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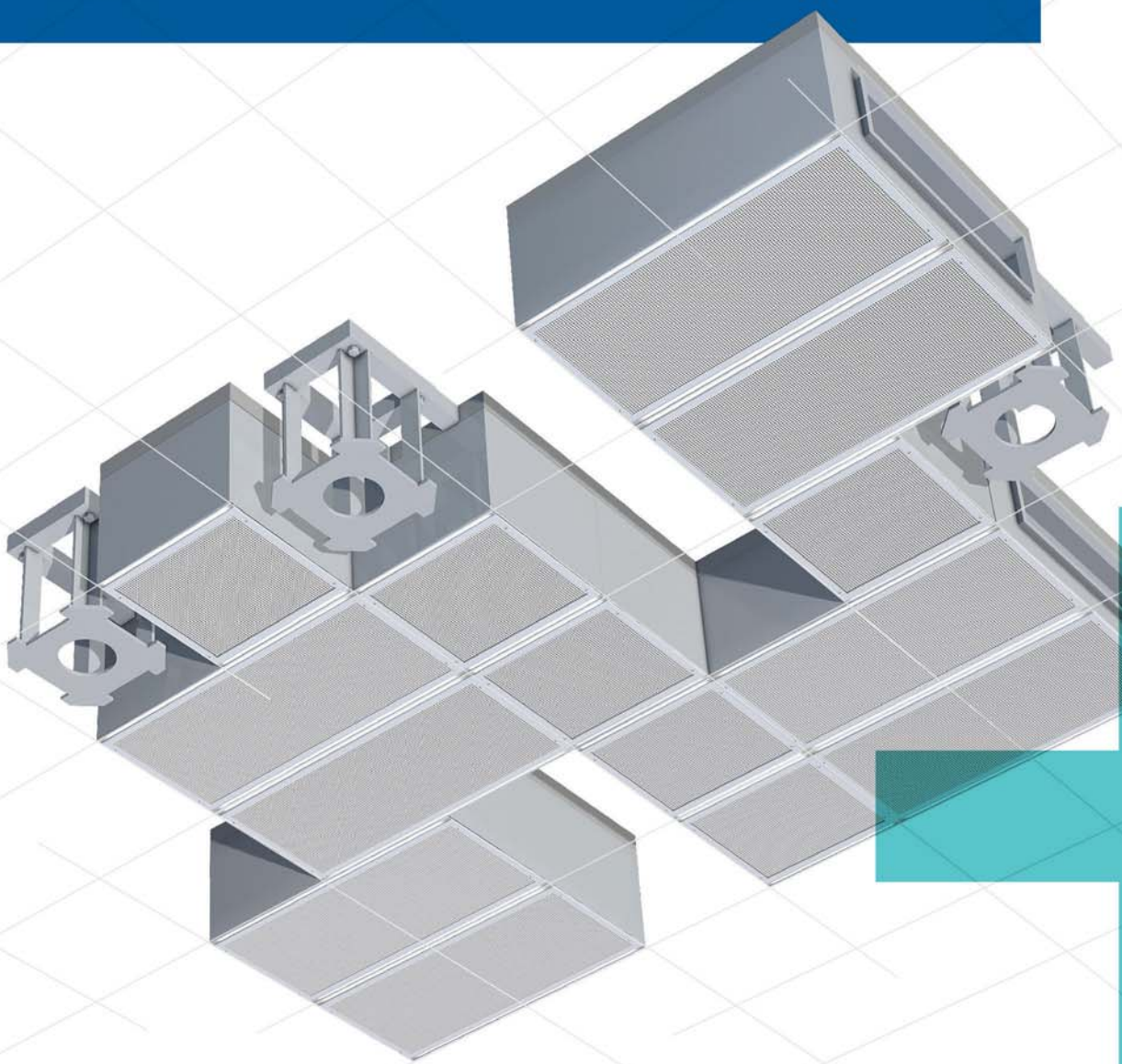

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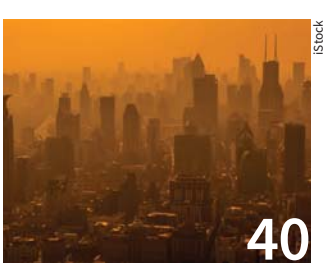

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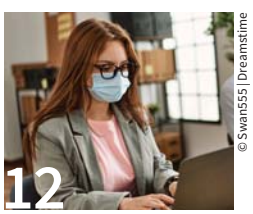

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HPAC Engineering (USPS Permit 464-930, ISSN 0039-0895 print, ISSN 1930-8957 online) is published 6x a year (Jan/Feb,,Mar/Apr , May/Jun, Jul/Aug, Sep/Oct, Nov/Dec) by Endeavor Business Media, LLC. 1233 Janesville Ave., Fort Atkinson, WI 53538. Periodical postage paid at Fort Atkinson, WI, and additional mailing offices. POSTMASTER: Send address changes to HPAC Engineering, PO Box 3257, Northbrook, IL 60065-3257. SUBSCRIPTIONS: Publisher reserves the right to reject non-qualified subscriptions. Subscription prices: U.S. ($ 111.25); Canada/Mexico ($ 123.75); All other countries ($148.75). All subscriptions are payable in U.S. funds. Send subscription inquiries to HPAC Engineering, PO Box 3257, Northbrook, IL 60065-3257. Customer service can be reached toll-free at 877-382-9187 or at HPACengineering@omeda.com for magazine subscription assistance or questions.

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Perhaps the word heard most at AHR Expo this year was "electrification," which many see as our industry's best path to net zero carbon emissions. Let's dive into its history. Take the quiz! Win prizes!.

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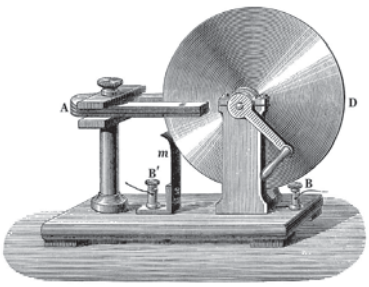

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[1] Certified performance per AHRI 550/590.

The Waiting Is The Hardest Part

At press time, the U.S. economy's widely expected recession still had not quite arrived, despite months of dire predictions from many economists. In fact, in early March, Credit Suisse Chief Economist **Ray Farris** coined a new term, evoking Samuel Beckett's famed play about a title character who never actually shows up.

"It's the 'Godot recession,'" Farris told *The Wall Street Journal*, referencing *Waiting for Godot*. Every six months, economists have predicted a recession six months later, he said. "By the middle of the year, people will *still* be expecting a recession in six months' time."

Rob McManamy
Editor-in-Chief

For now, though, even as the Fed continues to raise interest rates in its long, but only partly successful, effort to curb inflation, the U.S. construction industry still bulls forward. And the work is continuing at such a pace that worker shortages remain among the chief concerns for AEC firms still wrestling with the supply chain and the lingering effects of the pandemic.

In many ways, it seems our industry is ignoring talk of recession and just moving forward on the sizeable amount of work before it. On March 14, Associated Builders and Contractors (ABC) reported that its monthly Construction Backlog Indicator had increased in February to 9.2 months, keeping the elevated measure at "highs not seen since the start of the pandemic." Taken just at its most basic face value, that number means ABC members believe they already have enough work on the books now to take them into 2024.

Similarly, the American Council of Engineering Companies (ACEC) Research Institute conducted its own quarterly membership survey in mid-January and heard from 583 firms. Overall, 41% of respondents said they felt positively about the condition of the U.S. economy, while 29% felt negatively. The rest were neutral. Of particular note, ACEC pointed out that the positive numbers reflected a sizeable, 12-point increase since the fourth quarter of 2022, and an extraordinary, 27-point "leap" from the responses in the third quarter.

So, what the heck is going on?

Well, it would seem the resurgent enthusiasm we encountered among exhibitors and attendees at AHR Expo in Atlanta this February is just imposing its will on the market. After three years of pent-up stir craziness caused by a global pandemic, perhaps the industry is just determined to flex its muscles and push projects ahead.

Returning to that January ACEC study, it is also significant to note that "fear of an economic recession" did not even make the respondents' list of biggest concerns for 2023. By far, the top worry that engineering firms expressed was "continued upward pressure on wages" for staff and new hires.

Likewise at AHR Expo this year; the biggest topic was not recession, or even the pandemic. Instead, every other booth on the exhibit floor seemed to buzz with one word: *electrification*.

Indeed, so many new products now claim that energy source as an option, but as our industry continues to decarbonize more and more — and rightfully so — many professionals are worried at what cost that shift will take place. As Dr. **Max Sherman**, FASHRAE, states bluntly in this issue (see p. 12), "In the short term, electrifying everything would be an unmitigated disaster."

A retired staff scientist at Lawrence Berkeley National Laboratory, Dr. Sherman argues that currently, the national electrical grid simply is not yet ready for such a rapid and dramatic changeover. "The electric grid already teeters on the edge of collapse in many places," he writes. "While investing in building electrification research will position us well for the future, implementing building electrification now is just too fast and too furious."

I encourage you to read Dr. Sherman's article and to join the debate online, or even on these pages. Our goal is to engage our audience and to help educate each other. No reason any of us have to wait on that.

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AHR Expo: Strong Showing Signals Resurgence

Industry showcase's stellar performance is a welcome sign of growth and a hopeful indicator for future workforce development, say event organizers.

AHR Expo

The AHR Expo (International Air-Conditioning, Heating, Refrigerating Exposition) wrapped up the 2023 show in Atlanta with an exigent focus on reshaping the future of the industry.

"This year's show is one for the books," said Show Manager **Mark Stevens**. "We heard it in every corner of the industry - HVACR is gearing up for an exciting path forward. As a collective force, we are focused on change and growth inside our industry, as well as anchoring our combined efforts on serious developments to set the course for the future of HVAC. It's hard to miss the excitement."

Stats Reflect Industry Comeback

The 2023 AHR Expo hosted 42,794 verified visitor and exhibitor personnel, 1,779 total exhibitors, 425 of which were international, and filled more than 486,000 sq ft of exhibit space. While these numbers are still recalibrating from pre-Covid years, the strong showing from new audiences is a welcome sign of growth and a hopeful indicator for future workforce development.

Atlanta also hosted 17 industry podcasters in the show's Podcast Pavilion. Industry podcasters from multiple outlets dedicated their time at the show to covering trending topics and speaking to leaders across the industry with the added excitement of a live audience.

The broadcast pavilions were active all three days, producing exciting content to be rolled out in the coming weeks.

Full session recordings will be available on ahrexpo.com once edited content is released by the hosting podcasters.

Community and Communication

There was also a growing sense of community at the show. This year's AHR Expo set a goal to open new lines of communication between the communities that make up the whole industry, particularly those seeking new channels of access for discussion. A panel series accomplished this by posing topics and questions to spur discussion rather than seeking solutions. On the stage this year, we heard from industry leaders heading up our associations, commanders of trending topics and stewards of the trade.

