ASHRAE Philadelphia Chapter



Quaker City Climate

September 2020
Volume 56, Issue 1

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Thursday, September 10, 2020
12:00 PM to 1:30 PM
Virtual Meeting

"Managing HVAC Systems to Reduce Infectious Disease Transmission"

presented by

William P. Bahnfleth, PhD, PE, FASHRAE, FASME, FISIAQ

There is no charge for this session,
However, you must register in advance
to receive the login information.

Click here to register.

It's an ASHRAE **Membership Promotion "Night"**!
For more information, please click the
link: https://www.ashrae.org/membership

2020-2021

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PRESIDENT'S MESSAGE

Fellow Chapter Members –

Uncertain times. I guess that sums up the current state of things in ASHRAE at the local, regional and society levels as well as the rest of our own personal and public lives. Despite this current state of affairs I would like to share with you a certainty – during this Philadelphia Chapter of ASHRAE calendar year I will strive to work with the current board of governors to continue to serve you as best as we possibly can. Here is an outline of what you can expect from the Chapter this year:

- We will continue to have monthly meetings where we will aim to present you with engaging speakers on relevant and insightful topics. At this time, meetings through the end of 2020 will be held in virtual format and will be free of charge. We will continue to evaluate the best course of action for 2021 and keep membership informed of our plans.
- We fully intend to conduct the seminar on IECC/ASHRAE 90.1-2016 that was originally planned for this past spring but had to be postponed. We believe that to provide the most value, this seminar needs to be conducted live and in person. Our current plan is to hold the seminar in the spring of 2021 and we will continue to evaluate as things progress.
- We are launching the Digital Directory! Many thanks go out to Mike Calabrese for spearheading the conversion of our hard copy directory to digital format. This is an exciting leap into the digital age for our Chapter. The user experience and accessibility of the digital format are going to be awesome for both advertisers and users.
- The ASHRAE Basics Class will continue to be held this year but like monthly meetings, will be held in a virtual format at least through the end of 2020. I am certain that those of you that have taken the class, including myself 20 years ago, can speak to the invaluable knowledge and experience that is available through it. Please continue to encourage your colleagues and friends to attend. This class is unique to the Philadelphia Chapter and I encourage all to take advantage of it.
- We have decided to attempt to hold the golf outing that was postponed from the spring on Monday, October 5, 2020. We understand that membership may not be ready for such an event but if there is interest, we are willing to put in the work to make it happen.
- We will continue to work with the Student Chapters at local universities and promote YEA engagement. At minimum, be on the lookout for virtual happy hours!
- Work will continue in the core Committees of ASHRAE - Membership, Research Promotion, Sustainability, Diversity in ASHRAE and Government Affairs. Please contact anyone on the Board if you would like to get involved with one of these committees.

Since I began my involvement with the Chapter at the Board level, my focus has always been on member involvement. This began with trying to engage members to become more involved in the golf outings. As I held other Board positions, my focus changed to membership attendance at monthly meetings. Through a lot of hard work with the other outstanding members of the Board I have been lucky enough to serve with, I think that we have made positive strides in this direction. I think that although this year may present some challenges, we can still continue the discussion of how membership can be best served and increase member engagement. One positive outcome that we have already seen from the shift to virtual monthly meetings is that we are able to reach a wider membership audience that otherwise would not be able to attend in person meetings due to scheduling or logistics. My belief is that we can continue to uncover these positive aspects and use them to strengthen engagement. We also need you, our members whom we serve, to let us know how we are doing and what would inspire you to be more engaged.

We may all be experiencing our own version of Uncertain Times but please be certain that we, the Board, are here for you.

Tim Reinking
Philadelphia Chapter President
c021@ashrae.net

Philadelphia Chapter ASHRAE
Annual Golf Outing



Monday, October 5, 2020
11:00 AM to 7:00 PM
DuPont Country Club
Wilmington, DE

Click here to register!

This event wil take place at the **NEMOURS COURSE**.
Parking, check in and registration will be at the **BRANTWYN MANSION**.
Dinner will be outside at the Brantwyn Mansion.

COVID PREVENTION PROCEDURES:
- Social distancing must be practiced
- Masks must be worn at all times except when on the course or seated and eating
- Temperatures will be taken at registration and a brief questionaire will be required to be filled out
- Staff will wear masks and gloves when serving
- Tables at dinner will be limited to 4 guests

Schedule:
11:00 am - Registration Begins
11:30 am - Boxed lunches available
12:30 pm - Shotgun start
5:30 pm - Dinner and prizes

Registration:
Dinner only: $50
Golf and Dinner, 1 Golfer: $200
Single Hole Sponsor: $200 (does NOT include Golf or Dinner)
Two Hole Sponsor: $350 (does NOT include Golf or Dinner)
Three Hole Sponsor: $450 (does NOT include Golf or Dinner)

Tickets:
$50.00 2020 Fall Golf Outing - Dinner Only
$200.00 2020 Fall Golf Outing Golf & Dinner (one golfer)
$200.00 2020 Fall Golf Outing - Single Hole Sponsor (does not include golf or dinner)
$350.00 2020 Fall Golf Outing - Two Hole Sponsor (does not include golf or dinner)
$450.00 2020 Fall Golf Outing - Three Hole Sponsor (does not include golf or dinner)

ASHRAE Philadelphia Chapter Digital Directory

NEW!!

