Hybrid Heating Systems & the iFLOW Smart Switching Controller

ESC TMAF, SLC-UTAH

September 19, 2023

Electrification: Problem for Gas Utilities

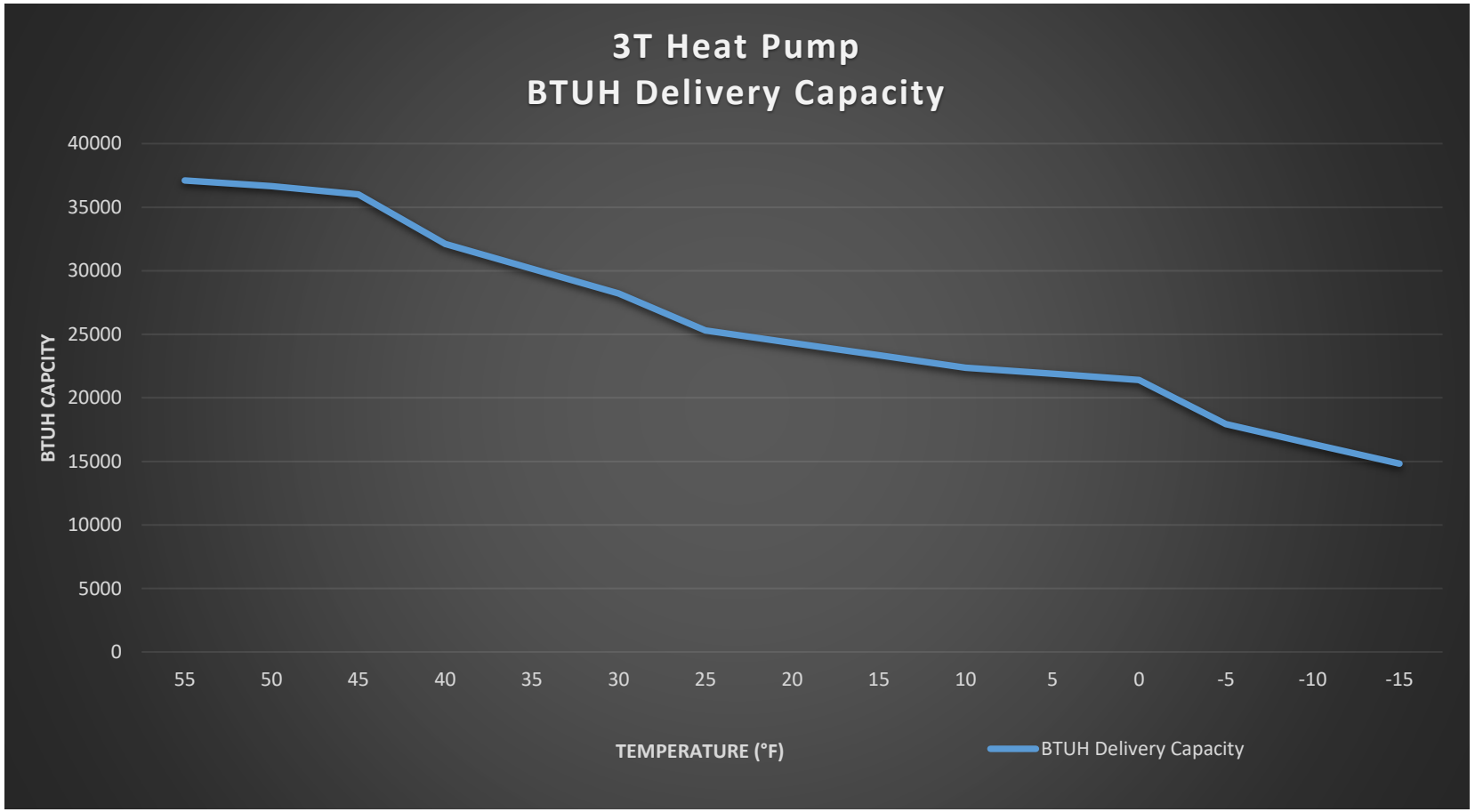
- Rapid move to heat pumps for space heating and DHW;
- Rebate incentives changing demand curve;
- Gas is being blocked in some locations for new RNC developments (Pacific Northwest: Vancouver BC, WA state);
- Little regard to counter arguments about electricity infrastructure, supply capacity/capability and source;

- So how do we keep gas in the residential heating game?

Hybrid Heating System Creation:

- iFLOW has an option for you:
  - Replace old air conditioner with a new inverter driven, variable speed heat pump to create a smart hybrid heating system (electric HP & gas furnace);
  - Use the heat pump during the shoulder seasons when the COPs are highest (Sept., Oct., Nov.; Mar., Apr., May), and when gas equipment would typically be cycling, resulting in reduced gas furnace efficiency;
  - Switch to the gas furnace for the coldest months (Dec., Jan., Feb.) when COPs drop, and when furnace would have longer running times, offering better efficiency; and when heat pump would not typically have BTUH capacity;
  - Home heating capacity is not at all compromised.

Heat Pump BTUH Capacity vs. Temperature:



