ASHRAE Philadelphia Chapter



Quaker City Climate

September 2022
Volume 58, Issue 1

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Thursday, September 29, 2022
12:00 Noon to 1:30 PM

Virtual Meeting

"Fixing the Great Indoors: HVAC and Indoor Air Quality"

Presented By:

Henry H. Slack
Mechanical Engineer
ASHRAE Distinguished Lecturer

See page 3 for more information.

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

The link will be sent to all registrants
prior to the event start time.

Click here to register.

2021-2022

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PRESIDENT'S MESSAGE

Greetings Chapter Members,

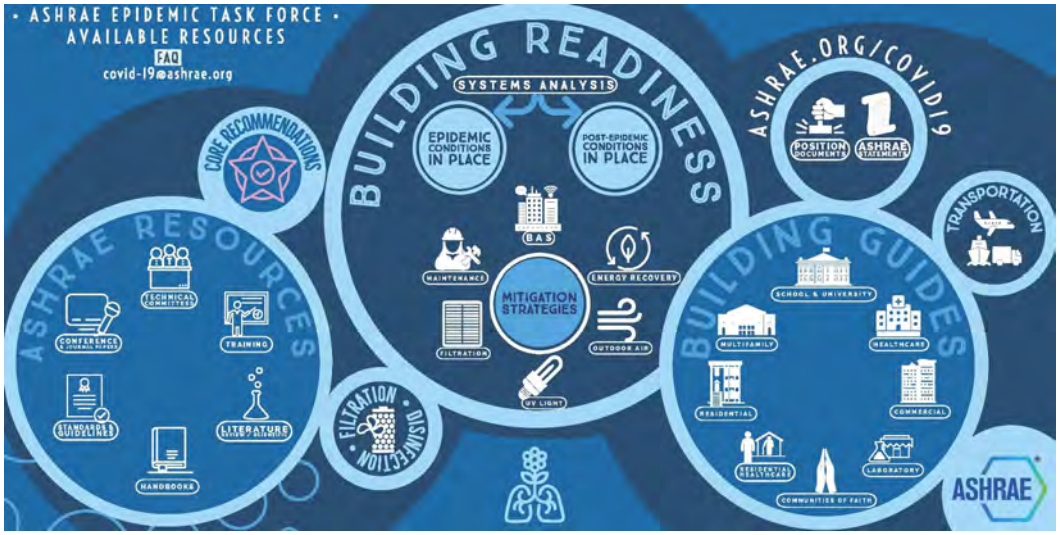
Welcome back as we have officially begun the 2022-2023 ASHRAE season. I would like to thank the 2021-2022 Board of Governors, led by Eric Feinschil, for a successful year while navigating an interesting year having both in person, virtual and even a few hybrid meetings. This season we are aiming to provide the Chapter with Distinguished Lecturers and top-level industry leaders as presenters. Topics will be interesting, diverse, and educational, with both technical and non-technical content. We will be starting out with a virtual meeting due to a speaker and venue conflict. We are excited to bring back all in person meetings at various upscale venues for the remainder of the year. We will have a variety of breakfast, lunch, and dinner sessions along with social events for all to attend.

My focus this year is to bring the Chapter back together in person. Since COVID changed how ASHRAE conducted business in 2020, it has been difficult to get people motivated and interested in ASHRAE. This year, as Chapter President and with the help of our hardworking board members, we will be striving to provide a format for which every member can attend and benefit from our Chapter Programs. Any ideas to gain ASHRAE interest are welcomed. We will be hosting educational presentations and meetings in venues that will provide the opportunity to enjoy the good food and social interactions that have been absent for much of the past two years.

In August, we recently came back from the annual Region III Chapters' Regional Conference (CRC) which was hosted by the Anthracite Chapter in Wilkes Barre, PA, and was well attended by the eleven chapters within our mid-Atlantic region. The CRC is an event where our Chapter leadership is trained to better serve you.
This September, we look forward to hosting a member of ASHRAE's Distinguished Lecturer list, Henry Slack. Henry is heavily involved on the ventilation side of the industry and is committed to making indoor air quality a priority. Henry became involved with ASHRAE in 1988 and has never regretted it.

The board and I look forward to seeing you this year!