Our 2020-2021 Chapter Digital Directory is now complete. This digital version is replacing the paper versions from years past. This provides flexibility during these challenging times, having access anywhere. It's easy to use, highly interactive, and always up to date. We hope you enjoy this refreshed publication. All chapter members will be receiving an email with link and unique login by September 10th.

The link to the directory is on our home page on the website, or you may click below!



ASHRAE®

Philadelphia Chapter

Sponsored by:

Burns

ASHRAE 90.1 Technical Seminar

*Rescheduled

Wednesday, March 24th
&
Thursday, March 25th

Live Instruction & Remote go-to-meeting

For More Information Contact: c021mem@ashrae.net or 610-971-2169

16 PDHs

Schedule

Wednesday March 24, 2021

7:30 - 8:00 AM	**Registration**
8:00 - 8:30 AM	**Intro, ECC, User's Manual, Scope:** Larry Spielvogel, PE Past 90.1 Chair
8:30 - 12:00 PM	**Building Envelope:** Joseph Deringer, AIA SuPerB, Past 90.1 Envelope Chair
12:00 - 12:45 PM	BREAK
12:45 - 1:30 PM	**Building Envelope:** Joseph Deringer, AIA SuPerB, Past 90.1 Envelope Chair
1:30 - 3:45 PM	**Lighting:** Carl Watson, PE Consulting Engineer and Code Official
3:45 - 5:00 PM	**Energy Modeling & App. G:** Michael Tillou, PE DOE PNNL, 90.1 ECB Committee

Thursday, March 25, 2021

7:30 - 8:00 AM	**Registration**
8:00 - 8:30 AM	**Intro, ECC, User's Manual, Scope:** Larry Spielvogel, PE Past 90.1 Chair
8:30 - 12:00 PM	**HVAC Systems:** Dick Lord Carrier, 90.1 Vice Chair & 90.1 Mechanical Committee
12:00 - 12:45 PM	BREAK
12:45 - 3:00 PM	**HVAC Equipment:** Dick Lord, Carrier, 90.1 Vice Chair & 90.1 Mechanical Committee
3:15 - 4:00 PM	**Service Water Heating:** Carl Watson, PE Consulting Engineer and Code Official
4:00 - 5:00 PM	**Compliance:** Ernie Conrad, PE Consulting Engineer 90.1 ECB Committee

The Philadelphia Chapter of ASHRAE is offering a comprehensive, in-depth and unique two-day program covering ANSI / ASHRAE / IES Standard 90.1 (2016) Energy Standard for Buildings (except Low-Rise Residential Buildings). This is the mandatory energy code in New Jersey, an option in Philadelphia and Maryland, and an expansion of the optional energy code in the rest of Pennsylvania. A program of this magnitude and depth is not available anywhere else and at this low a cost. Registration is open to everyone interested, and especially members of AIA, IES, IALD, USGBC, and CSI. **All presenters are the people who write and enforce the 90.1 Standard.**

Location:

Burns Engineering, Training Room
Two Commerce Square
2001 Market Street, Suite 600
Philadelphia PA 19103

Cost:

$100 Chapter Member and Code Official
$135 Society Member
$200 Reciprocal Society Member
(AIA, IES, IALD, USGBC & CSI only Information required)
$250 Guest

Registration fee includes both days and handouts. A continental breakfast, lunch, snacks and refreshments will be provided each day.

Standard 90.1 & 90.1 Users Manual for are available for purchase:

$90 Chapter Member or Code Official - Standard 90.1 (2013/2016/2019)
$110 Chapter Member or Code Official - 90.1 User Manual (2013/2016)
$110 ASHRAE Society Member - Standard 90.1 (2013/2016/2019)
$125 ASHRAE Society Member - 90.1 User Manual (2013/2016)
$120 Guest - Standard 90.1 (2013/2016/2019)
$130 Guest - 90.1 User Manual (2013/2016)

Available at a drastically reduced price (without shipping) when paid in advance with the seminar registration. Ordinarily, these books sell to non-ASHRAE members for $177+shipping, and to members for $133+shipping.

Register: https://ashraephilly.org/meetinginfo.php?id=104&ts=1583026970

Remote Participation (Online): Register for the seminar and then email c021mem@ashrae.net for the link and meeting details.

Public Transportation: *SEPTA Suburban Staton (3 blocks), AMTRAK 30th St Station (5 blocks)*
Nearby Hotels: *Sonesta, Soffel, The Westin, Holiday Inn Midtown, etc.*
Parking: *Burns discounted parking ($13) at the William Penn House garage, 36 S.19th St.*

PHILADELPHIA CHAPTER PROGRAMS CALENDAR 2020-2021

All meetings through December will be virtual.
More details to follow!



