Learn the Pros & Cons of Different

HVAC Equipment Options with Adam Mufich

SPEAKERS
Kendra Seymour, Adam Mufich

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Adam Mufich
00:00
A lot of people compare companies and estimates from different companies. They're looking at it like they're buying a refrigerator from your box store. You know, you have somebody look up Consumer Reports and they'll say, oh, Trane is the best system this year, or Carrier is the best system and the least rated system is this. So they get kind of blinders on based on price and then also based on what brand they're looking at, and they get really worried about what brand they're gonna buy. One thing that you really should consider is brands really don't matter. Most of the parts in the equipment are made by the same manufacturers, and then they're just, you know, packaged to different ways. It doesn't really matter. What really matters is, finding a company and a contractor that knows what they're doing and knows how to properly size and install the system without cutting corners.

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Kendra Seymour
00:54
Welcome to the HVAC plus D mini class series brought to you by Change the Air Foundation. This series is made possible thanks to the generosity of our sponsor, Santa Fe Dehumidifiers. We are deeply grateful for their support, which helps us continue raising awareness and providing free resources so that more families can breathe safe indoor air. A quick reminder, this 12 part mini class ceries offers a consumer friendly overview of common HVAC plus D topics. It is not a replacement for professional advice. You can watch the full series on our YouTube channel or by visiting ChangetheAirFoundation.org, and clicking on our resources tab.

KS
Kendra Seymour
01:50
Welcome to episode six. In this episode, we'll look at the pros and cons of different HVAC equipment. If you've ever had to buy a new system, you know how overwhelming the choices can feel. Should you go with the cheapest option, the most expensive, or something in between. We'll talk about whether brand really matters, clear up common misconceptions and compare different types of equipment, from traditional HVAC systems to mini splits, window units, heat pumps and more. A bit about our guest. HVAC started in Adam's family with his grandpa, Joe, who was the chief engineer at several notable buildings in

Chicago, including the historic Palmer House Hotel. Adam's father, Ralph Mufich, started working for Trane's Comfort Corps in the 1970s. Ralph opened a residential HVAC company in the early 1990s. Adam worked for the family business until the year 2012 when the company was sold. This was the birth of A-Team Heating and Air. A-Team aim to solve their customers comfort issues while delivering the best craftsmanship possible. He holds, or has held certifications with NATE, National Comfort Institute, Geothermal Alliance of Illinois and ACCA. Adam has also been trained by Measure Quick, The Energy Conservatory. Adam is the co-host of the HVAC Overtime and Cooler Heads podcast. He works with the social media team at HVAC School and has written for NCI and other organizations.

KS

Kendra Seymour
03:08
Adam, thank you so much for being here. I'm so excited for people to kind of dive into this topic. So why don't you take it away?

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Adam Mufich
03:16
Sounds good. All right. Very good. So I think the purpose of going through this today is, you know, you guys are doing all these different classes that, and we're at the point where a homeowner is purchasing, or looking into purchasing a new HVAC system, right?

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Adam Mufich
03:16
And what, what they see, usually, this is very typical, something like this, where you have a an estimate with three, maybe four or five different options, and when you get this, this is only the I did, a screenshot just at the very top of an estimate, right? So if you actually would scroll down, it has a lot more verbiage in it. So I think many homeowners would get very confused and they don't know what they're looking at, right? And typically, what I've found in the past is people usually make decisions based on number one price. So they'll look at their budget, and since they don't understand any of this, they'll look at, hey, well, what I could afford the most would be the most budget friendly option. So a good chunk of people would go with the cheapest option, not really understanding what they're buying, right? And then there's another group of people which they always want the best of the best. So no matter what you're offering them, they don't understand what they're getting, but they just, I want to go with the best option there is. And then you'll have another group of people that well, I don't want to buy the cheapest and I don't think I need the best, so I'll just go with something in the middle, and that's usually how decisions are made, in my experience on HVAC.

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Adam Mufich
04:52
So when you're looking at an estimate like this, this is usually kind of how most people feel, and then you'll have a contractor will very quickly explain what the options are. And a lot of times, you end up more

confused after they talk to you than what and you get to the point where you're kind of, you're like, well, just tell me what I need, you know. And that's how most people feel.

AM

Adam Mufich

05:21

So starting off and starting to describe some of these different options that you might be quoted in an HVAC system, I wanted to try to make things relatable. So I want to compare HVAC systems to a car, because that's something that we all use. You know, we're all, we all drive around in a car and that.

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Adam Mufich

05:42

So if we're talking about, if we're talking about either a furnace or an air conditioner or a heat pump, the most basic option you can go with would be a single stage system, right? And the way I'd like to compare it is, it's either on or off. It's full blast, or it's 100% off. So it's either, if you're a car, it's moving zero miles per hour, you're at a stop sign, or it's, it's going 100 miles an hour. That is, it's okay, and that's what a lot of us grew up using, right? But if you have, like, temperatures outside where you don't need a lot of heat, or you don't need a lot of air conditioning, it's you start having weird temperature swings throughout the house. It's less comfortable, it's less efficient, and it just is a it's not as a pleasant experiences that you might want, right? A lot of people you expect your HVAC system when, if you're going to spend 1000s and 1000s of dollars on replacing it, you want to be more comfortable in what you have currently, right?

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Adam Mufich

06:51

Another way I wanted to describe it is so if you if you're changing your shower head, and you go to Home Depot and you buy a shower head right off the shelf. Typically, the a shower head that you're going to buy now is, on average, two and a half gallons per minute of water. So if you take a shower and you know it's two and a half gallons over the span of a minute, you're using the water as you need it as you leather your hair and washing off the soap and that. And that's kind of how you want your HVAC system to function. With a single stage system, if you don't need a lot of heat, it's you're getting it no matter what. So imagine, instead of having that water spread out over the span of a minute, if you dump that two and a half gallons over your head all at one time. It's not going to be a pleasant experience, and it's just not working the way you'd really want it to work, right?

