. They also may perform services for customers, such as assembling multiple pumps on skids or trimming impellers. In order to provide the highest level of service, sales teams can attend a PSO Course and learn skills that will prepare them to discuss the various factors influencing the energy consumption, performance, and maintenance costs of a pump system. This enables a sales organization to become trusted advisors in the pump system design, which supports their business by establishing them as provider of additive service, increasing their value to a customer.

## **Pump System Assessment Professional**

The Pump System Assessment Professional course and certification distinguishes experts as qualified to assess pump systems and provide the most robust recommendations on system improvements. Certain requirements must be met in order to qualify to sit for the PSAP certification exam and become certified. Anyone wishing to become certified must have at least three years of experience working with pumps or pumping systems and possess an

undergraduate degree from an accredited university or college in a technical/business field.<sup>3</sup> Certified professionals must maintain the certification by staying current with relevant continuing education. With these requirements, HI is aiming to both ensure individuals taking the certification are prepared to succeed and that a candidate has foundational experience that may not be tested in the certification process.

Utilities should consider the PSAP certification as an important credential for their custom pump energy conservation programs, and can sponsor a PSAP course and certification exam in their region to drive energy savings at the system level and support robust energy savings estimates for custom projects. Furthermore, PSAP certification can support staff who interact across multiple utility types, such as municipalities that operate both power and water distribution systems.

### **PSAP Course**

The PSAP Preparation Course, hosted by PSM, provides comprehensive training on the tasks and knowledge requirements to conduct an assessment, and develop optimization recommendations based on total cost of ownership. The tasks and knowledge areas covered are identified in the PSAP Certification Body of Knowledge, which are the basis of the certification exam questions. The course also provides information on recent advancements, both in pumping technology and in building/energy codes and standards.

The course is broken into two days, with each day covering a separate set of topics. The first day covers pump and system component fundamentals, with a focus on system hydraulics, energy consumption, and control methods. The second day presents information on DOE's new energy conservation standard for clean water pumps, HI's Energy Rating Program, and a standard process for selecting/specifying pumps and optimizing systems. Day two also covers Life-Cycle Cost and the pump system assessment process in detail. An optional third day provides focused exam preparation that includes detailed pump system assessment exercises, and sample exam questions, with the option for a proctored certification exam in the afternoon. Attendees will leave the training equipped with detailed knowledge on how to perform a pump system assessment and optimize performance in pump systems. Attendees do not have to obtain the PSAP Credential by sitting for the certification exam, but doing so validates and advertises their expertise in pump system assessment.

### **PSAP Certification**

The certification ensures that pump system assessors have the experience and expertise to perform a high-quality assessment. The resulting recommendations to upgrade a pumping system will give rise to more energy efficient and reliable commercial and industrial pumping systems. There are four main target audiences for PSAP course and certification:

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<sup>3</sup> The requirement of an undergraduate degree can be waived if the applicant has 5 years of experience and has completed a minimum of seven pump system assessments.

**Site Engineering Teams** can use the PSAP certification to effectively optimize the systems for which they are responsible. For organizations with assets including pumping systems, PSAP certification ensures staff responsible for design, operation, maintenance, and upgrades are armed with a complete and thorough understanding of the system. Commercial and industrial facilities will benefit from the energy savings from more efficient pumping systems, reduced system downtime, greater reliability, longer pump equipment lifespans, and, perhaps most importantly, improved system performance. Employing a staff member with a detailed understanding of the variables that impact system performance can improve company profits by reducing costs. The certification provides technical resources to calculate Life-Cycle Cost and Total Cost of Operation, which are invaluable when discussing capital investment needs and cost-effectiveness of pump system upgrades.

**Consulting Engineers and Service Contracting Firms** compete for customers based on their qualifications and history of quality work, both of which are validated and communicated by PSAP certification. They must assure customers and potential clients of their ability to recognize areas for improvement in system performance. The PSAP course provides the technical capabilities to effectively maximize the energy savings they generate through their system audits and can help this group provide better pump-related recommendations to their customers.

**Energy Efficiency Engineers** are often tasked with auditing and optimizing system operations at customer sites and calculating an incentive based on the quantity of energy savings generated by an upgrade. PSAP training furthers their knowledge and capability in this task and improves the reliability of energy savings estimates. Certification assures participating facilities that an energy audit is thorough, and the resulting recommendations are comprehensive.

**Utilities** can reference PSAP or PSAP certified engineers in their custom pump projects and programs to ensure that pump energy savings assessments and calculations are performed based on the best available training and information.

## Conclusion

There is an emerging focus on pump system energy efficiency. Utilities can take advantage of new opportunities to build energy efficiency programs that provide rebates for efficient pump models, such as those based on the Hydraulic Institute Energy Rating. However, in order to take full advantage of the opportunity to promote energy efficiency in pump systems, utilities must go beyond rebates and educate the pump market about system performance.

A utility sponsoring a PSO training will increase awareness of energy efficiency in pumping systems and enable important market actors to consider energy consumption in the operation, design, or retrofit of a pumping system. PSAP training will expand the knowledge of professionals working in the pump industry, and can be the basis for custom project programs with a focus on pumping systems. Certification validates their credibility as experts in the field of pumping. Individuals trained in these courses will be prepared to assess performance of a

system and make recommendations that result in more energy efficient and reliable commercial and industrial pumping systems. Additionally, utilities can also use the opportunity to interact with key customers and educate them about pump system incentive opportunities. Together, these trainings bolster pump rebate programs and support a broad approach to achieving energy savings goals.

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