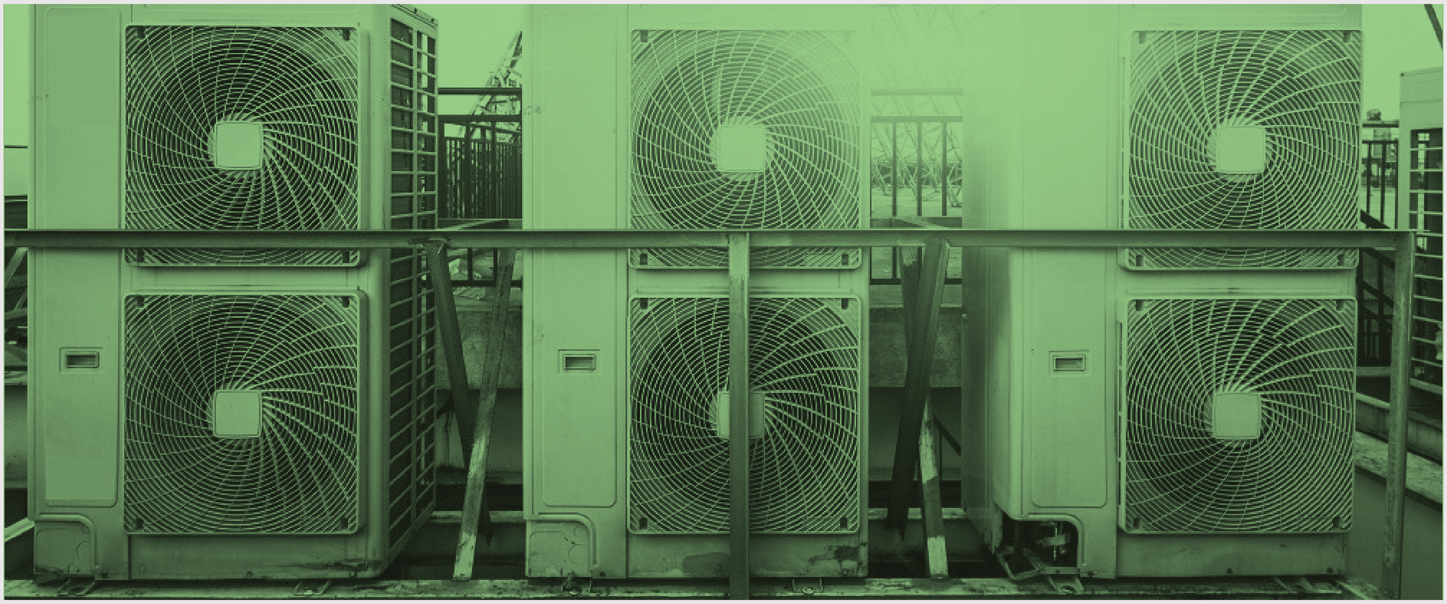
A COMPREHENSIVE LOOK AT SELECTING THE RIGHT HVAC SYSTEM

By: John Palasz, PE, HFDP

Primera

INDEX



So, you have a project that needs a new HVAC system. Whether it's a brand-new building or an existing building, there are quite a few things to consider when choosing the right system to Heat, Ventilate and Air Condition the different spaces. But where to begin?

Well, you are in luck because I am about to narrow it down for you. The first things to consider are the function of the space(s) and the code requirements. Now, whether the function is residential, commercial, or industrial, the mechanical code will help identify the requirements needed for the different spaces in your building. If the code is not clear, don't worry, the American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE) provides guidance with industry standards for nearly every application, space type, and system type. While ASHRAE publishes four main handbooks (fundamentals, applications, systems and equipment, and refrigeration equipment) there are also many other ASHRAE publications that guide engineers through the design process, including but not limited to, the guides and standards for: laboratories, hospitals and clinics, ventilation of health care facilities (standard 170), education/kindergarten through high school (K-12), grocery stores, retail spaces, offices, thermal comfort (standard 55), indoor air quality (standard 62.1), energy standard for buildings (standard 90.1), controls/BACnet (standard 135), and much more. These guides and standards are updated often by professionals and experts in the industry.

