8th Grade 2020 PPCS Energy Audit

How Can PPCS Reduce Our Energy Consumption?

Why is reducing energy use important for our school's future?

By Mona Roise and Aliyah Murphy

First Our Class Had to Look into Where the Energy is Going…

And this is what we found:

1. Heat Pumps
2. Smartboards and Chromebooks
3. Lighting

1. Heat Pumps

As a whole heat pumps take the most energy out of all of our energy using factors, and their energy consumption is highly connected to our thermostats.

2. Smartboards and Chromebooks

Smartboards and Chromebooks use a lot less energy compared to the heat pumps, but they can still be modified to lessen their energy consumption, and therefore benefit the school.

3. Lighting

- Our system is highly efficient
- We have occupancy LED lights
- According to Strom Electric, changing the system would not lead to greater efficiency or save money

Benefits of Reducing Our Energy Consumption

Reducing our energy use will not only reduce our environmental footprint but will also save our school hundreds of dollars each month, thus creating money for things like:

- Paying off the loan
- Adventure fridays
- School supplies
- PE equipment
- Playground
- Expeditions
- And field work.

PPCS electricity budget for 2019-2020 is around $17,000

This is $2,000 more than we had originally planned. (1)

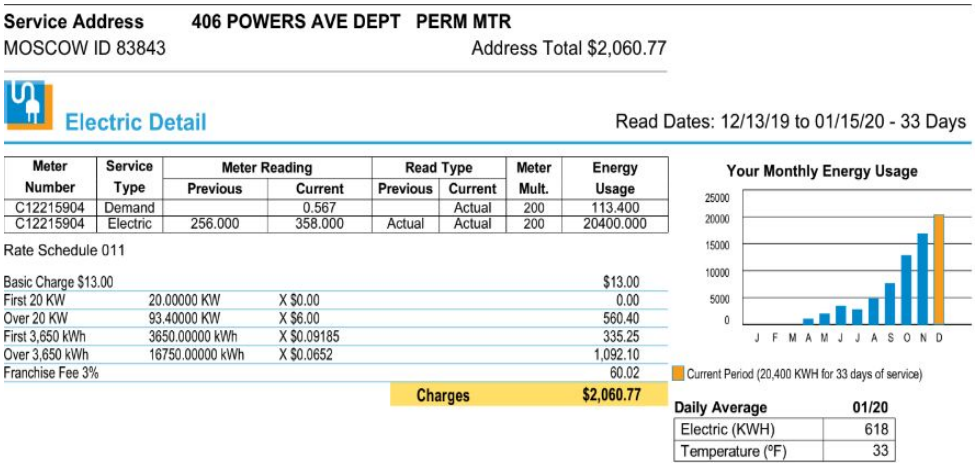
So how do our power bills reflect this information?

PPCS Avista Power Bills for 2019-2020

By Corbin Reed

Avista Charges Customers for Electricity in Two Different Ways

- Demand
- Electricity



Service Address **406 POWERS AVE DEPT PERM MTR**
MOSCOW ID 83843 Address Total $2,060.77

Electric Detail Read Dates: 12/13/19 to 01/15/20 - 33 Days

Meter Number	Service Type	Meter Reading Previous	Meter Reading Current	Read Type Previous	Read Type Current	Meter Mult.	Energy Usage
C12215904	Demand		0.567		Actual	200	113.400
C12215904	Electric	256.000	358.000	Actual	Actual	200	20400.000

Rate Schedule 011

Basic Charge $13.00			$13.00
First 20 KW	20.00000 KW	X $0.00	0.00
Over 20 KW	93.40000 KW	X $6.00	560.40
First 3,650 kWh	3650.00000 kWh	X $0.09185	335.25
Over 3,650 kWh	16750.00000 kWh	X $0.0652	1,092.10
Franchise Fee 3%			60.02
		Charges	**$2,060.77**

Your Monthly Energy Usage

Current Period (20,400 KWH for 33 days of service)

