

## Before You Start an Energy-Efficient Retrofit—Mechanical Systems

One of the best ways to make your home more comfortable, healthier and less expensive to operate is to upgrade the heating, cooling and ventilation systems.

Energy-efficient equipment upgrades can be expensive, but can be offset by lower operating costs.

Before you decide to upgrade mechanical equipment, it's also critical to understand how the overall performance of the house will be affected. Keep in mind that your lifestyle, the number of occupants, their age, the climate and the insulation levels of the house all have an impact on the performance of mechanical systems. This type of upgrade will require professionals to do it right and to avoid causing other problems in the house. It's important to weigh the benefits against the costs.

### HEALTHY HOUSING™

Renovating is an ideal time to make your house healthier for you, the community and the environment. When upgrading your mechanical systems to increase their efficiency, be sure to consider:

- **Occupant health**—venting strategy for combustion appliances, adequate ventilation for occupants, addition of air filtration.
- **Energy efficiency**—energy-efficient appliances, high efficiency motors for fans and furnaces.
- **Resource efficiency**—upgraded insulation and draft proofing to reduce heating needs and allow installation of a smaller heating system.
- **Environmental responsibility**—energy-efficient appliances to reduce the home's environmental impact.
- **Affordability**—energy-efficient fixtures to reduce ongoing operating costs.

### COMMON SITUATIONS

All equipment has an optimal life span. Older furnaces and boilers may need replacing simply because they have outlived their useful life, or because they may not have been regularly serviced.

If you have noticed a sudden change in fuel bills, it may be because you have started using the house

differently—perhaps the temperature settings have been increased because a new child has entered your life or an elderly person has moved in.

Older homes often have areas that are cold because of poorly laid out heating and mechanical systems.

Perhaps you are undertaking other renovation work that requires some adjustments to your present mechanical systems. In this case, you can also consider upgrading your mechanical equipment to take advantage of new, more efficient products. This may also be an opportunity to install a proper ventilation system where one does not exist.

It is important to note that mechanical systems must not change the balance between the air pressure inside and outside the house—since high pressure differences can lead to combustion spillage problems from furnaces, hot water heaters or fireplaces. If there are no fuel burning appliances of any kind in the house, then this is not a significant issue.