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Adam Mufich

07:48

So then you dive into furnaces, and furnaces, air conditioners and heat pumps that are multi stage. So typically, the most common multi stage you'll see would be a two stage operation. There are exceptions to that. Trane had a three stage furnace. There are Carrier models that have more more stages than two. I think it's a five stage, is what they have. But generally, the most common would be a two stage. So if you're running your car, you're either at a stop sign and you're not moving, or you're moving 60 miles an hour or 100 miles an hour. Now imagine you have to, you know, you're you're in slow, bumper to bumper traffic,

and you can only move at that 60 miles an hour. It's like stop it's it's not a pleasant experience, once again. It's going to be better than going from zero to 100 miles, miles per hour all the time, but it's it's less pleasant than being able to control it as needed, right?

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Adam Mufich
08:49
And then you get to the point where you're looking at variable speed equipment. Meaning, we're talking about inverter compressors, the higher end compressors, and then modulating furnaces. So a variable speed equipment is really load matching. So it's kind of like the accelerator. The harder you push the pedal, the faster it's going to move. So you have a wide range of capacities. And you know, at the bottom of this slide, I pointed out if it's sized correctly using math. The one issue that we run into which I know you're doing another episode on, you know the the ACCA Manuals, Manual, J, S and D. One of the things are all of these, all, every piece of equipment that you purchase has a minimum capacity, so it will ramp down to a minimum setting. So unfortunately, it's not like being at a stop sign. So you're at zero miles an hour, and you could go one or two miles an hour and ramp up. You know, you're in a school zone. You have to go slow. So, you the goal is to size the system correctly. So you have an appropriate system that can ramp down to as low as possible while still being able to meet the max load of the house.

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Adam Mufich
10:08
Now on, even if we're if we're talking about variable speed equipment or even staged equipment, another thing that throws people for a loop is different blower motor types and the most. Currently, there's two different types of motors that are being sold in residential furnaces and air handlers. One is called a constant torque and that's a not generally a nine speed motor. That doesn't mean you have it's going to run and operate at nine different speeds. That just means the installing contractor has the potential of changing those when they commission and set up your system. A constant torque blower motor, all it's doing is maintaining a certain amount of torque, so it's trying to look for back pressure, and it's doing that at all times in this system. So the problem with constant torque is you only have nine fixed speeds to work with, so there's a specific range. They don't, once you have a filter, let's say you have a filter in your system, your air filter, and it starts getting dirty your delivered airflow will actually start reducing as your filter starts loading up. So that could be a problem. And I know a lot of people aren't on a really tight filter changing schedule. So they run into this thing where they're they start reducing their capacity of their equipment and also their efficiency as well. So what I really like to recommend to people is a variable speed blower motor option. And like I said, the variable speed comes with you could have that with a staged system or a variable speed, meaning an inverter or modulating furnace. So a variable speed system is also known as a constant airflow. So what ends up happening with a variable speed blower motor is as that filter starts to load up with dirt, the blower motor senses that, and it starts to spin faster to overcome that restriction. So think of the restrictions in your system, your duct is a restriction. Your filter is a restriction. If you have an evaporator coil on the inside of your house for air conditioning, that's a restriction. So your restriction is like a kink in a hose and a variable speed blower motor does a much better job of overcoming those restrictions to make sure you're delivering the correct amount of airflow at all time and and the reason why I say at the bottom of the slide, airflow is always most important. Airflow is important because airflow, like the water in a hose, is a fluid, and we're trying to move heat, whether it

be moving heat out of the house or moving heat into the house, depending on the season, airflow is the means of transferring heat. So airflow is the most important thing in an HVAC system. We want to make sure we're always maintaining the correct amount of airflow. So it's always, in my opinion, upgrading to a variable speed blower motor at minimum, is it's a really good idea.

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Kendra Seymour
13:24
So with that, like, sometimes people will, they're like, well, I'm going to be gone all day at work, and so then they like, turn the system off, or they turn it really high. What are your thoughts on that?

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Adam Mufich
13:24
So I wanted to talk about a couple of different misconceptions, right? So I found so many different times I talked to different homeowners. I had myself, had my own contracting business. I've been in HVAC for, I don't know, almost 25 years, and a lot of people think they want a bigger system. They get upset if their system shuts off if it's running too long, right? So the the issue that they're thinking is they're spending more money on electricity if it's if it's running too long. But that's really not the case. So any type of appliance is most efficient if it's either on or if it's off. So those are the two most efficient states that you could possibly have. When you're constantly turning it on and off and cycling, that's where you're losing efficiency, right? You have cycle losses in that. And that reminded me, that's why I added the switches. Because when I was a kid growing up, my mom if I would play with the lights and turn them on and off, she's like, that's costing 10 cents every time that you turn it on and off, the light, right? Probably wasn't true. Actually, I'm sure it wasn't true. But that's kind of the point that I'm trying to make here is, you either want it to run or you don't.