Judd Vail
Philadelphia Chapter President
c021@ashrae.net



Thursday, September 29, 2022

"Fixing the Great Indoors: HVAC and Indoor Air Quality"

Presented By:
Henry H. Slack
ASHRAE Distinguished Lecturer

Click here to register.

Presentation Summary:

Most of the time, we breathe without a thought, hundreds of times each hour – unless there's a problem. When something's wrong, it's due to pollutants, people, pathways, and pressure differences. The best solution often is to find the sources and control them, or fix the pathways and pressures. This presentation will focus on what goes wrong in our buildings that engineers can manage –intakes, dampers, filters, coils, drain pans, fans, and controls. Instead of testing, a visual inspection (walk-through) can identify many likely sources and pathways, which are often inexpensive to fix.

Meet the Presenter:



From 1991 to 2018, Henry Slack managed the Indoor Air Program for the U.S. Environmental Protection Agency (EPA), Region 4, dealing with topics as diverse as mold, odors, ozone, carbon monoxide, air cleaners, green buildings, ventilation systems, tobacco smoke, and a guy who could see mold spores flying through the air and attack him. The EPA program is non-regulatory.

For the COVID-19 pandemic, he advised several non-profit organizations on prevention of super-spreader events with use of filters and ventilation. He has also lobbied members of Congress to solve the biggest problem in the world, climate change.

Mr. Slack earned a Bachelor of Science in Chemistry in 1974 from Southwestern at Memphis (now called Rhodes College) in Memphis, Tennessee, and a Master of Science in 1980 from Georgia Institute of Technology. He joined ASHRAE in 1988 and has never regretted it.

ASHRAE Philadelphia Chapter Digital Directory

Our Chapter Digital Directory is now available!

This digital version has replaced the paper versions from years past. This provides flexibility and allows for access anywhere. It's easy to use, highly interactive, and always up to date.

The link to the directory is on our home page on the website, or you may click here to advertise or purchase access to the directory!



HVAC Design: Level I – Essentials

When: September 26-28, 2022 | Baltimore, MD

Level I – Essentials September 26-28, 2022	Member	Non-Member
Early Bird – 60 Days	$1,086	$1,358
Early Bird – 30 Days	$1,109	$1,386
Standard	$1,143	$1,429

ASHRAE's HVAC Design: Level I – Essentials provides intensive, practical training for HVAC designers and others involved in the delivery of HVAC services. In three days, gain practical skills and knowledge in designing and maintaining HVAC systems that can be put to immediate use.

- Fundamentals
- Heating/Cooling Load Calculation
- System Selections
- HVAC System and Components
- Cooling System
- Basic Design of Hydronic Systems
- Basic Design of Air Systems
- Control/BAS

Click here to register!

See the next page for Level II.

Register for both sessions to save money and fast track your experience level.

HVAC Design: Level II – Applications

When: September 29 – 30, 2022 | Baltimore, MD

Level II – Applications September 29 – 30, 2022	Member	Non-Member
Early Bird – 60 Days	$747	$934
Early Bird – 30 Days	$763	$954
Standard	$786	$983

ASHRAE's HVAC Design: Level II – Applications provides instruction on HVAC system designs for experienced HVAC designers and those who complete the HVAC Design: Level I – Essentials training. In two days, gain an in-depth look into Standards 55, 62.1, 90.1, 189.1 and the Advanced Energy Design Guides. Training will focus on a range of topics including: HVAC equipment and systems, energy modeling, designing a chiller plant, and BAS controls.

- Sustainability/Green/LEED/ HPB/NZEB
- Standard 55
- Standard 62.1
- Building Systems: Education Facility
- System Applications: Chiller/Boiler, Air Handlers, VAV Terminals
- Life Cycle Cost
- Building Systems: Multi-story Office Building
- Water-to-Water GSHP Option 1 Chilled Beam with DOAS
- Water-to-Water GSHP Option 2 UFAD

Company Discount: Enroll 3 or more participants from the same company at the same time and SAVE!

Click here to register!

Register for both sessions to save money and fast track your experience level.

Engineers' Night Dinner Meeting

Thursday, October 13, 2022

The Manor House at Commonwealth
300 Tournament Dr, Horsham, PA 19044



5:00 pm - 6:30 pm Cocktail Reception & Vendor Display
6:30 pm - 8:00 pm Dinner and Presentation

Join SMCA at the Manor House as we host an expert panel discussing the latest edition of SMACNA's System Air Leakage Test Standard. Moderated by Eli Howard, SMACNA's Executive Director of Technical Services & Research, the panel will share thoughts, insights, and concerns from both the Engineer and Contractor perspectives of the industry.

