ASHRAE Philadelphia Chapter



Quaker City Climate

January 2022
Volume 57, Issue 5

INSIDE THIS ISSUE:

President's Message	2
Corporate Sponsorship	3
Golf Outing	3
Future City Philadelphia	3 & 4
ASHRAE Conference	5
Chapter Directory	5
Epidemic Task Force	5
Membership Promotion	6
CTTC Article	7-12

Wednesday, January 12, 2022
6:00 PM to 11:00 PM

January Social Event

Philadelphia 76ers VS. Charlotte Hornets

$36.00 Standing Room Only

Come watch as the 76ers take on the Hornets from the newly renovated Assembly Room. This is a standing room only ticket with full access to several cash bars as well as a kitchen serving area where food can be purchased. There is a large lounge area with fire places and plenty of room to congregate and socialize.

IT HAS JUST BEEN BROUGHT TO OUR ATTENTION THAT ANYONE ATTENDING THE GAME WILL HAVE TO MEET THE BELOW COVID POLICY. ANY QUESTIONS PLEASE DO NOT HESITATE TO REACH OUT.

Effective January 3rd, in compliance with the City of Philadelphia's policies, all guests and arena employees without a valid religious or medical exemption are required to show proof of vaccination to enter The Center. Until January 17th, guests also have the option to present proof of a negative test taken within 24 hours of tipoff.

Click here to register.

No food or drink is included with the ticket, plenty of drinks and food are available with purchase.

You must have a Ticketmaster account to receive tickets and enter the Wells Fargo Center. Tickets will be emailed out the day before the game. Please be sure to use the email address associated with your Ticketmaster account.

Wells Fargo Center
3601 S Broad Street
Philadelphia, PA 19148

Follow us on
LinkedIn

2021-2022

President
Eric Feinschil

President-Elect
Judd Vail

Vice President
Dan Brown

Treasurer
Jason Trefz

Secretary
Tyler Holland

Senior Governor
Tim Reinking

Governors
Tyler Holland
Anthony Scaccia, PE

Attendance
Colleen Mooney

Basic School Coordinator
James Lill, PE

Chapter Historian
Kristopher Verderber

Chapter Technology Transfer Committee Chair
Canaan Colwick

Electronic Communications
Mark Carbonaro, EIT

Government Activities
Anthony Scaccia, PE

Honors and Awards Committee
Tim Reinking

Membership Promotion Chair
Richard Adrian

Newsletter Editor
Hope Silverman

Program Committee Chair
Judd Vail

Public Relations
Tim Reinking

Reception
Colleen Mooney

Refrigeration
Hasanaat Prophete

Research Promotion Chair
Tim Reinking

Special Events
Judd Vail

Student Activities Chair
Tyler Holland

Young Engineers in ASHRAE
Tyler Holland

PRESIDENT'S MESSAGE

Greetings Chapter Members,

On behalf of the board, we hope everyone enjoyed the holidays and wish you a very Happy New Year!

We closed our 2021 event schedule with a fabulous lecture from Ryan Green of Nyle Water Heaters. Ryan presented on an approach to electrically generating hot water, lowering carbon footprint, and market and legislation trends. The presentation was well attended and well received. December's session was our corporation sponsorship appreciation event. We again would like to thank all our sponsors (https://ashraephilly.org/sponsors.php).

Wednesday, January 12th, is our Philadelphia 76ers Social event at the Wells Fargo Center. Please join us as the 76ers take on the Charlotte Hornets. We will be located in the newly renovated Assembly Room. There are several large lounge areas, fireplaces, and plenty of room to congregate and socialize. This is a perfect event to see some familiar faces and network with industry colleagues.

As we look ahead, we are planning a virtual talk in the month of February. We will then be looking to return to an in-person meeting in March with a virtual option. Please keep an eye out for our email announcements and events updates on our website.

Hope to see you soon…

Eric Feinschil
Philadelphia Chapter President
c021@ashrae.net

Save the Date!

