HEATING & COOLING PROGRAM

CONTRACTOR TRAINING

ieso
Connecting Today.
Powering Tomorrow.

SAVE ON ENERGY
POWER WHAT'S NEXT

Objectives of the Course

WHAT IS THE INTENT OF THIS COURSE?

This course is intended to:

- Provide an overview of some important points and tips regarding the equipment covered by the program
- Dispel some common misconceptions about the technologies
- Be in addition to, and not replace specific installation instructions, or local building codes and standards

Ontario's Plan to Reduce Energy Cost

ONTARIO HEATING AND COOLING CONTRACTORS HAVE A ROLE TO PLAY

Did you know?

- Ontario has a goal to save 8.7 TWh of Electricity by the end of 2020 – this is the equivalent of taking close to one million homes off the grid for a year!
- Contractors have an important role to play to help homeowners to make the right choices for their needs
- Heating and Cooling Program aims to enroll 1500 contractors to save 245 GWh of electricity in 90,000 homes by 2020 – or about enough energy to brew over 20 trillion cups of coffee!

What are the Benefits?

- Contractors participating in delivering the program ensure that the program is practical, and providing benefits to homeowners
- Helping your customers to manage their energy cost and use electricity more effectively is also good for your business

Objectives

WHAT WE HOPE YOU'LL TAKE AWAY FROM THIS MODULE

This segment will present:

- Energy saving equipment covered by the program
- Things to look for in recommending the equipment
- Information to pass along to your customers that will keep them satisfied with the equipment

This module will take about 30 minutes to complete.

Navigation Instructions
from Final On-Line System

Equipment

WHAT EQUIPMENT IS FEATURED IN THIS MODULE?

This module will provide information on four types of equipment:

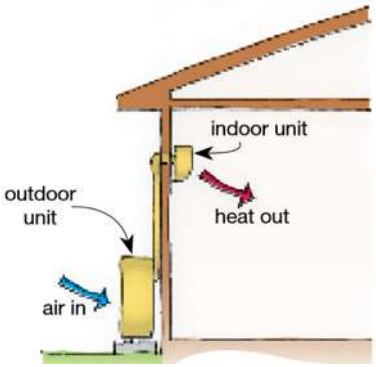
- Central Air Conditioning Units
- Air-Source Heat Pumps
- Electronically Commutated Motor (ECM) Circulator Pumps
- Adaptive or “Smart” Thermostats

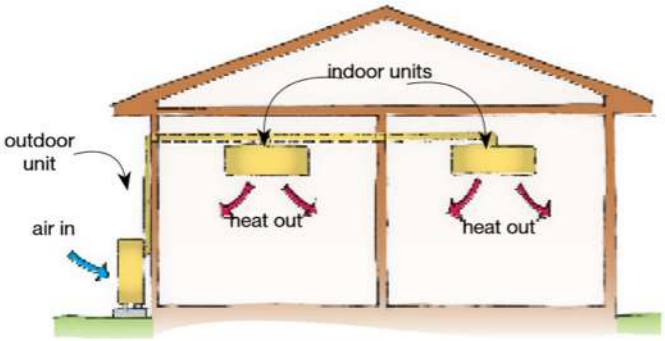
CENTRAL AIR CONDITIONERS & AIR SOURCE HEAT PUMPS

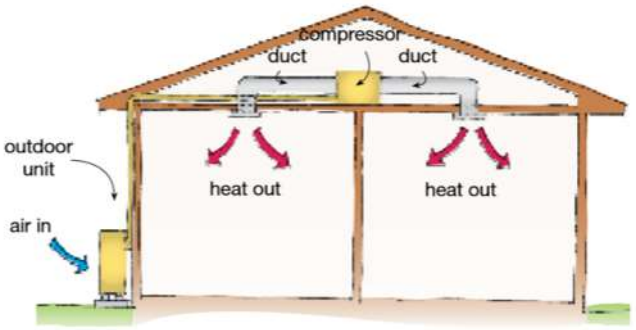
What equipment is eligible?

1 **Central Air Conditioners**
SEER rating ≥ 18 and EER ≥ 13

2 **Air Source Heat Pumps**







A. DUCTLESS

B. DUCTLESS MULTI-PORT

C. DUCTED

Source: https://consumer-nz-assets.s3.amazonaws.com/assets/2065/Good_practice_heat_pump_installation.pdf

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Selecting the Most Efficient Unit

DID YOU KNOW THAT MANY OF THE OLDER METHODS TO CALCULATE LOADS TEND TO OVERSIZE EQUIPMENT?

Right-sizing the system:

Calculate the heat losses and gains by using the following method:

- CSA – Determining the Required Capacity of Residential Space Heating and Cooling Appliances: F280-12 2017

Use heat loss and heat gain information to size heat pumps:

- CSA – Installation of Air Source Heat Pumps and Air Conditioners: C273.5-11

TOOLS AVAILABLE

Selecting the Most Efficient Unit

YOU'LL HAVE TO HELP EDUCATE YOUR CUSTOMERS ON HOW A PROPERLY SIZED SYSTEM RUNS

Homeowners have come to expect systems to cycle, which is what oversized units tend to do.