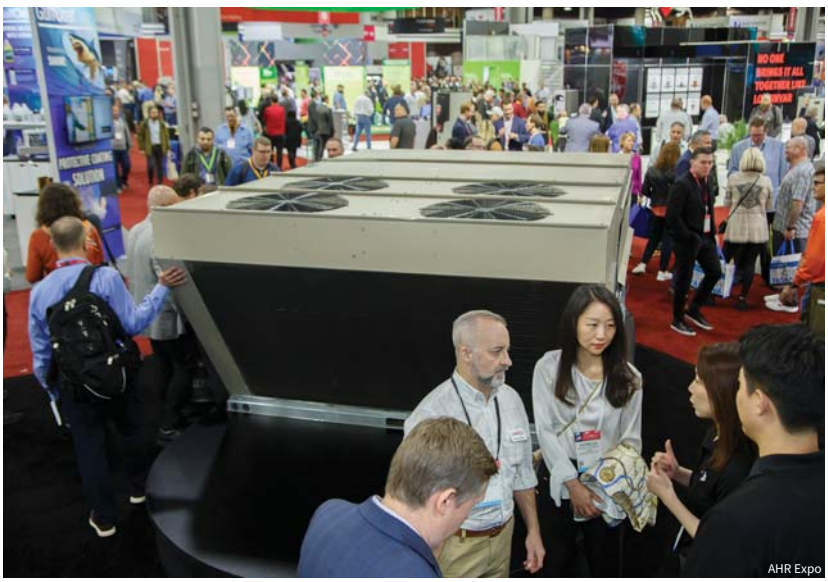
"In the months leading up to the show, we were intentional in our efforts to speak to members from all disciplines within HVACR," said Stevens. "We are grateful for the unique opportunity to connect all industry audiences and are devoted in our efforts to represent every role in our education programming. This is an area of growth for us and the fruits of these efforts are evident in the conversations we see blossoming.

"We live in an age of connection and the need for deepened communication at every level is apparent. As the largest event to host the entire industry, we are delighted to provide

a forum to host these conversations in our programming and in face-to-face networking on the show floor."

In the session, *HVACR State of the Industry, Leadership Panel Discussion: Today's Market, Challenges, Opportunities and What's Ahead*, leadership from AHRI, ASHRAE, HARDI, NCI and PHCC discussed gaps in the profession and marketplace that need to be addressed in order to continue on a progressive path. **Bryan Orr** of HVAC School moderated as the group highlighted what is working, areas for improvement, and what lies ahead.

On Tuesday afternoon, **Kyle Gargaro** of ACHR's *The News* moderated a discussion among industry advocates of decarbonization in the panel discussion, *Decarbonization and the Future of HVAC*, featuring **Luke Leung**, Principal at design giant SOM; **Kevin Edstrom**, Senior MEP Manager at Hines; ASHRAE Decarbonization Chair **Kent Peterson**, PE, FASHRAE, VP & COO at P2S Inc.; and **Donald Horn**, FAIA, LEED Fellow, GSA, Deputy Director at the Office of Federal High-Performance Green Buildings.



The show floor this year boasted 1,779 total exhibitors.

This year, AHR Expo expanded its education programming into Wednesday. The headliner panel, *HVAC & Social Media: Strengthening the Trade with a Community Mindset*, featuring social media influencers of the industry, featured a first-of-its-kind discussion. Hosted by some of the industry's most active content creators and trade mentors, new lines of communication were formed through a deep dive into an open conversation about how all shareholder roles can work together to better the industry as a whole.

Links to view these sessions in their entirety will be available on ahrexpo.com soon.

The Podcast Pavilion hosted 17 different broadcasts in front of live audiences.

Innovation and Mapping the Future of HVACR

The 2023 AHR Expo *Innovation Award Winner for Product of the Year* is Cielo WiGle, Inc. for their Cielo Breez Max.

Our 10 industry category winners offered a preview of the explosion of innovation that's currently happening across the industry. New product signage was prominently displayed across the halls, as this year proved to be a big year for progress in HVACR.

Learn more about all 10 products at *hpac.com/products/article/21253464/meet-the-ahr-expo-2023-innovation-awards-winners.*

Next Year We Will Meet in the Middle, in Chicago!

In 2024, AHR Expo will hit the road to Chicago. Save the date for January 22-24, 2024, and stay tuned as we roll out information to help prepare for your visit to another epic event.

"What a show," concluded Stevens. "This is the industry to be a part of right now. We are essential; we are poised for growth and the world needs us to be prepared to solve problems and meet demands. We're excited to play a role in launching new products, services, conversations and partnerships to make it happen. We hope to see you all next year in Chicago."

Registration for that event will likely open in early summer. For more information, more show recaps, and to sign up for updates, visit ahrexpo.com.

Cielo WiGle's Breeze Max smart thermostat took top prize.

About the AHR Expo

The AHR Expo is the essential event for HVACR professionals, attracting the most comprehensive gathering of the industry from around the globe each year. The show provides a unique forum where manufacturers and suppliers of all sizes and specialties come together to share ideas and showcase the future of HVACR technology. Since 1930, the AHR Expo has remained the industry's best place for OEMs, engineers, contractors, facility operators, architects, educators and other industry professionals to experience everything new in HVACR and build relationships. The AHR Expo is co-sponsored by ASHRAE and AHRI and is held concurrently with ASHRAE's Winter Conference. The next show will take place January 22-24, 2024 in Chicago.

For more, visit www.ahrexpo.com, or contact press officer Nicole Bush at nbush@ahrexpo.com.

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[1]*Per a 2022 MIAT Residential HVAC Competitive Time Study on base and mid-tier Endeavor Line products and commercially available competitor units of similar product tier.*

Electrification Fever? Too Fast, Too Furious

Decarbonization demands action, but the time is not right for building electrification. Until the grid can handle those loads, we must focus on energy efficiency.

By MAX SHERMAN, PhD, ASHRAE

As we all know, there is a major global focus right now to reduce the net amount of carbon being put into the atmosphere by human activity. But this is not a new concern and has had many names, the current one being "decarbonization."

Despite the glossy, Madison Avenue taint of that term, its goal is of critical importance to mitigating the impacts of climate change. Since the buildings sector consumes about 40% of all energy produced[1] and produces about 40% of carbon emissions, reducing the carbon footprint of providing building services, most notably HVAC, *must* be a key component to mitigating climate change.

In the long term, decarbonization requires both a substantial reduction in the use of fossil fuels *and* a substantial increase in electrification to maximize the use of renewable resources like wind and photovoltaic generation and any other carbon-free sources. While these long-term objectives are rather clear, the path that leads to them is anything but.

Many in the building sector equate decarbonization with putting a priority on the electrification of building services. In the short term, however, electrifying everything would be **an unmitigated disaster**.

Rapid Electrification Meets the Grid

There are a variety of reasons that rapid electrification is problematic.

The author is a retired Senior Staff Scientist at the University of California's Lawrence Berkeley National Laboratory, where for over 30 years he ran a research group investing in energy and indoor climate issues in buildings. Dr. Sherman has published over 200 papers and has been the U.S. representative to various projects with the International Energy Agency. Today, he is an Honorary Professor at the University of Nottingham where he continues to research indoor air quality. An ASHRAE Distinguished Fellow and Exceptional Service Awardee, Dr. Sherman is currently principal of the EPB Consulting Group. Contact him at MHSherman@lbl.gov.

The biggest reason is the *electric grid*—something our industry is not primarily focused on. The electric grid already teeters on the edge of collapse in many places.[2] We have witnessed or barely avoided capacity disasters all over North America—including high-profile places such as Texas[3] and California;[4] even energy-rich Alberta has had grid problems.[5] While there is plenty of finger pointing about whose fault these incidents might be, the fact remains that electric loads continue to grow faster than supply—especially at peak times.[6]

So, as it is, the grid is going to be less stable over the next several years and we should be looking for ways to reduce electric loads, not increase them.

Even if the existing grid had enough capacity to handle significantly increased loads, it is not clear that there would be a substantive impact on decarbonization through just any building electrification; a lot of electricity is generated from fossil fuels. Even in more progressive places, the fraction of renewable energy on the grid is usually low.[7] Over 60% of electricity generation comes from fossil fuels.[8] Electrification may reduce onsite carbon emissions, but will increase them at some other power plant, somewhere on the grid, giving the end user a false impression of success.

Miscalculating Success

To understand how much net decarbonization (if any) a given building electrification option achieves requires an engineering calculation involving carbon content of primary energy sources and a whole host of efficiencies (end-use, generation, transmission and distribution).

Take for example the option of replacing a gas boiler or furnace with an electric one. Perhaps the owner thinks that is decarbonization, but is it? We know that, on average, 60% of the electricity used will be generated by fossil fuels; so, is there at least 40% carbon savings? There might be if it weren't for the fact that a lot of energy is wasted in the conversion of the fossil fuel to electricity and the transmission and distribution of that to the building.[9] About 60% of energy consumed at a power plant is lost in conversion.[10] Applying such numbers to electric resistance heating leads to electrification being a clear lose-lose scenario.

One could consider using a heat pump, instead. The high COP of a heat pump means it would require substantially less electric power input. But it is still going to be a wash in terms of carbon emissions in many cases. However, in some, it may come out ahead. Even if so, there are still many problems:

> "The electric grid already teeters on the edge of collapse in many places. So, in the short term, electrifying everything would be an unmitigated disaster."

1. It further loads an unstable grid, even if it is less than electric resistance;
2. Heat pumps also represent an increased first cost, which must be figured into the economics;
3. Heat pumps have different performance curves and may not have the same capacity when the user needs it.

If the economics work, they *might* be worth it. But their value to decarbonization is going to be small—or worse.

Economics and End Uses

Of course, there could be economic reasons for electrification. In new construction, for instance, which is already going to be energy efficient, there may be a good justification for going all electric. After all, it eliminates gas infrastructure and heating loads are not likely to be high. Still, it is important to recognize that some end uses do not provide the same functionality when electrified.

For example, for many people and professional chefs there are significant performance differences between gas and electric cooking. System heating capacity (e.g. to recover from deep setback) may not be sufficient with an electric heating system. Recovery time in a heat-pump water heater may not be acceptable.

All of these acceptability issues can be barriers to adoption of electric technologies and must not be brushed aside. We must consider them in any recommendations we make and, if truly serious about decarbonization, then the industry must focus more of its research on such matters.

The case for electrification in existing buildings is much worse.

Not only do the aforementioned issues apply, but also, the costs are much higher and the options are more limited. Very often, existing buildings do not have the necessary installed electric infrastructure and capacity to handle loads that are likely to be much higher in older construction. Electrification of older buildings is going to be a poor way to get decarbonization[11] for the foreseeable future.