ASHRAE 2022 Golf Outing
May 9, 2022
11:00 AM to 7:00 PM

DuPont Country Club
1001 Rockland road
Wilmington DE 19803

https://www.dupontcountryclub.com/

Online registration and full outing details to follow.



Become a 2021-2022 Corporate Sponsor !

It's not too late to sign up as a Corporate Sponsor for 2021-2022!

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 if you are interested.

2022 Future City Competition Needs Your Help!

We're coming down to the final two weeks before the competition and the students are putting the finishing touches on their presentations and model slideshow, with a number of them scrambling with sudden virtual school and/or COVID absences.

Please encourage your colleagues to sign up as judges and other volunteers. We will need quite a few people to assist with Zoom, ranging from no experience needed to experienced Zoom hosts. Training will be provided as needed.

There will be a training session for Special Awards Evaluators the week of the competition, to help guide them through our virtual convention center.

Susan Best
Future City Philadelphia
Sponsorship Coordination

See the next page for more information!

2021 SPONSORS

Platinum Sponsor

Bentley Systems, Inc

Gold Sponsor

Pennoni
Project Management Institute, Delaware Valley Chapter
Urban Engineers, Inc.

Silver Sponsor

AECOM
American Society of Plumbing Engineers, Philadelphia Chapter
CVM Professional
Delaware Valley Regional Planning Commission
Gilbane Building Company
Jacobs Engineering
Langan Engineering & Environmental Services
The Kirkman Oliver Company

Bronze Sponsor

American Society of Heating, Refrigerating and Air Conditioning Engineers, Philadelphia Chapter
American Society of Mechanical Engineers, Philadelphia Section
Arora Engineers, Inc.
Associated Engineering Consultants, Inc.
Association of Energy Engineers, Greater Philadelphia Chapter
Ballinger
Boles, Smyth Associates, Inc.
Clemens Construction Company, Inc.
Future City Steering Committee
International Society of Automation, Philadelphia Section
International Society of Pharmaceutical Engineers, Delaware Valley Chapter
KMJ Consulting, Inc.
L.F. Driscoll Company, LLC
National Fire Sprinkler Association, PenJerDel Chapter
P2 Structural Engineering
Skanska USA Inc
TA Instruments
Target Building Construction

Sponsor

Advanced Infrastructure Design
American Institute of Chemical Engineers, Delaware Valley Section
American Planning Association, PA Chapter, Southeast Section
American Society of Civil Engineers, Phila Section, Young Members Forum
American Society of Highway Engineers, Delaware Valley Section
American Society of Highway Engineers, Southern New Jersey Section
American Water
Institute of Electrical and Electronic Engineers, Philadelphia Section
Institute of Industrial & Systems Engineers, South Jersey Delaware Valley Chapter
Institute of Transportation Engineers, Mid-Atlantic Section
Intelligent Transportation Society of Pennsylvania
Jennifer Wetzel
Ken Golkin, PMP
Mary and Jim Moyer
Nancy Hall
National Association of Women in Construction
National Council of Examiners for Engineering and Surveying
P. Agnes, Inc.
Pennsylvania Society of Professional Engineers, Delaware County Chapter
Project Management Institute Educational Foundation
Sally and John Kampmeyer
Society of American Military Engineers, Philadelphia Post
Society of Fire Protection Engineers, Philadelphia-Delaware Valley Chapter
Thomas and Julie Gennaro

FUTURE CITY® COMPETITION, PHILADELPHIA REGION

January 22, 2022

2021-2022 Sponsorship Program

The Future City® Competition is a hands-on, real-world learning experience for middle school students to learn how engineers shape the world we live in today and tomorrow. Last year, despite the pandemic and a virtual competition, Future City Philadelphia introduced over 500 middle school students at over 40 schools to the engineering profession.

Over the past few years, the Future City Competition has won three national STEM program awards: US2020 STEM Mentoring Award for Most Innovative Hands-On Project (2017), Henry C. Turner Prize for Innovation in Construction (2016), and the UL (Underwriters Laboratories Inc.) Innovative Education Award Grand Prize Winner (2015).