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Adam Mufich
14:56
So that's an interesting subject, because I, my opinion, I so I started tracking maybe about five years ago. I had access to a lot of the runtime data of customers that I had, and I would just basically look at charts and graphs of trends of different how people would operate their system, and then how it would function while they're operated in that in that state. And what I found was, specifically, it's more so common that people adjust the temperature at night when they're sleeping. And what I found is, you have a very long off cycle at night because the temperature is, you know your temperature in your house, let's say in the winter time, it's slowly dropping as you because it's cooler outside, so the temperature's slowly falling. And then you get to a certain point where it starts to cycle a little bit. But then in the morning time when you when you're waking up in the morning, and you have the thermostat kick on to your normal setting, the runtime that the furnace has to, you know, you basically have a runtime that's much longer than your typical runtime to overcome that temperature deficit that you're within. I would say, some circumstances it might be more efficient to do that, but a lot of times, you're just, you're shifting your runtime to a different period, it's in the morning versus overnight. The only caveat I would say that that's kind of wouldn't be true, would be, if you're, let's say you're going out of town, or there's a weekend you're going away, or or whatever else, where it's multiple days, then you're going to notice savings, right? Because you're, you're you're you're

keeping your you're maintaining that lower temperature for an extended period of time. But me, I'm and also, depending on what type of system you have, and we'll go over that a little bit, is I'm kind of like a set it and forget it, type of person,

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Adam Mufich

16:55

This is another big one, and I'm sure you're going to talk about this in Manual J and Manual S, but or you already have bigger is always better. And I think that's kind of like the American way, right? Like you look at some of the automobiles go to go back to cars and that around the world, and they have these really small economic cars, or they're or they're using little motorbikes and that to to get around. And then you come to the United States, and we have Tahoes and Escalades and Hummers and all these huge vehicles. So when somebody's buying an HVAC system, they're like, you know what, it was negative 15 here last, last winter. And I want to make sure that I'm warm. So I want you to bump up the size of the furnace, you know, go up one size. And for the AC, let's bump it up again. I want that bigger as well, too. And that's like the worst thing you could possibly do. So what that what ends up happening is you are reducing your run times, and then you, so something happens within any system, heating side is probably not as bad, but whenever you when you're cycling something frequently, you're putting more wear and tear on it. You're shortening in the lifespan. And then when you have a larger system that requires more airflow. And the problem is, typically, I found anywhere I visit, so I travel around and teach airflow throughout the country. And what I found is ductwork is usually undersized almost everywhere. And now, if it's undersized for its current system, when you install a larger system, you need more airflow. And if you, if you if you have more, if you have a system that's requiring more airflow, but you're not delivering that airflow, you're going to tax that system, and you're going to drastically shorten the lifespan of it. So bigger is definitely not better for efficiency, comfort, all around it's not better.

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Adam Mufich

19:02

This is another one. Here's a quote for you. An oversized inverter is the most expensive single stage system that you could install. So going back to what is an inverter? An inverter is a compressor, or you can call it the outdoor unit, cooling, heat pump, whatever it is that's a compressor that ramps up and ramps down. There's a general misconception of heating contractors, which a lot, probably the majority of heating contractors, say you can't oversize an inverter. It's just going to ramp down and it's going to match the capacity. The problem is, like I said earlier, a system is only capable of ramping down a certain amount. So if your minimum, the bigger the system, the less it could ramp down. And if you, if you're installing such a large system, where the majority of the year it's going live at that lower speed and it's never going to ramp up. You're not taking advantage of the full capacity of that system. You always want to you have, like, a capacity window in which it's going to ramp up and ramp down. You want to make sure that you size the system so you could, you're taking advantage of that full window of capacity. A lot of the efficiency of a system when, when manufacturers rate the efficiency, it's usually rated at that higher capacity, where thats at 100% capacity. So it could be operating at a lower efficiency, if it's always operated in a lower level. Another issue is, when we have manufacturers that rate the dehumidification, how much are we dehumidifying in our system? And a lot of those ratings are only based on 100% capacity. So we if it's operating at a lower level all the time, we have an unknown factor. Is it going to work? Maybe, maybe not.

We might be having, you know, we might be maintaining unhealthy humidity conditions within the house if we have an oversized system. And another thing to keep in mind, there is people that will tell you, well, this piece of equipment that I'm installing has a dehumidification mode. Which what a dehumidification mode will do is it will slow down the blower motor in the system to get that evaporator coil really nice and cold so it starts dehumidifying. The problem is, if it's oversized, it's always going to run in that dehumidification mode. And when you're dehumidifying and that blower motor is running slow, it's less efficient. So if you purchase a 20 SEER system and you have inadequate airflow, or it's always running at a lower, lower blower motor setting, that 20 SEER system could be operated in a 15 or 16 SEER. So that's why I'm saying this quote was said by me. I came up with this. But that's honest to God. You can, you could actually test the efficiency of a system, and you will see that if you're running at a lower blower speed, you're you basically wasted money. You might as well buy the least expensive system if you're going to oversize and just buy a single stage at that point.

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Kendra Seymour
22:16
Yeah, and this episode is so important. The one you'd mentioned it a couple times that precedes this is part five, and we actually broke that into 5A and 5B talking about, like, Manual J and all of that. Because the reality is, like, I've been in a home where the system was oversized, and I was like, why is it 72 degrees? It's the temperature I think I want, but the humidity was so high, like doors were sticking and it mean it was creating these problems, like, I don't understand. And once you dig into some of this, the bigger isn't better. And some of this stuff. It's not just, it's efficiency and wear and tear on your machine and health of the home. Is it going to create moisture and microbial issues? So it's, it's not a just pick one and put it in. So I love this.

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Adam Mufich
23:13
Yeah, it's, and that's the thing you hear all everyone say when you're traveling somewhere, you're like, they're like, it's not the heat, it's the humidity. And that's actually, that's the honest to God truth inside of a home as well, too. So if you're able to maintain a healthy and lower humidity level when you're trying to cool a home, you could feel cold at 75 degrees inside your house. You might, you know, there's times where I put on a sweatshirt when I set my thermostat to 75 degrees because I'm maintaining a lower relative humidity inside the house. Yeah, when you do feel you feel sticky, and that's when you you could always tell if somebody, and this, this can go for any homeowner, if you, if you are commonly turning your thermostat down to 69, 68, 67 degrees, and that's the only way you could feel comfortable. I would recommend going to your home depot and trying to buy some type of sensor which measures relative humidity in your home. Yeah, because the the likelihood of you having high humidity in your home, it's, it's pretty, pretty big, right? You're you, and that you're just not going to be comfortable.

