

**Ask Jon Eakes**

# **The 3-FLEX CONTROLLER -- getting the most out of every central heating system**

Last Updated: Friday, November 19th, 2021, Created: Monday, October 7th, 2013

If you are looking at changing or upgrading your heating system – read this article. It may introduce you to things you have never heard about and can certainly save you a lot of money while improving the comfort of your home.

## **BANNING OIL HEATING**

If you are concerned about the move to ban heating with oil in Montreal, read my open letter to all City Councilors on the island. You may also want to read about why changing to all-electric heating is rarely a good idea.

## **MAKING PRESENT SYSTEMS FAR MORE EFFICIENT**

Technologies to make existing systems more cost efficient while seriously reducing their ecological input already exist. They present real alternatives to throwing the baby out with the bath water. Énergie ABC Hybride Inc. of Montreal has really broken the code on heating comfort and economy. They have developed the technology to make all central heating systems - from forced air, gas, oil, electric furnaces to hydronic boilers - responsive to changing heat load conditions (the amount of heat the house needs to maintain thermostat setpoint). This results in far less and smoother heating system cycling (turning on and off) for much improved efficiency, comfort and in most cases drastically lower heating cost. Read on to understand how keeping controlled fuel fired systems can make more ecological sense than going all electric.

## **HOW CENTRAL HEATING SYSTEMS WORK**

Domestic heating systems are built to supply sufficient heat to keep the house at the desired temperature even during extreme cold snaps. Because these events are rare it means the heating system produces much more heat than needed to maintain thermostat set point for about 99.5% of the heating season. With no effective controls in place to adjust the supply of heat it cycles on and off, this lack of control makes the house feel uncomfortable while wasting energy.

## **EFFICIENT HEATING IS ALL ABOUT CONTROL**

Every driver knows that highway driving results in better mileage than stop and go city driving. It is also smoother and more comfortable resulting in less wear & tear and lower maintenance cost. The same holds true for a heating system that with proper controls in place, matches the amount of heat supplied by the heating system with the amount of heat the house needs to maintain the thermostat set point. This results in far less cycling for long periods of uninterrupted, even, very comfortable heat.

## **HOUSE THERMOSTAT LIMITATIONS**

The principle function of the house thermostat is to keep the house at set point temperature by turning heating appliance(s) on and off. Because a thermostat does not have the smarts to determine how much heat the house needs at any time to counteract heat losses incurred by the indoor space, it cannot regulate the heat supply accordingly. This results in frequent cycling as the thermostat attempts to strike a balance between excessive furnace heat and no heat.

## **CRACKING THE CODE**

Installed between the thermostat and the heating appliances, the 3-FLEX CONTROLLER takes over

where the thermostat leaves off. Equipped with the smarts to determine how much heat the house needs in real-time, it commands the heating system to supply only the right amount of heat needed to reach, and maintain the set point temperature without overshooting the setpoint and short cycling the heating system. This smooth heating goes on for as long as the house thermostat calls for heat. Although other systems are moving in the direction of multi-stage heating, none have cracked the code on matching heat supply with head load in such a smooth even manner.

The 3-FLEX CONTROLLER is an add-on to any existing system old or new and even offers the opportunity to modify your system to work even better – such as by moving from a Dual-Energy system to a Tri-Energy system. That change ends up being more cost efficient than geothermal heating at a fraction of the capital cost.

The article below is my take on this really great innovation to help you better understand what it is all about. For clear technical details on three common applications you can download the manufacturer's pamphlets here:

TRI-ENERGY FORCED-AIR HYBRID heating brochure

3- FLEX controlled ELECTRIC FURNACE + HEAT PUMP heating brochure

3-FLEX controlled HYDRONIC heating (hot water radiators or in-floor piping) brochure

## IT ALL STARTED WITH THE DUAL-ENERGY ELECTRICAL RATE PROGRAM

You have heard me speak as a strong supporter of Dual Energy programs for a long time. Let me tell you the history of an engineer from Montreal that has sold me on backing “the next step”: TRI-ENERGY. Tri-Energy is forced air Dual energy with a fuel fired Furnace and Heat Pump plus an electric element plenum heater and the 3-FLEX controller that makes all 3 heating appliances function together in perfect harmony, working like a conductor in a well-tuned orchestra.