To help support this educational program, complete and return the sponsorship form today!* The sooner the better so your sponsorship can be properly acknowledged in our publications and on our web site.

We look forward to including your name in the list of sponsors for the 2022 program!

**Invoicing accommodations can be arranged to meet your charitable giving requirements. Future City Philadelphia is a 501(c)3 outreach program of Discover E so your contribution is tax deductible as a charitable contribution to the extent the law permits.*

We have made the difficult decision that the competition on January 22, 2022 will be virtual, as it was last year. Given the nature of most of our expenses, they don't vary much between virtual or in person.



49% of Future City participants are girls. 33% of participating schools enroll at least 50% of students in a free lunch program.

"I love Future City. It makes my brain sweat!"
– Future City Student Participant

This Year's Essay Challenge:
Designing A Waste-Free City: Design a waste-free city that uses the principles of a circular economy.

We will need many volunteers: mentors, judges, special award evaluators, conferencing platform technical support, and other tasks. Please encourage your colleagues to volunteer for the competition. Volunteers will need to sign up online at www.futurecityphilly.org.

Questions?

- Contact Susan Best, Sponsorship Coordination at susanbest54@gmail.com
- Visit our website: www.futurecityphilly.org, http://futurecityphilly.org/Sponsorship.html

APPROVED FOR LISTING NASSP 2021–2022 STUDENT CONTESTS, PROGRAMS & ACTIVITIES



2022 ASHRAE Winter Conference
January 29–February 2, 2022
Las Vegas, Nevada

AHR Expo
Jan. 31–Feb. 2, 2022
Las Vegas Convention Center

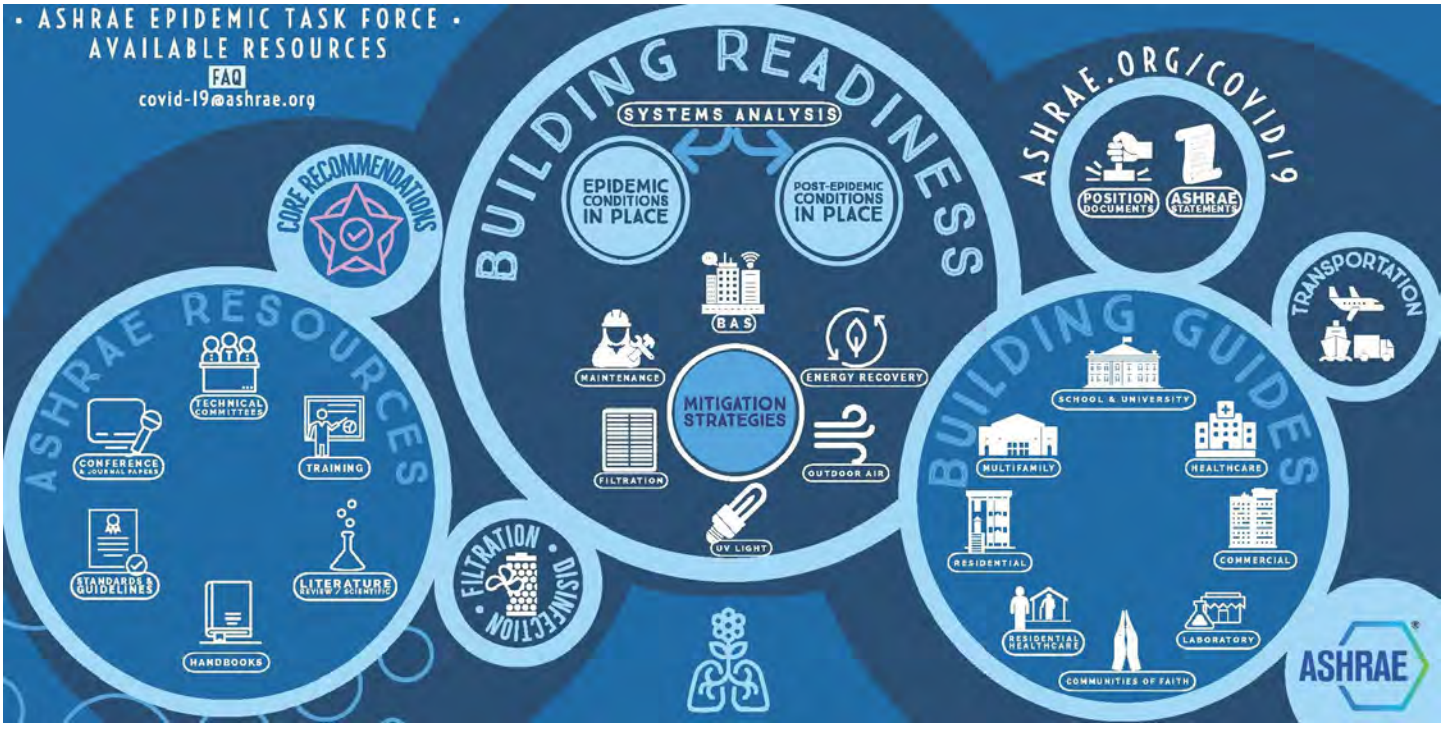
The 2022 ASHRAE Winter Conference will be a hybrid experience, offering both in-person and virtual options for participation for attendees. The in-person conference will be held in Las Vegas, Nevada at Caesars Palace.

