

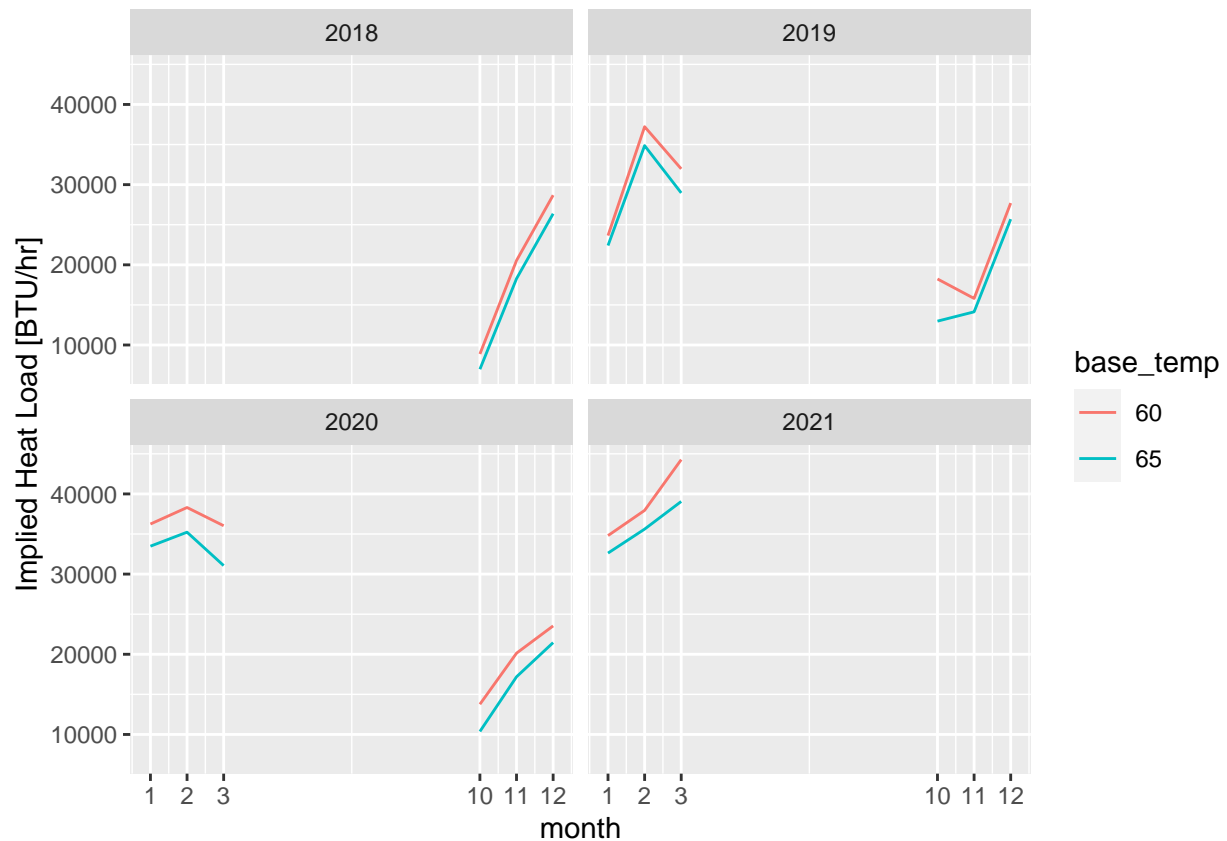
Heating Load Calculation

I combined gas usage and heating degree days data into a single data set (here called “fin”). Gas is used for furnace, water heating and laundry. The following operations calculate the implied heating load following this article. Assuming a design temperature of 0F.

```
furnace_efficiency = 0.93
design_temp = 0

fin <- fin %>% mutate(net_heat_delivered_btu = furnace_efficiency*therms*100000,
  btu_per_degree_hour = net_heat_delivered_btu/hdd/24,
  implied_heating_load = (base_temp - design_temp)*btu_per_degree_hour,
  ASHRAE_heating_load = implied_heating_load*1.4)
```

Looking just at October through March of 2018-2021



Full data for 65F base temperature

year	month	hdd	therms	net_heat_delivered_btu	btu_per_degree_hour	implied_heating_load
2018	6	94.6	20	1860000	819.2389	53250.529
2018	7	25.5	11	1023000	1671.5686	108651.961
2018	8	13.8	11	1023000	3088.7681	200769.928
2018	9	113.2	12	1116000	410.7774	26700.530
2018	10	469.2	13	1209000	107.3636	6978.634
2018	11	827.0	60	5580000	281.1366	18273.881
2018	12	1021.9	107	9951000	405.7393	26373.055
2019	1	1236.5	110	10230000	344.7230	22406.996
2019	2	1033.1	143	13299000	536.3711	34864.123
2019	3	939.0	108	10044000	445.6869	28969.649
2019	4	491.6	67	6231000	528.1225	34327.960
2019	5	281.2	37	3441000	509.8684	33141.447
2019	6	70.6	15	1395000	823.3003	53514.518
2019	7	16.5	7	651000	1643.9394	106856.061
2019	8	45.3	11	1023000	940.9492	61161.700
2019	9	157.5	11	1023000	270.6349	17591.270
2019	10	388.3	20	1860000	199.5879	12973.217
2019	11	855.4	48	4464000	217.4421	14133.739
2019	12	1078.2	110	10230000	395.3348	25696.763
2020	1	1038.2	138	12834000	515.0742	33479.821
2020	2	958.1	134	12462000	541.9580	35227.273
2020	3	737.9	91	8463000	477.8764	31061.966
2020	4	598.2	78	7254000	505.2658	32842.277
2020	5	278.7	60	5580000	834.2304	54224.973
2020	6	73.0	17	1581000	902.3973	58655.822
2020	7	5.3	12	1116000	8773.5849	570283.019
2020	8	32.2	9	837000	1083.0745	70399.845
2020	9	152.9	10	930000	253.4336	16473.185
2020	10	412.8	17	1581000	159.5809	10372.759
2020	11	644.7	44	4092000	264.4641	17190.166
2020	12	974.5	83	7719000	330.0410	21452.668
2021	1	1150.5	149	13857000	501.8470	32620.056
2021	2	1046.8	148	13764000	547.8601	35610.909
2021	3	793.2	123	11439000	600.8888	39057.772
2021	4	476.6	72	6696000	585.3966	38050.776
2021	5	269.9	35	3255000	502.5009	32662.560
2021	6	57.4	24	2232000	1620.2091	105313.589

Accounting for non-furnace gas consumption

Use the average June-August consumption and subtract from monthly therms:

year	month	implied_heating_load	implied_heating_load_adj
2018	10	6978.634	-375.7726
2018	11	18273.881	14101.3452
2018	12	26373.055	22996.3181
2019	1	22406.996	19616.3061
2019	2	34864.123	31523.9933
2019	3	28969.649	25294.7950
2019	10	12973.217	4086.5632
2019	11	14133.739	10099.7340
2019	12	25696.763	22496.3481
2020	1	33479.821	30156.0995
2020	2	35227.273	31625.6784
2020	3	31061.966	26385.6044
2020	10	10372.759	2013.5356
2020	11	17190.166	11837.7734
2020	12	21452.668	17911.6855
2021	1	32620.056	29620.7627
2021	2	35610.909	32314.4942
2021	3	39057.772	34707.4351