Attendees will not only be among the first to hear about the impact these revised standards will have on projects moving forward, **but they will also receive a free copy of the new manual** and an opportunity to question the experts!

Register online at www.smca.org. Deadline is Oct 4, 2022.

Engineers and SMCA Members are free of charge.
SMCA Supplier Liaison Council Participants are allowed a free vendor table and two attendees at no charge. Additional attendees will pay $125 per person.
Only those who attend in person, will receive the free copy of the new manual.

SMCA
955 Louis Drive
Warminster, PA 18974
610-828-4055
www.smca.org

Become a 2022-2023 Corporate Sponsor of the Philadelphia Chapter!

Your firm's participation in this program would enable us to make a donation to Research Promotion which includes over $ 1.5 million in local research funding.

Some of the benefits your company will enjoy as a Corporate Sponsor includes a listing on the Chapter's website with a link to your own website, five free log-ins to the Digital Directory, a $100 discount on an advertisement in the Digital Directory, and tickets to attend our dinner meetings which include quality educational programs.

We offer a few different levels of corporate sponsorship. Each level will receive the same types of benefits, with some differences in quantities and discounting.

Contact hope@mmco1.com before October 1 if you are interested.



2023 ASHRAE Winter Conference and AHR Expo
February 4-8, 2023
Atlanta, Georgia

Check out the registration page to see what's available for in-person and virtual registration options.

Click here to learn more!



ASHRAE 2023 ASHRAE Annual Conference

Mark your calendars!
2023 ASHRAE Annual Conference
June 24-28, 2023 | Tampa, Florida

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

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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.

New Philadelphia Chapter Members

New Chapter Members
Harold Alderfer
Stephen Agozzino
William Curran
Kevin Keenan
Michael Logan
Jack Shepper

New Society Members
Gary Bixby
James Bramwell III
Casey Lorimer

New Student Members
Dalia Sofia Diaz-Zorrilla
Jamie Emerick
George Gallo Jr.

If you are currently experiencing hardship, especially as a result of the pandemic, please contact our Member Services Department at members@ashrae.org
One of our Member Services Representatives will assist you in determining your hardship case and provide guidance with respect to an adequate adjustment to your dues and other member benefits for the 2022 – 2023 Society Year.

What are the benefits of paying Philadelphia Chapter dues* ?

Discounts:

$200 Discount for Basic Class
$150 Discount for 90.1 Seminar
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

New Technology for Indirect Adiabatic/Evaporative Cooling Solutions for Data Center Applications

White Paper 102

Revision 0

By Jon Pettitt

Executive Summary

Data center operators continue the drive for sustainable operations, low energy consumption, reducing carbon emissions, and conserving water. This drive has created an interesting debate for those data center operators evaluating their cooling system options whilst aligning with their sustainability goals. In this paper, we explore a new cooling technology that enables a flexible approach to adiabatic/evaporative cooling solutions.

Introduction:

As demand for energy rises, the power sector's water usage is expected to increase even further, straining scarce water resources. Thirty-six countries around the world already suffer from high or extremely high-water stress. Concern over water usage has generated an interesting debate around sustainability for those data center operators evaluating their cooling system options.

Data centers can have a heavy demand for water. IT equipment requires enormous amounts of energy to operate whilst generating considerable amounts of heat. The cooling process of traditional Direct and Indirect Evaporative Cooling solutions often involves that as soon as outdoor ambient conditions allow the solutions will be evaporating water for cooling with cooling towers or evaporative coolers. When water is cheap and plentiful, this makes sense due to savings in electricity and the cost benefits.

It is important to understand that by reducing the water consumption at the data center, the water consumption's incumbrance goes back to the source at the thermoelectric power generation process.

The average water consumption factor for electricity in the United States is 0.576 gallons/kWh*. Using water at the data center reduces the inherent electrical losses associated with the power required for the cooling between the power generation plant and the data center.

Traditional Direct and Indirect Evaporative Cooling solutions for data centers across the world have shown that they significantly reduce energy consumption compared to other technologies, but historically have resulted in relatively high-water consumption.