Our 2021-2022 Chapter Digital Directory is now available.

This digital version has replaced 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.

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!

ASHRAE Philadelphia Chapter Digital Directory



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

Visit
our web site at:

www.ashraephilly.org

Follow us
on LinkedIn

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 & Society Members

New Chapter Members

Bryan Eschleman
Michael DePetris
Dan McCullough

New Student Member

Yuqing Hu

New Society Member

Stephen Pettit

If you are currently experiencing hardship, especially with the current COVID-19 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 2021 – 2022 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

CTTC Article



A Better Heat Recovery Water Source Heat Pump (WSHP)

Water Source Heat Pump (WSHP) systems are considered energy efficient since they can move heat from one location within a building to another location.

However, there are two main limitations to this system. This first is that the heating compressors generate additional heat, even though during intermediate seasons there may be sufficient waste heat within the loop to satisfy the heating load. In addition, the compressors consume electricity simply to access this waste heat in the loop.

The second limitation is that the fluid loop temperature cannot go above 90 °F (33.2 °C) for heating compressors to remain operational, or they risk overheating. This limitation may require the operation of a heat sink in order to lower the loop temperature in certain seasons – and operating a heat sink consumes additional electrical energy.



The Hybrid Heat Pump System described here combines WSHP and hydronic heating into one operating system. It can heat or cool any space at any time of the year. Heat is either extracted from, or rejected to, the same two-pipe fluid loop just like any conventional WSHP system. The system components (boiler, fluid cooler or cooling tower, etc.) form an integral part of the system just like all WSHP designs.

In cooling mode, the Hybrid Heat Pump system operates identically to any other conventional WSHP. They are water-cooled air conditioning units, rejecting the building heat to a heat sink through the fluid loop.

For heating, a traditional WSHP absorbs heat from the fluid loop using the refrigeration cycle operating in the reverse mode. Conversely, the Hybrid units operate as simple fan coils, absorbing the fluid heat directly through a hot water coil located inside the unit.

The fluid heat being absorbed comes from two possible sources:

1) From the heat of rejection and compression of the cooling units.

2) From the boiler plant.