September Virtual Meeting Info

Abstract

This presentation begins by reviewing relevant information on airborne infectious disease transmission including disease transmission modes, infectious aerosol generation, and concepts of risk management. It then gives an overview of engineering controls including ventilation, filtration, and air disinfection and compares their advantages and limitations. Finally, ASHRAE's Covid-19 guidance is introduced and summarized.



Presenter Bio:

William Bahnfleth is a professor in the Department of Architectural Engineering at the Pennsylvania State University (Penn State) in University Park, PA, where he has been employed since 1994. Previously, he was a Senior Consultant for ZBA, Inc. in Cincinnati, OH and a Principal Investigator at the U.S. Army Construction Engineering Research Laboratory in Champaign, IL. He holds BS, MS, and PhD degrees in Mechanical Engineering from the University of Illinois, where he also earned a bachelor of music degree in instrumental performance. His is a registered professional engineer.

At Penn State, Dr. Bahnfleth teaches undergraduate courses in HVAC fundamentals, system design, and controls and graduate courses in chilled water systems, hot water and steam systems, and indoor air quality. His research interests cover a wide variety of indoor environmental control topics including chilled water pumping systems, stratified thermal energy storage, protection of building occupants from indoor bioaerosol releases, ultraviolet germicidal irradiation systems, and others. He is the author or co-author of more than 170 technical papers and articles and 14 books and book chapters. He consults on the design of chilled water thermal energy storage systems and has been involved in more than 20 projects world-wide.

Dr. Bahnfleth is a fellow of ASHRAE, the American Society of Mechanical Engineers (ASME) and the International Society for Indoor Air Quality and Climate (ISIAQ). He is also a member of the Indoor Air Quality Association (IAQA), the International Building Performance Simulation Association (IBPSA), and the Society of Building Science Educators (SBSE). He has served ASHRAE in a variety of capacities, including Student Branch Advisor, Chapter Governor, Technical Committee and Standing Committee Chair, and as Director-at-Large, Vice President, Treasurer, and 2013-14 Society President. His honors include a 1st place ASHRAE Technology Award, Transactions Paper Award, Distinguished Service and Exceptional Service Awards, The Louise and Bill Holladay Distinguished Fellow Award, the E.K. Campbell Award of Merit for service and achievement in teaching, and the F. Paul Anderson Award, ASHRAE's highest honor. He is also a recipient of the Penn State Engineering Alumni Society's World-Class Engineering Faculty Award.

In Memoriam Herb Phillips



Herbert Phillips April 28, 2020 of Lake Bluff, IL. Herb passed away peacefully at the age of 95. Herb was born on May 25, 1924, in Pottstown, Pennsylvania, one of four children of Edward and Fannie Phillips. Proud to have graduated from Purdue University in 1945 with a degree in mechanical engineering, Herb also attended midshipman school at Notre Dame University. As a US Navy Lieutenant JG and ship repair officer, he served in the South Pacific, constructing infrastructure for the atomic bomb tests on Kwajalein. After military service, he headed Philco Corporation's Advanced Development Laboratory in Philadelphia. There, he was credited with the first patent for a self-defrosting refrigerator. Moving into trade association work, Herb traveled the world, representing the USA in international technical and safety standards negotiations for home appliance and electrical equipment. He was an advisor to the US Trade Representative. He married Cecelia Brandt in 1950. They divorced in 1982 having had two children. He subsequently met and married Frada Buckman, who predeceased him after many happy years together. Herb enjoyed inventing, and love of family and friends. He served as a founder and Hebrew School principal at Temple Beth Tikvah in Philadelphia in the 1950s, and as Vice President of Am Echod congregation in Waukegan and Lindenhurst, IL, in the 1990s. He taught courses at Swarthmore College and College of Lake County (Illinois). Purdue and several professional societies awarded him honors. He is survived and remembered with love by sister Nadine Goldfinger, children Fred (Hyonsook Phillips) and Beth (Dennis Jensen), grandchildren Lara (Ryan Burke), Anna Phillips, Andy Jensen, Gina Phillips (David Wykes) and Simon Jensen (Mia Rosenthal), and great-grandchildren Clare and Meara Burke, and by Frada's sons Michael, Adam and David Buckman. Due to the COVID-19 pandemic, no family services will be held at this time. Memorial donations may be sent to the Purdue Foundation, 403 West Wood St., West Lafayette, IN 47907, marked as contributions to the Frada and Herbert Phillips Scholarship Fund.

He had been a member of ASHRAE since 1967 and was a Fellow Life Member of the Philadelphia Chapter.

In Memoriam Sam Colucci, PE, CEM, LEED AP



It is with great sadness that we share the passing of our dear friend and colleague, Sam Colucci.

Sam joined Precis Engineering as one of the firm’s principals in 2012. His career spanned 25+ years of engineering project leadership for biotechnology and pharmaceutical clients. His designs led to more efficient, productive, and environmentally responsible biological and chemical laboratories, pharmaceutical ingredient processing, manufacturing facilities, and central utility plants.

A detail-oriented project and team leader, Sam emphasized quality and technical excellence. He was quick to share his knowledge with his colleagues, mentor young engineers, and promote his sustainable design expertise in the industry. Precis and our staff will forever appreciate the impact of Sam's leadership, guidance, and friendship.