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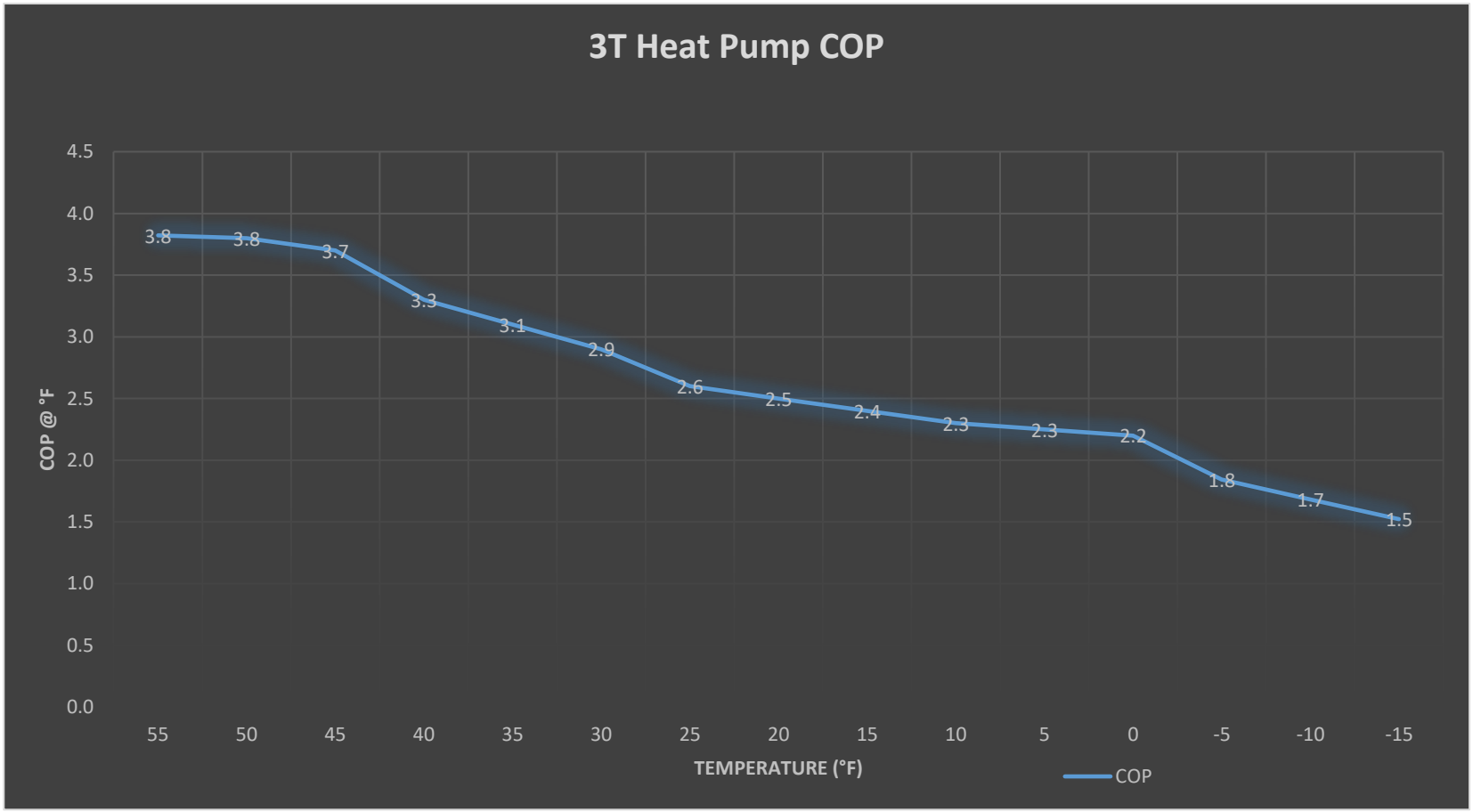
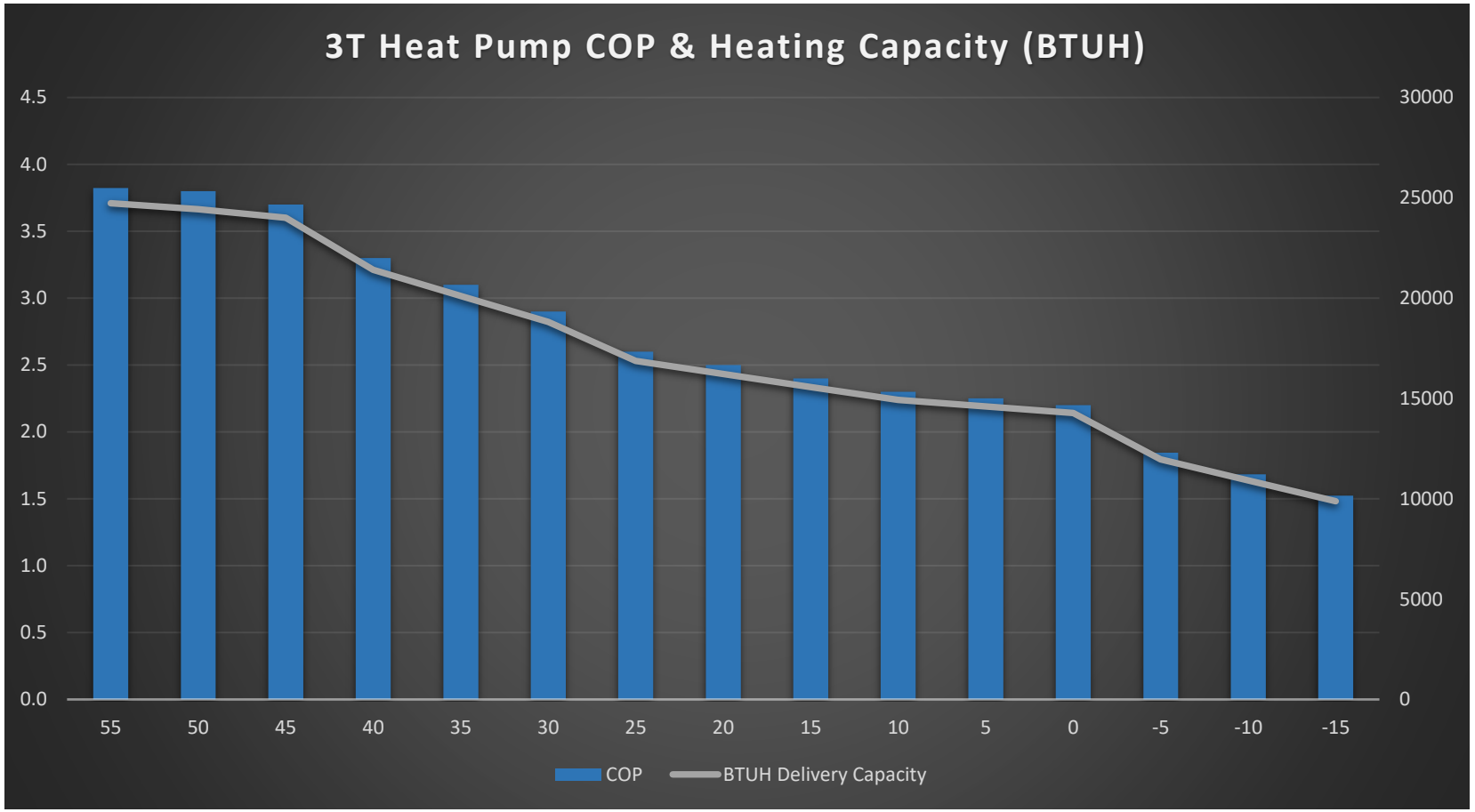


Heat Pump COP & BTUH Capacity vs. Temperature:



Actual Toronto Winter Heating Season

Example Load: 40 MBH

0 btu/h (No Heating Required: 70°F/21°C)