Prioritize Efficiency, Electrify Sensibly

From a public policy point of view, the highest priority is increasing the capacity and resilience of the grid while lowering its carbon emissions through renewable (or nuclear) generation. Building electrification at this stage is not ready for prime time, although for some end uses, the case for electrification is a slam dunk. Much of the transportation sector, for example, could be converted from petroleum-based fuels

to electricity with minimal or even positive effects on today's grid.[12]

Policy makers can and should sort out the best ways of encouraging decarbonization with their usual array of incentive mechanisms. But that probably should not include building electrification yet. It will surely take at least a decade for the grid to become stable and low carbon. Until that happens, building electrification is little more than **decarbonization theater.**

The industry can avoid that fate and make a substantial contribution to the profession and society by focusing its talents and resources on providing real decarbonization through what groups like AHRI and ASHRAE already do best: implementing efficiency and HVAC research. Lowering demand through efficiency needs to come before electrification.[13]

The most important thing the industry can do is enable increased efficiency in providing indoor environments and other building services. Every therm of fossil fuel not burned is a bit of decarbonization directly (if as end-use) or indirectly (if at the power plant). Every kWh saved is also one more kWh available to stabilize the grid.[14]

When we stick to our knitting, the industry can be very effective as, for example, ASHRAE was with its Epidemic Task Force, or more generally, with efficiency standards for equipment or buildings. We have a more secondary role in electrification and need to take it a bit slower.

We need to be ready for the time when the grid will have the low-carbon capacity to accept more building load. Getting ready for the future must be part of a research agenda—in this case for developing or adapting technologies for the time when building electrification is productive.

The time has not yet come for the building sector to make implementing building electrification a near-term priority. While there will certainly be times where it makes economic sense to go all-electric in a building or development, our current focus must be to make buildings more energy-efficient, regardless of the fuels being used. That is the best decarbonization we can now do.

The public interest in mitigating climate change is not well-served by investing public resources in implementing building electrification. It is better served by investing in building efficiency and creating a low-carbon and robust electric grid. The former is important for our industry. While investing in building electrification research will position us well for the future, implementing building electrification now is just too fast and too furious. HPAC

Footnotes

[1] www.eia.gov/tools/faqs/faq.php?id=86&t=1

[2] www.cnn.com/2022/05/31/us/power-outages-electric-grid-climate-change

[3] www.texasmonthly.com/news-politics/texas-electric-grid-failure-warm-up/

[4] www.newsweek.com/california-heat-wave-power-grid-tracker-blackouts-1740508#:~:text=The%20available%20capacity%20for%20the%20state%20is%20about%2051%2C000%20megawatts.

[5] globalnews.ca/news/9160969/alberta-grid-alert-electricity-aeso-september/

[6] On-site electric storage can help, of course, but at a price and efficiency loss.

[7] California is at approximately 1/3 renewable power.

[8] www.eia.gov/tools/faqs/faq.php?id=427&t=3

[9] The situation is even worse than that because when one is considering taking an action, it is the marginal generation (i.e. the next kWh generated or the first one saved) that is important and that is almost always from natural gas as renewable and baseload power is used up first.

[10] www.eia.gov/todayinenergy/detail.php?id=44436

[11] An exception could be when a "deep energy retrofit" is already taking place and the building is essentially being built anew.

[12] https://www.forbes.com/sites/bradtempleton/2022/09/12/evs-wont-overload-the-power-grid-in-fact-evs-and-ice-are-its-salvation/?sh=2e36e35049c5

[13] https://www.ashrae.org/file%20library/about/position%20documents/pd_buildingdecarbonization_2022.pdf

[14] The issue of utility load shapes and electric power storage is a complicated one and beyond the current discussion. It is also possible that using existing gas infrastructure to distribute hydrogen or synthetic natural gas to fuel appliances as an intermediate solution.

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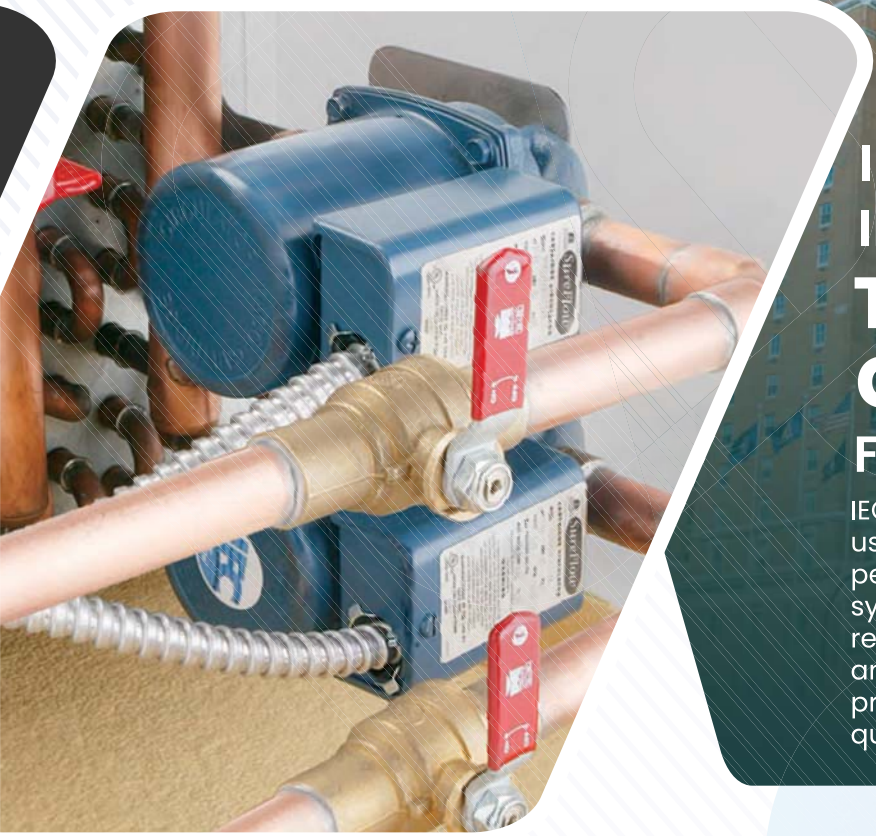

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Aerodynamic Containment Can Reduce Indoor Spread of Infectious Aerosols

Good ventilation design should ensure that clean filtered air is properly distributed while contaminated air is removed. CFD analyses can help engineers achieve both goals.

By KISHOR KHANKARI, PhD
Fellow ASHRAE

The current pandemic has elevated the awareness for better Indoor Air Quality (IAQ) and ventilation.

Often good ventilation is referred to as high-grade filtration with an increased supply of clean air or increased air change rates per hour (ach, h-1). However, simply increasing the supply of clean air may not be sufficient to achieve good ventilation. The primary goal of building ventilation is to create a healthy and comfortable environment for building occupants.

That can be achieved by supplying clean air to dilute the concentration of airborne contaminants, thereby, reducing the risk of airborne infection and hazard. The breathing zone of occupants, which is generally between 4 to 6 feet (1 to 2 m) height from the floor, is the most critical zone in which occupants breathe in and out.

But the sources of contaminants and receptors both are located in the same zone. Therefore, the ventilation design should ensure that the clean filtered air is properly distributed in the breathing zone and the contaminated air is effectively removed from this zone.

Based in Ann Arbor MI, the author is an ASHRAE Fellow and President of AnSight LLC, his own consulting engineering practice specializing in computational fluid design (CFD) for building HVAC and data centers. Contact: kishork@ansight.com.

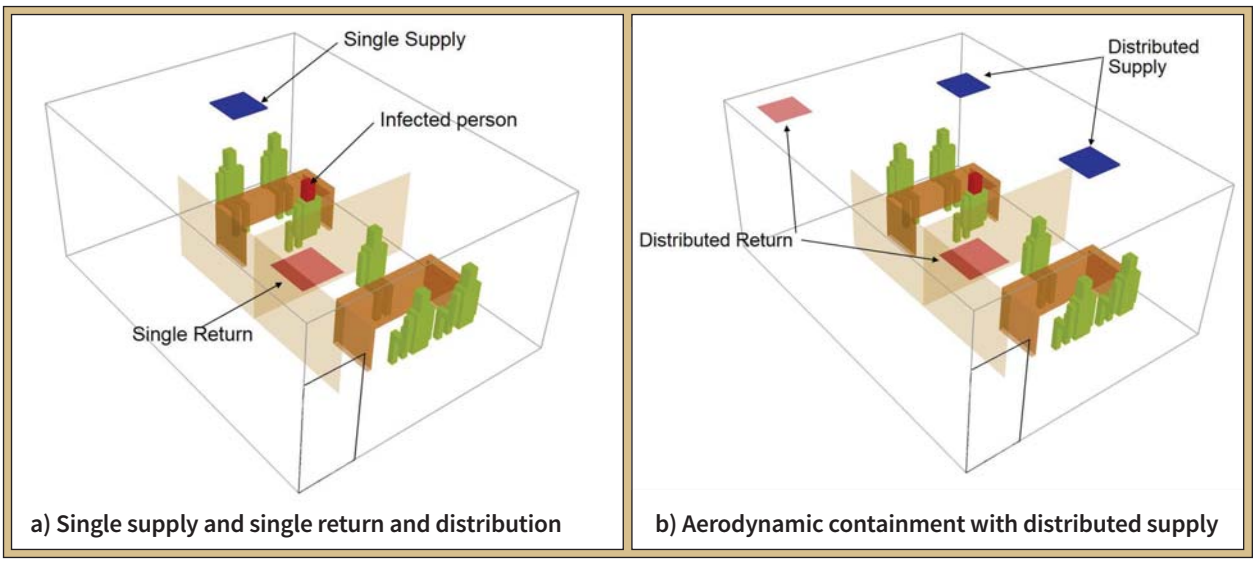

Fig. 1: This illustrates the difference between (a) a single supply-single return layout, and (b) one with two supply and two return locations, symmetrically distributed in space.

Airflow Patterns Matter!

Air is the primary carrier of heat, moisture, and airborne contaminants including infectious aerosols in indoor spaces. Therefore, how air moves in indoor spaces and whether it properly sweeps the contaminants become the most critical factor to consider.

Indoor airflow patterns play a crucial role in controlling the spread of airborne contaminants. The flow path of airborne contaminants depends on the airflow patterns. Poor airflow distribution in indoor spaces can spread infectious aerosols and make social distancing less effective.

Ideally, the clean supply air should sweep the contaminants from the breathing zone without significant recirculation and stagnation that usually promote the buildup of high-concentration zones. Similarly, the clean air should not escape or short-circuit the space without collecting and removing contaminants from the breathing zone.