Sam earned a B.S. in Mechanical Engineering from the University of Pittsburgh and was a Certified Energy Manager, LEED Accredited Professional, and member of ASHRAE and ISPE, for which he served on the Oral Solid Dosage Community of Practice Subcommittee. Sam's writing was published by *Engineering Systems* magazine, ISPE Delaware Valley, and in the Encyclopedia of Industrial Biotechnology: *Addressing Sustainability in Biomanufacturing Facility Design*.

The Philadelphia Chapter
of the
American Society of Heating,
Refrigerating and Air
Conditioning Engineers, Inc.

994 Old Eagle School Road
Suite 1019
Wayne, PA 19087-1866
P 610-971-2169
F 610-971-4859

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our web site at:

www.ashraephilly.org

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Republication of material contained herein is expressly forbidden without official Chapter authorization. The Chapter does not speak or act for the Society. Any member with material to submit for inclusion in the *Climate* can send the information to:

Hope Silverman
P 610-971-2169
hope@mmco1.com

Material can include letters to the editor, member news, upcoming events, comments on chapter programs or issues, etc.

What are the benefits of paying Philadelphia Chapter dues* ?

Discounts:

Session up to $20 off

$200 Discount for Basic Class

$150 Discount for 90.1 Seminar

Life Members can attend sessions, up to $30 off

Free access to the Digital Directory

And much more!

* Note that Philadelphia Chapter Membership Dues are $35/year.

To receive discounts, please remit you Chapter dues when renewing online or applying for a new membership. Feel free to upgrade online by clicking here or contact c021@ashrae.net for assistance.

Membership Advancement

If you are currently an ASHRAE Associate Member, becoming a full Member is easier than you think! The following count toward the required **12 points** to advance to full membership status. You must update your ASHRAE online biography and send an email to membership@ashrae.org to advance.

Non-accredited degree = 4 points
PE = 4 points
Accredited degree = 6 points
Industry experience = 1 point/year

ASHRAE – PHILADELPHIA CHAPTER

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND
AIR-CONDITIONING ENGINEERS, INC. PHILADELPHIA CHAPTER

BASIC HVAC SYSTEM DESIGN COURSE

ON-LINE FORMAT STARTING IN FALL 2020

Classes will meet Tuesdays and Thursdays from 6:15 PM to 8:30 PM beginning in October and continuing until the middle of March.

All classes in October, November, and December will be provided in a **virtual format**. Classes will remain on-line until further notice. Students are responsible for their own devices and internet connection.

If in-person instruction can resume at some point in 2021, classes would be held in Center City Philadelphia. Students would be responsible for transportation and parking costs.

This is a demanding one-year course that introduces students to the fundamentals of HVAC design.

2020-2021 Course Subjects Include:

Fundamentals and Psychrometrics
Load and Heat Transfer Fundamentals
Load Calculations
Pumps, Piping & Piping Systems
Basic Steam & Boilers
Fans, Air Distribution & Duct Design
Refrigeration
Controls & Instrumentation
Equipment Selection

The class is a great way to further, or even begin, a career in HVAC.

The Basic Class tuition is $1,200 ($1,000 for ASHRAE Members who have paid both their National and Philadelphia Chapter dues). Tuition includes all course materials.

Class size is limited to 30 students. To enroll, complete and submit the application including a **non-refundable** deposit of $200 payable to "Philadelphia Chapter ASHRAE". Balance due at first course session.

If you would like to enroll or receive further information, please contact:

Hope Silverman
Philadelphia Chapter ASHRAE
994 Old Eagle School Road, Suite 1019
Wayne, PA 19087-1866
Phone 610-971-2169
Fax 610-971-4859
E-mail: hope@mmco1.com
Web site: www.ashraephilly.org

Philadelphia Chapter ASHRAE

American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

Basic HVAC System Design Course Application

2020-2021

Personal Information

Name: _____
Last First Middle Initial

Home Address: _____
Street City State Zip

Phone No.: _____ Application Date: _____

Email: _____

Current or Most Recent Employment

Employer: _____ From: _____ To: _____ Total _____
Firm Name Date Date Years

Business Address: _____
Street City State Zip

Job Title: _____ Phone: _____ Fax: _____

Email: _____

Discipline: ____ Engineer ____ CAD/Designer ____ CAD/Drafting ____ Sales Rep ____ Trades ____ Administration

Learning Goals

Please describe what you hope to learn and take away from this class.

_____

_____

_____

Education

	School (Name & Location)	Years Attended	Major	Degree Or Diploma
High School				
College				
Other				

PLEASE SEE REVERSE SIDE FOR PAYMENT

PAYMENT

AMOUNT:

Members: _____ $200 Deposit _____ $800 Balance Due _____ $1,000 Total Fee
Members are those who have paid their ASHRAE National and Philadelphia Chapter Dues

Non-Members: _____ $200 Deposit _____ $1,000 Balance Due _____ $1,200 Total Fee

The balance due must be received by our office prior to the first evening of class.