7,000 btu/h

14,000 btu/h

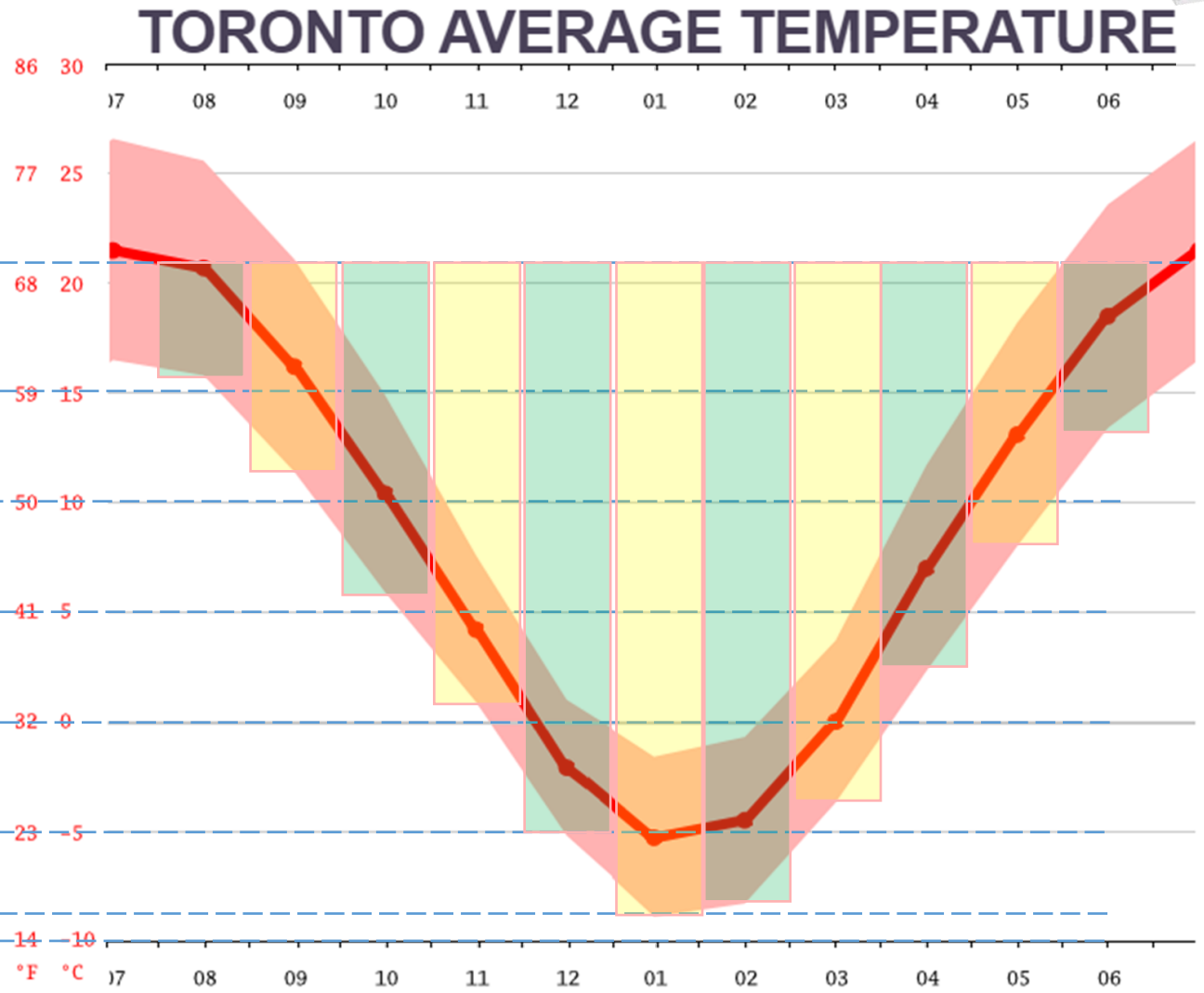
21,000 btu/h

28,000 btu/h

35,000 btu/h

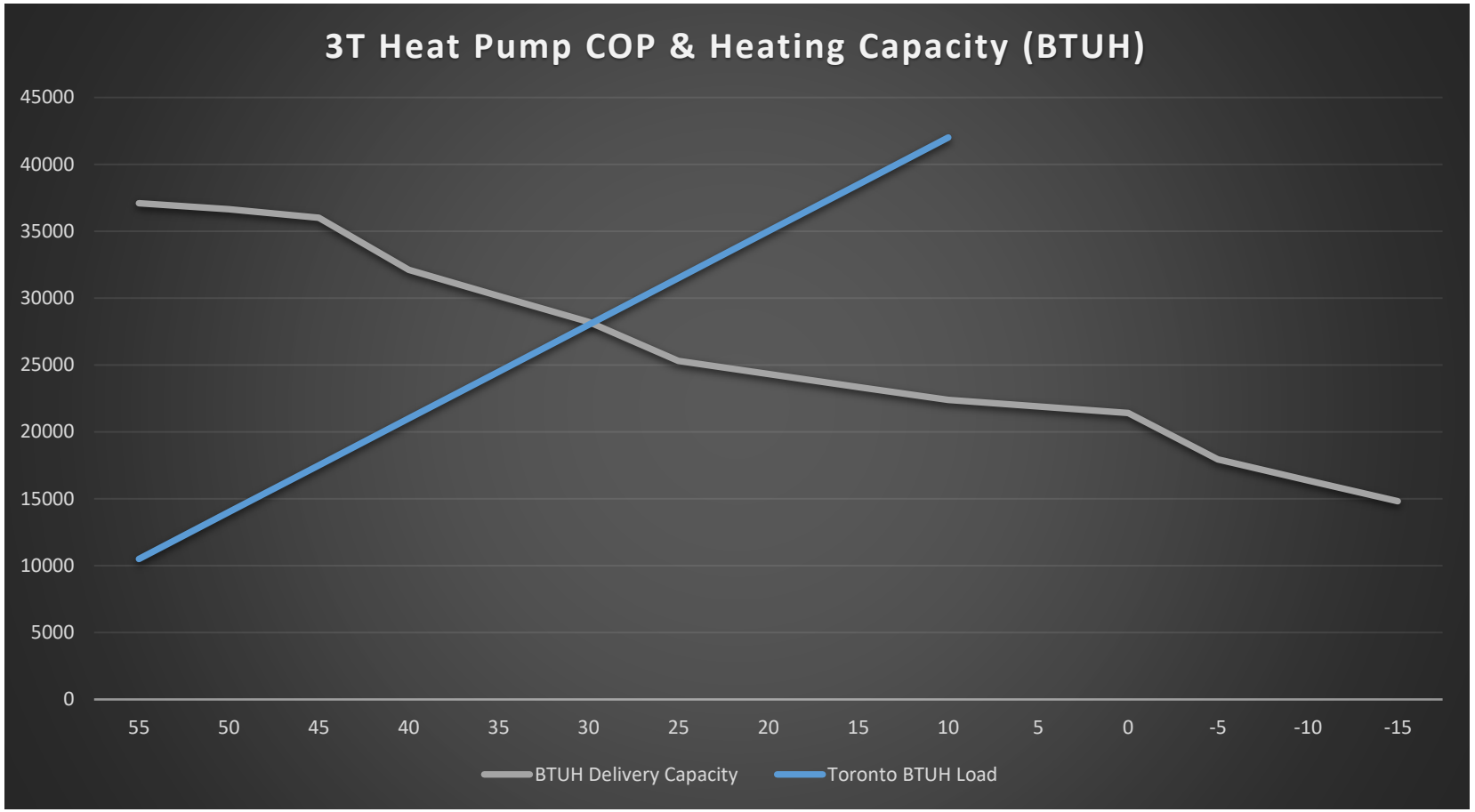
40,000 btu/h (Maximum Heating Required)

42,000 btu/h



en.climate-data.org/north-america/canada/ontario/toronto-53/#temperature-graph

Heat Pump COP & BTUH Capacity vs. Temperature:



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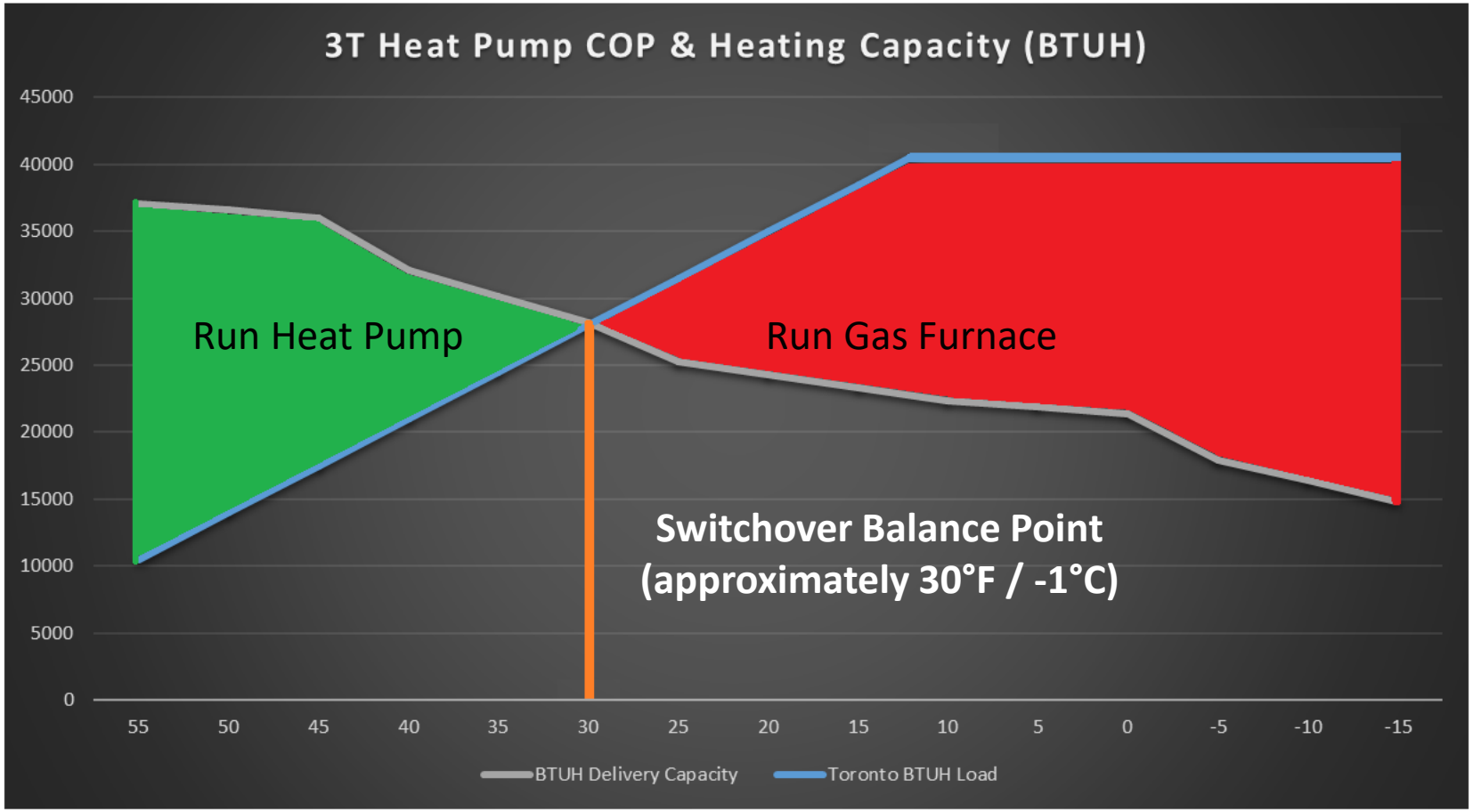