This is a lot of information to peruse but, depending on the complexity of the project, many of these guides help narrow down the system(s). Yes, many buildings must have multiple systems and various components, such as: air handling units, fans, pumps, boilers, chillers, cooling towers, and associated controls. Furthermore, it is important to identify the building classification(s): assembly, business, educational, factory and industrial, high hazard, institutional, mercantile, residential, storage, utility and miscellaneous – these categories will have specific requirements for building construction as well as the HVAC systems.

As mentioned earlier, the code must be established. One of the key choices for the design team to make is about the energy code. Some jurisdictions and owners allow the design team to comply with either International Energy Conservation Code (IECC) or ASHRAE 90.1, but others require the design team to follow a specific code such as IECC-2018. However, in the IECC-2018, section C401.2-1 indicates that one method of compliance is to comply with ANSI/ASHRAE/IESNA 90.1. So, when the IECC is required, the whole design team can make the choice to follow IECC or ASHRAE for energy code compliance as a team. In other words, all disciplines must follow the same energy code. The design team should advise which will be best for the project design scope. This decision will impact architectural, electrical, plumbing and HVAC requirements for the new system(s), so designers must choose wisely. Where these energy codes might be consistent for many requirements for plumbing and architectural, the requirements for lighting controls, and energy monitoring, as well as HVAC temperature controls requirements might be different and very costly.

Ok, so we know the function of the space(s), we know the codes to follow, the building classification, and have picked the energy code. That means we're ready to select our HVAC system, right? Not quite. There are a few more choices to make and a few more questions to answer to narrow down the best HVAC system for your project. Like, does the owner have any requirements? Yes, some owners will have written standards, while others do not have any written standards. Owners may have standards for the building, indicating what HVAC components are allowable to keep things consistent with the style, or keep the system components consistent and interchangeable for maintenance, or to make training of maintenance staff more standardized. In addition, there may be standards for HVAC setpoints for tenants. With or without published standards, owners typically agree that the mechanical system should make the space comfortable, it should be quiet, it should be low cost, reliable, maintainable and energy efficient. Sounds easy right? The trouble is that there is a fine balance between these choices and the costs. We'll explore each in more detail.

COMFORT

So, you want your space with a new HVAC system to be comfortable, right? We all want comfort; the problem is that comfort is subjective. Fortunately, ASHRAE has a method to quantify and calculate the comfort level, depending on the clothing that the occupant wears and their activity levels (refer to ASHRAE Standard 55). Yes, ASHRAE Standard 55-2010 section 3 defines the "clo" and "comfort, thermal," among other things.

- *clo*: a unit used to express the thermal insulation provided by garments and clothing ensembles, where 1 clo = 0.155m^2 • ° C/W (0.88 ft^2 • h • °F/Btu).
- *Comfort, Thermal*: that condition of mind that expresses satisfaction with the thermal environment and is assessed by subjective evaluation.

Still, comfort is perceived, and the best that the system designer can do is provide systems that are correctly sized and controlled to respond to the room dynamics. In other words, the primary focus here should be to make good decisions about the system zones and controls. If there are rooms that are critical for comfort, then those should have a thermostat. Larger spaces such as a gym or a large lobby may require more than one temperature sensor to provide adequate control. Typical office indoor design temperatures are 75°F dry bulb temperature and 50% to 60% relative humidity for the summer occupied hours, and 70°F dry bulb temperature for winter occupied hours.