Daily Average	01/20
Electric (KWH)	618
Temperature (°F)	33

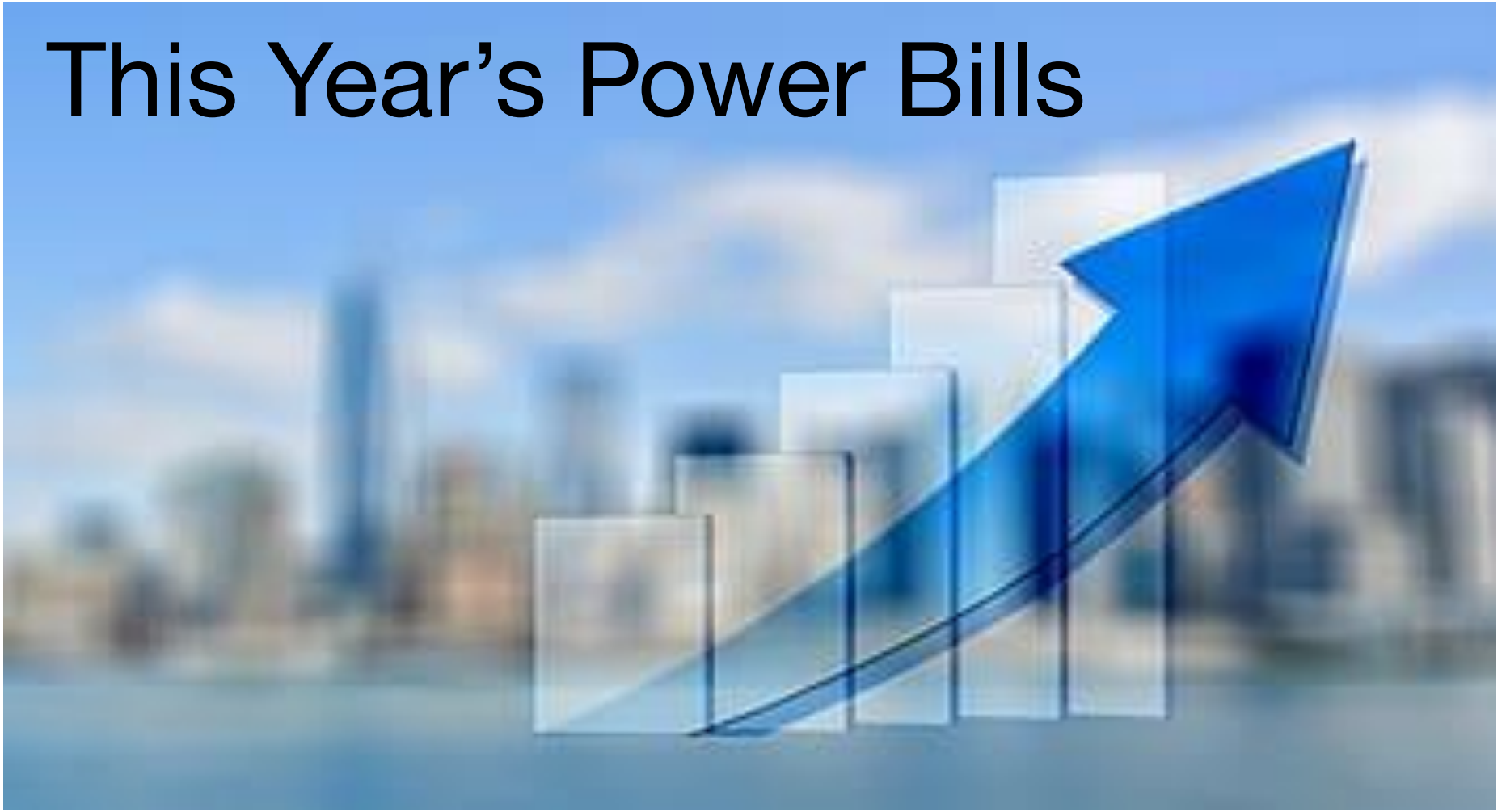
Demand (Measured in KW)

- Demand is how much energy a customer uses at once, within a 15 minute time period.
- Anything under 20 KW is free
- Over 20 KW is $6.00 per KW

Electricity (Measured in kWh)