Several factors related to the design and operation of HVAC systems can impact the airflow patterns in indoor spaces and the risk of infection. Some of these factors include the number, location and type of supply diffusers in the space; supply airflow rates (air change rates) and associated diffuser throws; supply air temperature; number, size and locations of return/exhaust grilles; the location and strengths of various heat sources in a room; an arrangement of furniture and other obstructions to airflow; location, type and capacity of in-room air cleaners; and, importantly, the relative positions of contaminant sources in space.

> **“How air moves in indoor spaces and whether it properly sweeps out contaminants are now the two most critical factors.”**

Air often follows a path of least resistance, which, however, is generally not intuitive.

Computational Fluid Dynamics (CFD)

Physical testing and real-time measurements of all the parameters that affect the ventilation performance are often both time-consuming and labor-intensive, if not impossible. Moreover, such measurements are not even possible during the design phase before the construction of a facility.

In such situations, CFD analyses provide a feasible tool to visualize the airflow patterns and the flow path of airborne contaminants, and thereby, optimize the performance of building ventilation. CFD involves the simulation of fluid flow, heat transfer, mass transfer, and other similar transport processes which are based on the fundamental laws of Physics of transport mass, momentum, and energy.

CFD analyses, if performed properly with adequate expertise, can provide valuable insights into the heating, cooling, and ventilation performance of buildings. Such insights gained during the early stages of the design can save expensive, trial-and-error, and often frustrating retrofits.

Aerodynamic Containment Layout

We used CFD to develop a concept of aerodynamic containment. The strategic layout of supply diffusers and exhaust grilles can form airflow patterns that can help reduce the

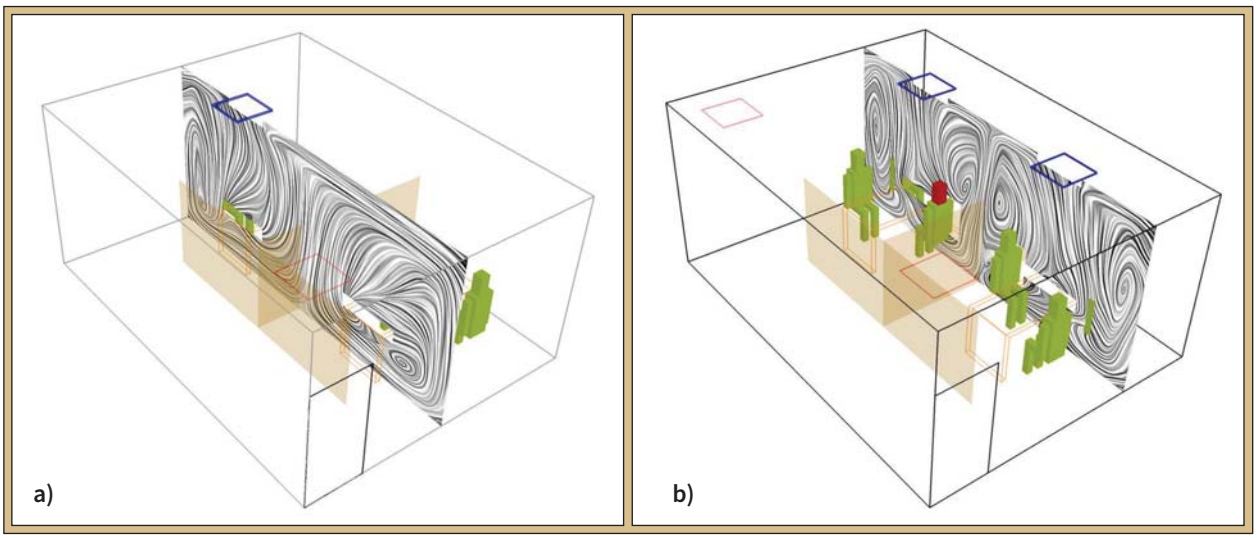

Fig. 2: CFD analysis shows airflow patterns in an office space with large air recirculation zones. These zones can form stagnant air pockets and can promote accumulation of contaminants.

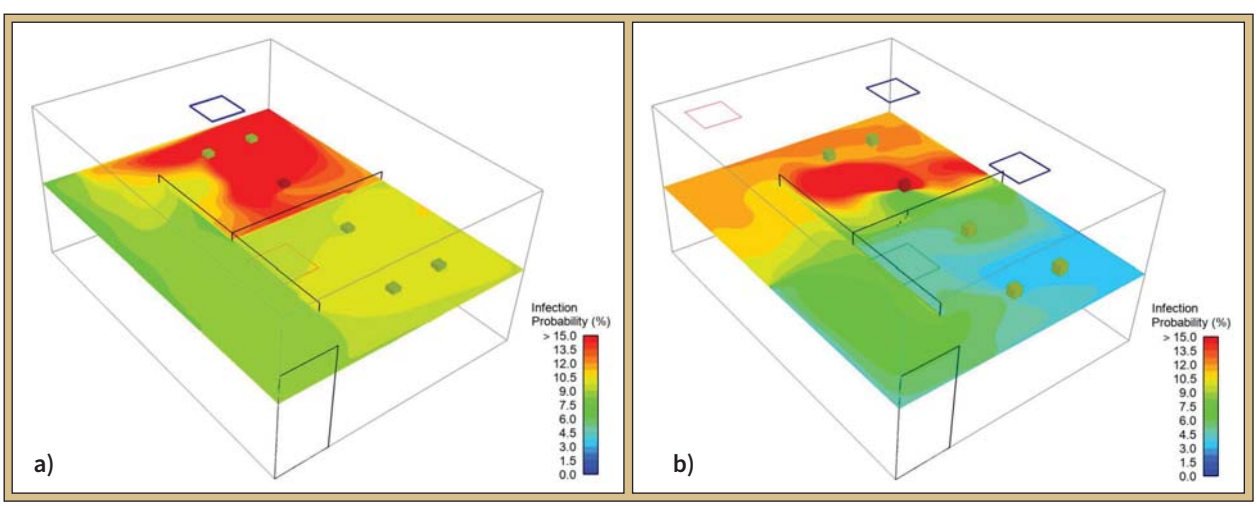

Fig. 3: CFD analysis shows contours of infection probability computed by the Wells-Riley correlation at a breathing plane of occupants. A single supply / single return layout can promote the spread of contaminants and increase the risk of infection. Conversely, the aerodynamic containment layout can reduce the risk of infection by properly distributing the clean air over the occupants and forming a path of least resistance for the contaminated air to leave the space.

risk of contaminant exposure in indoor spaces. Distributed supply and distributed exhaust in indoor spaces can help in better utilization of the clean supply air. It can enhance dilution in the breathing zone of occupants; provide a path of least resistance for the contaminated air to leave the space; and reduce the probability of infection.

Aerodynamic containment is a symmetric layout of distributed supply (diffusers) and distributed return (grilles) which can contain the contaminants in the vicinity of a source and can limit the spread of airborne contaminants in indoor spaces.

Our CFD studies demonstrate that even for a simple layout of a small office with two cubicles, the locations of supply and return air can affect the airflow patterns and the resulting risk of infection for the occupants. A layout in Figure 1a (p. 17, left) with just a single 4-way supply diffuser and a single return grille cannot provide adequate dilution and promote air recirculation and the formation of stagnant zones with a high concentration of contaminants.

The airflow patterns in Figure 2a (above, left), show large recirculation loops along and across the room. These large recirculation zones are formed inside the cubicles between the room walls and the dividing partitions. The stagnation of air in the recirculation zones forms pockets of high concentration. We used the Wells-Riley correlation to determine the risk of infection.

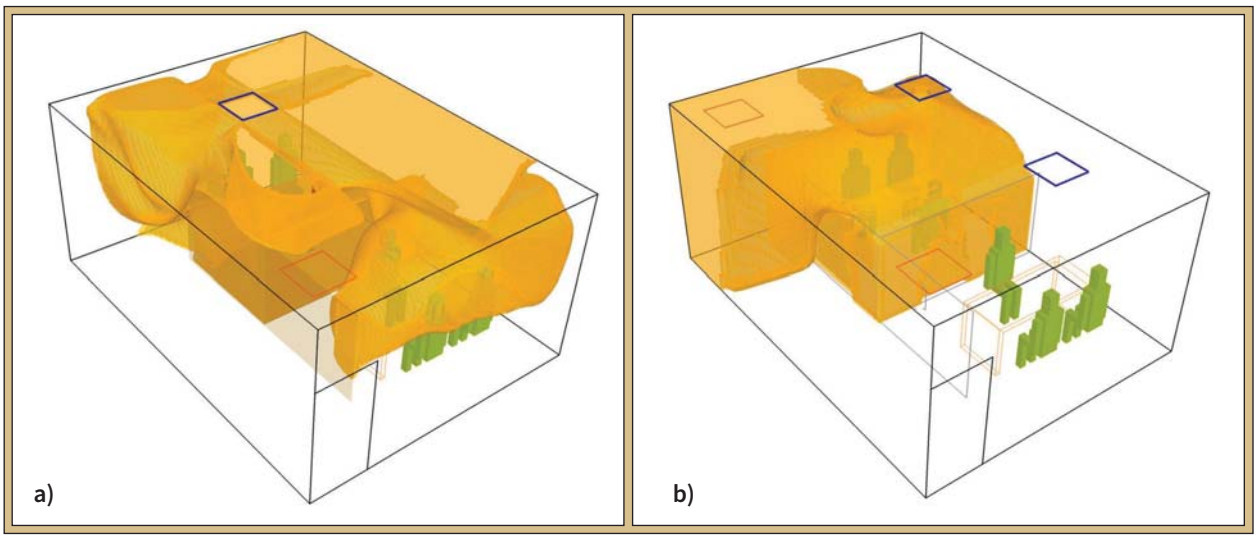

Fig. 4: CFD analysis shows clouds (Spread Index) of the probability of infection of 10% and higher. In the case of a single supply-single return, the cloud covers all the occupants and almost 50% of the room volume. In an aerodynamic containment layout, the cloud shrinks to 39% of the room volume and drops the probability of infection to under 10% for occupants in the rest of the cubicle.

As shown in Figure 3a (opposite, left), the risk of infection is above 15% in the vicinity of the infected individual, whereas the average probability of infection at the breathing plane is 11.3%.

We developed a new metric for ventilation effectiveness called the Spread Index which analyzes the extent of the spread of contaminants in indoor spaces.

As shown in Figure 4 (above), the Spread Index of 10% probability of infection is 49.4% indicating that about half of the space is at or above a 10% probability of infection. It should be noted that all occupants in this space are covered under the cloud of the high risk of infection.

Whereas the aerodynamic containment layout as shown in Figure 1b with the distributed supply diffusers helps with better distribution of clean air. Distributed return grilles provide a path of least resistance for the contaminated air to leave the space, and the symmetric layout of supply and return grilles forms airflow envelopes that promote local containment of the airborne contaminants.