(continued on next page)

CTTC Article (continued)



Traditional WSHP Operation

A WSHP is said to have a COP (Coefficient of Performance) of approximately 4. For every 1 unit of energy input, there are 4 units of heat output.

$$COP = \frac{\text{Heating capacity (Btu/hr)}}{\text{Energy input (Watts x 3.413 Btu/watt/hr)}} = \frac{\text{Fluid heat + Compressor heat}}{\text{Compressor electrical input}}$$

Hybrid System Layout

The architecture of the Hybrid system is identical to any conventional WSHP. It has all the same components and does not require any additional piping or complicated controls. For heating, instead of energizing a reversing valve to redirect the flow of refrigerant, the system energizes a simple water valve to redirect the flow of water away from the condenser to a hydronic coil. The coil, valve, piping and controls are all internal to the unit. The installer, contractor, or the design engineer sees no difference, and the system costs are no greater than a traditional system. The only modification required is an outdoor air sensor, and a large boiler plant. An outdoor sensor is required since the hydronic heating system is controlled by resetting the fluid loop temperature to ambient conditions, just like any conventional fan coil heating system. A larger boiler plant may be required since the heat normally generated by the compressors will be generated by the boiler plant. This is called fuel switching and is discussed further in this article. To offset the cost of a larger boiler plant, installation cost savings are possible with the hybrid system, since the design water flow rate is 2gpm/ton vs. the more traditional 3gpm/ton. This reduction in flow rate will provide capital costs savings for a smaller fluid cooler, smaller water pumps, and smaller pipes. Of course, lower flow rates will result in lower pumping energy over the entire life of the system.

What about mechanical cooling with elevated fluid temperatures?

Mechanical cooling will always be available up to a maximum fluid temperature of 125 °F (51.6 °C). However, in most cases, fluid temperatures greater than 115 °F (46.1 °C) are rarely required, even in very cold climates. Operating cooling units with elevated fluid temperatures in the winter heating season will reduce their energy efficiency. Fortunately, the penalty for operating with elevated fluid temperatures for a limited period in peak heating mode will be minimized if high efficiency models are used. Figure 1 compares the electrical consumption with 70 °F (21.1 °C) fluid and hybrid unit operating with 110 °F (43.3 °C) fluid. The only time the hybrid system may require 110 °F (43.3 °C) is during peak winter conditions when most of the units would be in heating mode, except for possibly interior zones. Therefore, for this example it is assumed that 75% of the units are in heating and only 25% in cooling. This is a very simplified snapshot, but it clearly demonstrates the electrical benefits of turning off the heating compressors even if the cooling units are operating with elevated fluid temperatures.

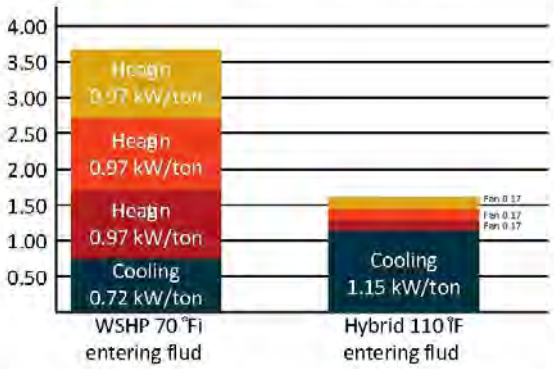


Figure 1, Electrical energy kW/ton for peak winter operatio

A traditional WSHP is very efficient in cooling mode (0.72 kW/ton) with 70 °F (21.1 °C) fluid serving the condenser, but less efficient in heating mode (0.97 kW/ton) with fluid serving the evaporators.

(continued on next page)

CTTC Article (continued)



What about pipe insultation?

The concern over the requirements for pipe insulation stems from Section 9.4.8.2 of the ASHRAE's Standard 90.1 – 1989. This standard has been set up to minimize the energy consumption of building systems. WSHP systems operate with fluid temperatures between 55 °F (12.7 °C) and 105 °F (40.5 °C) and according to this standard are exempt from requiring pipe insulation. Another exception is found in ASHRAE 90.1 – 1989, section 9.4.8.2 (d): "...where it can be shown that the heat gain or heat loss to or from the piping without insulation will not increase building energy costs."

It is repeated in ASHRAE 90.1 – 2007, section 6.4.4.1.3 (c): "or where heat gain or heat loss will not increase energy usage."