Humidity levels also contribute to the comfort level of the space. Typically, high humidity levels (above 60%) will be uncomfortable and low humidity levels (below 20%) will be uncomfortably dry. Many HVAC systems are dehumidifying the air during the cooling process, but many systems are not designed to humidify the air entering a space. Depending on your climate, cold winter weather may result in multiple days with very dry space conditions. Without a humidifier to boost the humidity, it is possible that there will be some days that are below the comfortable humidity levels. In addition to being uncomfortable, lengthy exposure to low humidity levels has been linked to health issues where the drying out of the sinuses will result in increased risk of contracting anything from the common cold to more serious conditions like influenza and other infectious diseases. Controlling humidity within the space may also be necessary for a manufacturing process, or to lengthen the life of building components such as a wooden gym floor. You must weigh the cost of installing and operating a humidifier against the value of having a comfortable environment, a healthy environment, the building process, and conserving the building components for those cold and dry winter days. After analyzing, ask yourself: do you truly want a system humidifier?

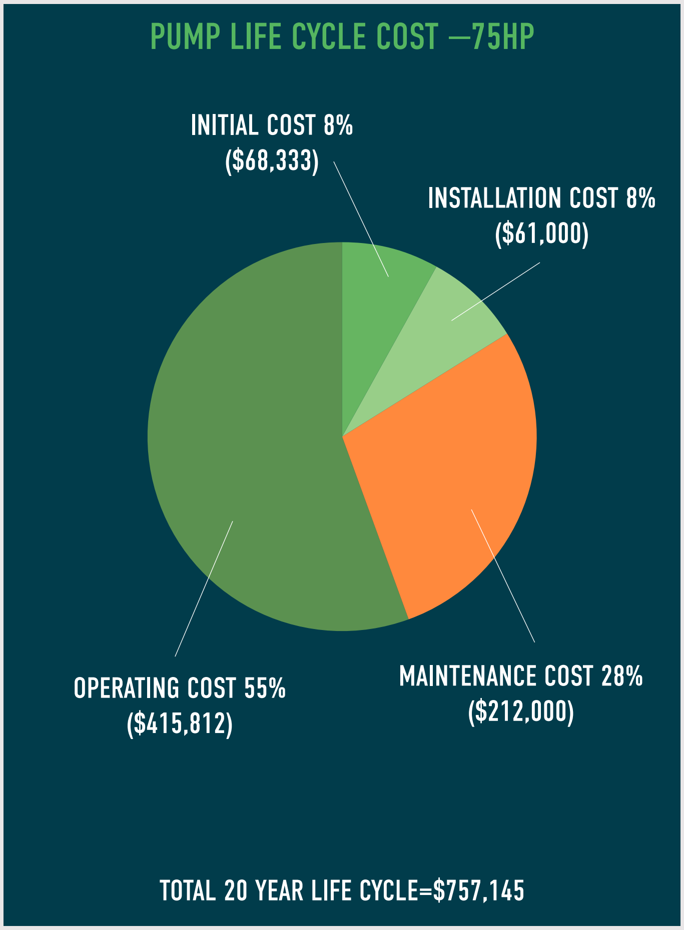
SOUND

Most owners want the HVAC system to be quiet, but how quiet? The acceptable sound levels for the renovated space must be defined to avoid acoustic issues. Fortunately, the sound levels can be calculated, quantified, and later measured and verified (for a price). And there are many project features and room aspects that impact the room sound levels, such as the exposed surfaces of the room, wall types, hard floors versus carpet, ceiling heights, and ceiling types such as gypsum or acoustic ceiling tile or an open ceiling design. The most important aspect is to identify acceptable sound levels for critical spaces (Standard ANSI ASA S12.2-2008 provides some recommendations). For some space types the acoustics are a primary design concern. I can't imagine not designing a quiet system for the following space types: recording studios, theaters, auditoriums, classrooms, or video conference rooms. For these, it is recommended to hire an acoustic consultant to guide the design team and calculate room sound levels to ensure that the specific sound criteria is achieved. If the room type does not require a sound consultant but you still want it to be quiet, it is important to work with the design team to establish and define the acceptable sound levels or criteria, such as the desire to limit noise transfer from one zone to another. Locating noisy mechanical equipment in sound-sensitive areas should also be avoided. Whether it is a high-pitched whistling noise from a diffuser, a low rumble from some roof-mounted mechanical equipment, or an intermittent click from a control valve, these undesirable sounds might can be avoided with the right planning. It is definitely more cost-effective to have the design team collaborate to ensure that the HVAC system choice meets the sound requirements versus having to hire an acoustic consultant to analyze and design a solution for an acoustic issue. Many system choices are available to achieve the typical room requirements even without expensive modifications. Typical offices require a noise level of NC35-NC40. Auditoriums may require NC20 or lower.