Let me tell you why I got sold on the Tri-Energy system with its 3-FLEX Controller. It all started off with trying to make Dual Energy work better and ended up with a controller that can make just about any central heating system perform better, including all-electric and hydronic (hot water radiators and in-floor piping) central heating systems.

The following 6 minutes video will show you an actual Tri-Energy installation so you can really see what is involved.

## A LOOK AT DUAL ENERGY TO BETTER UNDERSTAND TRI-ENERGY

Dual energy is an electric utility rate system (such as we have with Hydro Québec) that can save a lot of money when your home heating system consists of a combination of fossil fuel and electric heating. This Includes HVAC forced air dual energy with Oil, Gas or Propane furnaces with either a Heat pump or Electric element heater. Hydronic heating with fuel fired boiler and electric boiler are also eligible for this low DT rate.

For details on this good deal from your utility company, follow this link to “Is the Dual Energy electrical rate program worthwhile?” For a general overview of just what is a “Heat Pump”, follow this link Heat Pumps – an Overview.

Basically, with Dual Energy, Hydro Quebec gives eligible homeowners a preferred electrical rate which is up to 50% less than the standard Hydro domestic D rate (all year long, including air conditioning costs) but charges about 5 times more when the outdoor temperature drops below -12°C. Because these cold weather events are generally infrequent it is well worthwhile to pay the premium in return for a much lower rate above -12°C. Of course, there is an automatic switch to change from Heat Pump or Electric element heater to furnace heat only, so you are not using electricity to heat at the higher rate.

Why does the utility offer this deal? Because when it is really cold the utility is running close to full capacity and off-loading homes that can heat without electricity during extreme cold spells helps to even out their demand and protect their system from black-outs. Bottom line; it is profitable for the utility and for you.

## DUAL ENERGY HEATING DRAWBACKS

Although I strongly support the Dual Energy program, it does have drawbacks.

Introduced by Hydro Quebec some 60 years ago to reduce the load on the Hydro electricity grid during very cold days, this heating configuration does have some problems. It is common to have blasts of uncomfortable cold air during the various switching and cycling functions, especially on colder days when the heat pump puts out less heat and the system starts pumping uncomfortable cool air. But most people are willing to live with that if it is saving 40-50% on heating costs.

On the technical side, the capacity gap between the weaker heat pump and the up to 4 times stronger furnace causes cycling between heating appliances, especially during colder winter days. This creates thermal stress on both the furnace and heat pump as they go from hot to cold during on/off periods. This affects not only efficiency but also maintenance and heating appliance service life expectancy.

How do you know when your Dual Energy heating system is wasting money?

You have learned to pay attention to that little light in the kitchen that tells you when your electricity rate has changed from bargain electricity to expensive electricity. When it is cold enough outdoors for that light to turn on, your electrical heat pump is shut down and the fuel fired furnace kicks in automatically. That light usually goes on at -12C.

Think back to last winter, or if it is cold today, listen for when the furnace kicks in and then check to see if the "expensive energy" warning light is still OFF. If the furnace kicks in while the light is out, why are you burning expensive fuel while your electricity is still cheap? One of the reasons is that few heat pumps can provide all the heat for your house when below zero -- so the standard dual energy set-up is that as soon as your heat pump cannot do the whole job, it kicks out and the oil or gas furnace kicks in, even if it is only -3C, a long way from the Hydro cut-out of -12C. So, you spend a fair amount of time using oil or gas when it would be more economical to use electricity. This is the primary financial imperfection in the Dual Energy system.