In the winter the Hybrid system fluid temperature is not elevated above 105 °F (40.5 °C) until the ambient temperatures fall below 15 °F (-9.4 °C). Most designers who have used the hybrid system have concluded that any heat loss associated with the fluid being above 105 °F (40.5 °C) for a very short period of time during the peak winter mode is quite miniscule, to the point of being very difficult to quantify. They have therefore relied on the exceptions noted above to not insulate the pipe. Another common thought process is that any heat radiated from the pipe would be radiated to the building structure, so it would not be lost at all.

Making use of ALL the heat generated within the building.

Since the Hybrid system does not have a maximum fluid temperature limit of 90 °F (32.2 °C) in heating mode, the system can actually conserve and reclaim ALL of the heat rejected to the fluid loop by the cooling units.

During the intermediate seasons, there are often times when there is sufficient heat within the fluid loop to satisfy the heating demand. By turning off the heating compressors and using the hydronic coil, the building can be heated without additional heat input from compressors.

Figure 2 compares the two systems operating on a 40 °F (4.4 °C) ambient intermediate day. In this example, there should be sufficient heat within the loop to satisfy the heating demand. However, the WSHP cannot allow the fluid loop to climb beyond 90 °F (32.2 °C) and therefore must operate the fluid cooler in order to reject excess heat. A WSHP cannot operate in heating mode with fluid above 90 °F (32.2 °C) since this fluid serves evaporators and the resulting condensing temperatures and pressures would be too high. The heating compressors general additional heat even though extra heat should not be required on an ambient day of 40 °F (4.4 °C). The WSHP does not provide part load heating since full compressor heat will always be delivered regardless of the season.

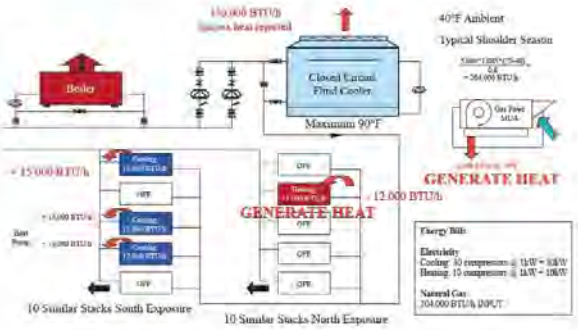


Figure 2, Conventioal W SHP system

Not only is heat being wasted to the fluid coolers, but another source of heat is also required to heat the ventilation air. Gas Fired Make Up Air Units are required in this example.

With the Hybrid design, we notice that heat is not being rejected to the fluid cooler but rather it is conserved within the loop to allow the loop temperatures to reach 95 °F (35 °C). Since the ambient condition 40 °F (4.4 °C), the heating units operating as fan coils will deliver only the required 7500 Btu/h. Essentially, the units are providing part load heating. The Make Up Air (MUA) unit is not consuming a fuel source, but rather is making use of the reclaimed heat. In this example, there is still heat left over for various building heating requirements.

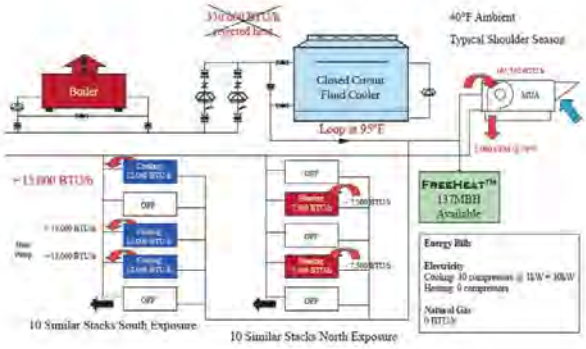
At the Frederick Hotel in Kansas City, this design is using the excess heat to provide towel warming. At the

(continued on next page)

CTTC Article (continued)



Nelligan Hotel in Montreal, heat removed from the restaurant and suites is used for snow melting as well as garage heating. In the Toronto Condominiums, Absolute and 360 On Pearl, fluid heat is used for under floor radiant heating to combat the cold down draft due to the very large glass areas. These "FreeHeat" examples are possible since heat is conserved within the fluid loop and the temperature is allowed to warm up beyond 90 °F (32.2 °C). Note that the electrical consumption has dropped to 30kW by turning off the heating compressors for the Hybrid system as opposed to 40kW for the WSHP. Also, the Natural Gas consumption has dropped to nil from 204,000 Btu/h.