BUILDING OCCUPANCY	GOOD	ACCEPTABLE
RESIDENCES	NC25	NC35
APARTMENTS	NC25	NC35
HOTEL ROOMS	NC30	NC35
EXECUTIVE OFFICES	NC22	NC30
CONFERENCE ROOMS	NC22	NC30
INDIVIDUAL OFFICES	NC30	NC35
OPEN PLAN OFFICES	NC38	NC42
CORRIDORS	NC40	NC45
HOSPITAL ROOMS	NC23	NC33
CLASSROOMS	NC23	NC30
AUDITORIUMS	NC20	NC30
THEATERS	NC18	NC25
CONCERT HALLS	NC15	NC22
RECORDING STUDIOS	NC15	NC18
TV STUDIOS	NC18	NC26

ENERGY EFFICIENCY

The next criteria to consider with your HVAC system is energy efficiency. I think most owners and designers want to maximize energy efficiency, but often the aspects of these efficient systems increase initial costs and even maintenance costs. Often highly efficient systems will have complicated controls which add to the first cost and must be understood by the maintenance staff. While many owners want high efficiency, they also want a low first-cost solution. If you plan to own and operate the building mechanical systems for a long time, then it is recommended to consider the equipment life-cycle cost. It is rare that the lower first cost design is also the best life-cycle cost HVAC system. One option is to determine the best life-cycle cost system with analysis and calculations using energy modeling software to compare different systems and equipment types. Designers can even compare building envelope features, like vertical or horizontal fins, or the amount of glass, the orientation of the building, the amount of roof insulation, or even the color of the roof. Analysis may be very complicated and takes some time, which means that it has a cost. This cost should yield valuable information that is calculated and documented to ensure that the building and HVAC system are best for the project. Another approach is more prescriptive by selecting a system type then reviewing the cost to upgrade components to an improved component efficiency. This makes some sense when comparing boilers, chillers, or packaged equipment like rooftop air handling units. Don't forget that sometimes utility companies will offer monetary incentives for installing high-efficiency equipment. On the other hand, the energy code defines the minimum efficiency of new equipment, so one might choose to forgo the detailed analysis unless they intend to submit for LEED (Leadership in Energy and Environmental Design), zero energy building certification, or other energy certifications.