PAYMENT BY CHECK: _____ (made payable to "Philadelphia Chapter ASHRAE")

PAYMENT BY CREDIT CARD: ____ VISA ____ Master Card ____ American Express

Total Amount to be Billed to Card: _____

Credit Card Number: _____

Expiration Date: _____

Name on Card (please print): _____

Billing Address for Card: _____

_____

_____

RETURN THIS FORM WITH PAYMENT TO:

Hope Silverman
Philadelphia Chapter ASHRAE
994 Old Eagle School Road
Suite 1019
Wayne, PA 19087-1866
Phone 610-971-2169
Fax 610-971-4859
hope@mmco1.com

For Official Use Only

Date Received: _____ Tuition: _____ Deposit: _____ Check No.: _____ Balance _____

From the CTT Committee

Pumping Systems – Low Hanging Fruit in Saving Energy

This article is provided courtesy of Armstrong Fluid Technology and their Philadelphia representative, Chesapeake Systems/Blankin Equipment Group.

Abstract
Pumping systems absorb in the neighborhood of 20% of all motor driven electrical energy usage in the United States. However, established efficiency incentive programs only contribute a small proportion of incentive dollars to save energy in pumping systems. The programs today are mostly centered around the use of high efficiency motors, which only result in small energy savings. The addition of variable speed often saves far less than envisioned. The programs center on component efficiency as opposed to a complete system approach which has the opportunity to save substantially more energy. Custom incentive programs for pumping energy savings are cumbersome, under resourced, and their usage is small.

Article
Pumping systems account for nearly 20% of the world's energy used by electric motors and 25% to 50% of the total electrical usage in certain industrial facilities. Clearly, pumping systems consume a significant amount of the total electrical energy. The combined total of United States and Canadian energy efficiency program budgets for ratepayer funded electric and gas programs is nearly $6.2 billion.

Electric Programs (Commercial and Industrial unless indicated as Residential)			
Lamps	92%	Residential: Clothes Washers	42%
Ballasts	91	Residential: Existing Home	42
Motors	82	Residential: Quality Installation	41
Residential: Compact Fluorescent Lamps	82	Any Data/IT	38
Packaged Units	80	Residential: Room A/C's	36
Unitary Heat Pumps	78	Residential: Dishwashers	33
Drives	76		
Unitary A/C	73	Quality Installation	31
Residential: Heat Pumps	67	Residential: Solar Thermal Water Heaters	24
Solid State Lighting	66	Residential: Heat Pump Water Heaters	23
Residential: A/C	66	Residential: Solid State Lighting	23
New Building	59	Any Agriculture	22
Residential: New Home	57	Residential: Computers	10
Residential: Refrigerators	56	Residential: TVs	7
Existing Building	51	Residential: Set-Top Boxes	6
Heat Pump Water Heaters	45		

Table 1. The product categories listed above are by percentage of respondents that responded "yes" to the question, "Is this product included in your program?" The results are for U.S. and Canadian programs combined, and are listed in descending order of percent coverage by programs. Note that heat pumps refer to a refrigeration technology and not fluid pumping systems.

Table 1 above lists the percentage of times that energy incentive program administrators indicated a product is included in the program. Not once in the list are pumping systems referenced even though pumps account for 20% of energy in electric motor systems. One could argue that mentioning the word motor or variable speed drive (VSD) is sufficient, as motors and variable speed drives (VSDs) indicate the greatest energy saving opportunity in a pumping system.

(continued on next page)

Figure 1 illustrates some of the opportunity in pumping systems by looking at the system as a whole instead of just its component parts. A typical component part look may say the motor is 89.5% efficient, and there is an opportunity to gain 4.7% by switching to a high efficiency motor. 89.5% is the average efficiency and 4.7 percentage points is the average efficiency increase between DOE 1998 pre-Epact motor efficiency and the current NEMA Premium.

Correspondingly, addition of a VSD may save 20%, based solely on the author's observation in the field, and a more efficient pump could save energy by improving the pump operation from the efficiency figure of 74% to the efficiency of 78% (i.e., a fairly aggressive pump end efficiency gain of 4 percentage points). This approach yields an efficiency gain of 4.7 percentage points on the motor, plus 20% overall savings for the VSD, plus 4 percentage points for the pump resulting in a power savings of 28.4% for the pumping system.

In this scenario, the industry considers changing the motor very easy as the higher and lower efficiency motors are interchangeable physically, the difference in apparent energy efficiency is readily readable from the nameplate and any millwright and electrician can take one motor out and put the other motor in. Adding a VSD is a little more difficult but still relatively easy. The VSD must be checked for compatibility with motor, and often this reinforces that the motor be changed as well. Most motors supplied today are generally compatible with variable speed VSDs whereas even 5 years ago this was not the case.

Also, it must be determined how the VSD is to be controlled. How will the VSD know what reduced speed and power level to run at? The easy mode of reducing speed is simply manually setting a lower speed by determining the system still operates successfully or ideally opening a throttling valve and setting the lower speed to maintain the same flow after the valve is opened. The next level up would be decreasing the speed in relation to an easy control that can be installed. An example of an easy control is having the pumping unit maintain a set pressure. This means the control components are all set close to the pump in the mechanical room and installation costs and required system control thought is minimal. Finally, installing the VSD is relatively easy and any electrician can place the VSD on the wall and run the motor power through the VSD before going to the motor. The relatively easy installation described saves 28% of energy costs on average. The utility and the owner can feel quite happy that their work has saved 28% of energy with only a little effort.