The reason that evaporative cooling solutions are so effective is that water is a more efficient medium than air for removing heat because evaporation increases the cooling process. The effectiveness of evaporative cooling either direct or indirect is very location-dependent since regions with a drier less humid climate results in greater efficiency of the system.

For Data Center designers, it is very often thought that there is no middle ground for data center cooling. The final decision will often drive the final solution based on the key demands of the client. The options invariably are either.

- Keep energy consumption low and consume significant volumes of water. (typically, Direct, or Indirect Evaporative cooling system)

- High energy consumption and no water usage. (typically, chilled water, DX or pumped refrigerant)

Utilizing data center cooling solutions that can efficiently and effectively operate in free cooling mode in low to mild external temperatures means data center mechanical systems require less energy. The dilemma often occurs once free cooling is no longer available. Traditionally a cooling system would either switch to a mechanical DX or chilled water-cooling mode or an adiabatic/evaporative mode (including mechanical DX mode for top-up) offering little or no flexibility.

Technology:

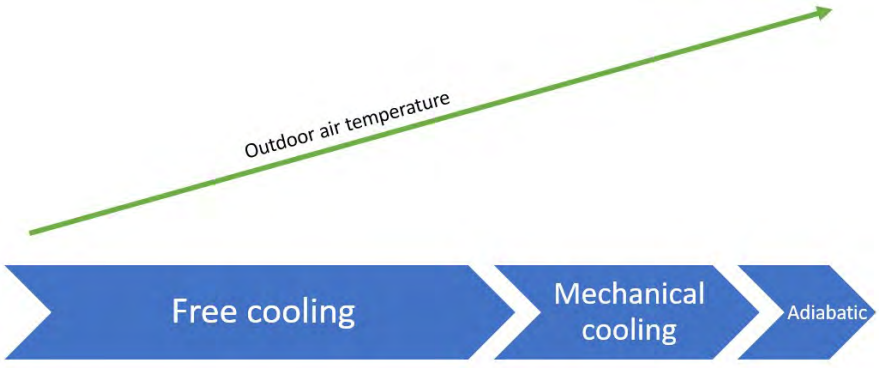
Recent developments in Indirect Evaporative Cooling technology have seen the emergence of a new type of cooling solution. The new technology allows the data center operators to determine which method or combination of cooling methods to cool their data center most effectively & efficiently with the flexibility to change as the internal and external conditions vary. Such as an increase in IT load or as power and water costs increase and decrease.

For the purpose of this report, we will compare two types of cooling methods.

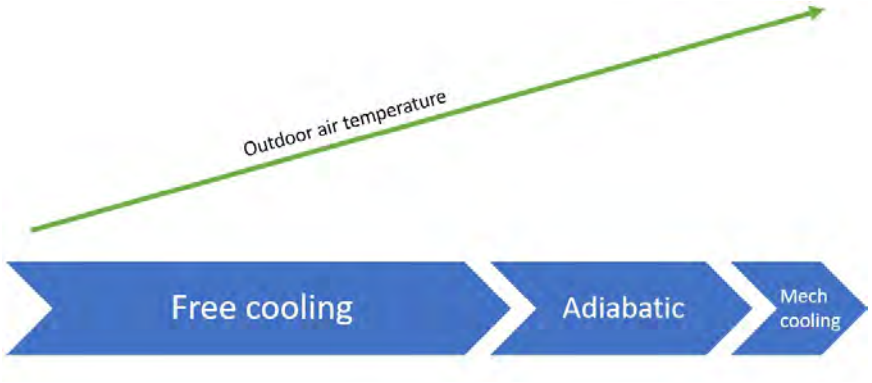
1. Water Priority method
2. Energy Priority method

The two methods are often available within the same solution enabling the cooling to match the data center's requirements.

- Water Priority method: Higher energy consumption & minimal to zero water use
    - Stage one free cooling
    - Stage two mechanical cooling
    - Stage three adiabatic cooling



- Energy Priority method: Lower energy use with use of adiabatic/evaporation system
    - Stage one free cooling
    - Stage two adiabatic cooling
    - Stage three mechanical cooling



Comparison:

This report explores the performance of the new technology, demonstrating and exploring the possibility of choosing the most viable cooling method based on site-specific conditions across seven locations operating a 3 megawatt data center.