A properly-sized unit will run longer but more efficiently

- Will run longer, but is quieter than bigger systems
- Will be less humid and more comfortable
- Will be less draughty

Selecting the Most Efficient Unit

RIGHT-SIZING THE SYSTEM

If unit is:	Performance	Effects
Undersized	Operation may be in defrost mode too often **(ASHP Only)**	• System is not delivering heat • System may be blowing out cold air
	Increased duration of operation for less-efficient auxiliary heating **(ASHP Only)**	• Increased heating costs • Reduced efficiency
	System cannot meet the cooling/heating load for the house	• Space is too hot during summer • Space is too cool during winter **(ASHP only)**
Oversized	Increased start-up power use	• Increased running costs • Reduced efficiency
	Short cycling because output exceeds demand	• Too much air movement (draught), even at low fan speed • Increased noise • Undue wear and tear
	Runs at low load too often	• Reduced efficiency

Selecting the Most Efficient Unit

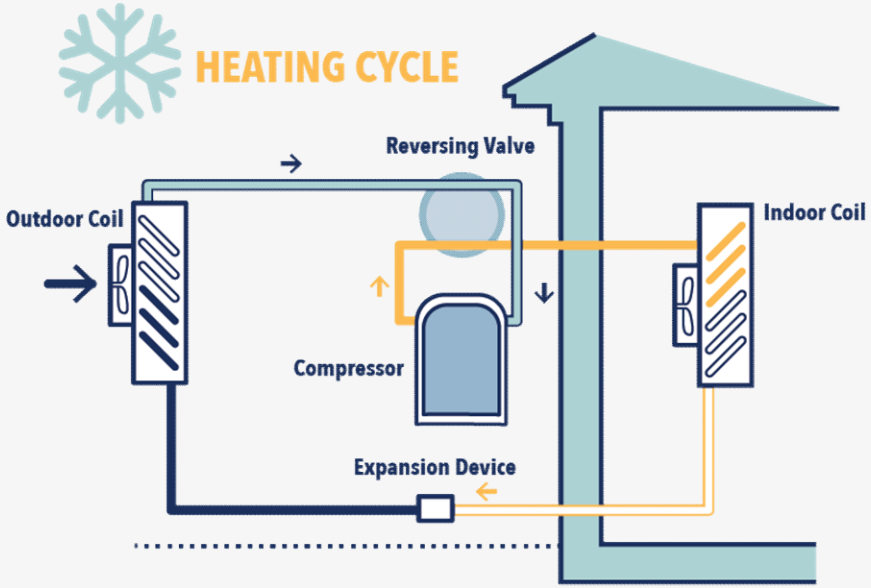
MATCHING COMPONENTS

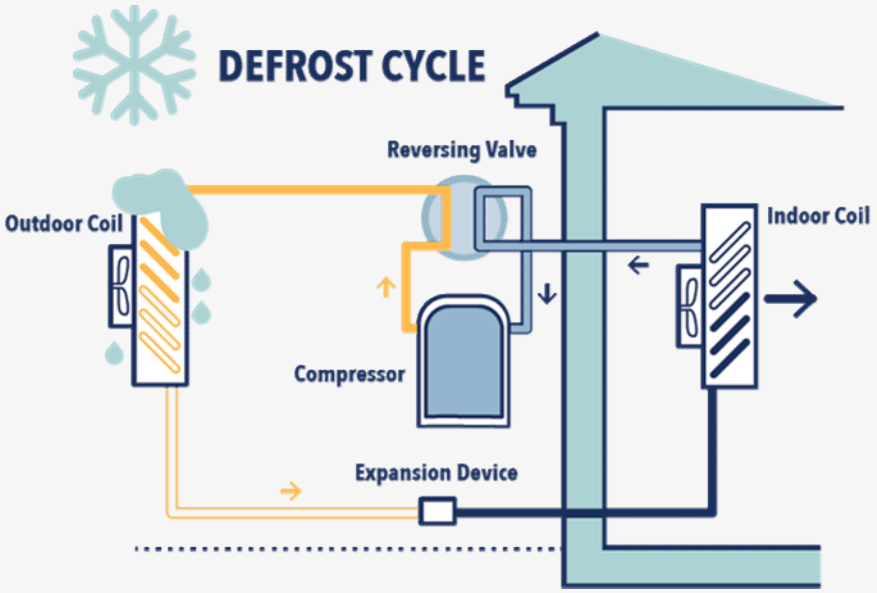
- It's important to ensure that the indoor coil matches the outdoor condensing unit to ensure that the system reaches its rated SEER

- Mismatched coils can lead to premature failure of the compressor, increased operating costs and reduced comfort

Selecting the Most Efficient Unit (ASHP)

DID YOU KNOW THAT ONE OF THE MOST IMPORTANT FACTORS AFFECTING ENERGY EFFICIENCY OF HEAT PUMPS IS HOW WELL THE SYSTEM DEALS WITH FROST BUILD-UP ON THE OUTDOOR UNIT?





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Selecting the Most Efficient Unit (ASHP)

DEFROST CYCLE

1. Can affect energy usage: frost build-up decreases efficiency of outside coil
2. But; unnecessary defrost cycles can also use energy
3. Significant savings: demand defrost uses about **2-4%** of total seasonal energy use, whereas time-temperature accounts for **9-16%**
4. Make sure manufacturer-stated efficiency includes defrost cycle, otherwise it's probably not an accurate indication of efficiency in the field

When Installing an ASHP or CAC

DID YOU KNOW THAT ONE OF THE BIGGEST FACTORS IMPACTING ENERGY EFFICIENCY IS THE AIR-TIGHTNESS OF THE DUCT SYSTEM?