In this description usually the owner would not change out the pump as there is only 4 percentage points of additional energy to be saved, and changing the pump can be quite involved. Usually the pump is not interchangeable physically, and changing the pump can mean necessary foundation and pipe modification work, which is not considered worth the effort. The real savings, however, is in the rest of the system, pipe design, valves and control type in conjunction with the pump, VSD and motor.

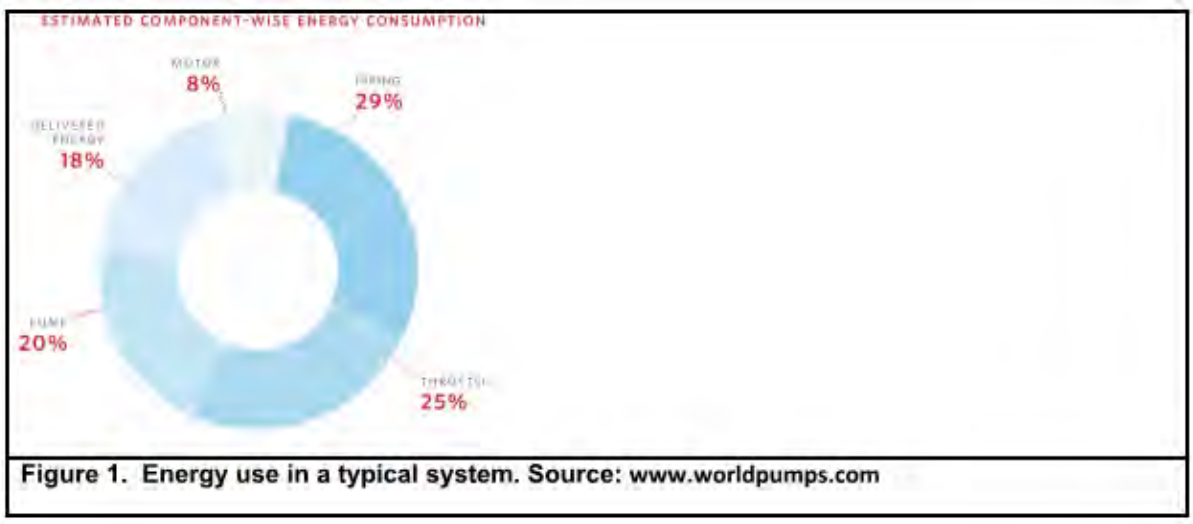


Figure 1. Energy use in a typical system. Source: www.worldpumps.com

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Figure 1 illustrates the energy use in a typical pumping system. From the energy use, the opportunity to save energy is illustrated by the size of the percentage. The figure says that only 8% of the energy produces valuable work. The remaining 92% is wasted energy and available for more efficient operation. The motor accounts for only 8% of the energy loss, and yet that is the main target for energy reduction in systems today through a history of both utility incentives as well as legislation.

The second target is VSDs in pumping systems, which however can only contribute limited reduction in the energy consumption of a pumping system on their own. The true opportunity of 92% can only be seen by finding an optimum pumping system with minimum hydraulic pipe losses combined with the proper size and energy efficient control of the pumping system.