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Kendra Seymour
24:23
Yeah, I mean, and I tell this all the time, there are certain tools I think every homeowner should own, and at a minimum, you there's like a $10 hygrometer on like Amazon, I mean, and the there are ones that are

more expensive, that are more precise, but generally they can give you a sense of of what might be going on. It's a good starting point for or a good entry point, I should say, for homeowners and renters. Great tip.

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Adam Mufich
24:44
Yeah, thank you. So this illustration kind of shows typically, this would be, like a super average house in the in the US, probably anywhere really, but if you had, like, a multi story home, and this would be in the winter or the summer, you would notice you would have cooler temperatures in the basement and then in different areas throughout the house. And the higher you get, usually it's going to get warmer. So, and this happens for a couple different reasons, not going to bore you with with the science, but warm air is less dense, so it tends to rise, and cool air is more dense, so it tends to fall and we, we that's, that's kind of what's happening throughout the house,

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Adam Mufich
25:28
But, and there's different ways you could overcome that. If we, if we look at zoning, that's something that a lot of people offer throughout the, you know, throughout the country, and there's different ways to do it. You could zone with multiple systems, and that's kind of like this that's shown in the image here. This would be maybe a first floor and a second floor system, and we would have two different thermostats, and each thermostat, we can control each one of the systems independently. This could be a really nice setup in any house. Usually this would be, you would set this up from new construction. This would be like planned out from the beginning. It would be a lot more costly to do it after the fact. The issue with this would be, it's a lot more expensive, right? You're spending a lot more on ductwork. You're spending a lot more on the equipment, and then you have to maintain the equipment, you know, and then 10, 15, 20 years down the road, you're replacing that equipment. So a lot more cost is involved with this type of setup,

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Kendra Seymour
26:30
Because it's essentially double the machines, right? Like, exactly Each zone has its own duct work and its own machinery and things like that. So you're, you're multiplying that times two.

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Adam Mufich
26:41
Yeah, and it might not. It might sound like a good idea up front, but then once you start looking at you're doubling the the maintenance, and you're doubling the equipment replacement and all that, it starts adding up very quickly.

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Adam Mufich

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And then this illustration, this would be another, another option. This would be zoning with dampers, which there's a lot of people that have never even heard of this. So they make motorized dampers that you would insert into a duct, and you would have multiple thermostats throughout the house, and then, based on what the thermostats are doing, the dampers would open up and close. If you install a zoned system on a let's say you have a single stage or multi stage equipment, you would usually install a bypass damper, which you could see on the left hand side of that illustration. All that's doing is creating a loop of air from the supply side back to the return. And I'm showing you, know, you, if you have a bypass, it's less efficient. And what, what's happening is we're taking a big chunk of the air that should be delivered to the house, and we're just recirculating it. And by doing so, if we're heating, we're taking really hot air and recirculating it, or really cold air. And when you do that, if you look at the the ratings on the equipment, they're rating all the manufacturers ratings are within a certain temperature range, and we're taking it out of that temperature range when we're doing this. So it's like operating in unknown conditions. So that's an issue, and one way to get around that, if we're if we're getting too hot or too cold, because of that, the bypass they they make a sensor that contractors install in the plenum, so if it gets too hot or too cold, we could cycle off the equipment and let it warm up or cool down, and then cycle it back on again. The problem is that gets back to what I was talking about earlier, is short cycling again. So it's it's a less efficient way of doing things.

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Adam Mufich

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But then there's another option, if you go to like an inverter style air conditioning system or heat pump and then or a modulating furnace, the higher end zoning systems have variable dampers, which, instead of opening up all the way or closing all the way, it's looking at how much demand, how much heating or cooling demand is in each one of the zones. So you might have a damper that's fully open and then another damper that's open 25%. So that having a system like that eliminates that bypass damper. But it's this is a generally, it's quite a bit more expensive because you have to go with the higher equipment, and then the dampers and the controls are a little bit more expensive as well, too. But these type of setups would help you even out the temperatures. This is usually solutions to try to equalize the temperatures throughout the house.

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Adam Mufich

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So this is something that a lot of people think a lot of contractors insist on this, right? It is impossible to achieve even temperatures in a multi story house without zoning. And I am here to tell you that is not true. You can! If it's if a system is designed properly and commissioned properly, you can absolutely have even temperatures. I've done it. I've experienced it. My house I'm living in, right.

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Adam Mufich

30:15

So these are some of the things that you're going to have to pay attention to, and the contractor has to be really in tuned to and not all contractors are created equal. And on that note, I wanted to just revisit the that first slide that I if you remember that first slide was like four different options of equipment. One thing I wanted to talk about, which I kind of slipped my mind, is a lot of people compare companies and estimates from different companies. They're looking at it like they're they're buying a refrigerator from your box store. So they say, hey, I have three companies trying to sell me Samsung refrigerators, and they're all different prices. Well, or then you'll find you, you know, you have somebody look up Consumer Reports, and they'll say, oh, Trane is the best system this year, or Carrier is the best system and the least rated system is this. So they get kind of blinders on based on price and then also based on what brand they're looking at, and they get really worried about what brand they're going to buy. One thing that you really should consider is brands really don't matter. Most of the parts in the equipment are made by the same manufacturers, and then they're just, you know, packaged a different way. So you'll have circuit boards made by White Rogers. You'll have gas valves made by Honeywell or White Rogers and different brands have some of the same parts. So it doesn't really matter. What really matters is is finding a company and a contractor that knows what they're doing and knows how to properly size and install a system without cutting corners. You could have two different contractors selling the same system, and one will give you a system that you'll have issues with within the first couple of years, and it will die prematurely, and another one you might install a system that's worry free, and it will last you 20 years because it was installed and commissioned correctly. But yeah, so not all contractors and are created equal, right? And there's a lot of times, there's a reason why they're cheaper. What corners are they cutting? But this is one of the ways that you would even out temperatures in a house you would have proper duct sizing. So the pictures of this, this job is, this is actually one of the last big jobs I did as a contractor before I started working for National Comfort Institute. This house was almost 5000 square foot, and we had ductwork amongst four floors. We had a basement, first floor, second floor and third floor. And the biggest thing that you have to worry about is airflow. So that means you need to size the ducts properly.