DUCT SEALING

- Leaks in supply ducts cause direct losses in the system's overall capacity and leaks in return ducts often bring unconditioned and unfiltered air into the house from the attic or crawlspace
- All new supply and return ducts must be suitably sealed with a long-lasting sealant to minimize air leakage
- Ducts should be inspected by a technician as part of the annual maintenance

When Installing an ASHP

DID YOU KNOW THAT HEAT PUMPS DELIVER A HIGHER FLOW OF WARM AIR THAN MOST CENTRAL SYSTEMS?

AIR FLOW

- Flow rate is 20% - 30% higher than central forced-air furnace: efficiency deteriorates if airflow is much less than 350 cfm per ton

- Can increase the airflow by cleaning the inside unit evaporator coil or increasing the fan speed, but usually duct modification is required for retrofits

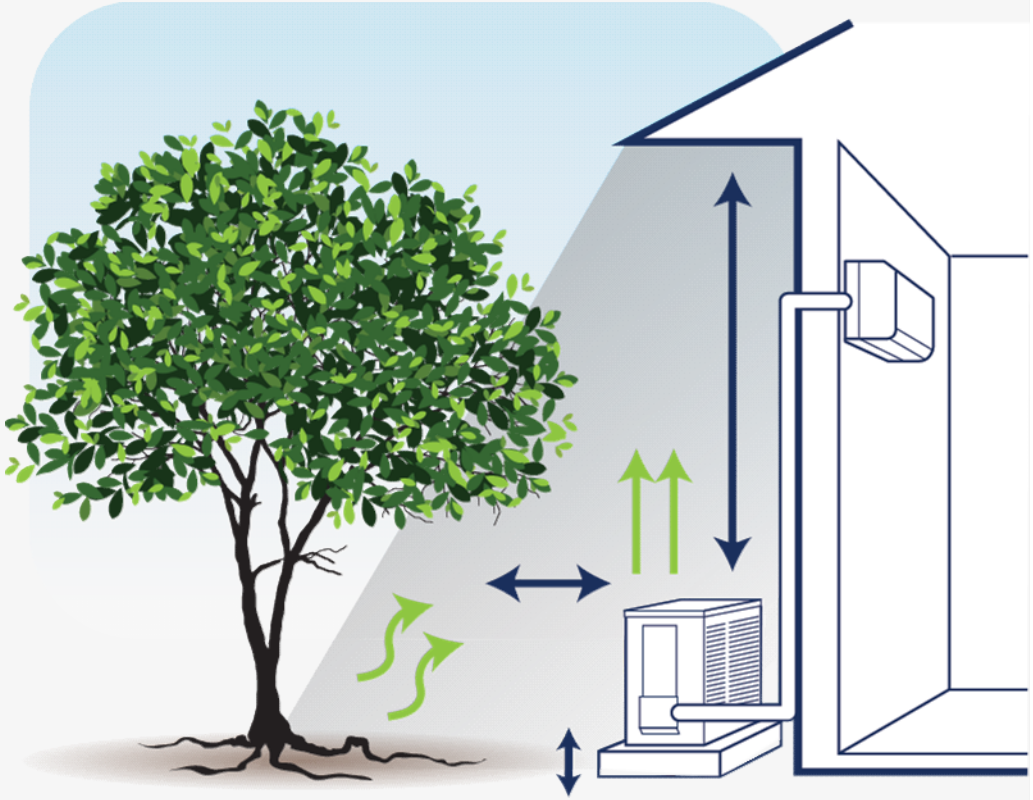
When Installing an ASHP or CAC

EXTERIOR UNIT PLACEMENT

CAC and ASHP

1. The outdoor unit should be kept free of debris, away from fences, walls and other surfaces that could reduce airflow and located in the shade in summer if possible.

2. Outdoor units should be installed above anticipated snow level and away from the dripline of the house



Sources: https://s-media-cache-ak0.pinimg.com/originals/c3/3d/5e/c33d5e1c6fbafb589d2d1c51b9e4db87.jpg, http://chainsawjournal.wpengine.netdna-cdn.com/wp-content/uploads/2016/01/Hayward-HeatPro-Placement-Clearance-diagram-large.jpg