- How much a customer uses in a month.
- 9 cents per kWh under 3,650 kWh
- About 7 cents per kWh over 3,650 kWh

This Year’s Power Bills



September Bill

Service Address **406 POWERS AVE DEPT PERM MTR**
MOSCOW ID 83843 Address Total $548.31

Electric Detail

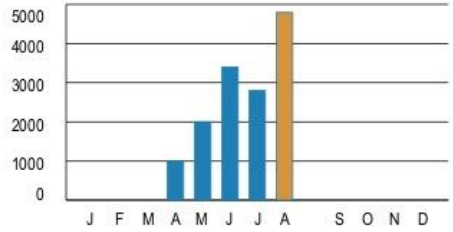
Read Dates: 08/13/19 to 09/13/19 - 31 Days

Meter Number	Service Type	Meter Reading		Read Type		Meter Mult.	Energy Usage
		Previous	Current	Previous	Current		
C12215904	Demand		0.170		Actual	200	34.000
C12215904	Electric	46.000	70.000	Actual	Actual	200	4800.000

Rate Schedule 011

Basic Charge $13.00			$13.00
First 20 KW	20.00000 KW	X $0.00	0.00
Over 20 KW	14.00000 KW	X $6.00	84.00
First 3,650 kWh	3650.00000 kWh	X $0.09776	356.82
Over 3,650 kWh	1150.00000 kWh	X $0.06828	78.52
Franchise Fee 3%			15.97
		Charges	**$548.31**

Your Monthly Energy Usage



Current Period (4,800 KWH for 31 days of service)

Daily Average	09/19
Electric (KWH)	155
Temperature (ºF)	68

October Bill

Service Address **406 POWERS AVE DEPT PERM MTR**
MOSCOW ID 83843 Address Total $1,056.97

Electric Detail

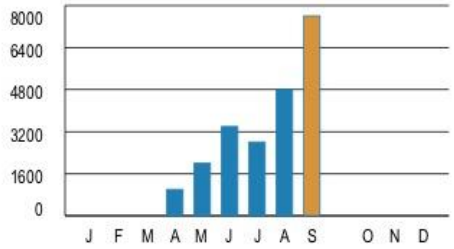
Read Dates: 09/13/19 to 10/14/19 - 31 Days

Meter Number	Service Type	Meter Reading		Read Type		Meter Mult.	Energy Usage
		Previous	Current	Previous	Current		
C12215904	Demand		0.412		Actual	200	82.400
C12215904	Electric	70.000	108.000	Actual	Actual	200	7600.000

Rate Schedule 011

Basic Charge $13.00			$13.00
First 20 KW	20.00000 KW	X $0.00	0.00
Over 20 KW	62.40000 KW	X $6.00	374.40
First 3,650 kWh	2001.61290 kWh	X $0.09776 (for 17 of 31 days)	195.68
First 3,650 kWh	1648.38710 kWh	X $0.10133 (for 14 of 31 days) New Rate	167.03
Over 3,650 kWh	2166.12904 kWh	X $0.06828 (for 17 of 31 days)	147.90
Over 3,650 kWh	1783.87096 kWh	X $0.07185 (for 14 of 31 days) New Rate	128.17
Franchise Fee 3%			30.79
		Charges	**$1,056.97**

Your Monthly Energy Usage



Current Period (7,600 KWH for 31 days of service)

Daily Average	10/19
Electric (KWH)	245
Temperature (°F)	49

November Bill

Service Address **406 POWERS AVE DEPT PERM MTR**
MOSCOW ID 83843 Address Total $1,584.43

Electric Detail

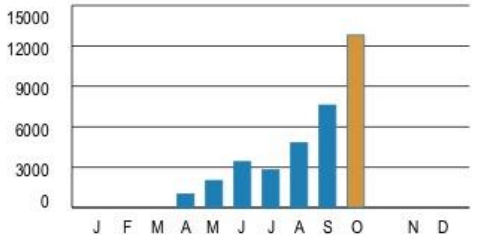
Read Dates: 10/14/19 to 11/12/19 - 29 Days