Opportunity Potential

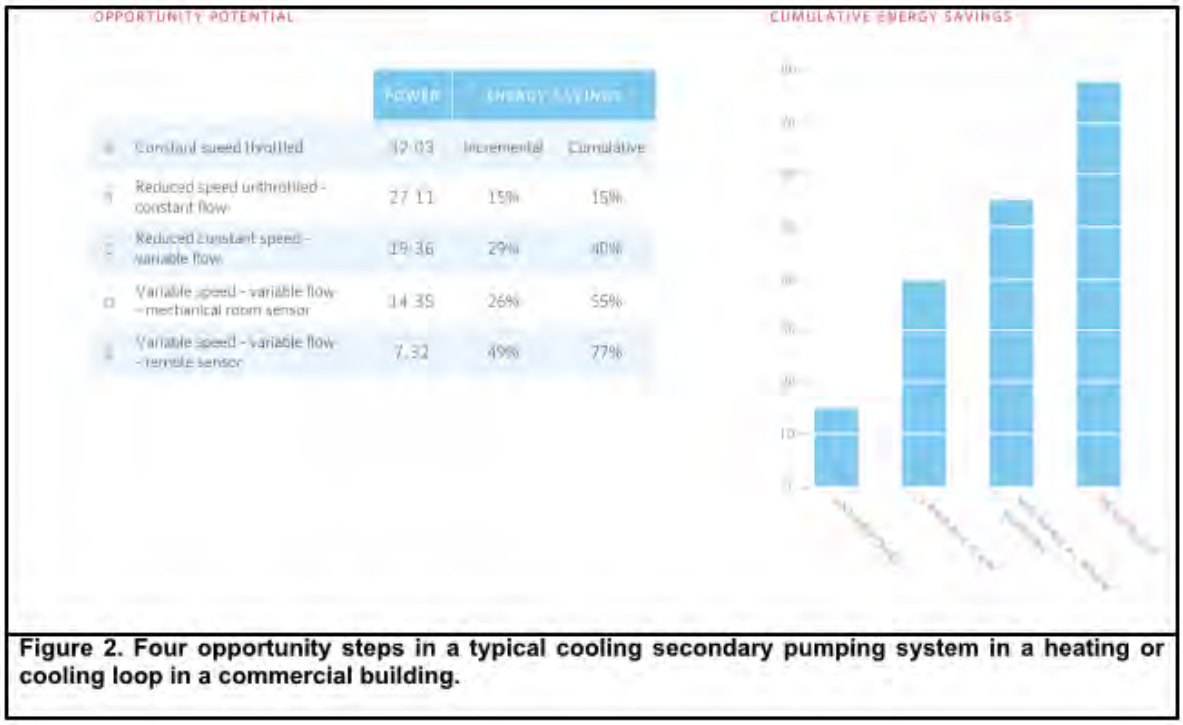


Figure 2. Four opportunity steps in a typical cooling secondary pumping system in a heating or cooling loop in a commercial building.

Figure 2 illustrates four opportunity steps in a typical cooling secondary pumping system in a heating or cooling loop in a commercial building. It starts with a 3-way constant flow pumping system which any system installed prior to 1995 (perhaps 50% of the installed base today) probably employed. The first step in the energy saving opportunity is the installation of a VSD, opening the throttling valve in the system where a typical system would have a throttling valve dissipating a percentage of pressure estimated at 15% of the pumping power of the system. Many systems operate today with the variable speed set at a constant reduced speed. It definitely saves energy. However, only 15%. The second step of the energy reduction is changing the system from constant flow system to a variable flow system in a simpler situation. This can be done by closing the bypass line of each three-way control valve.

In this mode, the pump “rides” its performance curve to provide the flow needed by the system and an additional 29% energy is saved.

The next step of opportunity is to change the variable speed VSD control from constant speed setting to a variable speed and control it by maintaining a constant pressure across the pump. This is considered by the heating and cooling industry as the easiest method to control a variable speed VSD in a pumping system as the control sensors and wiring

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are all contained in the mechanical room. It is an easy system to install and troubleshoot. It saves an additional 26% in energy.

A final opportunity is to have the system controlled to the true pumping demand of the system. This can be done by either placing the control sensor out into the system itself which raises the cost of the control system and makes trouble shooting more difficult. Or, by using integrated pump controls available in the marketplace in the last decade only, which sense the true system requirement through electronics present in the pump itself. This final step of improvement increases the energy savings by an incremental 49% to a total system savings in energy of 77%. It should also be noted that a number of other energy saving opportunities have not even been included in the above example such as the opportunity to change the motor to a higher efficiency motor available today, the opportunity to right size the pump and optimize the selection against load profile to optimize energy use, in a retrofit installation an upgrade of the pump for wear can increase pump efficiency an additional 1 to 5%.

Offsetting these additional opportunities not mentioned could be other factors which discount the above energy savings referenced. The above description does not allow for the power loss through the variable speed VSD control as these devices are not 100% efficient even at full load and are less efficient at part load and reduced speed. The same statement applies to motors as the motor efficiency is reduced as it runs at reduced load and reduced speed.

There are two major points in the above description. The first is by looking at the whole pumping system as opposed to one component, the savings in efficiency can be increased from 15% or less, to 77% or more! The second point is that most programs today, as referenced from Figure 2 above, look only at the change out of the motor for an average energy savings in the neighborhood of less than 5% or the addition of the variable speed VSD for a savings of perhaps 20%, missing the overall 77% or more opportunity available!

The above speaks to the circumstance where any component in a pumping system is even considered. The number one referenced product in Table 1 was lighting. The author has attempted to quantify what percentage of the $6.2 billion in energy incentive programs has gone to pumping systems and has been unable to dimension the number as it is so small and generally therefore not recorded. When the author asked a utility representative this question the answer was “We give away a lot of light bulbs”. Figure 3 below illustrates the potential savings between pumping systems and lighting. To convert from a T12 to T8 lighting system saves in the neighborhood of 30% and with a payback of 1 to 3 years after utility rebates.

Lighting was the number one referenced product in the programs and probably the area where most of the utility incentive dollars have been directed. If we compare this to a pumping system opportunities where saving can be in the neighborhood of 75% and payback less than a year, it does make one ask why pumping does not receive more attention and incentive.

Need for Incentives

From here we should move to the question whether incentives are needed to ensure the upgrade of pumping systems.

A report by the US Department of Energy recorded the success of a motor challenge program. The program documented over a dozen major upgrade programs that had an average energy savings of 33% with some as high as 60 percent. They found, however, that despite the success of a few companies and the relative maturity of the technologies used to achieve motor system efficiency, the level of knowledge and adoption of system efficiency measures among facility managers is very low.