When Installing an ASHP or CAC

EXTERIOR UNIT PLACEMENT

1

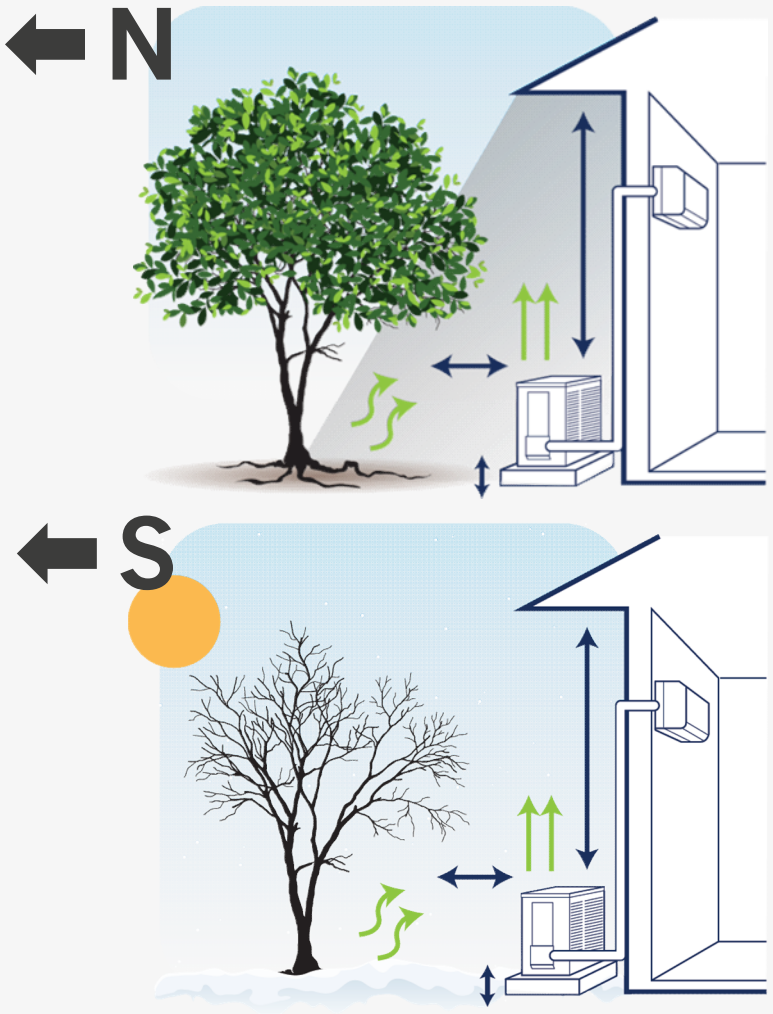
CAC

- Should be located on the NORTH side of the building to **avoid** solar heat gain in the summer.

2

ASHP

- Should be located on the SOUTH side of the building to **take advantage** of solar heat gain in the winter
- Protect from high winds to avoid defrost problems



Sources: https://s-media-cache-ak0.pinimg.com/originals/c3/3d/5e/c33d5e1c6fbafb589d2d1c51b9e4db87.jpg, http://chainsawjournal.wpengine.netdna-cdn.com/wp-content/uploads/2016/01/Hayward-HeatPro-Placement-Clearance-diagram-large.jpg

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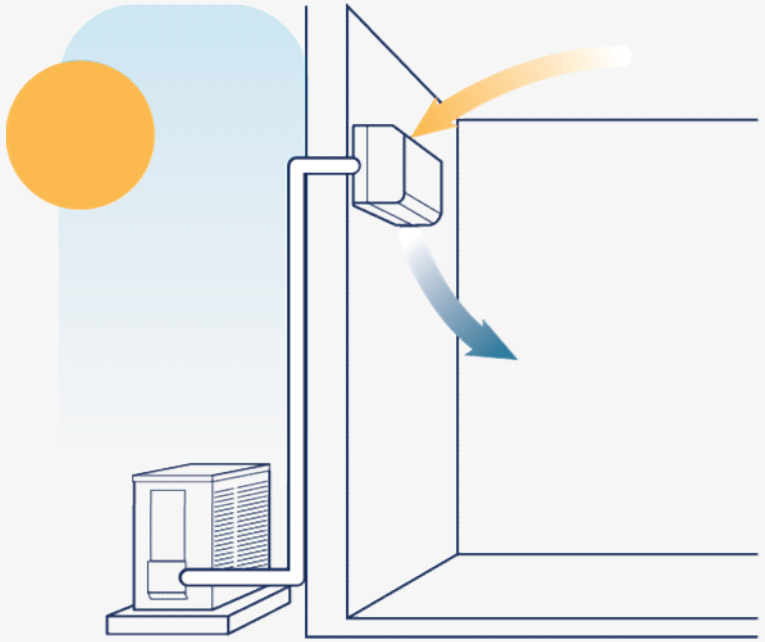
When Installing an ASHP or CAC

INTERIOR UNIT PLACEMENT

- Free of obstacles to airflow, place coil on cold/upstream side of furnace for maximum efficiency

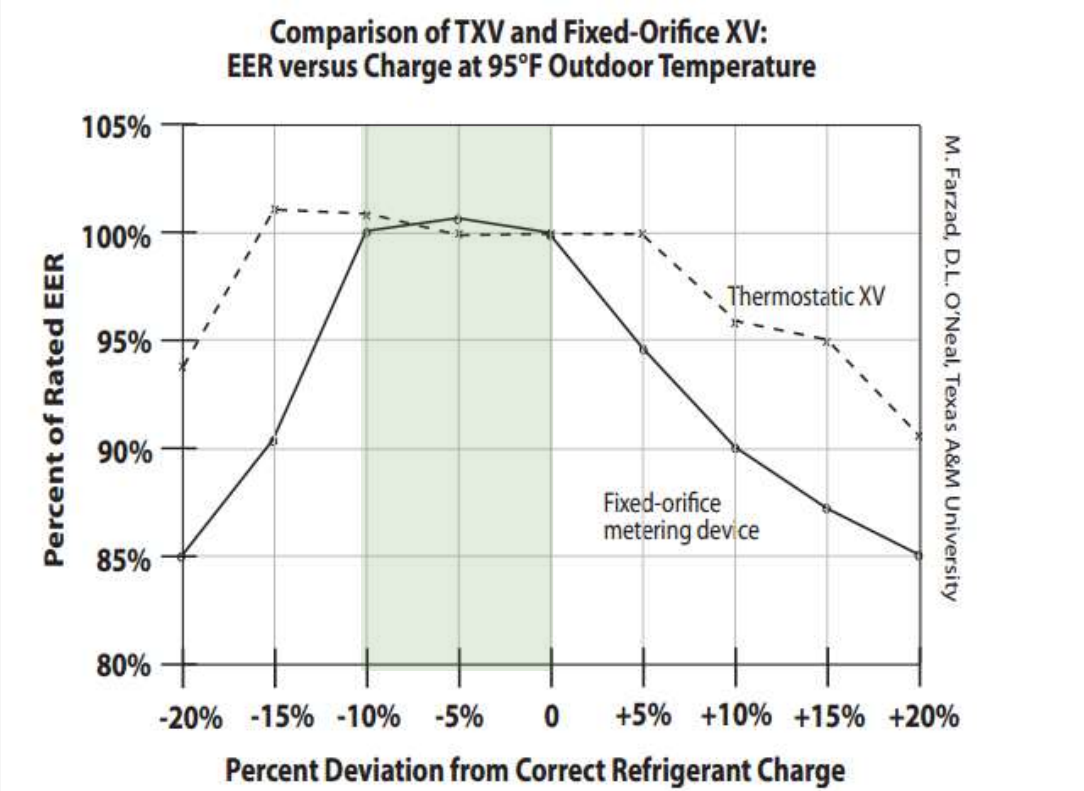
- For ductless-type indoor ASHP units, be aware that installing units close to the ceiling can mean higher return air temperatures, which reduces the overall efficiency