The seven locations are.

- (USA) Ashburn, VA
- (USA) Dallas, TX
- (USA) San Jose, CA
- (UK) London
- (Germany) Frankfurt
- (Netherlands) Amsterdam
- (France) Paris

The report will use a testing model that measures the pPUE* and WUE for the two operational modes in each location.

The overall energy operating costs of the data center can be seen in the partial Power Usage Effectiveness (PUE), a metric of energy efficiency. By shifting the cooling burden from electricity to water, facilities can improve their PUE because water consumption is not factored into the calculation.

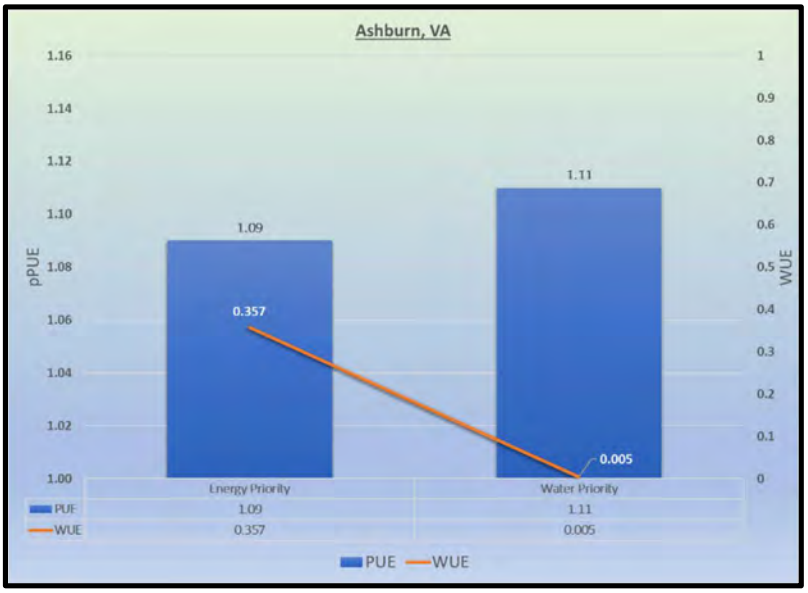
To take an overall view of the efficiency of a data center the water consumption must be considered. Water Usage Effectiveness (WUE) becomes a critically important metric to measure how efficiently a data center uses water.

WUE is calculated as the ratio between water used at the data center and electricity delivered to the IT hardware. The WUE of an average data center is 1.8L per 1kWh. To add some perspective, a data centers with a WUE of 0.2 L/kWh or below use less than 250ml (8 fluid ounces) or approx one cup of water for every kilowatt-hour delivered to servers.

Combined with PUE, WUE gives a complete picture of a facility's efficiency.

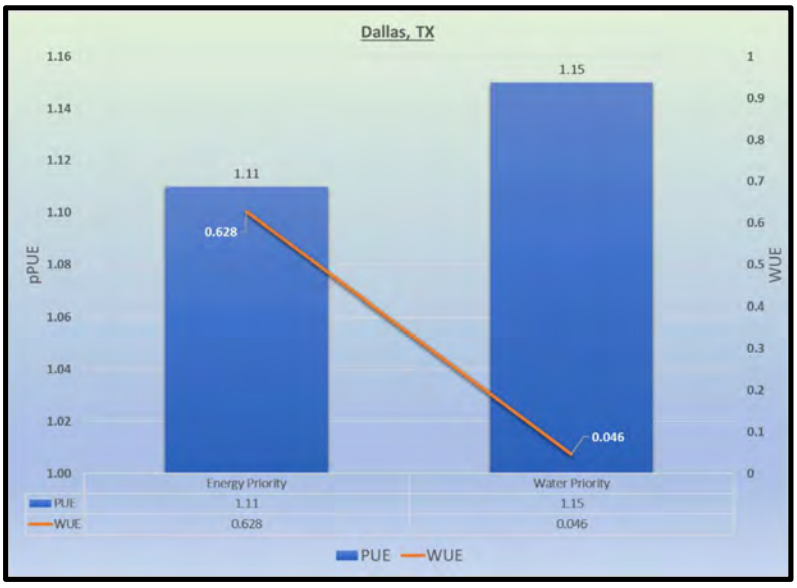
Ashburn, VA (tested at 60hz 480v)