They found that only the largest plants had implemented the most common kinds of system improvements in the past two years to any great extent, and the pattern of knowledge and implementation, even among the largest companies was inconsistent. Among all manufacturing facilities, 24 per cent reported that they had not implemented any of the long lists of potential system efficiency measures over the past 2 years.

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It was found that industrial facility managers face significant barriers to capturing the financial and operating benefits of motor system energy improvements. The most important were:

- Low priority of energy efficiency improvements among objectives. Motor systems were less than 1% of operating costs.
- Lack of awareness of energy saving opportunities— was this a function of the importance of the objective? Why take the time to learn if it is not important?
- Low staffing – Staff is rationed, and there are no resources to implement efficiency programs.
- Conflicting incentives among suppliers. Do salesmen spend time on an efficiency improvement project for $20,000 or a new construction project for $250,000?

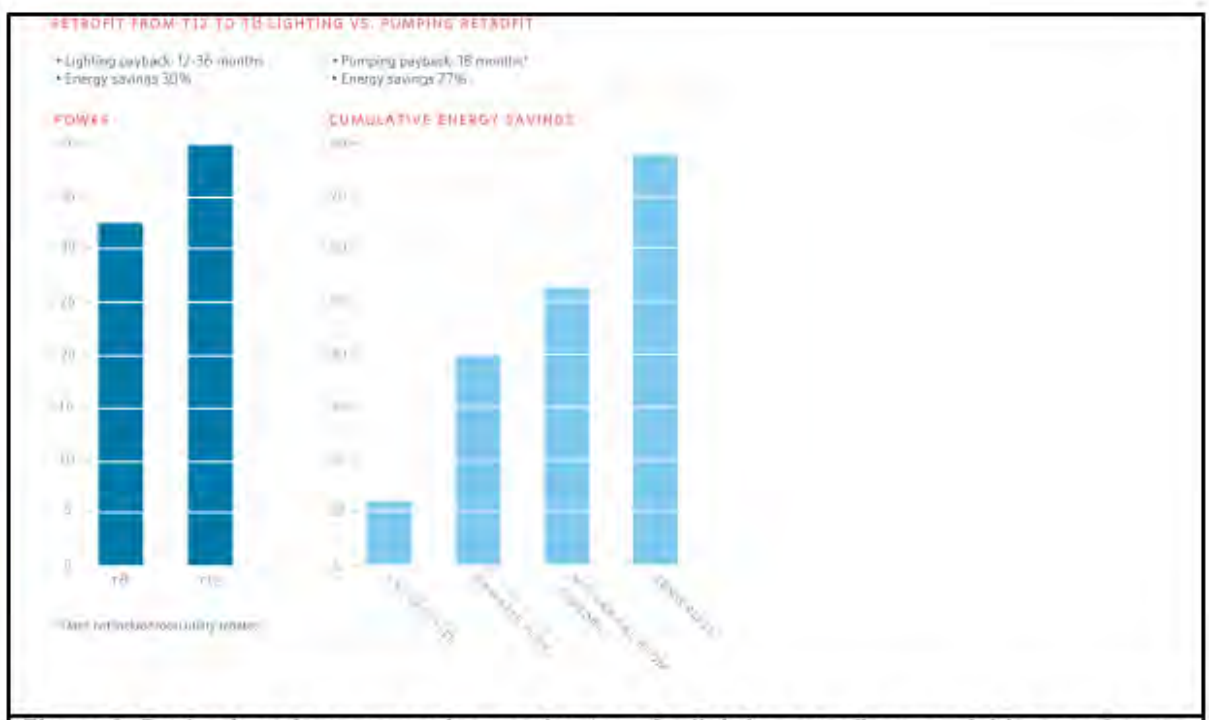


Figure 3. Payback and energy savings estimates of a lighting retrofit vs. variable speed pump retrofit

General Conclusions

- Utility programs total $6.2b in North America. Very little of this is allocated towards pumping systems;
- Pumping systems make up 20% of the energy consumed by electrical motor systems;
- Pumping system upgrades can have higher energy savings than lighting. Lighting is the main subsidized area in utility rebates;
- The private sector has many priorities ahead of saving energy in pumping systems.

Pumping system upgrades are an excellent way for the utilities and society to achieve their energy reduction goals and yet so few pumping systems are upgraded. What is the solution?

Very few prescriptive utility energy incentive programs exist for the upgrade of pumping systems. Previously, utility rebate programs have existed for motor efficiency level improvements and today legal minimums ensure higher motor efficiency levels. However this, although a highly publicized and traditionally funded opportunity, only contributes a small

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percentage to energy reduction. Prescriptive rebates exist in many locations for the installation of VSDs. However, their installation —because the whole system is the important issue—also produce only a percentage of the energy savings possible.

The few prescriptive programs found include:

- A flat dollar amount rebate varying by pump horsepower for the installation of pumps which incorporate integrated controls.
- A flat dollar amount for installation of variable speed or 2 speed pool pumps.
- A flat dollar amount per HP for booster pump systems HP reduction

These are the type of easy to understand and apply for energy incentive rebates which are needed to ensure low hanging energy saving opportunities in pumping systems progress.