When Installing an ASHP or CAC

REFRIGERANT CHARGING

1. Split-system heat pumps and CACs are charged after they're installed
2. Refrigerant charge testing and adjustment should be done after airflow measurement and after duct testing and sealing
3. During installation, add / withdraw until measured temperatures and pressures match manufacturer specs.



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Operating a CAC or ASHP

Temperature Control

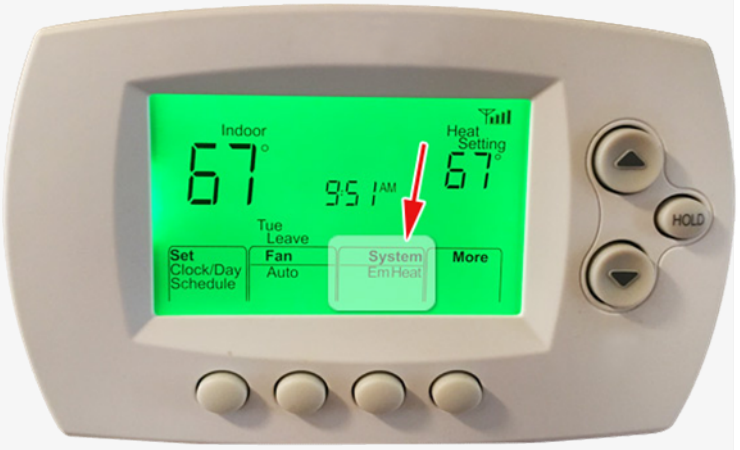
Do:

- ✓ Use temperature setbacks with a CAC to save money
- ✓ Turn off baseboard heaters when ASHP is installed (only use if necessary, and turn them off when it gets warmer again)
- ✓ Set fan to auto (not 'on') to reduce potential mould issues

Don't:

- ✗ Use temperature setbacks with an ASHP; this will NOT likely save money
- ✗ Set ASHP thermostat to 'Emergency Heat' during the heating season

NOT RECOMMENDED



Sourceshttp://www.allaroundhomeair.com/blog-emergency-heat.html

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Maintenance of a CAC or ASHP

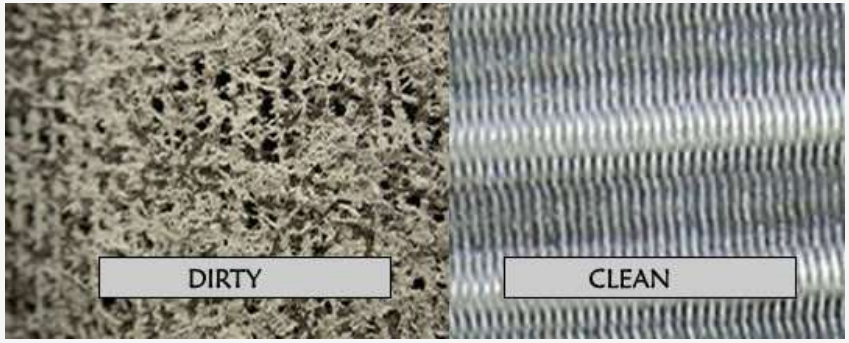
To ensure the system runs as efficiently as possible, a technician should perform the following services on an annual basis:

- ✓ Verify correct refrigerant charge and check for refrigerant leaks
- ✓ Inspect and seal duct leakage
- ✓ Verify electric control and make sure that the heating system and cooling system cannot operate simultaneously
- ✓ Measure air flow through the system
- ✓ Inspect electric terminals, and, if necessary, clean and tighten connections, and apply nonconductive coating
- ✓ Lubricate motors, and inspect belts for tightness and wear
- ✓ Verify correct thermostat operation

Maintenance of a CAC or ASHP

Maintenance

- Regular maintenance can save 10% to 25% of energy per year
- Change filters on a regular basis, as recommended by the manufacturer
- Clean coils regularly