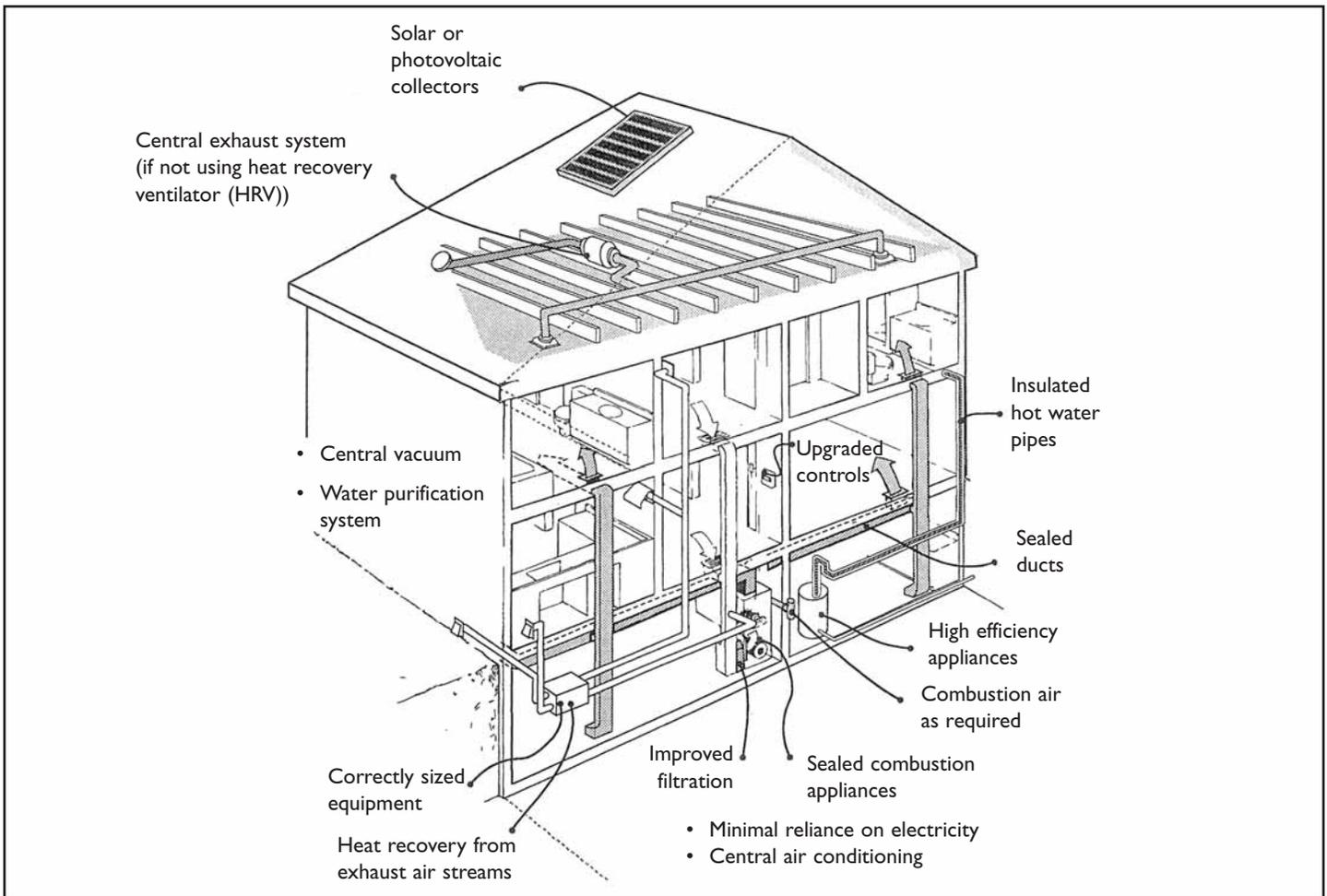


Figure 1

### HOUSE AS A SYSTEM

A house is much more than just four walls and a roof—it's an interactive system made up of many components including the basic structure, heating, ventilating and air conditioning (HVAC) equipment, the external environment and the occupants. Each component influences the performance of the entire system. A renovation provides an opportunity to improve how your house performs.

Energy-efficient mechanical systems such as gas furnaces, usually have a sealed combustion chamber that isolates the flue gases from the house. Direct vent gas fireplaces can be a decorative heat source too, while not compromising the indoor air quality. New appliances may require special provisions for make-up air if the combustion appliances are not the “sealed combustion” or “induced draft” type.

### AVOID SURPRISES

Knowing the properties and operating characteristics of your heating system will help you to determine the changes you may want to consider.

You will want to hire a professional heating contractor to make changes in the mechanical systems. Thinking about what changes you'd like to make or anticipating problems ahead of time will help the heating contractor address the shortcomings of your home's system. Here are some of the likely situations that people encounter.

## ASK YOURSELF . . .

- How old is the furnace or boiler? Is it more than 15 years old?
- When was the last maintenance service done?

CONSIDER YOUR  
OPTIONS . . .

- Replace the furnace, depending on its age and condition. Furnaces typically last 15 to 20 years, while boilers may last up to 40 years if maintained correctly.
- Older furnaces have very inefficient motors and the heat exchangers are not as efficient at extracting heat compared with newer furnaces. Hot water based heating systems may have inefficient boilers and pumps. New equipment is much more energy-efficient than the older equipment likely to be in your home.
- Have your heating system maintained regularly to keep it operating safely and efficiently. Filters must be cleaned or replaced regularly. Combustion system components must be maintained as outlined in user manuals.
- Choose more energy-efficient appliances that may make it possible to eliminate existing chimneys. This is worth considering if the chimney is located on an exterior wall or mostly outside. These types of chimneys can contribute to backdrafting of combustion gases.
- Many existing furnaces are oversized. Choosing a new properly sized furnace can lead to a smaller, less expensive furnace and possible gains in efficiency.

## . . . AND IF YOU DON'T

- Inadequate maintenance will mean a shorter life span for the equipment and can lead to premature failure, incomplete combustion of fuels and backdrafting of combustion gasses. Clogged filters and flues are a fire hazard. Cracked heat exchangers allow combustion gases into the home's air.
- Newer, combustion-fuelled, energy-efficient equipment requires venting and combustion air supply directly to the unit. This may also have an impact on the overall environment within the house.
- Many new furnaces, because they are significantly more efficient, may require some modifications to the original heating ducts.
- If only one appliance is upgraded and removed from a flue, then there may have to be modifications made to the chimney so that the remaining appliance is vented correctly.