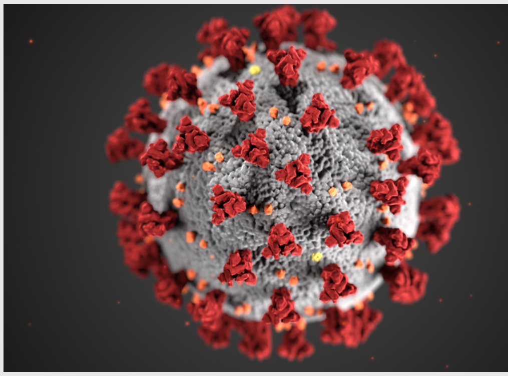


RELIABILITY

The next thing to consider is the importance of the HVAC system reliability. The reliability will be improved by specifying quality components by reputable manufacturers and having detailed descriptions of the component and system warranty. If reliability is important, then we should also talk about redundancy. Some system types are naturally more reliable, and some system types even have built-in redundancy. To determine if system redundancy is desired the owner must understand the effects when the HVAC system components fail to heat, ventilate, or air condition the space. For some facilities, it is essential that the systems continue to operate to prevent loss of life or loss of revenue. If reliability is so critical, then redundancy will be needed. Many buildings will have some redundancy for the heating system to protect the property and reduce the likelihood that freezing temperatures that could cause a water pipe to burst, causing damage, expensive repairs, and loss of revenue while the repairs are made. However, ventilation and air conditioning systems will only have redundancy on a case-by-case basis. While it would be expensive to provide 100% standby equipment (N+1) for all HVAC equipment, there are less expensive alternatives that provide some reliability and redundancy. If some redundancy is desired, then a duplex pump might be used, or a chiller might be specified to have two refrigerant circuits, or an air handling unit might be designed to utilize a fan array (aka fan wall) for supply so if a part of the system stops working, then the ventilation and cooling systems are not completely offline. These solutions are often a small additional cost to the project and provide significant benefit.

AIR PURIFICATION

Due to COVID-19, many owners are looking for ways to protect building occupants with high-efficiency filters and additional outside air (when possible). Minimum Efficiency Rating Value (MERV) 14 or higher filters are recommended. HEPA and ULPA filters (MERV 17- MERV 20) will be effective against small particles such as viruses, but there is a cost associated with these filters (both maintenance cost and energy cost). If having high-efficiency filters are used then it is recommended to have a central air handling unit (AHU) and ductwork to distribute all the clean air. Many of the small unitary air systems cannot support a high-efficiency filter. Still, it is common and allowable to have devices that recirculate air within a space, even for many hospital applications. It is also possible and recommended to control the AHU to have a purge cycle, a few times per day if infrastructure and weather permits. Other types of air purification might be considered such as ionic purifiers or irradiation (normally UV lamps).



OTHER CONSIDERATIONS

Your new HVAC system type depends on the size of the project space. For large facilities it is common to have a central plant that utilizes boilers and water-cooled chillers with hot water and chilled water pipes to distribute the heating and cooling throughout the facility or campus. This will help to keep the loud equipment in one secured and manageable location where the maintenance staff can monitor it and repair the equipment. For smaller buildings or spaces, it might make more sense to have packaged gas-fired equipment and/or an air-cooled cooling device (chiller) to serve the space. A high-efficiency central plant might utilize condensing boilers, or it might be a Co-Gen plant which has gas-fired generators that provide the facility with power and the HVAC system utilizes the waste heat to heat the building(s). For a smaller project, a micro-turbine generator may be used for Co-Gen. A Co-Gen plant can be extremely energy conscious when both the generated power and generated heat can be utilized in the facility. While many facilities do not need waste heat in the summer, by incorporating an absorption water-cooled chiller into the central plant, that waste heat can be used to make chilled water.

The best new HVAC system type for you depends greatly upon the climate zone. In Chicago, we have all four seasons, with plenty of days below zero in the winter and some hot and humid summer conditions above 100°F. Areas with a cold winter will often use gas-fired equipment due to the utility costs. This can be direct or indirect fired equipment to heat air, to heat water, or to generate steam. For climates with a mild winter season, heat pumps and electric heaters might be preferred. For large cooling projects, especially in a hot and dry climate, water-cooled chillers with cooling towers would likely be designed to take advantage of the evaporative cooling effect. For smaller projects, or for other climates, it may be preferred to use a dry cooler which sacrifices energy efficiency for reduced maintenance. If you want the best of both worlds, then perhaps an adiabatic cooling machine is right for you. The adiabatic cooler will operate as a closed-loop dry cooler the majority of the time, but also has a component that will use water to pre-cool the air entering the cooler and boost the unit capacity (and efficiency). This can be an economical first-cost solution, too, because the adiabatic cooler is often physically smaller than a similar capacity dry cooler, and because the dry cooler part is a closed-loop system, this design approach will use a lot less chemical treatment and make-up water to take advantage of the evaporative cooling during those peak cooling days. An air-cooled chiller, dry cooler, or adiabatic cooler will involve a lot less chemical treatment and maintenance cost than a cooling tower or other open system.