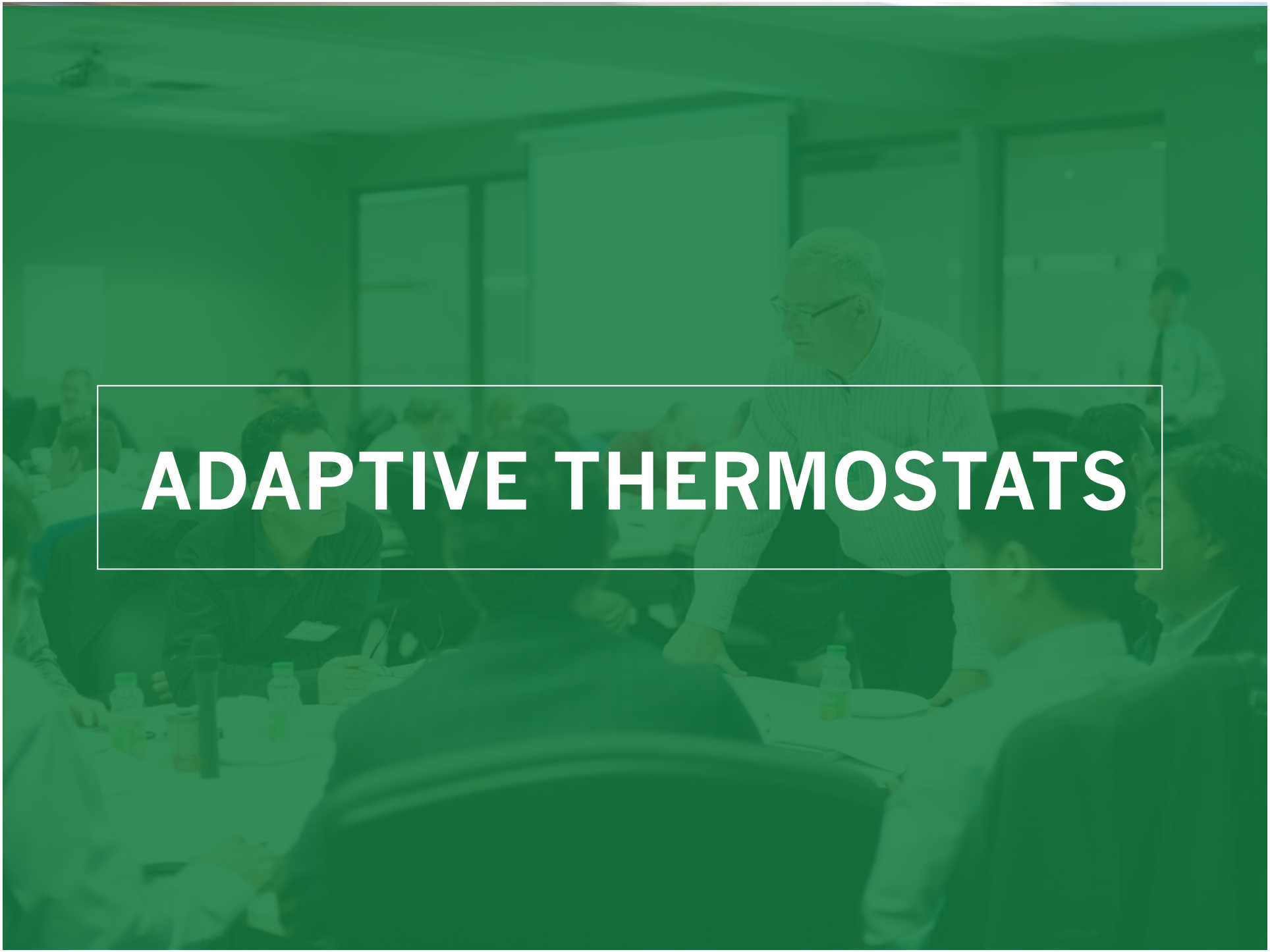
Be sure to tell your customers…

1. Let your customers know that equipment running for long periods of time is a good thing – this means it is sized properly!
2. Plant some deciduous trees and shrubs around the outdoor unit to provide shade in the summer for better performance.
3. Indoor units should be installed in areas free of obstacles so that air can move freely.
4. Filters should be cleaned and/or changed on a regular basis to ensure adequate air flow and indoor air quality.
5. Set the fan to “auto” to achieve maximum energy savings.

Be sure to tell your customers…

For Air Source Heat Pumps Only…

1. Avoid setting the thermostat back at night or when you're gone for the day – with most thermostats, this strategy is not likely to save your customers money.
2. If your customers currently use a stand alone dehumidifier in the cooling season, they can probably get rid of it once they have their new ASHP (and save even more energy!).
3. To save money, select a unit with demand defrost instead of time temperature defrost.
4. Turn off the baseboard heaters when the unit is installed and only turn them on in times of extreme cold. Remember to turn them back off once the outdoor temperature begins to rise!
5. The 'Emergency Heat' feature on the heat pump thermostat should only be used when there is truly a need for 'emergency heating', such as a broken ASHP.


ADAPTIVE THERMOSTATS

Adaptive Thermostats

DID YOU KNOW THAT NOT ALL EQUIPMENT AND HOMES WILL BENEFIT EQUALLY FROM ADAPTIVE THERMOSTAT FEATURES?

Image: http://thewirecutter.com/reviews/the-best-thermostat/

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Selecting Adaptive Thermostats

When to Choose an Adaptive Thermostat

- ✓ Forced-air electric furnaces
- ✓ Central air conditioning units
- ✓ Occupancy habits vary from day-to-day, week-to-week, month-to-month
- ✓ Customers interested in their HVAC data and monitoring their energy usage

When an Adaptive Thermostat May Not be the Best Option

- ✗ Properly-sized heat pumps should generally operate using a fixed set-point, set-backs may not be effective for energy savings
- ✗ If occupancy habits are constant (home is generally occupied), set-back features may not be used
- ✗ Set-backs may be useful for comfort reasons, if not for energy efficiency reasons

In either case, select an Adaptive Thermostat with a web-based user interface. Increased connectivity and communication will probably lead to increased participation, which has been shown to help reduce energy consumption.