### ASK YOURSELF . . .

- Is the house warm enough?
- Is it easy to keep the house at a uniform temperature?

### CONSIDER YOUR OPTIONS . . .

- Replace old thermostats with programmable models. New thermostats that can automatically setback temperature settings can result in energy savings.
- Improve cold air returns to increase the capacity of the system to deliver adequate airflows.
- Consider draft proofing and insulation upgrades to reduce the heating load.
- Choose a new, more efficient heater that will likely be much smaller.

### . . . AND IF YOU DON'T

- The furnace may operate inefficiently. Furnaces that frequently turn on and off (excessive cycling) can deteriorate prematurely, along with the flue. This may happen if your furnace is oversized.

- Are there areas that are difficult to keep warm?

- Check to make sure that dampers and valves are open and registers and cold air returns are not blocked by furniture. It may be necessary to install balancing dampers to divert heat away from areas that receive too much heat to rooms that are too cool.
- Upgrade or replace circulation pumps in hydronic heating systems with individual zones.
- Install pumps or fans in older gravity systems.

- Prolonged periods of low temperatures will create uncomfortable conditions. There will also be increased relative humidity in those areas, so that condensation may take place on cold surfaces. Wet surfaces are ideal for mold and fungus growth, compromising indoor air quality.
- Warm air ducts that run through unheated spaces need to be sealed with duct sealers and insulated; hot water pipes need to be insulated.

- Is there enough fresh air in the house?
- Do smells linger? If you burn breakfast toast, can you still smell it at lunch time?

- Install a proper mechanical ventilation system to provide adequate air exchange. The system must have a fan capable of operation for long periods. This may mean a fan that runs continuously or at least for many hours per day. Opening windows does not provide adequate air exchange, even if weather conditions are satisfactory.

- Poor indoor air quality can compromise health. If those smells are a result of combustion, such as lingering smells from a fireplace, wood or oil stove, then it may mean that the appliances are not operating properly and may be a health and safety risk.

## ASK YOURSELF . . .

CONSIDER YOUR  
OPTIONS . . .

## . . . AND IF YOU DON'T

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- Choose a heat recovery ventilator to provide controlled, fresh air, while conserving heat in the winter for optimum energy efficiency.
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| <ul style="list-style-type: none"> <li>■ Would it make sense to switch to natural gas?</li> <li>■ How hard will it be to install the new fuel service?</li> </ul> | <ul style="list-style-type: none"> <li>■ Consider whether you will really save money by switching fuels. Your heater must convert the fuel energy efficiently to save you money.</li> <li>■ Consider maintenance costs.</li> <li>■ Factor in the cost and inconvenience of switching fuel. If you switch from electricity or oil to natural gas, you will need to install a natural gas feed from the service to the house. This will mean digging a trench. If there are extensive rock outcroppings or large hard surfaces in the yard, it may add to the cost of installation.</li> </ul> | <ul style="list-style-type: none"> <li>■ In most cases, there will be a limited range of upgrading options and you will likely remain with the fuel you are now using. Fuel choice should be made on the basis of availability, fuel and installation cost and availability of service tradespeople to install and maintain the equipment.</li> <li>■ If fuel switching is not possible or appropriate, using more efficient equipment or tuning the existing system can still improve energy efficiency.</li> </ul> |
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| <ul style="list-style-type: none"> <li>■ Will the planned renovation affect the mechanical systems?</li> </ul> | <ul style="list-style-type: none"> <li>■ Consult a professional heating contractor or consultant. If you are doing extensive remodeling, it is usually an opportunity to address any shortcomings that may exist in your present system. Elements of the mechanical system may also be more accessible during the renovation.</li> </ul> | <ul style="list-style-type: none"> <li>■ If air sealing, window replacement and insulation upgrades are part of the work, combustion appliances in the house may need make-up air to minimize pressure imbalances.</li> <li>■ Central vacuums exhausting to the outside, as well as dryers and range hoods, depressurize the house and must be considered in the overall pressure balance of the house.</li> </ul> |
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|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>■ Is there a constant shortage of hot water?</li> </ul> | <ul style="list-style-type: none"> <li>■ Have the hot water system checked by a professional plumbing contractor. Hot water shortages may occur from a change in lifestyle, number of persons in the house, low temperature setting or problems with the heating elements.</li> </ul> | <ul style="list-style-type: none"> <li>■ If temperature settings are too low, conditions are appropriate for bacterial growth that could compromise health.</li> <li>■ Lack of adequate hot water is unpleasant.</li> </ul> |
|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

ASK YOURSELF . . .