As shown in Figure 2a, the aerodynamic layout forms independent zones of airflow and develops two identical, mutually opposite airflow patterns within each zone of supply and return.

As shown in Figure 3b, the risk of infection is reduced in the second cubicle, and the zone of high infection above 15% remains in the vicinity of the infected individual. The average value of the probability of infection reduced from 11.3% to 9.1%. The Spread Index as shown in Figure 4b reduced from 49.4% to 39.3%. Unlike the previous cases, only about one-third of the room space is at or above 10% probability of infection.

Dividing the supply air through two diffusers created two distinct aerodynamic containment zones. The airflow patterns from each diffuser create their zone of containment, which minimizes bi-directional air movement between the zones. Providing returns for each zone reduced the long travel of contaminated air through the occupants.

Additionally, moving the supply diffusers away from the returns helps sweep the clean air through occupied zones. Such aerodynamic containment with a symmetric layout of distributed supply and distributed return alters the flow path of contaminated air and moves it away from the occupants.

Since the location of an infected individual in a room is not known in advance, such aerodynamic containment strategy can potentially reduce the risk of cross-contamination.

Designing for Aerodynamic Containment

Based on our CFD analyses, aerodynamic containment requires the following steps:

- Create a distributed supply layout by increasing the number of supply diffusers (without increasing the supply airflow rate) and strategically placing them over the occupied zone;
- Create a distributed return layout by increasing the number of exhaust outlets to create a path of least resistance for the contaminated air to exit the space;
- Place the exhausts/returns away from the occupied zone;
- Create a symmetric layout of supply diffusers and return grilles to form independent airflow envelopes of supply and return.

Since each space has a unique layout and function, CFD analyses can help to optimize the design of aerodynamic containment. HPAC

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Decarbonization in Action, with ASHRAE's New Industry Point Man, Kent Peterson

Now in its second year, the Task Force on Building Decarbonization is ready to make waves. We spoke with its energetic new chair about what to expect in 2023.

"We have to remember; we're all on a journey."

In March, *HPAC On The Air* welcomed **Kent Peterson**, P.E., the new chair of ASHRAE's Task Force on Building Decarbonization, which is now in its second year of existence. An ASHRAE past president, Peterson is co-founder and COO of consulting engineer P2S Inc., in Long Beach CA.

In the wake of ASHRAE's Winter Meeting in Atlanta and the recent COP27 United Nation's Climate Conference in Egypt, we discussed how the task force is now gaining momentum and leveraging the efforts of more than 160 volunteers to share the information it has gathered with every corner of the global society.

What follows is a partial transcript of our conversation. To listen to the full episode, visit www.hpac.com

HPAC: Kent, thanks for joining us this month on 'HPAC On The Air'. Please tell our listeners a bit about your background, your history with ASHRAE, and how you came to be chairman now of its vital Task Force on Building Decarbonization...

Kent Peterson: Thank you, Rob. First, let me say, I'm honored to join you and your listeners on your podcast today and talk about this important subject of decarbonization.

I've been a consulting engineer in the building and infrastructure sector my entire career, and my identical twin brother and I together founded P2S Inc. back in 1991. It's now grown to a 300-person consulting engineering firm, working all up and down the West Coast of the United States

And I am lucky in my day job to work with some pretty passionate engineers who really care about the environment and understand the many challenges we face in our industry. I joined ASHRAE as a student member back when I was in the university, and I have been fortunate to be able to work with some of the best and brightest people throughout my career in ASHRAE.

I've donated extensive time to the society throughout my career and I've been honored and fortunate to be able to help advance energy efficiency and sustainability in our industry. As you mentioned, I had the honor to serve as ASHRAE President back in 2007-08. My theme in that year was *Greater Efficiency Today, Blue Skies Tomorrow.*

So, even 15 years ago, we were starting to talk about the impacts of climate change and what the building industry needed to start looking to do as we moved into the future.

I did chair ASHRAE Standard 189.1, the High-Performance Building Standard Committee, when it was published in 2010. That now is known as the International Green Construction Code. I've also served on the Federal Government Green Building Advisory Committee from 2011 to 2022. Last year, I co-chaired the Federal Building Decarbonization Task Group while I served on the ASHRAE Task Force, which I was asked to actually take over and chair this year. And it's an honor to be able to work with so many great thought leaders on this subject matter.

HPAC: In June, ASHRAE published its first Position Document on Building Decarbonization. Can you please provide a high-level summary of ASHRAE's positions in that document and how well it was received by the ASHRAE membership?

KP: Absolutely. We're really excited about it. We had a previous position document on climate change also, but ASHRAE's position on this is relatively simple.

Eliminating greenhouse gas emissions from the built environment is essential to address climate change. We're all on board with the fact that, by 2030, the global built environment needs to halve its 2015 greenhouse gas emissions. And we're saying right now, by 2050, the entire building sector, meaning all new and all existing buildings around the world, really need to be at net zero emissions across the whole lifecycle

We considered a lot of possibilities in working on this position document and got the ASHRAE board to adopt several additional positions. One is very important for us, and that is that any building decarbonization strategies and policies need to consider healthy, safe, and comfortable environments.

The environmental and social impacts sustainability, resilience and economics. And we realize that economics is extremely important as we start to move forward on this. But increasing stringency and enforcement of energy codes is also going to be really critical as we look across the globe to be able to impact decarbonization. It's a worldwide problem.

So this is another aspect of that whole-life building carbon, which is what we're considering as an organization to be essential. And when I talk about whole life, we're talking not only about operational carbon reduction. We're talking about embodied carbon reduction. Both components really matter to the total carbon picture when talking about built environment options and alternatives. We need to be looking at that both for new construction, as well as for retrofits.

Another one that's also worth mentioning is that ASHRAE feels strongly that building performance standards really should be considered as a policy tool for mandating existing building decarbonization.

HPAC: Last fall, the United Nations' COP 27 meeting convened in Egypt, something we discussed here in December with USGBC's Elizabeth Beardsley. She said one prevailing theme there was that the time truly is now for making things happen. That the clock is ticking. How does that even greater sense of urgency affect the work of the TFBD now? How do you communicate that to other ASHRAE members and, ultimately, to building owners?

KP: Elizabeth was correct. Every year that goes on, it's just becoming much more urgent for action. So, if I was to say the last decade was a time for realization of global climate change issues, it was also a time when many awakened in our building industry to the issue and started to make decarbonization commitments for the future. This decade has been more about the people who made those commitments asking, "What do we do now to act on those commitments?"

People are saying that we now need to move to start to decarbonize. And decarbonizing is not black and white. It's a journey that we're going to go through to get to these goals over a period of time. But what can we do to start ratcheting down our energy consumption? Our carbon emission consumptions? To educate the building industry relative to embodied carbon and, and operational carbon and refrigerant emissions, and everything that goes along with all of this? It is going to make a difference in the long run, on getting the momentum that we need in order to accomplish these goals.

Toward that end, the task force has really been out collaborating with many other organizations representing the entire building value chain. We've been working with real estate owners, developers, building managers, architects, engineers and sustainability professionals. And through their professional organizations, we're trying to get a collaborative together in the building industry where everyone's kind of on the same page, to help harmonize what our message is to all of our members to be able to accomplish these difficult goals that we have before us.

HPAC: A year ago, we also spoke with your predecessors here, the Task Force's previous co-chairs, Tom Phoenix and Don Colliver. Please update us in general on the Task Force, its efforts this past year, and what we can expect to see in the near future.

KP: History's always good in understanding how this thing started. They emphasized last year just how important it was. ASHRAE realized that we really needed to put a strong effort forth to do a force multiplier with all of our volunteer efforts within the society in order to really address building decarbonization.

So, the goal of the first year was really to gather industry thought leaders, to brainstorm and to understand the various aspects of building decarbonization: what knowledge existed in our industry, what were some of the potential knowledge gaps that were out there, and what did we need to actually do? We used that first year to really build that knowledge base. And, as I said before, it's essential for everyone to understand that we're on a journey.

It's not that tomorrow we have to have the solutions, but we need to start building the solution sets.

We need the innovation over the next three decades in order to accomplish these 2050 goals of having all existing buildings and new construction being net zero carbon. So, no one has all the answers today, and there's going to be substantial innovation that's going to be needed to accomplish this, both affordably and equitably.

So it's not just a matter of carbon that we're measuring. There are other factors that go into a lot of this.

After getting a lot of this knowledge base together, we met last spring to strategize. And I'm one of these people who really believes strongly that strategy and execution need to marry with each other. So it was important enough for us to have a strategy as we started to move forward with all the information we had gathered.

Now we're using strategy to inform our execution arm on the task force. We have a strategic group that does nothing but think strategy. They are thought leaders who are well-balanced across the industry. We also have global advisory panels where we're actually meeting with other international organizations, saying, "This is what we're doing. What are you doing? How can we work together?"

We want to leverage all these groups together. So we developed a plan last spring that culminated at the June ASHRAE meeting when it went to the board for approval. That now represents a multimillion-dollar investment by ASHRAE, along with a lot of volunteer resources that will also be needed to go along with it.

HPAC: I understand ASHRAE is also quickly addressing decarbonization in many of its key building industry standards and guides. Can you let us all know what is in the works there?

KP: We have roughly 160 volunteers in ASHRAE who are working on the task force and its deliverables. Right now, this includes developing seven building decarbonization design guides, as well as education training, a decarbonization website to disseminate knowledge, and a social media presence to get the message out to our members and others in the industry. And we're also "decarbonizing" key ASHRAE standards as we start to move forward.

We've already published our first technical resource guide on building performance standards. That's available for free on our website. It's for people interested in seeing how standards will help as the U.S. starts using this policy tool to encourage building owners to improve the performance of their existing buildings. Other decarbonization guides will include development of heat pump applications, a how-to guide for existing buildings, because they are very different from new buildings in terms of decarbonization. Also, whole life carbon for building systems or MEP systems, building grid interface. That's a design guide on how to actually interface a building with the electric grid, to use the time and thermal storage strategies and demand strategies.

And then we have a special guide that's a hospital guide. We wanted to take a heavy, energy-intensive-type structure, like a hospital and see if we can do a decarb guide for that building type. Then it's going to be easier to see how we can decarb other types of things. And all these things are coming together. They're all in the works now and we're moving fast.

We have separate working groups on each one of these guides that are developing. And we have three more guides that'll be coming out before the end of this year. And then the last three remaining guides are scheduled to come out by June of next year.

HPAC: And what about existing standards? When will they be updated or revised?

KP: Well, we write a lot of industry standards; ASHRAE is known for that. So there is a whole separate effort that the task force has been working with our standards project committees and the standards committee in order to get decarbonization into those standards.

To hit some of the targets we talked about in our position documents, we realize that ASHRAE Standard 90.1 is going to have to get to zero carbon by 2030. And so we have three code cycles left. Right now, their target is 2031, which just happens to be where the three-year code cycle hits. But they're also coming out right now and working on a jurisdictional option for zero carbon. That will be out by the end of this year.