- Weather data WMO station number 724055
- IT Load in white space = 3MW
- Redundancy = N+1
- Required supply air temperature = 24°C (75°f)
- Delta T between supply air temp and return air temp = 12°C (21.6°f)
- Utilization = 75%



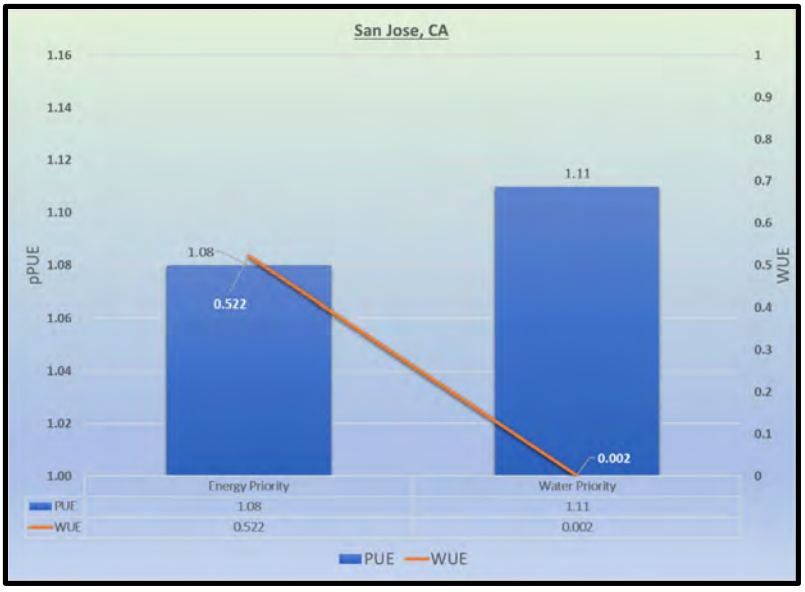
Dallas, TX (tested at 60hz 480v)

- Weather data WMO station number 722590
- IT Load in white space = 3MW
- Redundancy = N+1
- Required supply air temperature = 24°C (75°f)
- Delta T between supply air temp and return air temp = 12°C (21.6°f)
- Utilization = 75%



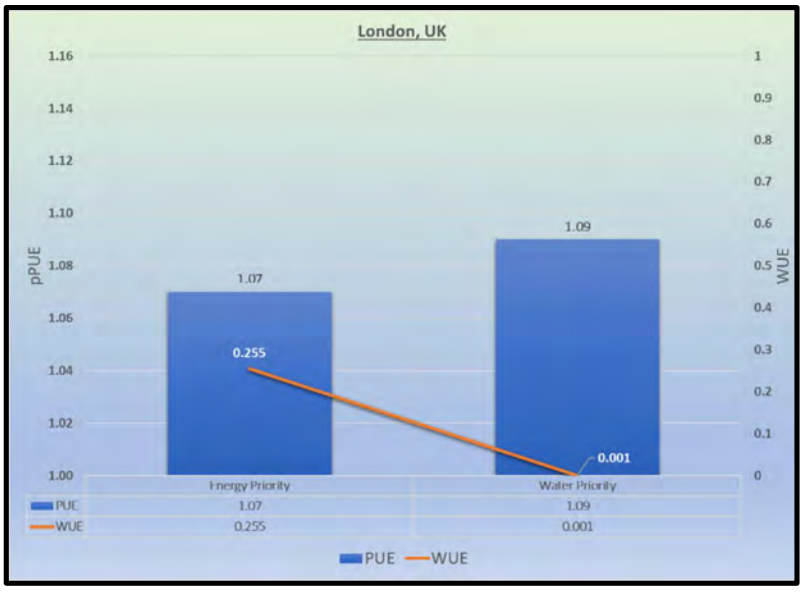
San Jose, CA (tested at 60hz 480v)

- Weather data WMO station number 724945
- IT Load in white space = 3MW
- Redundancy = N+1
- Required supply air temperature = 24°C (75°f)
- Delta T between supply air temp and return air temp = 12°C (21.6°f)
- Utilization = 75%