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Adam Mufich

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Another big deal is, which a lot of people don't think about, and a lot of contractors will give you bad advice about, is sealing the ductwork. You have to make sure all your ductwork is sealed. That's a big thing in order for you get to get your airflow from point A to point B. So in the Midwest, I would say one of the biggest misconceptions are our our duct work is all generally inside of the house, meaning inside the envelope. And I know, you know, there are people thinking like, hey, what do you mean, that's just normal. That is normal for us. But in different areas of the country, we have ductwork in attics and unconditioned crawl spaces in that, right? So we need to make sure that those can in under every circumstance it's very important to seal duct work. If it's inside the envelope or not, in order for us to get the proper airflow to the right locations.

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Adam Mufich
34:03
And then this is another big one, is insulated ducts. Very important to have high R values if you have ductwork in the attic or a crawl space. But actually, if you start measuring how much heat is being delivered each space, this is a big thing as well, too.

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Adam Mufich
34:21
And then an air balance system. So if you have a hard to heat or cool rooms, I've seen this multiple times where, where homeowners say I want a new system, because it's not working the way I want. My bedroom is hot. Well, I to break to, you know, I hate to break this to people, but, like, your system is probably not the cause of it. Your airflow is. There's dampers on all your ducks, and you need to have a trained professional balance the system in order to fix some of those problems.

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Adam Mufich
34:53
And this just shows getting off on this little tangent here, but this just shows this was that house that I was talking about, that top yellow box, I had data loggers on each one of the floors. This was measured when it was negative two degrees outside, right outside of Chicago. And then you could see all four floors were within two degrees of each other. So you don't necessarily the whole point behind this is you don't necessarily need a zoned system if you do the job well and you have somebody actually commissioning it and setting it up properly.

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Kendra Seymour
35:28
And that's what this whole series is about. We want to get you the right equipment for your home so that you're not having to do all this, you know, problem solving and troubleshooting down the road.

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Adam Mufich
35:38
A lot of the solutions that are sold to homeowners are kind of like, hey, we're just going to we're going to mask the symptom. We're not actually solving the problem.

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Adam Mufich
35:47
Alright, so a couple alternatives for cooling and that I have in this picture. The one on the left is a mini split that's being installed. And mini splits, I like to think of them as kind of like a glorified window unit, right? There's different types that you'll see. There's ones that you would install in a ceiling. This is a high

wall version. And then you'll have, like a low wall type deal. And they have many ducted ones as well, too. But these are used a lot of contractors install these in in rooms that are uncomfortable, where it's hard to fix the issue, or this situation that this was installed was a an addition, so we couldn't get ductwork to the addition. So you install something like this, like a mini split. They're not cheap. I know you could, you know, they have DIY ones in that but yes, they have their place. Then the one on the right is the old fashioned window unit, right, the window shaker, and that would be probably your the lowest cost option for cooling. The problem with both of these options are their point of use, right? So wherever they're installed, that's where you're getting your cooling. And if you have multiple rooms in that, you might not mix air properly,

KS

Kendra Seymour
37:10
Yeah, can we pause here for a moment? Because I think if you could go back to your other slide, I think one of the things that I see a lot in the community, who is dealt with mold and water damage is they want to turn to something like the mini split, because it feels like, well, I can see it if, and I'm not going to have all the problems with like moisture and stuff growing on my coils like I would with maybe a traditional system, and some of the downsides that I don't think people realize is a mini split still needs to be cleaned and maintained, right? And it's it can still, I've seen them with microbial growth, so it's not, it doesn't suddenly become maintenance free, either. And then the one of the trade offs here with mini splits is you are not introducing fresh air from outside, so it's essentially just recycling the air that's already in your home. Am I? Am I understanding that correctly?

AM

Adam Mufich
38:05
Absolutely. Yeah. So I was going to say sorry, the is, as far as maintenance goes to, the maintenance which I have a slide on that what to show you, what it would kind of look like. It's a pain. It's not fun, and if a contractor is doing the maintenance properly, they're going to charge you substantially more than what they would charge you for a conventional system. It's going to cost, easy, double, if not triple, what they're charging for maintenance on a conventional system.

KS

Kendra Seymour
38:34
Yeah, yeah. So all of this is about understanding the pros and cons of like, every option, and then making the best choice for your home and your unique situation. Awesome.

AM

Adam Mufich
38:43
Alright, so this is kind of what you were talking about right the slide on the right, this is the we have, it looks like some sort of microbial growth. It's probably a mixture of that and dirt, but that, a lot of that is stemmed from the picture on the left, that's the filter. So this is what we're we are relying on, as far as trying to filter the air in the space. And the problem is, whenever you have any sort of cold, dark areas that are damp, if you allow dirt to form you, you know, collect in that area. You're giving mold food, and it's

basically the perfect conditions for mold to grow. And the picture on the right, with all that growth, that is not uncommon, that's extremely common in a mini split. So now you have air blowing, blowing all that mold and growth out into your space. So you're, you're spreading that in your house. And you know, if it's you say, okay, well, I'm going to clean that, and you clean it, you'd be surprised how quickly it starts growing back again after it's clean. So it's, these are my. These are, I think they have a place, but these are probably my least favorite option that you can go with.