So, for any jurisdictions that want be leaders, that will be out there and published by the end of 2023. Also, 90.2 is our residential building energy efficiency standard. And they don't want to be just the minimum standard; they want to be a reach standard now. So they're already moving half way towards net zero energy by the end of 2023. And they're also creating a zero energy and zero carbon as an informative appendix in the 2023 publication. Their goal is to actually have their standard be zero carbon and zero energy by 2025. So, not just an informative appendix, but if someone wants to adopt that whole standard, it'll be possible in 2025.

There's a lot of other things, too. Our Standard 100 has been traditionally for existing buildings and their energy performance. We now are modifying that standard to be our building performance standard to address both energy *and* greenhouse gas emissions (GHG), to go along with what is happening with building performance standards in the industry.

We've also gone to our previous Standard 211 committee members for input. That is our standard for ASHRAE energy audits, i.e. Level 1, Level 2, Level 3, etc. And we need to now modify that standard and add decarbonization assessments. So they've already gone and developed a document that's an informative appendix, that should be out in the revised version within a couple months. It's out for public review now, but they've already developed that to get building decarbonization assessment standards together for what that really means when building owners want them.

And the other big thing that's exciting right now is that ASHRAE and the International Code Council (ICC) have

teamed up with a brand new standard that we just started late last year, and that's evaluating greenhouse gas and carbon emissions and building design, construction and operation. It's known as Standard 240 (proposed). And that committee's also already begun work on this. But eventually, that probably is going to get into the building codes on how to address the whole life carbon cycle of a building. So there's a lot going on with standards right now.

HPAC: I'll say. That really is quite a full plate. Just one last question... On this subject, I feel like I still need to address a persistent gorilla in the room, because it also threatens to impede implementation of your recommended decarbonization strategies. Incredibly, despite overwhelming (but admittedly not unanimous) scientific consensus, there is still some skepticism and even climate change denial within our industry. Dealing with that in the general public is one thing, but how do you handle pushback from that vocal minority of colleagues? Does the Task Force have a strategy for dealing with that? Or do clients ultimately end the debate?

KP: I certainly appreciate you ending on a very challenging question.

You know, climate change moves so slowly that its pace is really only evident primarily through graphs and statistics. And some scientists and policymakers have raised concerns that the effects of climate change might be exaggerated, that the natural cycles are the primary cause of the warming trend. We know that there's certainly some evidence to support these claims. And there is no question that some politicians and others who aren't in-the-know may overexaggerate claims and blame everything on climate change these days.

But we also know, when we look at the scientific evidence, as you said, the overwhelming majority *really* points to human activities as the primary cause of climate change since the industrial age. And atmospheric CO2 emissions, those levels were under 300 ppm for some 800,000 years that humans existed prior to 1950. Then they started to go over 300 ppm. In 2013, they went over 400 ppm.

We also know that greenhouse gases trap heat in our atmosphere. As population has been growing, and as we build more buildings, we're now scheduled to double the global building stock by 2060. When we get to 2050, there will be close to 10 billion people on this Earth. So, we need to figure out better ways to do this. And that's the bottom line.

As I said earlier, we're on a journey. We have to find reliable and affordable methods to decarbonize. The building industry and the electric generation industry are going to have to work together to optimize what that solution is going to be.

Anyone who tells you that you have all the solutions today, they really don't understand the complex social, economic, geopolitical, energy and security concerns surrounding building decarbonization. We're going to need a lot more innovation in the building and energy supply sectors to achieve what the optimal solutions are going to be by 2050. But we've got to start today. That's the biggest thing.

And with respect to those people who are in the minority, and they're vocal, the building industry is moving forward to address building decarbonization with or without the vocal minority. That pretty much has been addressed in the last couple years. And certainly it was on full display at the AHR Expo in Atlanta among all the manufacturers. You go to that conference, and everyone can see that this is the issue now. So we will move forward, with or without you.

You can still be a vocal minority, but the building industry is moving forward. We're doing things on the task force to educate our members to really understand what the issues are and to underdstand that the industry is moving in this direction. And if you want to be relevant, then you need to educate yourself on what the tool sets are to help decarbonize buildings for the clients you have out there.

HPAC: Kent, I'm afraid that's all we have time for. Thanks so much for joining us. We wish you the best of luck on achieving everything in front of you in this eventful year.

KP: Thanks for having me, Rob. It was a pleasure to talk with you and your listeners. HPAC

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Boiler Fans in Biomass Energy Need Extra Care

An expert fan engineer offers money-saving tips on proactive maintenance and monitoring best practices for industrial boiler fans.


New York Blower

By DOUG JONES, Fan engineer,
The New York Blower Company

Boiler fans support many critical functions in biomass energy applications. Because of this, fans must be able to withstand the harsh conditions found in biomass energy plants, such as heavy dust loads and very high temperatures, to deliver reliable performance and efficiency, day in and day out.

Specifying the appropriate equipment for this demanding job is only half of the equation, however. The other half is making sure the equipment is properly maintained and monitored to identify and prevent potential problems before they lead to failure.

Benefits of Proactive Monitoring

Proactively monitoring and maintaining air blowing equipment not only helps ensure maximum uptime and productivity, but it also reduces power consumption caused by inefficient fan operation, mitigates safety hazards, and helps maintenance teams avoid costly, unexpected repairs.

For example, with condition monitoring, maintenance teams can identify potential problems before they become critical, allowing for timely repairs and replacements. When small problems are identified early, maintenance teams can quickly diagnose and correct the problems *before* they lead to costly equipment damage or failure.

Furthermore, a proactive approach to fan maintenance can extend the lifespan of the equipment, saving replacement costs.

Here, we'll explain the various types of fans found in boiler applications and their most common maintenance issues—along with maintenance and monitoring best practices to help teams get ahead of potential failures.

Three Types of Fans in Boiler Applications

In biomass energy applications, both **Primary Air Fans** and **Secondary Air Fans** are involved in the combustion of fuel. Primary fans in a boiler are the bark feeder fans and the over-fire air fans. The bark feeder fans supply combustion air and convey power to stoke the furnace with bark.

From there, secondary and tertiary air fans supply combustion air at higher levels in order to take advantage of the heating value of the gasified bark. These fans are usually forced draft (FD) fans. **Induced Draft (ID) Fans** are used to create negative air pressure and remove flue gases from the combustion chamber.

Common Maintenance Issues

As with any piece of industrial equipment, boiler fans are subject to wear

A fan engineer with a wealth of industry experience, the author joined Willowbrook IL-based The New York Blower Company in 2018. There, Jones primarily focuses on providing engineering support for heavy industrial projects. He holds a master's degree in mechanical engineering from Clemson University.

and tear. And these fans often operate in extreme conditions which only accelerate this process. ID fans are especially susceptible to premature wear as they operate in highly corrosive and erosive environments.

The following are some of the most common maintenance issues associated with boiler fans:

Bearing Wear and Failure: Fan bearings are more likely to fail prematurely when operating in high temperatures or with inadequate lubrication. These conditions cause increased friction that can further damage the fan;

Misalignment or Imbalance: Fan components can become misaligned or imbalanced for a variety of reasons. For example, high dust loads and uneven dust accumulation on fan blades can cause an imbalance that puts stress on the fan and can lead to failure if left unchecked;

Corrosion: No matter how rugged a fan's construction, over time parts can corrode and weaken. For example, silencer baffles can corrode and then collapse, blocking the airflow into or out of the fan. This immediately degrades fan performance and increases noise. If the deterioration continues, it can lead to parts of the silencer baffles breaking off and entering the fan, which can destroy the impeller;

Lack of Lubrication: Damper or variable inlet vane (VIV) bearings and/or bushings must be properly lubricated. If the bearing is neglected or the bushing fails, the damper blade shaft can become stuck and fail to rotate properly. This can lead to blades becoming out-of-sync—which increases vibration, creates excessive noise, and degrades fan performance. Blades that are out-of-sync can even lead to aerodynamic disturbances that can cause a blade to break off, enter the fan, and lead to system failure.

Proactive Fan Operation and Maintenance

Both field service and proactive monitoring systems are essential for ensuring the proper operation and maintenance of boiler fans. These techniques should be used in combination to keep equipment running at optimal levels of performance, efficiency, and reliability.

Real-Time Condition Monitoring: Vibration is often one of the first indicators that a potential problem is brewing. Vibration sensors permanently mounted to the fan can continuously monitor fans for unusual or excessive vibrations and alert the operators to potential issues.

Similarly, temperature sensors can be used to monitor equipment so problems like overheating can be promptly addressed, and power monitoring sensors can detect changes in a fan's power consumption to indicate when a fan is running less efficiently than normal. This allows maintenance teams to respond quickly before these issues impact production.

Regular Inspections and Preventive Maintenance: It should go without saying that regular preventive maintenance and inspections are a must for boiler fans (and any critical equipment operating in a harsh industrial environment). This typically includes activities like balancing the fan, as well as changing and relubricating motor bearings, couplings, actuator, and damper linkage(s). Regular fan service should also include less obvious inspections of the fan's aerodynamic and mechanical properties.

Furthermore, while modern condition monitoring technologies can be invaluable for providing early indication of a problem, they too can fail or become misaligned. Because of this, manual inspections should be sure to include a check of any condition monitoring sensors to verify readings and ensure they are working properly.

Conclusion

Proactively maintaining boiler fans is essential for safe, efficient, and reliable operation. Teams that stay on top of preventive maintenance and inspections—and also employ modern condition monitoring techniques—will be well equipped to prevent unexpected equipment failures, increase uptime, and extend the life of their air blowing equipment. HPAC


New York Blower

ABMA To Focus on Next Generation at Spring Manufacturers Conference

Boiler manufacturers will meet outside Chicago this April for MC2023, a unique industry event focused on middle managers and those entering leadership roles at their firms.

By SHAUNICA JAYSON, American Boiler Manufacturers Association

Back after more than four years, ABMA's popular Manufacturers Conference (MC) returns for the first time since 2018 this April 11-13 at the Hyatt Lodge Oak Brook in the suburbs of Chicago, IL.

MC2023 is a unique event for the boiler industry focused on middle managers and those entering the leadership within their companies. The Manufacturers Conference is known for sharing a range of content to broaden the attendees' knowledge of the boiler industry and it offers a memorable, hands-on experience with ABMA member company manufacturing tours.

This event also brings together a diversified representation from the industry with a new emphasis on markets, worker recruitment, potential new environmental regulations, industry challenges, and marketing tools.

Conference highlights include:

- Peer-Collaboration
- Technical Sessions
- ABMA Member Plant Tours
- End-User Tour

Who Attends?