Selecting Adaptive Thermostats

When making recommendations, ask questions on how the customer uses their home / equipment – such as:

- When are they at home the most?
- Is their routine predictable?
- How many people live in the home?
- Do they use temperature setbacks at night or during the day?
- Do they use a computer / smart phone to track usage or operate other home functions?
- Have they ever used a programmable or adaptive thermostat before?

Operating Adaptive Thermostats

TEMPERATURE SETTINGS

Did you know that lowering temperature settings by 1°C (2°F) over an 8 hour period can save roughly 2% of a homes annual heating energy use?

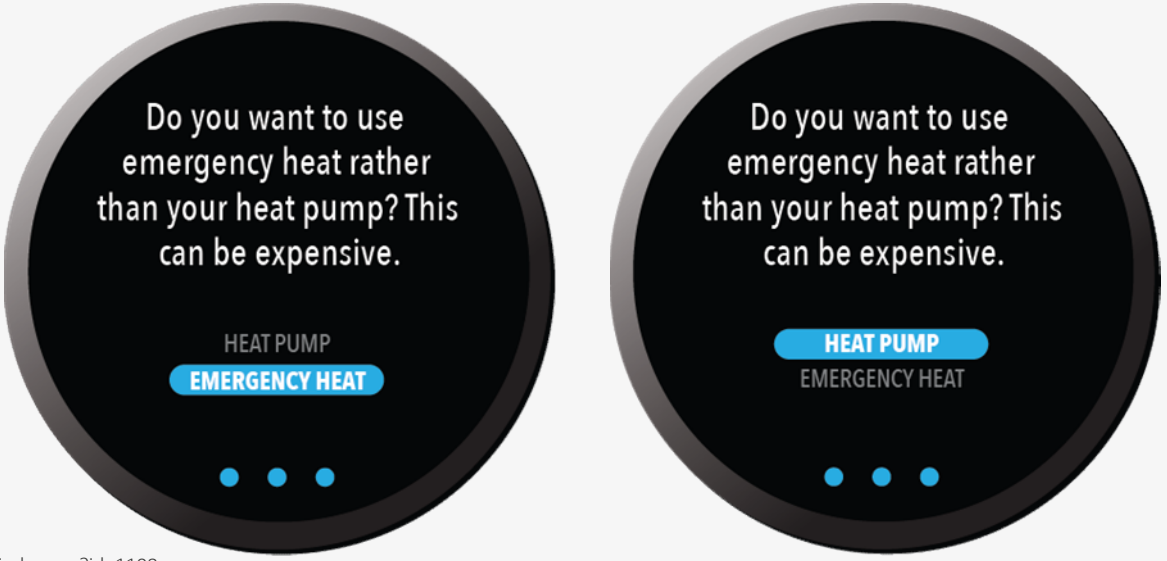
1. Adaptive thermostats are designed to overcome a certain degree of human forgetfulness relative to programmable thermostats, as these systems are designed to be responsive to human behavior
2. Temperatures can be set-back when occupants are away for at least 3 hours or more, but setbacks are most beneficial when they are set for a longer time period
3. Unadvisable to set temperatures below 17 deg.c (63 deg. F) to avoid potential condensation/mold issues on outside walls
4. Care needs to be taken if operating Adaptive Thermostat with a heat pump (see heat-pump section for temperature settings)
5. The fan setting should always be set to 'auto' as opposed to 'on'

Operating Adaptive Thermostats

AUX HEAT LOCK-OUT TEMPERATURE CONTROL FOR HEAT PUMPS

- Install an Adaptive Thermostat with Aux Heat Lock-Out Temperature Control to prevent the more expensive auxiliary heating system from operating when it's not needed

- Setting the lockout temperature on the thermostat will only enable the auxiliary heat to turn on if indoor temperatures drop below this setting



Sources: http://www.gokeeprite.com/go/index.asp?id=1108

Operating Adaptive Thermostats

- The Heat Pump Balance setting on certain Adaptive Thermostats will allow the customer to prioritize savings, comfort, or balance.
  - **MAX SAVINGS:** Will take longer but uses less energy
  - **MAX COMFORT:** Will take less time, but uses more energy
  - **BALANCED:** In between Max Comfort and Max Savings