AM

Adam Mufich
39:52
And this is if you're like, hey, you're set on going with a mini split and you want to see what does a maintenance entail. You have to take the whole thing apart, and then you have to set up this plastic garbage bag looking funnel contraption underneath it, and try to collect water as you're using pressurized water and a soapy solution to spray off all this mold. So you have the potential of damaging paint with your dirty hands as you're taking everything apart. And then imagine if this is over a nice, expensive, whatever, you know, a floor or, you know, you have it over a china cabinet, or kitchen cabinets, or whatever, the technician has to blast all this water and hopefully collect it all in this funnel. It's, it's not fun to do, and it's always nerve wracking, because you're always worried about damaging the customer's home, which is a fairly likely thing that could happen.

KS

Kendra Seymour
41:02
Yeah, yeah. And if you're mold sensitized, whatever is being aerosolized, like there's not negative pressure or containment going, you know, there's, there's a lot to think about. And I'm really glad you're showing this picture, because we tend not to think about, we think about the pre purchase. We think about the installation. Oh, I got to be home because they're going to do it. We tend not to think about what is the next 8, 10, 12, 15, years going to look like as I maintain these different systems. So this is really helpful,

AM

Adam Mufich
41:29
And this is something that's yearly, if not twice a year should be done, and it's it's not fun, and it's not cheap.

AM

Adam Mufich
41:37
So the next thing I wanted to talk about when we when we're thinking about mini splits. And I know this was, we brushed on this a little bit earlier, but there's two types of heat in your house that that, and a lot of homeowners aren't really aware of it. So the first is the picture on the left, which I think that's a nest thermostat that's called sensible heat. So sensible heat is basically the number. So if we if our house is 80, we want to get it to 78 or 75 that's all sensible. It makes sense to me because it's showing me a number on the wall. Sensible Heat's making sense. The the other heat, the invisible heat, is latent heat, and that's moisture removal, and that's the humidity to relative humidity that we were talking about. If it gets too

high, we're uncomfortable, and then we're giving we're creating conditions where you'll have mold and different things that could happen in your house, on drywall and different things. The problem with mini splits are, you'll see a lot of them are really high efficient, right? They have high SEER ratings. So when you have something that's high SEER, they're really bad at dehumidifying. Some of them will have dehumidification modes, but it's a really, it's mostly all sensible. You know, you're you're not doing the best job of dehumidifying.

AM

Adam Mufich
43:02
So now just looking at different heating alternatives, right? So you have a heat pump, and what I've found is heat pumps have become more popular in the Midwest in the last handful of years, and a lot of customers, when you offer them a heat pump, they're like, well, that's great, but what am I going to do to cool my house? Well, a heat pump works kind of like an air conditioner. It heats and cools, right? So one of the benefits of a heat pump is it's better at load matching than if you just installed a gas furnace, and that's because it, it's it has a wider range. It ramps down much lower than a gas furnace is capable of. Another thing is, and this is one of the biggest benefits I see, is it's safer than a combustion appliance. So any type of fuel, oil, propane, natural gas furnace, anything that you're going to burn something in, you have a potential of having carbon monoxide. At National Comfort Institute, we teach technicians, that's one of the classes we train people on is carbon monoxide and combustion safety. And you'd be surprised how many people throughout the country get poisoned on a yearly basis. So this is a huge Pro for over you know, a traditional gas fired furnace. You could take advantage, a lot of people are going with solar panels on their houses these days, right? And if you have a solar panel, or you're considering solar now, you're able to capture that electric energy and use it to heat your house as well, too, because we're using electric to heat and not gas. So this and a heat pump could also be lower operating costs than other alternatives. A lot of times, this usually ends up happening if you have somebody that's on propane or something like that fuel oil, where you have a high operating costs on the gas combustion side.

AM

Adam Mufich
45:03
Some of the cons of a heat pump Are you have a reduced capacity at lower outdoor temperatures. So if you're in an area where it's really cold outside, the colder it gets, a lot of generally speaking, there's different style heat pumps, but generally speaking, the colder it gets, the less heat a heat pump can collect. A lot of times, you're going to need another source of heat, if you live in an area where it's really cold, if you have a heat pump, so you might need an electric backup. You might need a gas furnace backup. So some a lot of times, you're going to need something besides a heat pump to continue to heat your house throughout the winter. When you're comparing a heat pump to a traditional air conditioner, and you're you have an air conditioner now and you're considering a heat pump, there's more that goes into installing a heat pump, as far as the control and the wiring to the unit in that so you treat it usually, and the unit itself costs a little bit more money than a traditional air conditioning system. So it's going to the installed cost is higher. Another thing I talked about commissioning before, when commissioning is basically setting up your system and making sure everything is dialed in perfectly and running the best it possibly can. That's super important for any type of system, across the board, if it's a gas heat, traditional air conditioning, whatever it is, mini split. But if you have a heat pump and you're in a cold climate, that is

so much more crucial, right? It's so important that you set this up properly. So it's important that if you, if you have this installed, you have a reputable contractor that has experience with heat pumps.