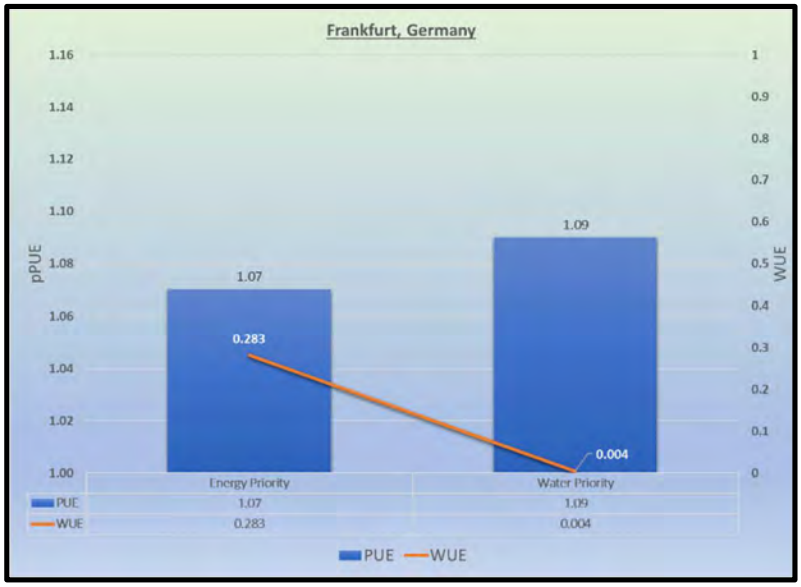
London, UK (tested at 50hz 400v)

- Weather data WMO station number 037720
- IT Load in white space = 3MW
- Redundancy = N+1
- Required supply air temperature = 24°C (75°f)
- Delta T between supply air temp and return air temp = 12°C (21.6°f)
- Utilization = 75%



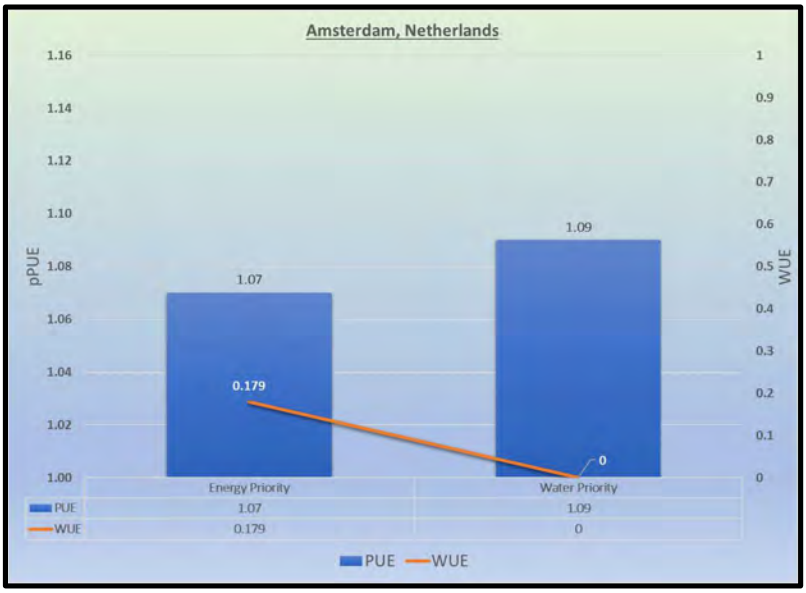
Frankfurt, Germany (tested at 50hz 400v)

- Weather data WMO station number 106370
- IT Load in white space = 3MW
- Redundancy = N+1
- Required supply air temperature = 24°C (75°f)
- Delta T between supply air temp and return air temp = 12°C (21.6°f)
- Utilization = 75%