HVAC SYSTEM TYPES

Now we're going to take a look at some of the different HVAC system types that can be used in your project. **Natural gas-fired boilers** are commonly used to generate hot water or steam. Unless you plan to use the steam for humidification, sterilization, or another process, then it is recommended to use a hot water boiler. Steam is often more difficult to control which leads to discomfort. Typically, a condensing hot water boiler is recommended to have improved efficiency (above 90% when designed and controlled correctly), and a high degree of control. With variable speed pumping, and a modulating gas-fired condensing boiler, the hot water supply temperature could be reduced down to 100°F or lower, and the flow rate can be reduced as needed to handle those mild heating days. On those sub-zero days, the hot water flow rate is ramped up to full flow, and the temperature is raised, typically above 150°F. With a high-efficiency building envelope and a new condensing hot water boiler system, the building will likely be very comfortable, efficient, and maintainable.

One of the most energy efficient HVAC systems is to utilize **ground-source heat pumps** coupled with a dedicated outdoor air (DOA) handling unit to provide ventilation. The heat pumps are small air conditioning units within the facility that are reversible. They can either cool or heat each zone; the heat pumps use water to transfer the energy to other zones within the building as needed, or into the ground when necessary. The ground source is often a closed-loop array of vertical wells (as much as 500 feet) deep into the ground to absorb or release energy into the earth. Sometimes the pipes are coiled in a pond, lake or river, or are buried in trenches three to six feet underground over a large area. In all cases, the water is pumped through the pipes to exchange energy. A ground-source heat pump is an all-electric system with a high coefficient of performance (COP), so if your goal is to have the facility more green or "carbon neutral," then this may be the best system for you.

One of the latest trends in the HVAC industry is to utilize **variable refrigerant flow (VRF or VRV) systems**. This is often coupled with a dedicated outdoor air handling unit to provide ventilation. There is a water-cooled type that may be coupled with a geothermal well system, and an air-cooled type that can be used even in cold climates. Both air-cooled and water-cooled are high-efficiency systems and will perform similar to a heat pump system but using refrigerant pipe to transfer energy within the facility instead of water. In comparison with the heat pump system type mentioned above, this is quieter as the compressors are located outdoors. The VRF system is also quick to react to changes in building loads, so it is perfect for classrooms and conference rooms where there may be full occupancy for one hour, then vacant for multiple hours. One drawback for this system is that it is not easily expandable. Another drawback is that this type of system is so new that the industry is not very standardized yet, so it is sometimes difficult to have an apple-to-apple comparison between manufacturers that bid on your project. This system is still a contender for high efficiency and can help achieve "carbon neutral" for the facility. It is also rather compact, which can help with retrofit projects that have physical space limitations.

Fan coil units (FCU) might be considered if hot water and chilled water are available. The FCU design approach might use recirculating units along the perimeter of the building, or within the ceiling space. The FCU can be 4-pipe (a separate heating coil and cooling coil) or 2-pipe type (one coil that changes from heating to cooling seasonally). While the 4-pipe system will have more zone controllability (heating or cooling as needed), the 2-pipe system will be much cheaper as it has about half as much piping (insulation, supports, etc). Ventilation air can be ducted to the unit directly from the outdoors, using a DOA, by natural ventilation, or by other means. With direct-drive fans and EC motors, this design solution can be very low maintenance and high efficiency when coupled with a condensing boiler plant and high-efficiency chiller. The system type is a favorite because it is expandable and easy to modify if you want to modify or add more zones in the future. Fan coil units are a simple system concept and simple maintenance.

Single-zone variable air volume packaged rooftop air handling units are a common and very cheap solution, as this type of unit is built to be set in place on a roof curb with packaged controls, often ready to operate. This unit might only last 10 – 15 years, but it is easily replaced, and there are many unit manufacturers that will compete to install their product on your project. This system is a contender for the lowest first cost.