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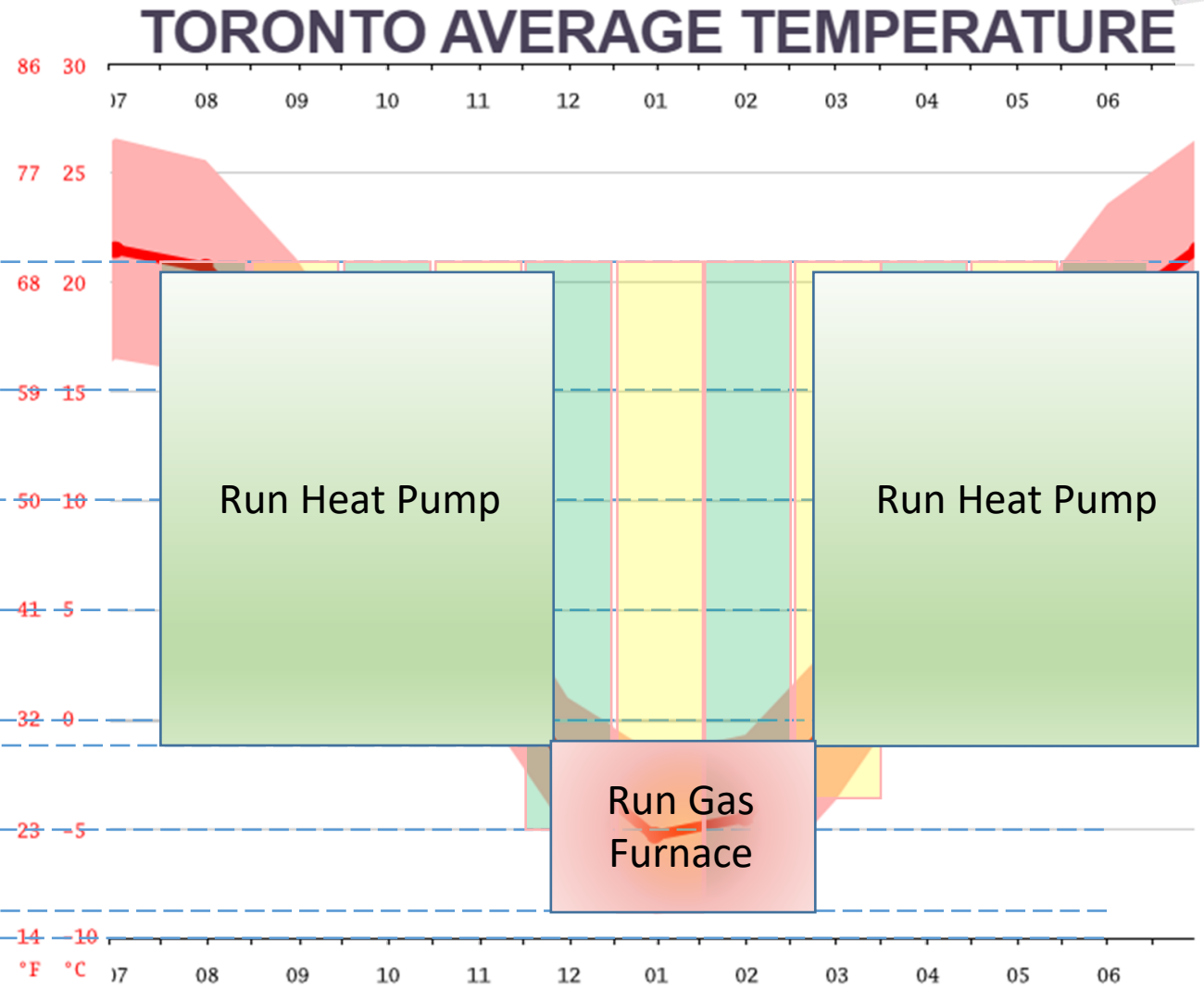

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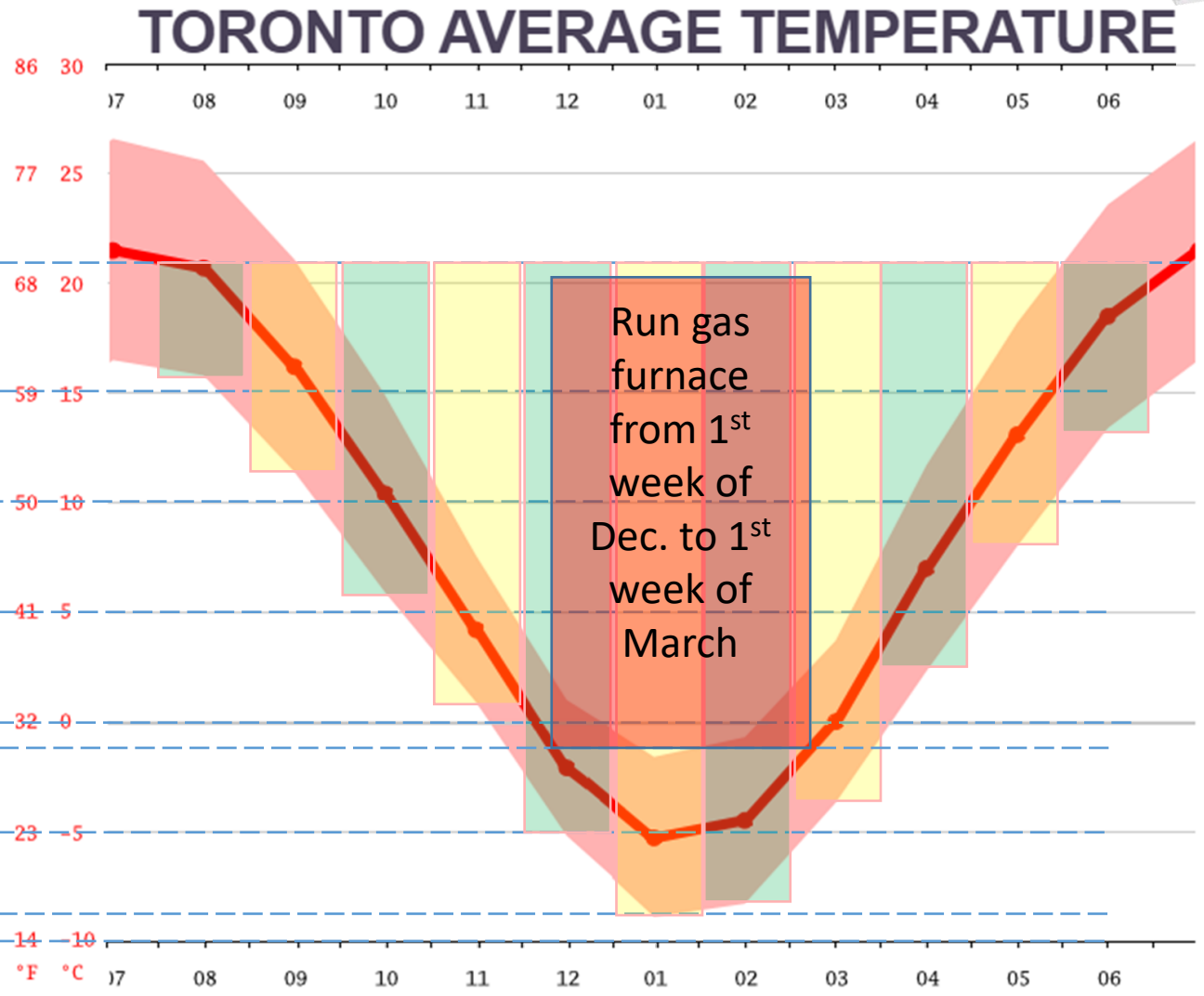

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Hybrid System Results:
High Efficiency Furnace (95%) & Heat Pump:

- Effective Estimated Hybrid Heating System COP: 1.94
- 0.95 to 1.94 = **2.04X** improvement in system efficiency
- No risk of heating capacity shortage

HIGH EFFICIENCY FURNACE (95%)										
Month of Year (Heating Season):	Sept.	October	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Total Effective Hybrid COP:
Estimated Average Outdoor Temperature Per Month:	63	51	39	26	22	23	32	44	56	
COP @ Above Average Temperature:	3.8	3.8	2.3	0.95	0.95	0.95	2.2	3.6	3.8	
Estimated BTUH Load (Toronto) @ Above Average Temperature:	6000	13500	22500	32000	36000	34000	28000	18500	10000	
Estimated BTUH Load per Month as % of Total Heat Load (Toronto):	3.0%	6.7%	11.2%	16.0%	18.0%	17.0%	14.0%	9.2%	5.0%	
Effective Contribution to total COP:	0.11	0.26	0.26	0.15	0.17	0.16	0.31	0.33	0.19	1.94
Operational % of Heating Season (Toronto)	20.9%			50.9%			28.2%			
% Contribution to Hybrid Heating System Effective Esimtated COP:	32.4%			24.9%			42.7%			