Meter Number	Service Type	Meter Reading		Read Type		Meter Mult.	Energy Usage
		Previous	Current	Previous	Current		
C12215904	Demand		0.515		Actual	200	103.000
C12215904	Electric	108.000	172.000	Actual	Actual	200	12800.000

Rate Schedule 011

Basic Charge $13.00			$13.00
First 20 KW	20.00000 KW	X $0.00	0.00
Over 20 KW	83.00000 KW	X $6.00	498.00
First 3,650 kWh	3650.00000 kWh	X $0.10133	369.85
Over 3,650 kWh	9150.00000 kWh	X $0.07185	657.43
Franchise Fee 3%			46.15
		Charges	**$1,584.43**

Your Monthly Energy Usage



Current Period (12,800 KWH for 29 days of service)

Daily Average	11/19
Electric (KWH)	441
Temperature (°F)	40

December Bill

Service Address **406 POWERS AVE DEPT PERM MTR**
MOSCOW ID 83843 Address Total $1,786.95

Electric Detail

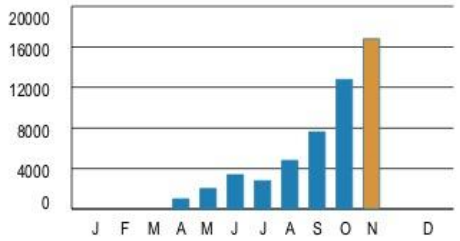
Read Dates: 11/12/19 to 12/13/19 - 31 Days

Meter Number	Service Type	Meter Reading Previous	Meter Reading Current	Read Type Previous	Read Type Current	Meter Mult.	Energy Usage
C12215904	Demand		0.482		Actual	200	96.400
C12215904	Electric	172.000	256.000	Actual	Actual	200	16800.000

Rate Schedule 011

Basic Charge $13.00			$13.00
First 20 KW	20.00000 KW	X $0.00	0.00
Over 20 KW	76.40000 KW	X $6.00	458.40
First 3,650 kWh	2119.35484 kWh	X $0.10133 (for 18 of 31 days)	214.75
First 3,650 kWh	1530.64516 kWh	X $0.09185 (for 13 of 31 days) New Rate	140.59
Over 3,650 kWh	7635.48387 kWh	X $0.07185 (for 18 of 31 days)	548.61
Over 3,650 kWh	5514.51613 kWh	X $0.0652 (for 13 of 31 days) New Rate	359.55
Franchise Fee 3%			52.05
		Charges	**$1,786.95**

Your Monthly Energy Usage



Current Period (16,800 KWH for 31 days of service)

Daily Average	12/19
Electric (KWH)	542
Temperature (°F)	34

January Bill

Service Address **406 POWERS AVE DEPT PERM MTR**
MOSCOW ID 83843 Address Total $2,060.77

Electric Detail

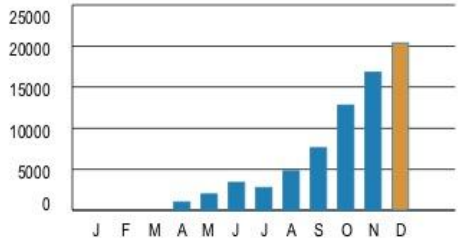
Read Dates: 12/13/19 to 01/15/20 - 33 Days

Meter Number	Service Type	Meter Reading Previous	Meter Reading Current	Read Type Previous	Read Type Current	Meter Mult.	Energy Usage
C12215904	Demand		0.567		Actual	200	113.400
C12215904	Electric	256.000	358.000	Actual	Actual	200	20400.000

Rate Schedule 011

Basic Charge $13.00			$13.00
First 20 KW	20.00000 KW	X $0.00	0.00
Over 20 KW	93.40000 KW	X $6.00	560.40
First 3,650 kWh	3650.00000 kWh	X $0.09185	335.25
Over 3,650 kWh	16750.00000 kWh	X $0.0652	1,092.10
Franchise Fee 3%			60.02
		Charges	**$2,060.77**

Your Monthly Energy Usage



Current Period (20,400 KWH for 33 days of service)