- C-level Executives
- Product Managers
- Sales Managers
- Marketing Managers
- Engineers

Open to both ABMA Members and non-members, MC2023 offers attendees an educational experience on critical issues and concerns presently facing the boiler industry. At press time, ABMA was excited to announce this initial list of confirmed presentations and speakers, focused on compelling topics pertinent to the boiler industry. More topics will be added in the coming weeks.

- **Achieving Lower NOx: End-User Demand & Regulatory Requirements** — Steve Sock, ClearSign Technologies Corp.;

- **Mobile Boiler Market: Uniqueness and Challenges** — Michael Pfeiler, Wabash Power Equipment Co.;
- **It's Not Just A Boiler, It's A Boiler Room** — Aaron Zoeller, SCC, Inc.;
- **Advanced Energy Sustainability with Boiler Technology** — Marc Dupuis, Vapor Power Int'l, LLC & Alan Chmiel, R.W. Beckett Corp.;
- **Opportunities for Boiler Industry Engagement with NBBI** — Joel Amato, The National Board of Boiler & Pressure Vessel Inspectors;
- **Going to Market in Today's Boiler-Burner Industry** — Jason Howard, Power Flame Inc.

MC2023 also includes facility tours of ABMA members **SCC, Inc.** and **Vapor Power International**, as well as an End-User Tour of the boiler room at AMITA Health Alexian Brothers Medical Center. That optional, end-user boiler room tour during the conference will offer attendees the opportunity to see how a hospital system addresses its steam and hot water needs.

The AMITA Health Alexian Brothers Medical Center, located Elk Grove Village, IL, is a Level II adult and pediatric trauma center and has been recognized with *America's 50 Best Hospitals Award™, America's 250 Best Hospitals Award™*, and more.

The hospital tour will navigate participants through the entire boiler room to include three, 700 HP steam boilers with a PLC-based combustion & burner management system, deaerator with a total capacity of 60,000 PPH and storage tank with a total capacity of 1,400 gallons to overflow including a PLC-based control system, and condensate surge tank with a total capacity of 2,000 gallons. The boiler room is complete with a blowdown separator and blowdown heat recovery system.

Featured General Sessions

On the afternoon of Tuesday, April 11, ABMA will kick off MC2023 with an opening keynote presentation by **Joe Shake**, CFO and Principal of ProCFO Partners on creating and achieving professional goals with organizational alignment and focus. A financial executive with over 30 years experience in leadership roles across a variety of industries, Shake will offer his insights and expertise gained from having led multiple small to mid-size organizations throughout his career.

Linking sales and operations so they work in tandem, he specializes in turning businesses around to help them go from losing money to achieving profitable revenue growth.

The final day of MC2023, Thursday, April 13, will feature a closing keynote presented by **The Second City Works**, an offshoot of the renowned Chicago comedy troupe. Using the improv methods pioneered on local Second City stages, the performers help people and companies to improve business results and team building. Their humorous and engaging presentation combines interactive exercises, facilitated debriefs, and practical applications that help to get people excited about learning.

That firsthand experience helps participants internalize better ways to communicate, collaborate, and innovate — all while building comfort with risk and change.

A complete listing of sessions and program highlights can be found on our website at **ABMA.com/manufacturers-conference.** HPAC

AMITA Health Alexian Brothers Medical Center in Elk Grove Village, IL

Carbon Air Purifier

Carrier unveils its Carbon Air Purifier with ultraviolet light to purify the air by helping to reduce unwanted odors, volatile organic compounds and common household gases from indoor air. The technology aids in the reduction of microorganism growth, including bacteria and viruses, on the evaporator coil. The unit provides dual treatment technology through a carbon core and UV light to improve indoor air quality. It is easy to install and maintain, requiring replacement of the carbon core each year and UV bulb every two years. Can be combined with an additional UV light for even greater surface coverage on evaporator coils.

Carrier

Pūrgo Air Purifier

The Pūrgo Air Purifier from Molekule's patented SteriDuct technology uses safe, solid-state UV-C emitters at the optimum wavelength to eliminate harmful pathogens. Coverage is four to six air changes/hour in a 3,000-cubic-foot room. UV germicidal irradiation effectively removes 99.99% of organic airborne microorganisms (viral, bacterial, and fungal) to meet latest federal guidelines for indoor air quality. Easy-to-use magnetic latch simplifies filter cartridge replacement; virtually no maintenance needed. Results of independent testing against the Omicron variant of SARS-CoV-2 show a 94.17% gross reduction after 30 minutes, and a 99.998% gross reduction after 60 minutes in a room-sized chamber.

Molekule

Variable-Speed, Ultra-Low Emissions Gas Furnace

Lennox's SL297NV ultra-low NOx gas furnace produces 65% lower NOx emissions than standard low NOx furnaces. The variable-speed motor maintains a consistent temperature in the home. iComfort S30 ultra smart thermostat compatibility adjusts heating for energy savings based on occupants' routine. Has an energy rating of up to 97.5%. A variable-speed blower motor allows for constant and efficient adjustments of air flow speed and gently disperses even heat throughout the home. It also prevents loud blasts of air that can occur when a single-speed system starts up, providing quiet operation for enhanced comfort.

Lennox International

System M Air-To-Water Heat Pump

Taco Comfort Solutions' System M is a packaged air-to-water heat pump system for residential heating, cooling and domestic hot water generation. With just six pipe connections, the heat pump provides up to 44,000 Btu/hr., 3.5 tons of cooling and a max COP of mor than 4. The technology is solar PV- and smart grid-ready. The outdoor portion of the heat pump features advanced inverter technology, a variable-speed fan and quiet operation. The indoor HydroBox unit contains an integrated buffer tank, simplified wiring hub, user interface with smartphone app control, and a high-efficiency, dual-ECM pump piping module.

Taco Comfort Solutions

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HPAC ON THE AIR

Our monthly Podcast series offers unique and compelling industry insights for engineers in the HVACR market. Each month, we talk with engaging thought leaders and practitioners like ASHRAE President Farooq Mehboob and USGBC ambassador Elizabeth Beardsley. Produced by *HPAC Engineering* magazine and hosted by Editor-in-Chief Rob McManamy, this series is just one of several exciting **Members Only** features, designed to enhance your HPAC multimedia experience.

Check out all the new media offerings at hpac.com/members.

ENDEAVOR BUSINESS MEDIA

Evolution 987M Variable-Speed Modulating Gas Furnace

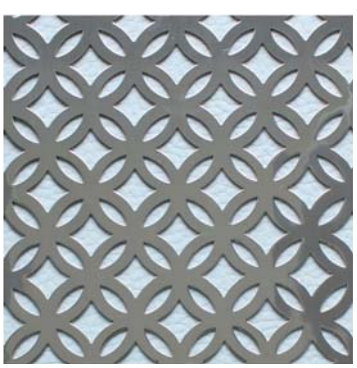
Bryant's Evolution 987M variable-speed modulating gas furnace is Energy Star-rates and features up to 98.3% AFUE efficiency. Perfect Heat technology means consistent comfort by adjusting system operation to changing conditions. Perfect Humidity technology removes more moisture than a standard furnace during cooling operation (when installed with a matched air conditioner or heat pump). Fan On Plus technology lets you choose between four speeds of continuous fan operation with a compatible control. Fully insulated cabinet for quieter operation; external filter cabinet makes filter changes easier. Hybrid Heat system capable, allowing gas furnace/heat pump system combinations for enhanced heating efficiencies.

Bryant Heating and Cooling

Grinnell G-Fire One-Bolt Figure 579A Coupling

Johnson Controls launches the next-generation Grinnell G-Fire One-Bolt Figure 579A coupling with customized gaskets for more secure fitting on fire suppression pipe joints. The grooved, rigid coupling features center-stop gaskets customized to specific coupling sizes to help ensure proper positioning. The 1.25- and 1.5-in. coupling sizes keep their proven, powder-lubricated gasket, ideal for small pipe diameters, while 2- through 4-in. sizes use a redesigned self-lubricating gasket intended to optimize protection against rolls or pinches. A low-profile spine allows contractors to install couplings in tighter spaces, while 360-degree pipe contact ensures a truly rigid joint. The coupling's single-bolt design eliminates alternate tightening.

Johnson Controls/Tyco Fire



Inner Circle Perforated Grille

Decorative perforated grilles from Chicago Brass are tailor-made; use them to transform cabinets, panels, doors, vents or radiator covers. Cut from solid brass sheets to your specifications; all pieces are cut, trimmed and finished to order. Styles include cross, overlapping circle (pictured), honeycomb, diamond, square, large or small club. Can be supplied with fine or open back mesh backing to add depth of appearance, diminish viability through the grille or create contrast. Mesh is aAvailable in two sizes: fine (1/16-in. internal width) and coarse (1/8-in. internal width).

Chicago Brass

ENHANCE-ION Bipolar Ionizer

Fresh-Aire UV introduces the ENHANCE-ION bipolar ionizer designed to enhance common HVAC filter media for higher capture efficiency by capturing airborne particulates. It increases particulate capture in residential ducted HVAC systems up to five tons. Mounted anywhere inside the duct work or HVAC system, the unit creates positive and negative ions; its turbulence generator disperses the charged ions into the airstream. The ions electrically attract and collect in a mass, thus creating larger airborne particles that can be better captured by the HVAC filter. A 38% and 18% improved capture rate was recorded for MERV 7 and MERV 8 media filters, respectively.

Fresh-Aire UV

TRUAire Retrofit Grilles, Registers, Diffusers

RectorSeal's TRUAire Retrofit GRD (formerly Airtec GRD) features a patented one-piece design, allowing the system to be installed without requiring assembly. Its retrofit flexibility eliminates the need for mastic and external sealers. Constructed with professional-grade polymers, it has stepped collars designed to accommodate three standard duct sizes. The retrofit product is especially popular in markets without existing ductwork.
RectorSeal

DC Tromb Dust Extractors

Dustcontrol UK's DC Tromb dust extractors are designed to cope with the demands for a clean and healthy working environment. They can handle fine dusts and materials created from cutting concrete, sanding, grinding or drilling floors or walls, as well as dust from many other industrial factory processes. Machines can be connected to floor grinders and handheld tools such as cutting machines, chisel hammers and saws. Due to their compact design, they are also easy to move and transport. As a standard, machines are equipped with a patented self-cleaning filter (washable polyester) and a H13-filter. A signal lamp shows when it's time to clean the filter.
Dustcontrol UK

Air Distribution Product Line

Greenheck's air distribution products include a selection of grilles, registers and diffusers (GRDs), and air terminal units that are designed, engineered and tested to meet a wide range of performance and aesthetic requirements. Air distribution products are also offered for specialty applications such as displacement ventilation for spaces with ceiling heights of 9 ft. or greater, allowing more heated waste air to be removed. Stainless steel GRDs are available for applications requiring corrosion resistance and durability. A line of fire-rated air distribution products is designed for use in three-hour fire-rated exposed grid suspended ceilings. Engineered polymer products are also available for environments with nonferrous requirements such as MRI rooms, pools and water treatment plants.
Greenheck Fan Corp.