Hybrid System Results:
Mid-Efficiency Furnace (80%) & Heat Pump:

- Effective Estimated Hybrid Heating System COP: 1.86
- 0.8 to 1.86 = **2.35X** improvement in system efficiency
- No risk of heating capacity shortage

MID-EFFICIENCY FURNACE (80%)										
Month of Year (Heating Season):	Sept.	October	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Total Effective Hybrid COP:
Estimated Average Outdoor Temperature Per Month:	63	51	39	26	22	23	32	44	56	
COP @ Above Average Temperature:	3.8	3.8	2.3	0.8	0.8	0.8	2.2	3.6	3.8	
Estimated BTUH Load (Toronto) @ Above Average Temperature:	6000	13500	22500	32000	36000	34000	28000	18500	10000	
Estimated BTUH Load per Month as % of Total Heat Load (Toronto):	3.0%	6.7%	11.2%	16.0%	18.0%	17.0%	14.0%	9.2%	5.0%	
Effective Contribution to total COP:	0.11	0.26	0.26	0.13	0.14	0.14	0.31	0.33	0.19	1.86
Operational % of Heating Season (Toronto)	20.9%			50.9%			28.2%			
% Contribution to Hybrid Heating System Effective Esimtated COP:	32.4%			21.0%			42.7%			

Hybrid Heating System Control:

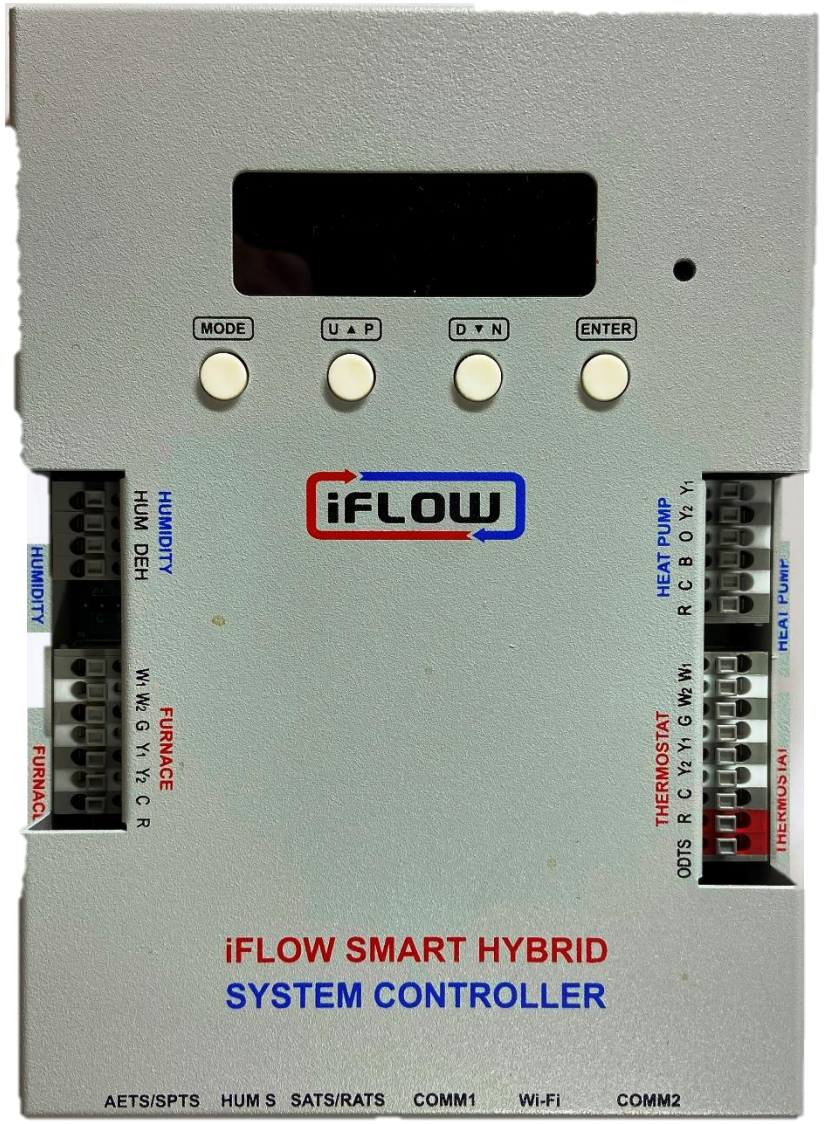
Okay…

So you create a hybrid system, now how do you control it?

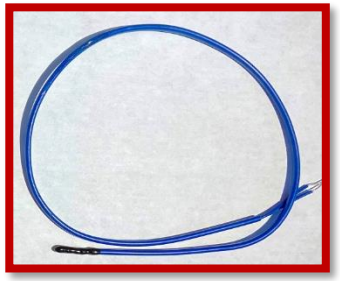
Let’s take a look at the iFLOW Solution!

Introducing the iFLOW Smart Controller…

- iFLOW controls switchover between heat pump and gas furnace based on outdoor temperature;
- Wi-Fi enabled and capable of Utility Demand Response through customizable APIs;
- Wires with any thermostat; Heat Pump thermostat not required;
- Supply & Return Air, evaporator & condenser temperature sensors for system operation recognition & feedback;
- Remote diagnostics capable;
- Internet connection not required;