We want to avoid using fuel whenever electricity is cheap.

The important thing to realize is that heat pumps continue to provide some efficient heat even when it is very cold outside. They continue to do that more economically than any other heat source, but when it gets colder it doesn't generate enough to heat the whole house -- however it is still an important source of cheap heat.

The Tri-Energy concept involves a multi-stage electrical heating element, like a mini-electrical-furnace, right in the ductwork of your heating system. This heater is strong enough to combine with the heat pump and furnish all the heat you need, right down to the Dual Energy switch over point, usually -12C, always using the heat pump to its maximum and the multi-stage duct heater only as much as is needed to top it up. If the heat pump needs to go into a defrost cycle, no problem, the plenum heater goes up to maximum and takes care of the job without turning on the furnace. That means that you are heating the house with less money right up until the fuel fired furnace must kick in. At this point your electrical rate increases and both the electrical devices shut down. That is how you can save around 40% more, above and beyond the 40-50% you already saved by going to Dual Energy with the Hydro Quebec DT rate system.

You still control the thermostat. You set the desired temperature and the 3-Flex controller juggles all the rest to be sure you get the temperature you requested at the least cost possible at any moment of the day, night, fall, spring or dead of winter.

Comfort and economy above all

This electrical plenum heater is also being used to keep the supply air comfortable at all times. It even turns on modulated electric heat during colder winter days when the heat pump starts pumping out air that is no longer comfortable, long before the thermostat registers that the house temperature is dropping. In fact as I read through the comments of homeowners who have used this system for one winter or more, they confirm the money savings but seem to be far more interested in the even heat

and increased comfort. Like this note:

"Everyone talks about money saved, but more importantly for us is how much more comfortable we are. The air is not dry because of burning fuel and excessive heat. We have a grandson now, and he enjoys playing with the air duct on the floor in front of the solarium and feeling the air blow in his face. It is always a comfortable temperature for him."

Equivalent to the efficiency of geothermal heating

When you sit down and study the numbers – in real houses – it is surprising to discover that a Tri-energy heating system is as economical as a geothermal system – up to now the most efficient heating system available. The big difference is that the up-front cost of the Tri-Energy system, especially when simply added onto an existing Dual Energy system, is a small fraction of the large capital outlay required for a geothermal system. Since the 3-Flex controller is very versatile, it can even be used to improve the efficiency of a geothermal heating system. Follow this link for more information on when geothermal heating is a good choice.

Should I change from fuel based to ALL-ELECTRIC heating?

If you have an Oil or Gas furnace with central A/C or heat pump, converting to all electric often recommended by heating contractors, is like "killing the goose that lays the golden eggs". With "all electric" heating, you no longer qualify for the reduced Dual Energy electrical rate. This means you pay more for using your appliances all year long, including a significant increase in air conditioning costs. Factor all of that in and "all electric", even with the relatively low Hydro Quebec standard rates, turns out to be the most expensive option after an oil furnace without dual energy.

With today's energy prices and the Hydro rate structure, all electric heat, even with a heat pump, is not the most economical option. If your oil or gas furnace is still in good working condition even though it may be old, upgrading to Tri-Energy (with or without a heat pump) by adding an electric plenum heater makes it eligible for the low Hydro rate. And because the furnace is now only used below -12°C it runs little, making furnace efficiency no longer important as "it is sitting pretty" just to get the low Hydro rate. In the case where no city gas is available, propane can be used, requiring only a small gas tank because the furnace runs little. Even if oil is your only option to all electric, new oil furnaces are worth taking a look at when combined with Tri-Energy. It's really all about control. Click here for more detail on changing to all electric heat.

Improving on ALL-ELECTRIC with the 3-FLEX controller

Where your all-electric heating is done through a central forced air furnace or an electric hydronic boiler, improving operating efficiency by installing the 3-FLEX controller does not result in huge savings, but will make the heating system more efficient, comfortable and with the build-in airflow safety sensor, the system is safer to use.