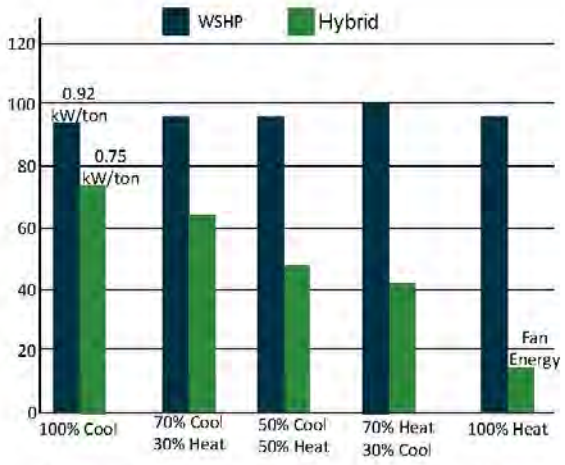


Figure 3, Heat Pump Electrical Energy consumptio, kW hr

Figure 3 shows simply snapshots in time and compares electrical energy consumed by 100-1 ton heat pumps operating for one hour. A complete energy modeling is required to properly analyze the system with the appropriate amount of operating hours at various load conditions. However, this simple analysis is quite useful to see what happens to the electrical consumption moving from the 100% cooling season, through the intermediate seasons and finally to the 100% heating mode. In 100% cooling mode, the Hybrid units consume less energy since they are high efficiency models as opposed to simply meeting the ASHRAE Standard 90.1 minimum requirement of 12 EER. Using high efficiency models will also limit the energy penalty when operating cooling units with elevated fluid loop temperatures during peak heating mode. Considerable energy savings are achieved in the intermediate seasons when the Hybrid system off the heating compressors and absorbs the waste heat through a hydronic coil. The traditional WSHP will always require compressor operation regardless of if they are in heating or cooling mode.

This graph only represents the energy consumed by the heat pumps themselves. If it does not address the boiler plant output. With either system, boiler plant output will not be required until there is insufficient heat of rejection and compression from the cooling units. The Hybrid design will require more boiler plant output than the traditional WSHP, since it does not generate heat with compressors. Typically, the incremental cost to install a larger boiler plant is relatively low and is offset by very short payback. The Hybrid system simply shifts the compressor or heating load to the boiler plant, where a lower cost fuel can be used – typically Natural Gas.

It must be noted that both systems will deliver equal amounts of heat during peak heating mode. However, the WSHP will derive approximately 25% of the heat from electricity. Figure 4 shows the financial benefits of shifting the electrical heat to the boiler plant.

(continued on next page)

CTTC Article (continued)



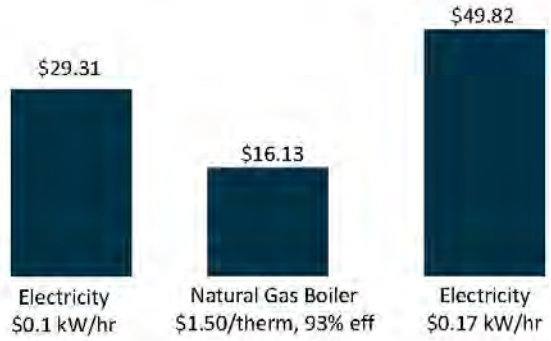


Figure 4, Cost to generate 1 million Btu of heat

1 million Btu/3,413 = 293.1 kW x 1hr x $0.1 = $29.31
1 million Btu/100,000 = 10 therm x $1.50/0.93 = $16.13

In this example, generating heat with electricity heat costs more than heat provided by Natural Gas boilers (+81.7%).