Outdoor Temperature Sensor

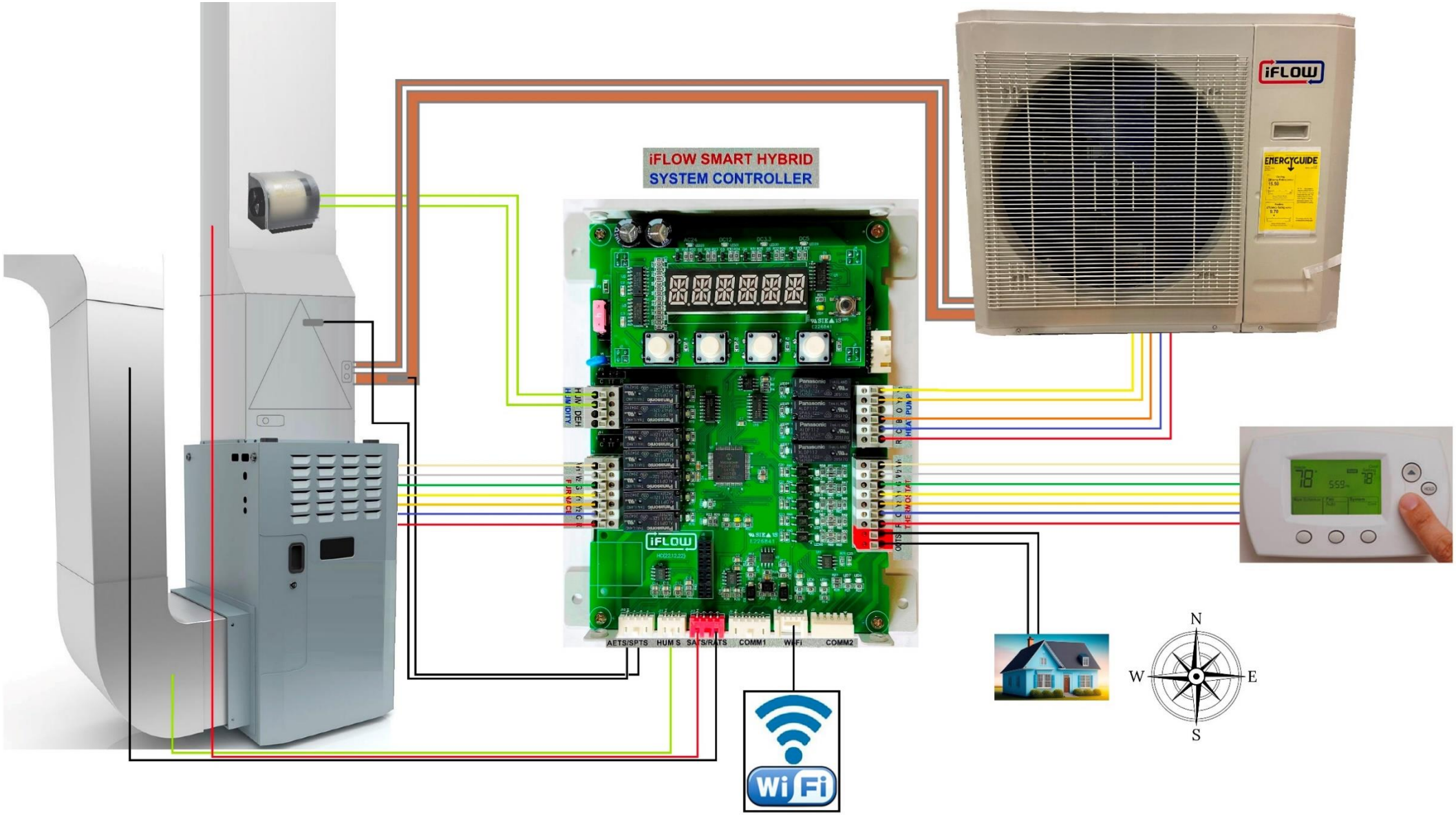


Supply & Return Air Temperature Sensors

Humidity Sensor

Evaporator (Freeze Protection) & Suction Line Temperature Sensors

Wiring of the iFLOW Smart Controller:



iFLOW Smart Hybrid Heating Controller Operation:

- Installs in the mechanical room with your existing HVAC equipment;
- Enter the COP of your heat pump;
- Enter the efficiency of your furnace;
- Enter the cost of electricity;
- Enter the cost of gas;
- Enter any peak rate periods (can select up to 3);
- When iFLOW receives a call from the thermostat, it will calculate the switchover point based on the information entered and time of use;
- It will then call on the gas furnace or the electric heat pump.
- Utility can be given capability to override calculations and implement gas or electric operation on demand.
- Once operational, the iFLOW controller monitors system operation through its various field installed sensors to determine the performance of the hybrid system (unique to iFLOW; no thermostat based system can do this).

Hybrid Heating System Control:

So using the iFLOW Smart Hybrid Heating Controller, and an iFLOW Heat Pump, you can double the efficiency of any existing furnace and A/C system!

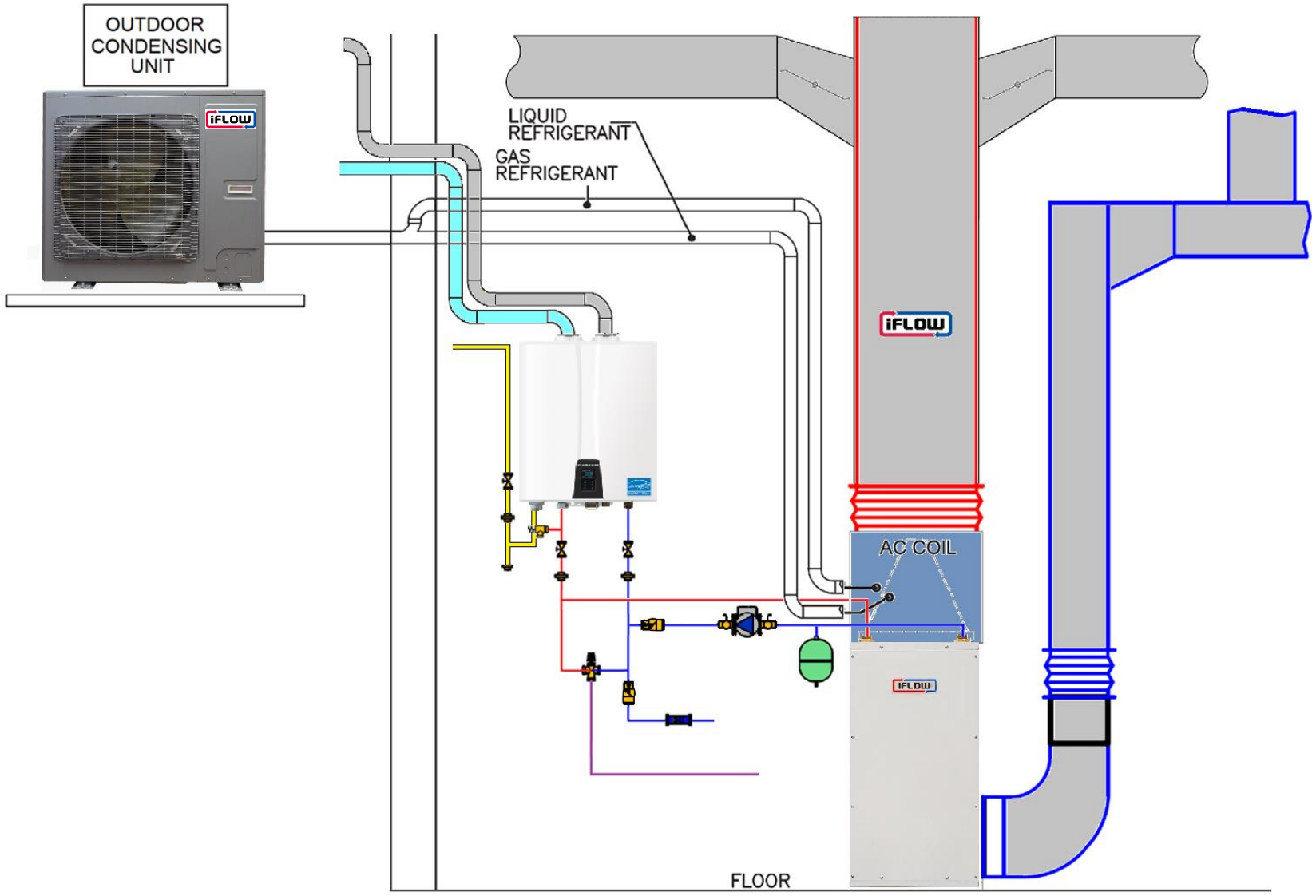
Hybrid Heating System Control:

But it gets even better!

Let's take a look at the iFLOW Hydronic Furnace and iFLOW Heat Pump Solution!

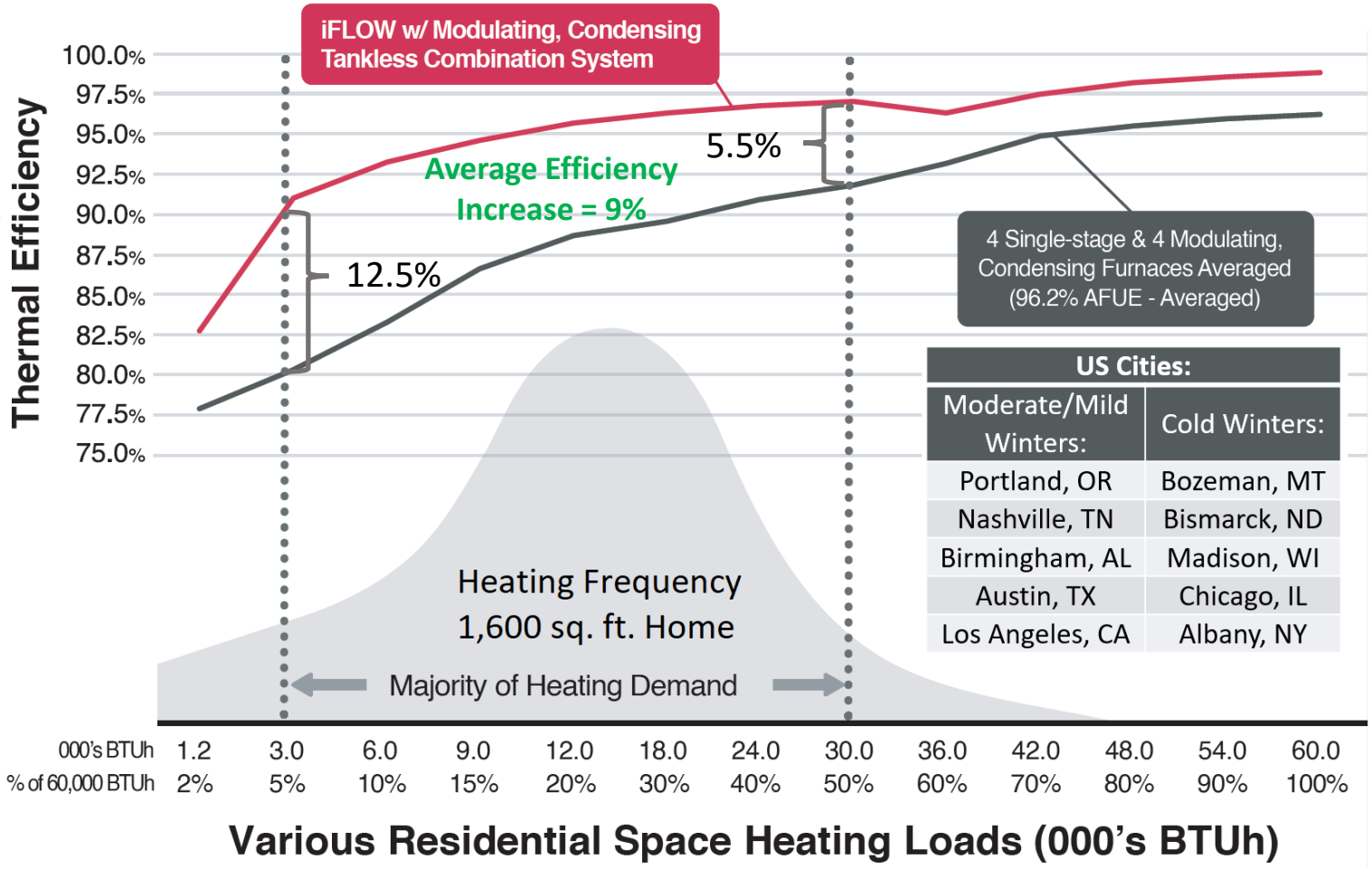
Design Schematic:

- Upgrade to a condensing tankless water heater;
- Replace old furnace with an iFLOW Hydronic Furnace;
- Eliminate need for 2 set of vent connection (ideal for RNC)
- Replace A/C with iFLOW ccASHP
- Improve performance by approximately 10% over the best Energy Star rated gas furnaces, bar none!!
- Best efficiency and best Comfort in the HVAC industry! Bar none...



Efficiency Performance Comparison:

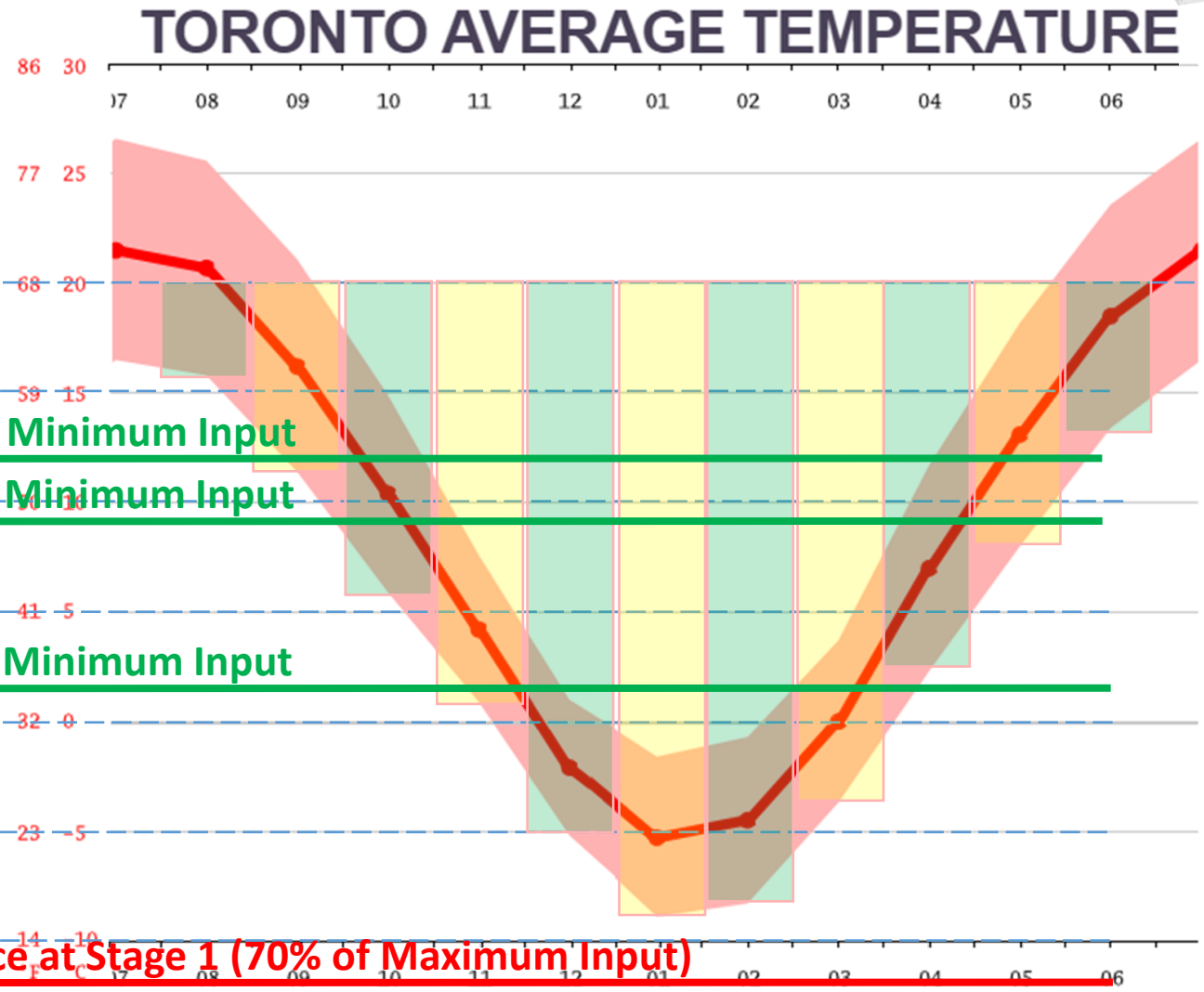
iFLOW Combi-System vs. Condensing Furnaces Averaged



https://conduitnw.org/Upload/RETACProducts/b1e526fa-3c49-4ced-a7d0-7e2ca9c4512aiFlowNavien%20Combi%20GTI%20Final%20Report%202019.08.05.pdf

Actual *Toronto* Winter Heating Season

Example Load: 40 MBH



0 btu/h (No Heating Required)

5,000 btu/h

10,000 btu/h — Navien NPE-180A2 / S2 Minimum Input

12,000 btu/h

13,300 btu/h — Navien NPE-240A2 / S2 Minimum Input

19,000 btu/h

24,000 btu/h — Best Mod/Con Furnace Minimum Input

26,000 btu/h

33,000 btu/h

40,000 btu/h (Maximum Heating Required)

42,000 btu/h — 60 MBH 2 Stage Furnace at Stage 1 (70% of Maximum Input)

47,000 btu/h (Maximum Heating Required)