## HYDRONIC HEATING

Hydronic heating is a central hot water radiator system or in-floor heating pipes that works well with the Tri-Energy Controller.

Hot water hydronic heating works with a hot water boiler. Normally a boiler is set to the highest temperature you need, and then the circulation of that hot water is turned on and off by the thermostat. That causes hot and cold swings just as with traditional central hot air systems.

The 3-Flex Controller controls the boiler differently. You set the thermostat as usual. But again, the thermostat no longer turns anything on or off, but just becomes a target for the 3-Flex Controller. The controller actually does a combination of dynamically changing the temperature of the stored water in the heating system, and controlling the circulation of that water. Hence the radiators always have enough heat, but the temperature of the radiator changes according to the energy needs of the house at any given period of the day. This sliding scale is what gives the comfort as well as the economy. And the 3-Flex Controller learns just how your house gains and loses heat, so it customizes your

boiler operation to your house and your lifestyle.

Tri-Energy backup protection and safety.

As the saying goes “don’t put all your eggs in one basket”. Like any other electro-mechanical device, heating appliances can, and over the longer term will at some point malfunction. And if it happens, like Murphy’s law, it likely will fail at the most un-opportune time, like the middle of the winter. A Tri-Energy system is well prepared for such event automatically switching to electric element heat in case of a heat pump malfunction, or even turn on below -12°C in the case of a fuel furnace malfunction. It will even shut down all heating appliances and raise an alarm in the case of a blower fan malfunction.

Standby generator option

With increasingly severe winter weather conditions including high winds and freezing rain, our overhead electrical power distribution system is more and more effected by power outages. When this happens during winter it can become much more than a minor inconvenience. For this reason, increasingly more homeowners invest in a standby generator. If the heating system is all electric, the cost of a standby generator can become not only prohibitive but also more difficult to manage. A hybrid heating system with a fuel furnace in the mix makes the addition of a standby generator affordable and manageable by keeping the heating system going in fuel furnace heat mode and not try to heat the whole house with the generator. See my entry on Getting Generator Electricity into the home.

Heating contractors

Most heating contractors that I have spoken with about this concept think it is great, but privately they don’t want to sell something that is not as profitable as upselling a new heating system, or they have vested interests in a single manufacturer who does not provide a controller which integrates all the aspects of heating in your house including dynamic changes in indoor, outdoor and duct temperatures. I support this product because I have studied its reliability and from both a financial payback and energy efficiency point of view I believe that all heating systems should start using intelligent controllers like this, a controller born right here in our very cold climate. New patented ideas like this, unless they come out of giant corporations that can just push them onto the market, need all the support they can get to gain consumer confidence and become a standard item in a heating contractor’s offerings. Having almost what you could call a cult following of very satisfied customers for over 10 years now, they are well on their way to creating a new standard.

## CONCLUSION

Although the world is slowly moving towards less fossil fuel use, the cons for all-electric heating seem to outweigh the pros when it comes to home heating in colder climates like Canada. That is especially true considering the unreliable nature of the electricity grid, especially outside city centers where overhead pole distribution and electrical black-outs are the norm. Tri-Energy not only benefits eligible homeowners with a low cost highly effective heating solution, it also extends service life of otherwise perfectly good heating equipment. Slashing CO2 emissions by up to 80% with simple efficiency will go a long way in reaching government environmental objectives even though you will be leaning on fossil fuel for extreme cold days.

You can increase your home’s comfort and decrease its heating costs above and beyond what you have already done, often with a 3 to 4 year payback, all while seriously reducing your ecological footprint. That’s a better investment than the stock market. Contact ABC Hybrid Energy Inc.

Jon Eakes

### Keywords:

Ads, Furnace, 3-FLEX heating controller, Heating, Tri-Energy Systems, Hybrid Heating, Heat Pump, Forced Air, Overview, Video - Included, Rates, Electrical, System