Intelliswitch Digital Controller

Berner International introduces the Intelliswitch, a digital controller platform for the industrial air curtain market. Standard on all Berner air curtains, it was adapted for industrial air curtains to offer building managers flexibility in operations with a built-in time delay, preset programs, seven-day scheduling, a temperature probe, low voltage circuit for unit activation via door switch or building management system. Facility managers can program, operate and monitor the air curtains through either a BMS using the BACnet-IP protocol or a smartphone via the Berner AIR app. Monitors air curtains with heating options (electric, hot water and steam), with the exception of direct gas heat.
Berner International

Acoustic Heat Pump

The Acoustic Heat Pump from Equium uses thermoacoustics to pump heat efficiently and to raise its temperature for thermal and ecological comfort. Acoustic waves do the work of compression/expansion to produce cold or heat without greenhouse gases with a low carbon footprint. It features a Seasonal Coefficient of Performance higher than traditional high-temperature heat pumps, a lower total cost of ownership than traditional boilers and high temperature heat pumps, reduction of CO2 emissions by 80% compared to traditional gas boiler, and a maintenance-free thermoacoustic core. It has a longevity of more than 30 years, and is designed with 100% recyclable materials.
Equium

ACS Slim Line Air Purification System

SecureAire Technologies unveils its ACS Slim Line air purification system, designed specifically for rooftop unit (RTU) HVAC systems. It offers a simple installation for RTUs and takes the place of 2-in. simple mechanical filters, allowing the conversion of any RTU with a 2-in. filter into a complete air purification system in minutes. It uses ACTIVE Particle Control technology, which is based on the same particle control technology used in semiconductor manufacturing cleanrooms. The technology causes smaller particles to collide with one another and stay together, making them large enough to be moved to the filter by airflow alone. Studies have shown that this technology can remove up to 99% of the most dangerous particles in the air.
SecureAire Technologies

Multi-Position Air Handlers

Fujitsu's multi-position air handler units are now compatible with the company's XLTH (extra low temperature heating) outdoor units, which provide heating capacity at outdoor temperatures as low as -15° F. Available in four residential sizes from 24,000 to 48,000 Btu/hr., the units feature all-aluminum indoor unit coils, high static pressure capability, indoor sound levels as low as 24 dBA and adaptive fan motor control for optimum comfort. Minimal clearance is needed on three sides of the indoor unit, with only 21 inches clearance needed in the front for service. Down-flow and horizontal right kits come standard with each system.

Fujitsu General America

ID300 Perfectspeed

Nidec introduces the ID300 Perfectspeed, which combines the SynRA motor with the ID300 drive to create an integrated drive motor. It allows commercial HVAC contractors or building maintenance staff to connect to building automation. The unit can eliminate separate mounting of VFD, needs no calibration of drive to motor, has a reduced radio frequency due to close proximity of drive to motor, IE4 or IE5 efficiency, and lowest lifetime cost of operation option for commercial building applications.

Nidec Motor Corp.

Integrated Pressure Switch

Superior Sensor Technology offers an integrated pressure switch featuring three threshold pressure modes as part of its NimbleSense architecture, a system-in-a-sensor, application-specific pressure sensor platform for HVAC, medical and industrial products. Modes include a Fixed Mode specific to the manufacturer's application, a Variable Mode 1 that the manufacturer sets during product production, and a Variable Mode 2 that is field programmable using software. The new pressure switch capability maximizes design flexibility, reduces PCB board space, lowers power consumption, and minimizes product design complexity and manufacturing costs. Customers can purchase pressure sensors with features specific to their product application requirements.

Superior Sensor Technology

Series 90 Butterfly Valve

Mueller Steam Specialty introduces the Series 90 butterfly valve, designed for commercial and industrial applications — working with pipe from 2 in. to 40 in. and meeting high-performance specifications for data centers, hospitals and educational institutions. It is ideal for water supply applications in hydronic cooling and fire protection systems, and can be used to control the flow of liquids, gases and slurries. It is bubble-tight at 290 psi differential, enabling it to work with larger pipe. The valve includes a double offset RPTFE seat designed for 500° F and a carbon steel body, also with a stainless-steel stem and disc.

Mueller Steam Specialty/Watts

AMP-L Water-Tube Boilers

Thermal Solutions' AMP-L condensing boiler and water heater is available in five sizes: 400, 500, 650, 800 and 1,000 MBH. It is available in either a natural gas or propane configuration. Models feature a low-water cut-off; high and low gas pressure switch; and a 3-in-1 vent connector, which allows for the use of polypropylene, CPVC or stainless-steel venting. The units are capable of up to 200 equivalent ft. of vent in AL29-4C, polypropylene or CPVC. Modbus communication also comes standard. In addition to standard 10:1 turndown, 300 gpm flow rates and the self-cleaning nature provided by the commercial grade water tube design, an outdoor model is also available.

Thermal Solutions

TFTN Gas Boiler Series

The TFTN gas boiler series from NTI is designed for residential and light commercial hydronic applications. It introduces a high-quality, 7-in. color touchscreen and offers onboard Wi-Fi capability to provide contractors with more functionality and diagnostic ability. Efficient installation includes top or bottom supply and return connections, direct-vent options or use with indoor combustion air, and an integrated three zone controller. Other features: stainless-steel heat exchanger, 2- to 3-in. venting options built-in, low-water cut-off, a 120V convenience outlet and EZ Set Up Wizard. Available in sizes 85, 110, 150 and 199 MBH.

NTI Boilers

Bradford White Connect

Bradford White Connect is an external adapter providing app-driven monitoring technology for the AeroTherm heat pump water heater series. It allows users to monitor the heat pump water heater, adjust settings and receive alerts through a mobile app available on Google Play or Apple's App store. Contractors can use the app to monitor in-service Aerotherms, analyze their performance, and set alerts for water heater errors. For utility programs, the adapter conforms to grid-enabled demand response requirements with its CTA-2045 port.

Bradford White Water Heaters

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MARKETPLACE

AD INDEX

Greatest Challenge China Poses May Be on Climate

While tensions continue to grow over economic and geopolitical rivalries, we had best not forget about our shared environmental responsibilities.

Larry Clark
A regular contributor to HPAC Engineering and a member of its editorial advisory board since 2012, the author is a principal at Sustainable Performance Solutions LLC, a south Florida-based engineering firm focusing on energy and sustainability. Email him at larry@sustainflorida.com.

"*China, China, China.*"

It's all over the news these days. And the current mood in the U.S. seems more and more jingoistic.

Of course, we still read and hear about China as a major trade partner. According to the U.S. Dept. of Commerce, China was our nation's third-largest in 2021. In that year, 8.6% of total U.S. exports of $1.8 trillion were exported to China, and 17.9% of total U.S. imports of $2.8 trillion were imported from China.

At the same time, however, China is also an economic competitor, especially for human capital. Both the U.S. and China strive to sustain economic growth; secure supply chains; create robust science, technology, engineering, and mathematics (STEM) sectors; and develop workforces for industries of the future. And, of course, China remains a growing challenge to U.S. national security interests (and it's not just balloons and TikTok).

Says U.S. Secretary of Defense **Lloyd Austin**, "The People's Republic of China is the only competitor out there with both the intent to reshape the international order and, increasingly, the power to do so."

But you know what we aren't hearing a lot about these days re China, even though it was big news not long ago? Climate change.

According to the World Bank's *2022 China Country Climate and Development Report*, "China's development and climate change are deeply and increasingly intertwined. The country is both a contributor to rising global greenhouse gas (GHG) emissions and is severely affected by its adverse impacts... Alongside other larger emitters, China's contribution to reducing global climate risks is therefore crucial."

And yet, the Centre for Research on Energy and Clean Air (CREA) and the Global Energy Monitor (GEM) recently reported that Chinese coal power plant permitting, construction starts, and new projects all significantly increased last year. Incredibly, new permits for coal power plants were issued at a rate of *two per week*, reaching the highest level since 2015. To put that in perspective, the coal power capacity project under construction in China last year was 600% of the rest of the world's combined capacity.

Think about that.

So, as we now push harder here to reduce U.S. carbon emissions, admittedly with some misguided policies, the U.S. – still the second largest carbon emitter in the world (5.0 billion mCO_2e) behind China's 11.5 billion mCO_2e in 2021 – nevertheless has managed to reduce its emissions by 12% since 2010.

Clearly, however, we also need to develop foreign policies that will genuinely encourage our trading partners to reduce their carbon emissions, as well. After all, we can only blame so much of the world's climate woes on West Virginia's hard-working coal miners! HPAC

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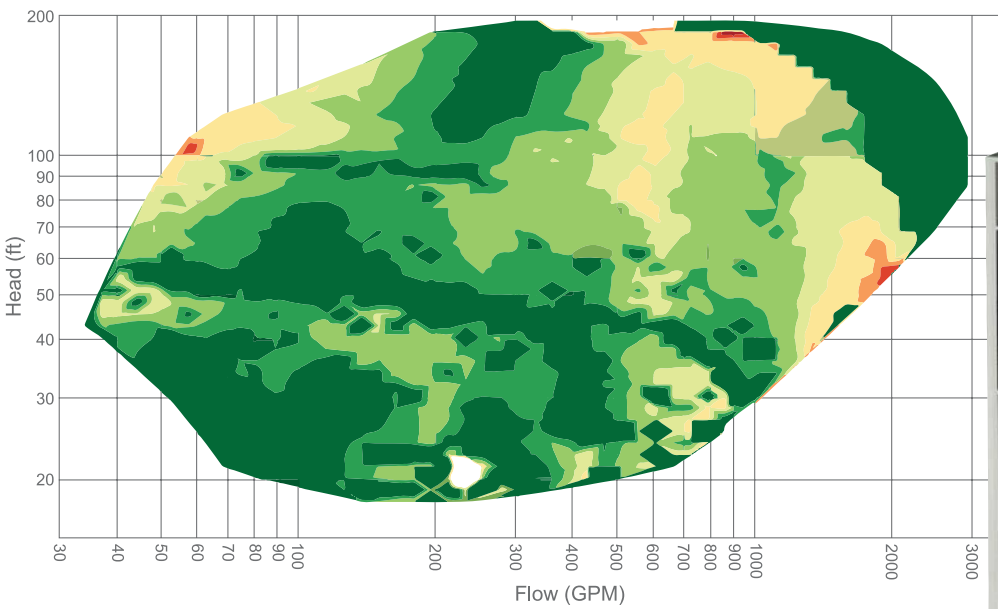

*Taco vertical in-line pump efficiencies vs. leading competitive pump at 1,696 duty points.

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