60,000 btu/h — 60 MBH Single Stage Furnace at Maximum Input

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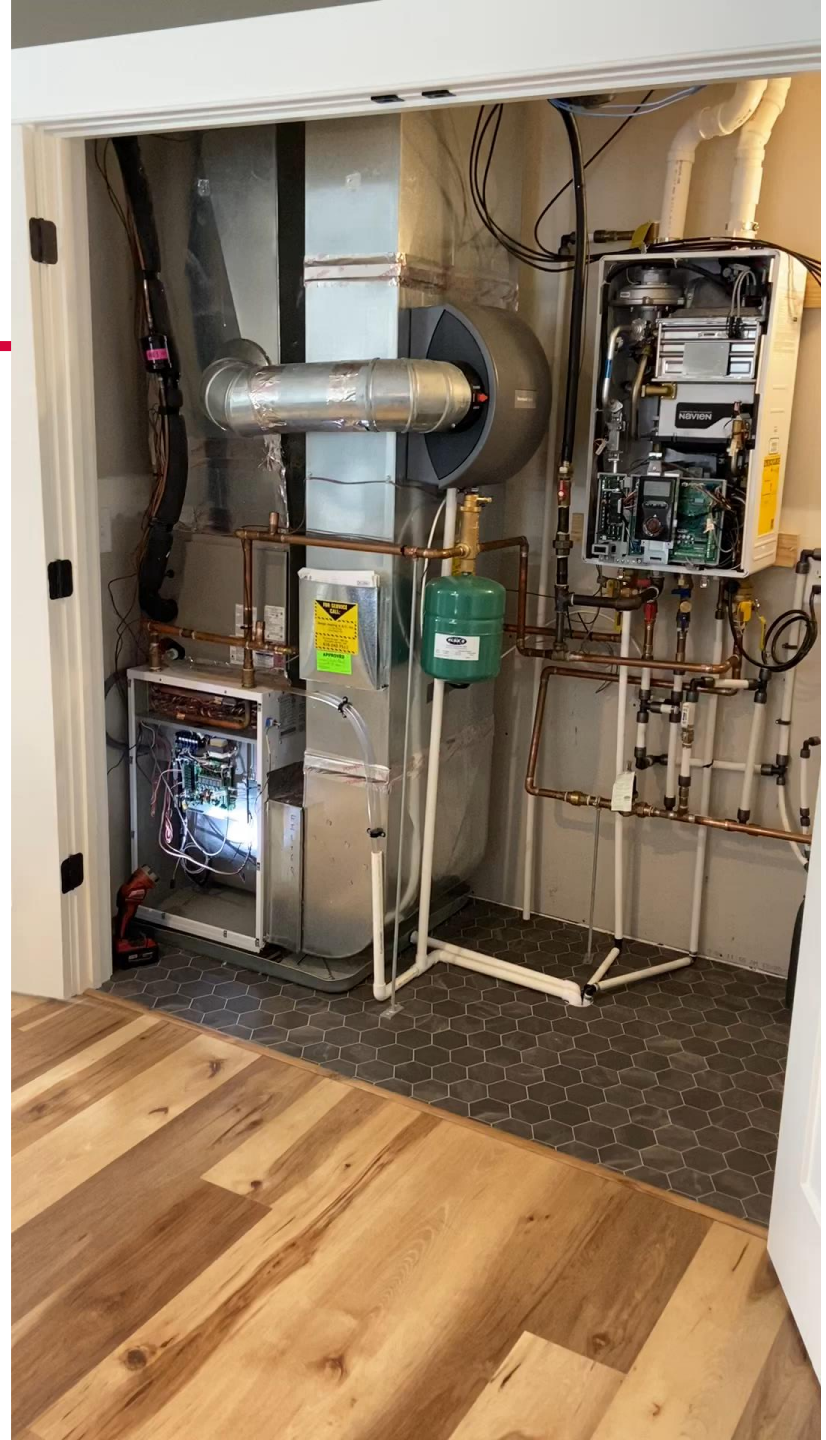
An iFLOW Combi-System w/ Navien Tankless

- A Navien Condensing Tankless water heater
- With an iFLOW Hydronic Furnace
- And with an iFLOW Cold Climate Heat Pump
- The ideal HVAC system! Best Efficiency! Best Comfort!
- Video demonstrates outdoor reset capability & full modulation; no thermostat nor homeowner adjustment necessary! All automatically done to maintain perfect comfort in the home



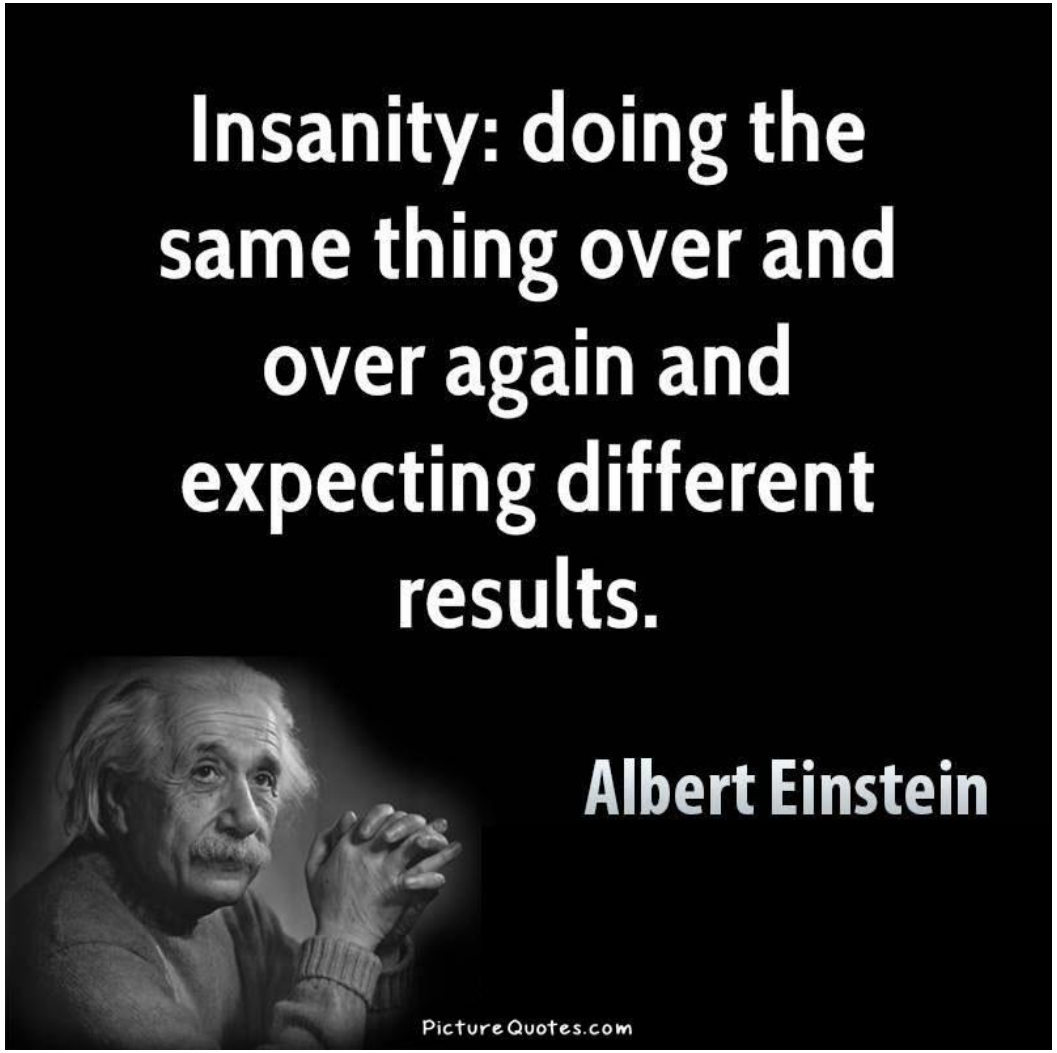
Why Consider a Combi-System?:

- It's about better HVAC Solutions: ***Better Comfort*** and ***Better Savings***...

- As we all know first hand, technology is changing rapidly and it is now an integral part of our lives...from smartphones, to cars that drive themselves, to rockets taking passengers into space, etc. etc...all things 20 years ago were just a dream...

Houston…we have a problem:

This is 2023, there is new technology, there are better solutions…



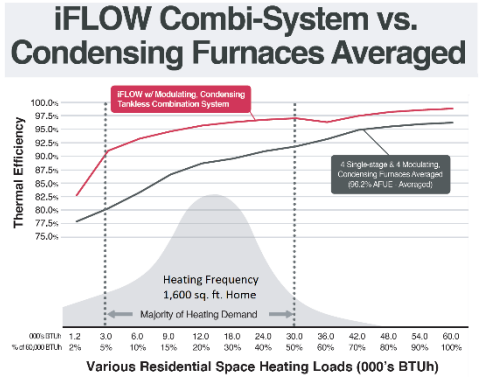
WE CAN DO BETTER!!:

iFLOW has your solutions...

iFLOW

HVAC *EVOLUTION*?

HVAC *REVOLUTION*?

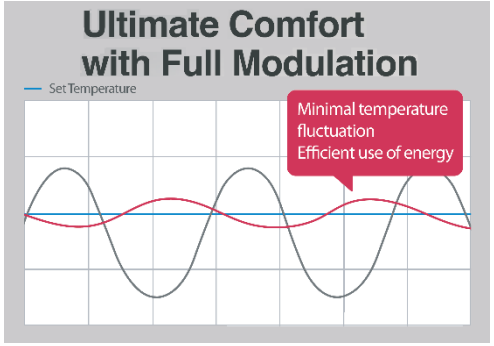


EITHER WAY, JUST *BETTER HVAC SOLUTIONS*...

Save Energy

Save Money

iFLOW



Questions?

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