CONSIDER YOUR  
OPTIONS . . .

. . . AND IF YOU DON'T

- Upgrade the hot water system to meet increased needs. Insulate any hot water pipes that run through an uninsulated or poorly insulated part of the house.
- Relocate the water heater if it is a long distance from most of the bathrooms and kitchen.

■ Is it time to consider an air conditioner?

- Upgrade insulation, air sealing and exterior shading devices to reduce overheating. Renovations are a great opportunity to install these effective passive cooling elements.
- Consider upgrading or installing an air conditioning system, especially as part of another planned renovation.

■ High temperatures and humidity are not only uncomfortable, but also unhealthy.

REWARDS

■ A comfortable, warm interior environment will be pleasant for your family.

■ An even indoor climate is the result of a properly functioning, energy-efficient mechanical system that is well matched to the design

of the house. It will offer superior indoor air quality and be easier on your budget.

SKILLS TO DO THE JOB

A homeowner is usually able to assess the condition of the appliances and install the replacement filters, following the manufacturer's instructions. However, the nature of possible changes to the entire mechanical system may be much more difficult.

Because of the consequences of any changes, most work must be done by qualified tradespeople. Your local utility will be able to provide advice or refer you to competent technicians who can assess your home and the mechanical systems.

Heating contractors that install and service a variety of heating system types should also be able to give you advice. However, if they specialize in only one type of system, they may not be able to provide impartial advice on possible alternatives.

COSTING YOUR PROJECT

Cost of mechanical system upgrades will depend on the work that needs to be done. When reviewing bids from contractors, make sure that the

quotes you are comparing are for the same work, including the same or truly equivalent equipment.

**Use the Mechanical Systems Assessment Worksheet to record the present condition, any problems with your mechanical system and preliminary costing.**

| <b>Mechanical Systems Assessment Worksheet</b>                                                                                                  |                            |                   |      |
|-------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-------------------|------|
| Type of heating system                                                                                                                          |                            |                   |      |
| Year installed                                                                                                                                  |                            |                   |      |
| Last time service performed (There should be a service technician's ticker on the unit.)                                                        |                            |                   |      |
| Maintenance service costs                                                                                                                       |                            |                   |      |
| Heating cost and amount of fuel used<br>(This is listed in energy units on your fuel bill.<br>Your utility can often provide this information.) |                            |                   |      |
|                                                                                                                                                 | Present condition/problems | Proposed upgrades | Cost |
| Performance Issues:                                                                                                                             |                            |                   |      |
| • Noise                                                                                                                                         |                            |                   |      |
| • Dust                                                                                                                                          |                            |                   |      |
| • Uneven Heat Distribution<br>(cold spots in the house)                                                                                         |                            |                   |      |
| • Effectiveness of Thermostat                                                                                                                   |                            |                   |      |
| • High Fuel Bills                                                                                                                               |                            |                   |      |
| • Lingering Smells                                                                                                                              |                            |                   |      |
| • Fuel Smells                                                                                                                                   |                            |                   |      |
| Other                                                                                                                                           |                            |                   |      |

## About Your House

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**To find more About Your House fact sheets plus a wide variety of information products, visit our website at [www.cmhc.ca](http://www.cmhc.ca). You can also reach us by telephone at 1-800-668-2642 or by fax at 1-800-245-9274.**

### **Priced Publications**

|                                           |                 |
|-------------------------------------------|-----------------|
| <i>Healthy Housing Renovation Planner</i> | Order No. 60957 |
| <i>Homeowner's Inspection Checklist</i>   | Order No. 62114 |
| <i>Renovator's Technical Guide</i>        | Order No. 61946 |

### **Free Publications**

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| <i>A Guide to Mechanical Equipment for Healthy Indoor Environments</i> | Order No. 62015 |
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#### **About Your House** fact sheets:

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| <i>Measuring Humidity in Your Home</i>                                    | Order No. 62027 |
| <i>Combustion Gases in Your Home</i>                                      | Order No. 62028 |
| <i>Your Furnace Filter</i>                                                | Order No. 62041 |
| <i>Hiring a Contractor</i>                                                | Order No. 62277 |
| <i>Assessing the Comfort and Safety of Your Home's Mechanical Systems</i> | Order No. 62266 |
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