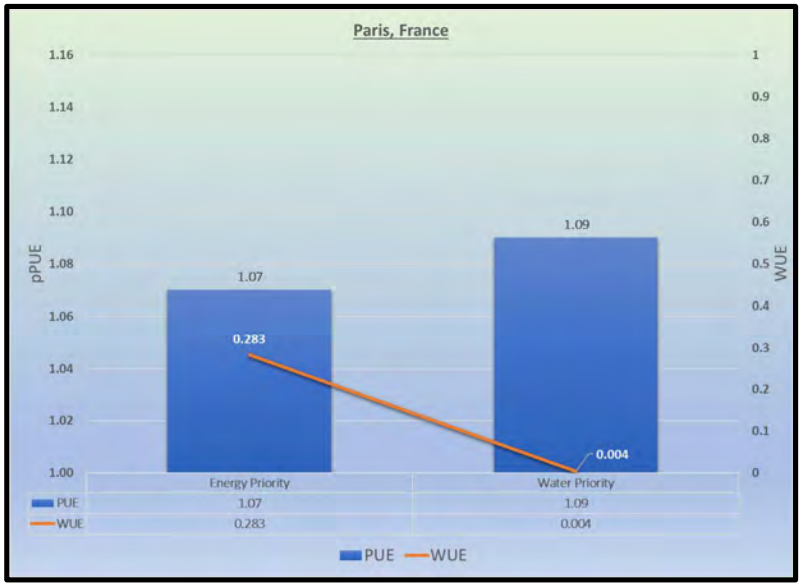
Amsterdam, Netherlands (tested at 50hz 400v)

- Weather data WMO station number 62570
- IT Load in white space = 3MW
- Redundancy = N+1
- Required supply air temperature = 24°C (75°f)
- Delta T between supply air temp and return air temp = 12°C (21.6°f)
- Utilization = 75%



Paris, France

- Weather data WMO station number 71570
- IT Load in white space = 3MW
- Redundancy = N+1
- Required supply air temperature = 24°C (75°f)
- Delta T between supply air temp and return air temp = 12°C (21.6°f)
- Utilization = 75%



Summary of results:

Each graph of results per location demonstrates the pPUE* and WUE differences whilst operating in either cooling energy priority mode or cooling water priority mode of the new technology.

According to the latest annual Uptime Institute survey, the average power usage effectiveness (PUE) ratio for a data center in 2020 is 1.58. It would follow that the average pPUE* for cooling would be in the region of 1.40. The graph comparing the results in Dallas, TX show the highest pPUE (cooling only) of all the locations of 1.15.

According to a US Department of Energy report, the WUE of an average data center is 1.8L per 1kWh. The graph comparing the results in Dallas, TX show the highest WUE of all the regions of 0.628 (cooling only). This value is significantly lower than the US Department of Energy report average. In water priority mode, all results reflect a higher energy use compared to energy priority mode. It is important to note that to have the adiabatic/evaporative system operate when the outdoor air temperature is very high will reduce the peak input power for the system therefore reducing the size of electrical infrastructure such as back-up generators, auto-transfer switches, switchgear and cabling.

Conclusions:

When evaluating cooling solutions for data centers the cost of the whole facility needs to be considered. Factors such as location, greenfield or brownfield, availability and cost of energy and water all come into the final decisions. However, it is important to understand that by reducing the water consumption at the data center, the water consumption's incumbrance goes back to the source at the power generation process.

In 2017 a study completed and presented by the Department of Energy's Argonne National Labs, showed that the average water consumption factor for electricity in the United States is 0.576 gallons/kWh. Using water at the data center reduces the inherent electrical losses associated with the power required for the cooling between the power generation plant and the data center.

Achieving and maintaining the correct balance between energy consumption and water usage at a data center whilst operating sustainability will always be the key. A solution that offers the flexibility to adjust the balance and future-proof the project will be critical to delivering the planned results.

In this paper we have explained the differences and shown there is not a 'one size fits all method' but with emergence of new technologies the options are of water vs no water are no longer polar opposite, and a flexible middle ground can easily be achieved.

When designing data centers for a sustainable future, the client can be positive that water use in the cooling of an adiabatic/evaporative solution can be closely aligned with the efficiency and sustainability goals of low energy, reducing carbon emissions and conserving water.

*Appendix:

- All test carried out in Excool test facility in the UK.
- All test carried using Excool Zero data center cooling unit as demonstration solution.
- Tests for locations in US carried out at 60hz/480v.
- Tests for locations in Europe carried out at 50hz/400v.
- Annual weather data used from ASHREA weather data viewer version 6, 2017.
- The metric partial power usage effectiveness, (pPUE), defines a certain portion of the overall PUE of a data center within a clearly defined boundary. In the case of this report the pPUE refers to the cooling portion of the overall PUE.
- 2017 Department of Energy's Argonne National Labs, showed that the average water consumption factor for electricity in the United States is 0.576 gallons/kWh.