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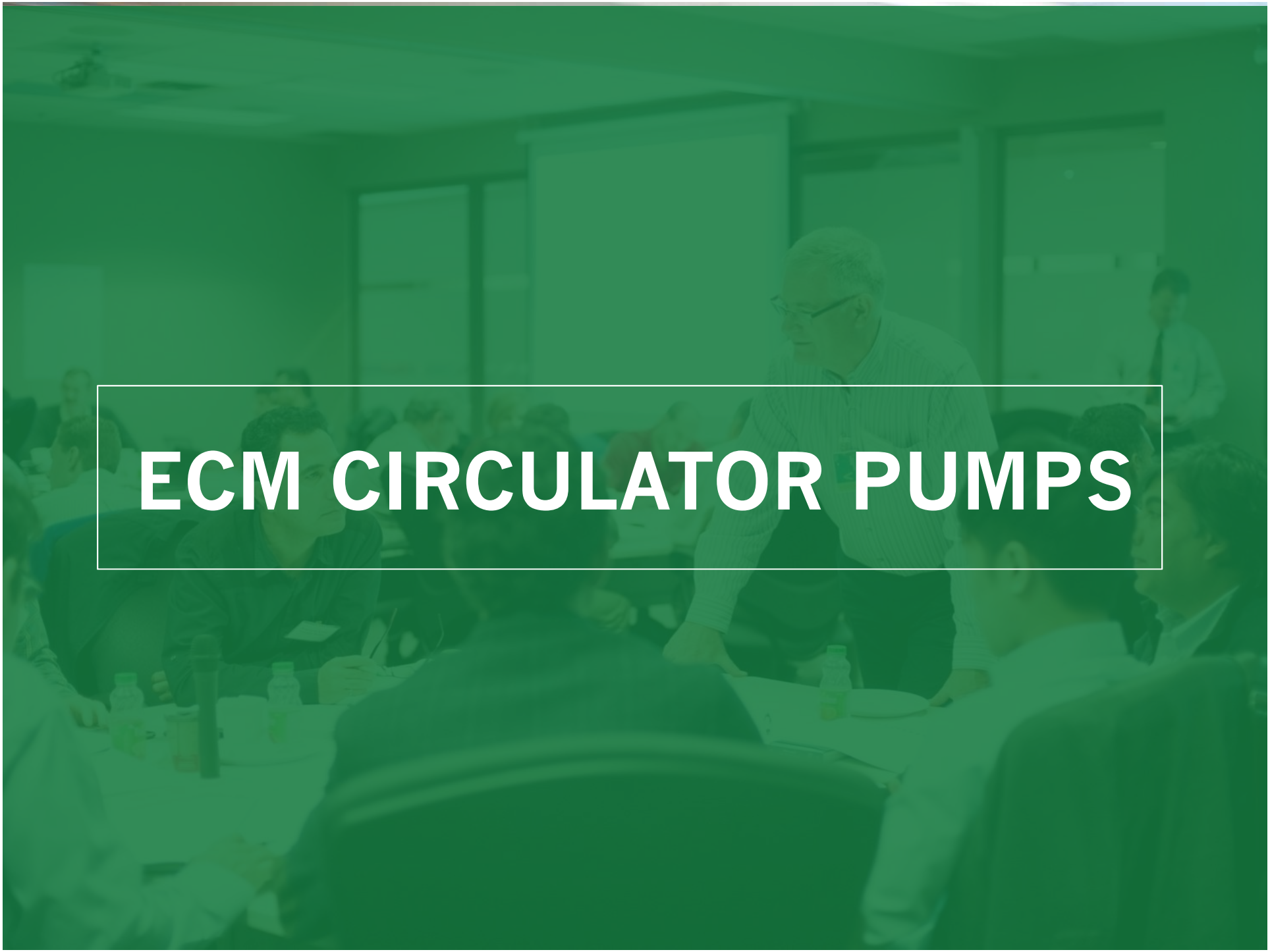
Be Sure to Tell Your Customers…

1. An Adaptive or “Smart” Thermostat with wi-fi technology will increase connectivity and communication, and can lead to increased participation and even more energy savings.
2. Energy-saving temperature settings for CACs and furnaces should be set for at least three hours, such as during the day when occupants are gone, or at night when occupants are asleep.
3. Adaptive thermostats are best used for CACs and furnaces – if used with heat pump equipment, the energy savings may not be as significant.
4. Install an Adaptive Thermostat with Aux Heat Lock-Out Temperature Control to prevent the more expensive auxiliary heating system from operating when it’s not needed.
5. A Common wire may need to be installed in their home to provide AC (alternating current) power to the adaptive thermostat.
6. Ensure that the fan setting is set to ‘auto’ and not ‘on’ to save energy.


ECM CIRCULATOR PUMPS

ECM Circulator Pumps

DID YOU KNOW THAT ECMS CAN SAVE UP TO 80% OF ELECTRICITY WHEN COMPARED TO THAT USED BY TRADITIONALLY USED PSC MOTORS?

Unit Selection and Installation

Universal Hydronics Formula:

$$GPM = BTUH \div (\Delta T \times 500)$$

Delta-T: fixes temperature differential so that speed (GPM) varies to meet BTUH demand

Delta-P: fixes pressure differential (hence regulating GPM), best for systems that use Thermostatic Radiator Valves

Unit Selection and Installation

THINGS TO LOOK OUT FOR:

- Circulator pumps are commonly oversized - be sure to size the new pump according to the specific requirements and piping sizes and losses of the job site

- Circulator pumps are easy to install, but need to be properly set-up and programmed in accordance with the manufacturer's specific procedure

- An Application for Inspection is not required when the replacement motor is specified in their certification records as acceptable alternatives for the motors they are replacing. If this is not specified, an Application for Inspection will need to be filed with the Electrical Safety Authority, in accordance with the Ontario Electrical Safety Code

Be Sure to Tell Your Customers...

1. Reducing operating speeds of the pump can reduce wear due to high velocity and increases the life of the system components, including boiler performance; especially if the original pump was badly oversized.

2. Ensure that, upon installation of an ECM circulator pump, automated controls are selected to ensure optimal efficiency.

3. Ensure that the selected ECM circulator pump is specified by the Electrical Safety Authority as an acceptable alternative for the motor it is replacing.

Thank You!

Thank you for participating in the Heating and Cooling Incentive Program Contractor Training.