This analysis clearly demonstrates that heating with electricity costs more than heating with Natural Gas (+81.7%). Of course, the cost of fuel varies from one city to another. In New York City, with electricity at $0.17kW/h, the gap is even larger at +309%.

Geothermal

A variation of the Hybrid Heat Pump system has been applied to Geothermal systems. Since the compressors do not operate in heating mode, a method of removing the heat from the ground is required. Water to Water Chillers are used for this purpose. Substantial energy savings are realized in the intermediate seasons by turning off the heating compressors when there is sufficient heat in the loop, similarly to the closed loop system. Caneta Energy conducted a study on the Springdale Professional Building near Toronto and concluded that a Hybrid system will save 23.8% HVAC energy over a conventional geothermal system.

Energy Analysis

Enermodel Engineering, a well-respected energy consultant, performed a building energy analysis to determine the energy savings benefits of the Hybrid Heat Pump system vs. a standard WSHP. Both systems were modeled with identical parameters in terms of EERs, flow rates, capacities, etc. Using the software eQUEST, their analysis conclusions are summarized in Table 1.

Table 1

HVAC Analysis

	WSHP	Hybrid	Savings
kW/h	2,491,069	1,617,706	873,363 (35%)
Therms 100,000 Btu	121,972	133,672	[illegible]
Total energy million Btu	20,699	18,888	1,811 (9%)
Building energy cost	$416,802	$332,761	$84,042 (20%)

Total Building Analysis

	WSHP	Hybrid	Savings
kW/h	5,245,304	4,371,941	873,363 (17%)
Therms 100,000 Btu	121,972	133,672	[illegible]
Total energy million Btu	20,699	18,888	1,811 (6%)
Building energy cost	$416,802	$322,761	$84,042 (11.6%)

($0.1115 kW/hr, $1.14/therm, $1.14 CCF)
Note: Extra fan energy was factored in for the hydronic coil (APD = 0.05")

With the cost of Natural Gas at $1.50/therm, the total building annual savings would be $79,829 (10.4%), or 17% for the HVAC only.

Maintenance

It seems self-evident that if the compressors only operate in cooling mode, they will last longer. Compressor manufacturers rate the useful life by the quantity of start-stop. Eliminating the heating mode operation will drastically reduce the quantity of start-stop and extend the useful life of the compressors.

(continued on next page)

CTTC Article (continued)



Summary

A traditional **WSHP** has certain limitations:

a) Compressors must consume electricity to extract waste heat from the fluid loop, and they generate additional heat – even during periods when there should be sufficient waste heat in the loop. Hence, the WSHP may be generating heat and consuming electrical power needlessly during spring and fall.

b) Approximately 25% of the heat delivered is generated from electricity. Typically, heat can be generated less expensively using alternate fuels such as Natural Gas.

c) The fluid loop maximum temperatures limit of 90 °F (32.2 °C) in heating mode limits the amount of heat that can be reclaimed and may result in needless rejection of energy to a heat sink.

Hybrid System

By comparison, the Hybrid system absorbs heat directly from the loop without additional heat generation since the compressors do not operate. Since there is no longer a maximum loop temperature limit of 90 °F (32.2 °C) the system allows for greater heat conversion.

Energy and Cost Benefits

Reduced Energy and Cost

- Reduced electrical consumption in heating mode by turning off the compressors.
- Switches the compressor generated heat to the boiler plant where lower fuel costs can be used.
- Reduced heat sink operation in intermediate seasons, since heat is conserved within the fluid loop.
- The conserved heat can be used for various building heat, which reduces other fuel consumption components such as Natural Gas, Fired Make Up Air Units.

Conclusion

A Hybrid Heat Pump system is a novel design that delivers better heat recovery capabilities than a traditional system, resulting in significant energy savings. It overcomes the limitations of Water Source Heat Pump systems and provides innovative energy solutions that buildings across North American Can profit from.