Daily Average	01/20
Electric (KWH)	618
Temperature (°F)	33

Avista Bills from Sept. 2019- Jan. 2020

- The bills from Sep. 2019- Jan. 2020 show a steady increase from $548-$2061
- The demand from Sept.-Jan. has also steadily increased from $84-$560

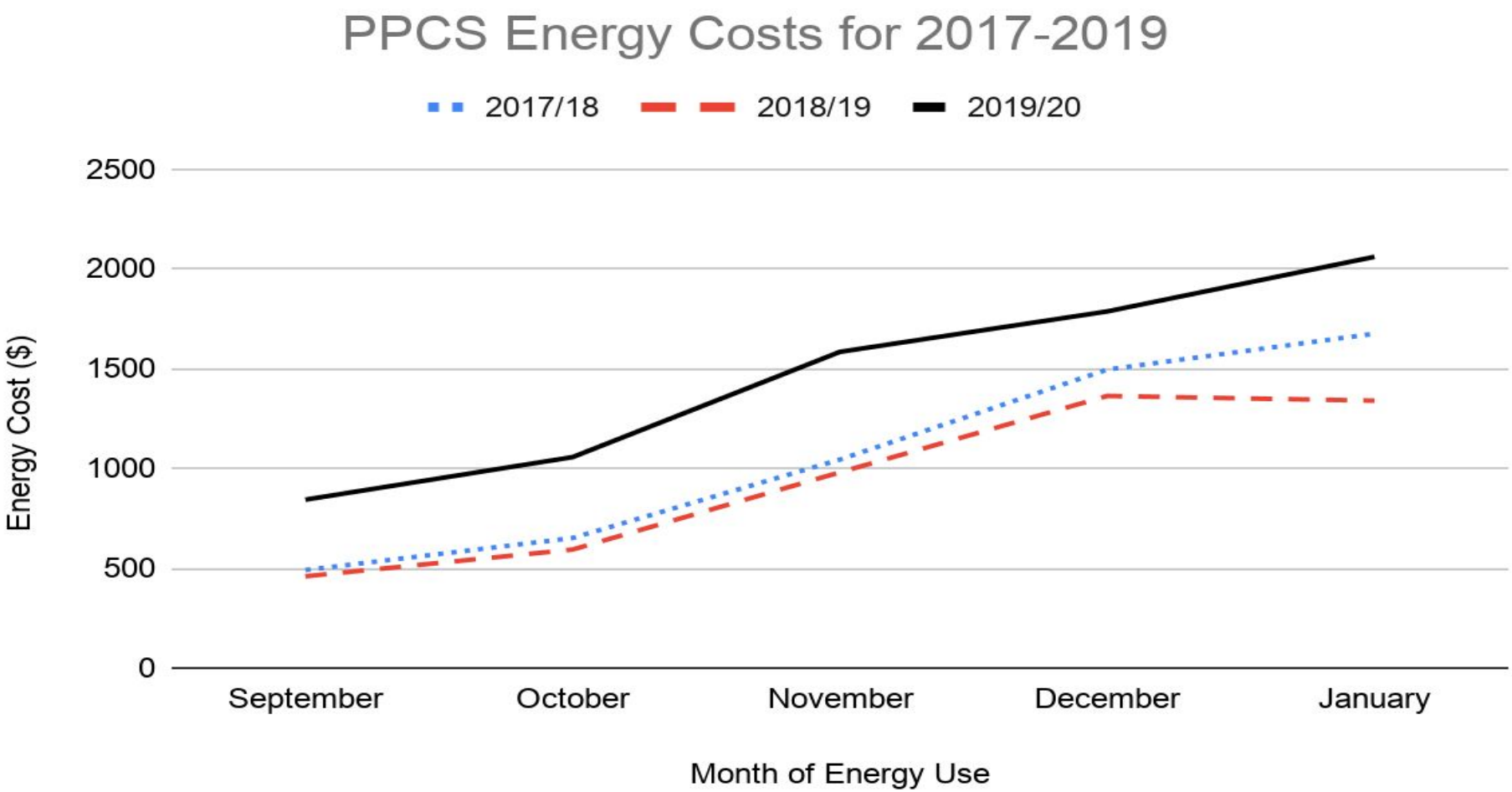
Avista Power Bill Summary

On our power bill we are charged for two types of energy, demand and electricity. The cost of these two types of electricity has steadily increased over the last five months, and has surpassed the old school in electricity cost