AM

Adam Mufich
46:50
So to give you an idea of how these, how these work, you have, when a heat pump is operating in cooling mode, we're grabbing the heat from inside the house, and we're transferring it outside. I'm sure everyone has gone through where you have your traditional air conditioner and you walk outside on a hot summer day and you feel the air blowing across the top, and it's nice. It's really hot air coming out of it that's actually heat that's been collected from inside of your house, and we're discharging it outside. So that's how a heat pump works In cooling mode,

AM

Adam Mufich
47:23
And now in heating mode, basically what's happening is we're reversing the flow of the refrigerant inside of the heat pump, and we're redirecting it. So now what we're doing is we're capturing heat from outside and we're transferring it inside the house. One thing that I think is a really big misconception and understanding is a lot of people think, well, if it's colder outside, how could you be capturing the heat from outside? That's kind of the magic of vapor compression refrigeration. We are, there's heat all the way down to there's measurable heat all the way down to absolute zero, which, if you guys remember from, you know, science class, from high school, whatever, it's around negative 460 degrees outside, there's measurable heat. Just remember, there's no such thing as cold. My wife gets irritated when she tells me, hey, it's cold in here. I'm like, no, it's not, it's less warm than you'd like it to be, but it's not cold. There's no such thing as cold.

KS

Kendra Seymour
48:28
I love that.

AM

Adam Mufich
48:30
So a gas furnace more capacity for extreme temps. So there's just think of it like, more horsepower, right? It's, it's, we have a fire and we're burning it, and we could put out a lot of heat with a gas furnace. If something breaks on a gas furnace, it's a lot easier for a technician to come down into your basement or your attic or whatever and work on it, versus if it's negative 10 degrees outside, sitting out in a foot and a half of snow with gloves on, trying to work on a heat pump, so it could be easier to service in extreme situations. You, with any kind of gas furnace, I have potential. You have a possible lower operating cost in extreme temperatures. So this could be the case. It really depends on a case by case basis. And are you using natural gas or using propane, and how much are you paying for propane? So certain situations, a heat pump will be cheaper than propane all day long, across the board. So it's kind of a case by case and how much you're paying for your utilities.

AM

Adam Mufich

49:36

The cons you have a potential fire hazard. There's a lot of people working on residential heating systems that are not really qualified or not properly trained, and if they don't know what they're doing, they could put your furnace into a state of a dangerous condition where you could potentially have fire inside of your home, right? It is possible. Is probably not super common, but the possibility is there. You have raw flame inside your house. Once again, carbon monoxide is a serious risk. So any burning appliance, if you're not if it's not tuned up properly, you could have the potential risk of carbon monoxide. So that's another thing with a gas furnace that you really need to make sure you you have somebody that's a certified technician, that's a combustion certified technician that is able to use a proper combustion analyzer to measure the byproducts of the combustion in your home, if you have a gas furnace, and could actually tune it up to make sure it's operating in a safe way. The cons are a gas furnace, even if it's a stage system, oversized most of the year. So when you size a furnace, it's only sized for it's correctly sized for the worst case condition. So if your design conditions outside is zero degrees, the only time it sized correctly is when it's zero degrees outside. If it's warmer than that, it's oversized. It's too big for the house, which could lead to temperature swings and uneven conditions and just a less comfortable situation.

AM

Adam Mufich

51:20

So to give you an idea of how gas furnaces work, I know a lot of people have never seen the inner workings of one. This is three different just showing, like, you know, the different sized flames based on this style of furnace that you have installed. But basically what it is is we're blowing a flame inside of a tube or a chamber, and that flame is warming up the outer walls of that tube or the chamber, and then you have air that passes around the outside of the walls of that tube or chamber, and it's warming the air on the hot metal. That's how a gas furnace works. And now, when you have a furnace that fails, you know, you'll I'm sure a lot of people have gone through the thing where they'll have somebody come out and they'll say, my heat exchange, your heat exchanger is cracked or it's rusted. That means there's a breach in your heat exchanger. And the combustion products, the byproducts, are carbon monoxide that's inside of that chamber. That should be contained inside of that chamber could possibly leak out into the airstream of the house, and you could be mixing carbon monoxide in the house.

AM

Adam Mufich

52:27

And this, I think, is the last one I have, is the dual fuel option. So this is kind of my favorite option. This is using a heat pump coupled with a gas furnace. The reason why I say this is my favorite option is, you have the widest range of load matching capability. So you have the you could you have that really tight range on the heat pump side, and then if you live in a really cold climate, you have that added horsepower at the end, when it's zero degrees outside. And you could really match the full range of the house. You could benefit from a reduced operating cost. So a heat pump is most efficient at warmer temperatures. It's still very, very efficient when compared to straight electric heat like electric baseboards are resistant no matter what the outdoor temperature is, is usually more efficient than that, but you can use your heat pump when

it's the most efficient, and then when gas becomes the more efficient option, you switch over to your gas furnace for heating. So you're taking advantage of which is the most efficient option at the outdoor temperature range. And the bonus of having a dual fuel system is if one breaks, you have another way to heat your house. It's a backup heat.

AM

Adam Mufich

53:46

And then the the cons would be your installed cost. It's going to cost more to install. The equipment is more expensive. You need a somebody that's probably trained a little bit more so. There's more components involved, more wiring, just the cost is a little bit higher, and once again, you have that potential risk of carbon monoxide. And a lot of people, I want to touch on one thing, a lot of people think carbon monoxide. When they think of carbon monoxide poisoning, they think of somebody dying of carbon monoxide. You could have long term serious health effects of carbon monoxide. If you have low level exposure, and people can have a low level exposure over years, you could have a source of carbon monoxide in your home. And one thing that they don't realize is you have most of the carbon monoxide detectors or alarms that you buy off the shelf at Home Depot, they are something under it's called UL 2034 certified. So as long as your house maintains less than 70 parts per million carbon monoxide, it will never go off. It will read zero on the alarm indefinitely, forever. And then once you get up to 70, it will sound. So at NCI, we have National Comfort Institute, our trained and certified contractors have access to a low level monitor, which will alarm almost instantly, and it gives you real life updates on what the what the carbon monoxide is your house. It's not just going to show zero all the time because you don't want to have long term exposure and health effects on that.