A **packaged variable air volume (VAV) air handling unit** is similar to the single-zone unit indicated above, but it has slightly more sophisticated controls. It is coupled with VAV boxes and can serve multiple zones. The air handling unit could be a packaged RTU with a gas fired section, or it could be located indoors with another heating source like hot water. These units use a VFD to control the speed of the supply fan, or fan array. The unit either has an integral or separate fan for return or exhaust air to help control building pressure. It may incorporate energy recovery as mandated by code, or if desired by the owner, and can have airflow measuring stations to monitor and control ventilation air. This is a common system type that is easy to expand or modify by adding VAV boxes. This system is common and has been around a long time. This means that it is easy to understand, trouble-shoot problems, and maintain. The VAV boxes can have hot water or electric reheat coils or no heating coil. The VAV AHU can be coupled with other systems or system components like chilled beams, fan coil units, fan powered boxes, as well as electric, hot water, or steam perimeter heaters.

Arguably, one of the most comfortable and quiet HVAC systems utilizes **radiant heating** and **radiant cooling** components, typically ceiling panels, but also radiant floors and radiant walls can be designed. These are usually designed to have a high thermal mass by using a material to absorb and store energy, typically water pipes embedded into concrete. One of the drawbacks of this system is that it typically cannot quickly react to changes in load. Also, with the pipes sometimes embedded in concrete, there are expensive costs to repair, replace, or modify the system. Still, a warm floor in winter is very comfortable for a daycare center where kids spend a so much time sitting or crawling on the floor.

Another system that might be considered is a **perimeter induction unit system (PIU)**, or a system consisting of active chilled beams or passive chilled beams. The perimeter induction unit and active chilled beams operate similarly and utilize air from an air handling unit (AHU) to propel additional room air through a coil in the zone to provide additional cooling or heating within the zone. The difference is that the induction unit is floor-mounted and the active chilled beam is a ceiling-mounted device. A passive chilled beam does not have supply air connection and relies on the buoyancy of the heated or cooled air to propel air through the device. Passive chilled beams are far less effective than active chilled beams but have fewer moving components, which leads to less maintenance. These systems each perform well when there are high sensible (dry) cooling loads and require chilled water and hot water. One drawback for these systems is that the building must have some method to control humidity levels to ensure that condensate does not form on the chilled beams or induction units. This usually means that there must be an AHU that is capable of dehumidification and that the building envelope must be tight. It is not recommended to use this system with natural ventilation.

A common unitary HVAC system is the **unit ventilator**. Often used in schools, this fan powered unit located along the room perimeter takes in outside air and provides zone heating and cooling, typically with hot water and chilled water, or a packaged all-electric unit is also available. These often have packaged controls and are relatively low cost, but they do take up some floor space. These systems are usually inexpensive and somewhat quiet, but if there is a noise issue, then it is difficult to resolve because the unit must be near or in the space it serves. One draw-back is that these systems cannot support MERV 14 filters.

With most of the above mentioned systems it is possible to utilize operable windows, or other openings to provide natural ventilation. For many projects it is preferred to have an air handling unit (AHU, RTU, MAU, DOA, etc.) to control the ventilation rate and maintain the building as positive pressure. This is a common practice that helps to make the building more comfortable by limiting infiltration and drafts. In summary, there is a lot of information needed to determine the right HVAC system for your project. Even with all the information, there are still many options to consider when selecting the right HVAC system. To make things a bit easier, I have listed some key questions on the next page and have also listed some HVAC systems that are commonly considered. With any luck, these lists will get you started on your journey to selecting the best HVAC system for your next project. However, if you get stuck or have any additional questions you can always reach out to **Primera Engineers** for help with all your HVAC and mechanical engineering needs.