KS

Kendra Seymour

55:30

Adam, I'm so glad that you brought that up, and you keep reiterating that we actually have a great episode we'll link to in the show notes, and we tackle all of those things that that you just talked about. But maybe you can come back and do a carbon monoxide interview with us, because, like most homeowners, hopefully they have at least the typical carbon monoxide, but you will have to purchase one that's rated for low level exposures, because we've shared stories of people they're having flu like symptoms and just a wide range of things, and they don't realize that it's carbon monoxide. And so when we talk about indoor air quality, whether it's mold, there are other things too that could be at play. So I'm so glad you paused there to kind of elaborate on that, and I think that's gonna be really helpful for people.

AM

Adam Mufich

56:16

Awesome. Thank you. One other thing is, dual fuels have a more complex control strategy, and the company or installing contractor, or whoever's commissioning the system really has to be in tune to how to set it up. It's not kind of like a plug and play type of deal. You really need to understand when you want the heat pump to run and when you want the gas furnace to run.

AM

Adam Mufich

56:40
So I'm not going to dive too much into this, because I saw you had something on filtration in that. But when you get your estimate, a lot of times, you'll have add on things and things to consider right little options that you'll get. The one things I wanted to point out that are most important to me, and I think everyone should consider, is a better filtration system. So you want to look at a media filter. You really want to get away from that one inch filter. Go with something a little bit wider. So that first option on the left is Aprilaire. And I believe they make MERV 11 and Merv 13 filters. The bigger physical size, the better. We want more surface area. You know, if you, if you have a, currently a 16 by 20 filter, if you can get a 20 by 25 in that same space, or even larger, you're going to do a better job of filtering the system. And you're going to have you're taking out one of those restrictions for airflow. The bottom picture is a MERV 16 filter that's made by Dust Free. That's the Dust Free 16, The MERV 16 filter.

AM
Adam Mufich
57:42
And then another thing, we talked a little bit about humidifier, or dehumidification, a lot of people, especially in the Midwest, probably not so much down south, right? But we want to, we want to make sure we're maintaining humidity in the winter. So you might want to consider a humidifier. There's different options for humidifiers you have bypass, power, or steam. The most robust option is a steam humidifier. It's basically changing water directly to water vapor, and, you know, dispersing it throughout your home. So that's a two steam humidifiers on the right. The other thing is dehumidification. This is actually, I know AJ did one or two episodes for you guys, and this is his picture. He he sent me a bunch of different things I was using for something else, and I thought I would use it. It was appropriate to use here. So different. They have whole house dehumidifiers, and that's important. There's a range of humidity that you want to maintain to make sure that you're healthy and that you're not promoting microbial growth throughout your house, right? So we want to make sure winter, we have enough humidification. And, you know, summer and even down south, even in the winter, we want to make sure we have enough dehumidification.

AM
Adam Mufich
58:59
And last, but not least would be ventilation. This picture is a called ERV. It's a energy recovery ventilator. There's all different I don't want to waste a bunch of time going through it, but there's many different way strategies for ventilation. But if we're talking about indoor air quality, I know that's the main focus of what you guys are looking at, the three most important things are filtration, humidity control and ventilation. If you have I would, I would steer clear. I know John Ellis is doing one, and I'm sure he's going to talk all about the other gadgets and gizmos. Those are the three things I would, I would consider installing in my home the rest of it, I'd probably pass on, and that's it.

KS
Kendra Seymour
59:45
Adam, this was wonderful. I learned so much your your pictures were fantastic. And I love how you kind of laid out the the pros and cons of everything, because that's how we have to, you know, approach this and understand the house as a system. So thank you so much for your time today.

AM
Adam Mufich
1:00:03
Awesome. Thanks for having me.

KS
Kendra Seymour
1:00:04
So before we wrap it up, is there any thing you want to mention that maybe forgot to bring up, or a final point you just want to reiterate for listeners?

AM
Adam Mufich
1:00:15
So take your time. I found that the like I said in the beginning, people usually have the wrong reason for choosing equipment. Try to educate yourself, because you're going to feel like you're making a better decision. And you know what you want to do when you're educated on it? I know this video series is going to help. And one thing I wanted to mention, I do work for National Comfort Institute. I work on the curriculum side and on the training side, we train and certified contractors across the country. A lot of the guys that are certified by us are qualified to do this type of work, and would do a great job for you. So that could be a starting point. Try to find somebody that's certified by National Comfort Institute.

KS
Kendra Seymour
1:01:00
What's the website. We'll link to it in the show notes.

AM
Adam Mufich
1:01:00
I believe it is, oh, you're putting me on the spot. I think it's NationalComfortInstitute.com.

KS
Kendra Seymour
1:01:05
Perfect. We'll verify that, but you can just put it in Google. But that's that's really helpful. We always want to give people a starting point with people who have this kind of building science background and

knowledge and are very intentional about why they're doing certain things and not just throwing a system in or selling you an add on, and not thinking about what that means for you six months a year, 10 years down the road. So wonderful for everyone listening, if you found this interview helpful, I don't want you to miss what's to come or if you missed the parts that came before this. It's best to watch the series in order. That is not a requirement, but it's usually helpful. But if you don't want to miss this series as it drops head, on over to ChangetheAirFoundation.org, and sign up for our newsletter, because we'll be sure to send you updates. You can also find this information. It's going to be evergreen. It's gonna be out there. 24/7, 365, we're not taking it down on our website. If you head to our resource tab, you'll see a mini class section, and you can click there and listen to Adam and all the other wonderful presenters that we have for this series. So thank you everyone. So much for listening, and I hope you'll join us for our next episode. Take care.