KEY QUESTIONS TO ASK BEFORE SELECTING YOUR HVAC SYSTEM:

1. What types of rooms are served by the new HVAC system? What is the function of each space?
2. Where is the project?
3. What is the Authority Having Jurisdiction (AHJ)? What is the mechanical code?
4. What is the building occupancy classification (Assembly, Business, Educational, Factory and Industrial, High Hazard, Institutional, Mercantile, Residential, Storage, Utility and Misc.)?
5. Energy Code: ASHRAE 90.1 vs IECC 2018?
6. Does the owner have a published standard?
7. What temperature and humidity are preferred for the occupied spaces? 70°F to 75°F at 50% RH +/-1.5°F?
8. Do any rooms have special temperature or humidity requirements?
9. Do any of the spaces have acoustic requirements?
10. What are the system energy efficiency goals?
11. Is a study desired, with energy modeling and life-cycle cost analysis?
12. How important is reliability? What is the impact if the Heating, Ventilation or Air conditioning stops working?
13. Do you want any system components to have redundancy (N+1)?
14. Do you want the new system to have high efficiency filters, and additional outside air (when possible) or other air purification systems such as ionic purifiers or irradiation?
15. Does the system need to be flexible for future modifications? Or does it need to have the capability to modify the distribution?
16. Does the system need to react quickly to building loads?
17. Is natural ventilation an option? Do you want any windows to be operable?
18. Do you want the heating fuel source to be natural gas, electric or other?
19. Is the project pursuing any certifications such as LEED, BREEAM (Building Research Establishment Environmental Assessment Method), Zero Energy Building, or other?

HVAC SYSTEM TYPES

This list has system options and common combinations of HVAC components:

1. **Heating**
   a. Steam boiler (non-condensing)
   b. Hot water condensing boiler
   c. Hot water non-condensing boiler
   d. Heat pump
   e. Electric heaters: duct heater, baseboard heaters, unit heaters, etc.
   f. Co-Gen (generate electricity and use the waste heat to heat the campus, or facility)
   g. Gas-fired AHU/ RTU
   h. Air-cooled heat pump, VRF/VRV, or similar
   i. Hot water or electric radiant heaters, radiant ceiling panels, or other convectors

2. **Ventilation**
   a. AHU/RTU
   b. Dedicated OA Unit (DOA)/Make-up Air Unit (MAU) coupled with:
      i. fan coil units
      ii. variable refrigerant flow
      iii. heat pumps
      iv. induction units
      v. chilled beams
   c. Unit ventilators
   d. Direct/ducted to the room unit
   e. Natural ventilation

3. **Air Conditioning**
   a. Water-cooled chiller or air-cooled chiller coupled with:
      i. fan coil units
      ii. induction units
      iii. active chilled beams
      iv. passive chilled beams
      v. radiant cooling
   b. Adiabatic cooler coupled with:
      i. Water-cooled VRF
      ii. Water cooled heat pump
   c. Heat pump
      i. Coupled with ground source wells
      ii. Coupled with a cooling tower and small boiler
   d. Variable Refrigerant Flow (VRF)
      i. Air-cooled
      ii. Water-cooled
         1. Coupled with ground source wells
         2. Coupled with a dry cooler or adiabatic cooler and a boiler (if needed)
   e. Window AC units
   f. AHU with VAV boxes
      i. VAV boxes with no reheat
      ii. VAV boxes with electric reheat
      iii. VAV boxes with hot water reheat
   g. AHU with parallel fan powered boxes
      i. Fan powered boxes with no reheat
      ii. Fan powered boxes with electric reheat
      iii. Fan powered boxes with hot water reheat
   h. AHU with series flow fan powered boxes
      i. Fan powered boxes with no reheat
      ii. Fan powered boxes with electric reheat
      iii. Fan powered boxes with hot water reheat

REFERENCES:

- ASHRAE Standard 55
- Recommended Noise Criteria Per Standard ANSI ASA S12.2-2008

ABOUT THE AUTHOR

John Palasz, PE, HFDP
Senior Mechanical Engineer

John Palasz, PE, HFDP is one of Primera's leading Mechanical Project Engineers. His expertise is the result of 20 years of experience in the design of heating, ventilation and air conditioning systems for a variety of project types including education, data centers, high-rise, and institutional facilities. John is ASHRAE certified in Healthcare Facilities Design with a specialization in laboratory and healthcare design, and is a registered Energy Professional with the City of Chicago.