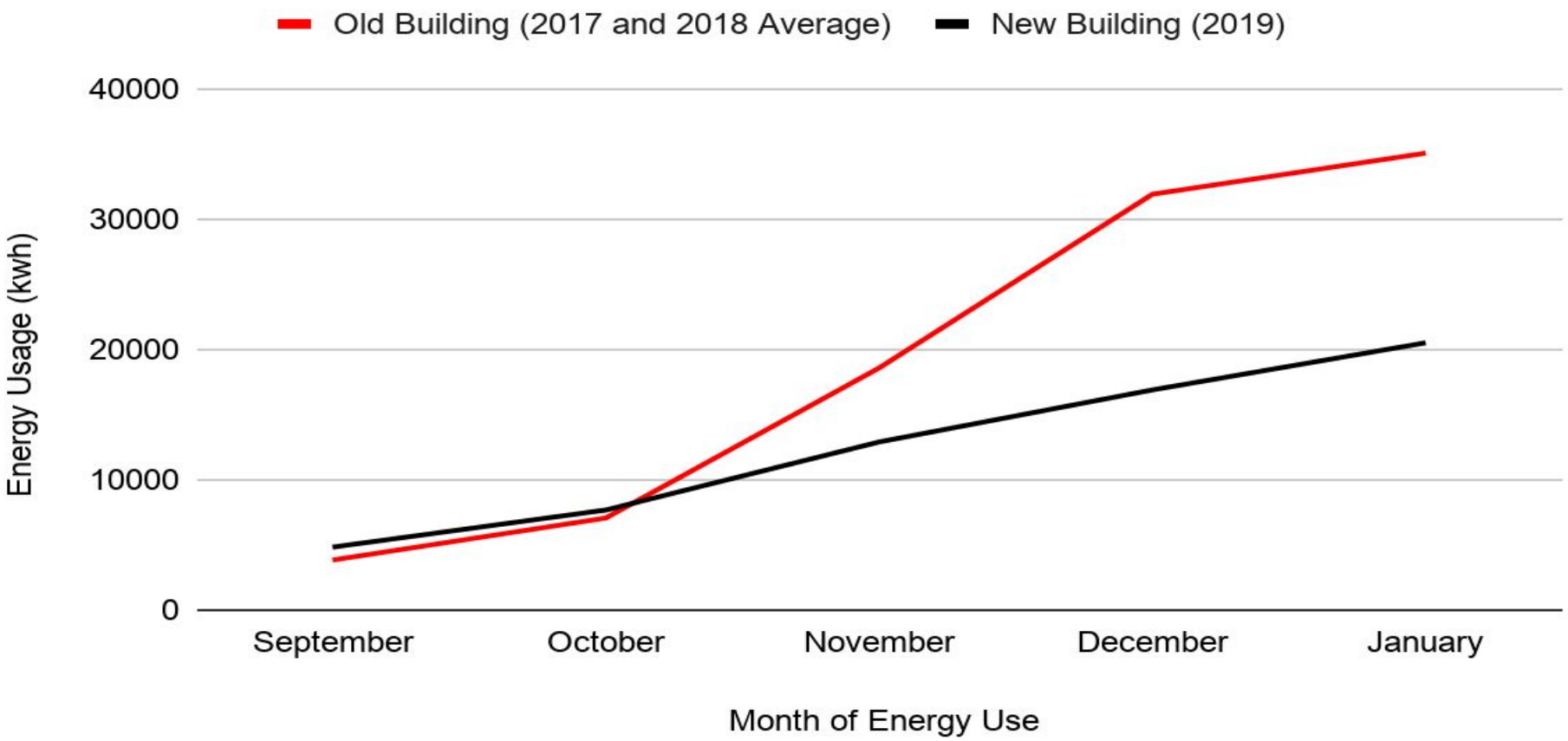
How Does Electricity in Our New Building Compare to the Old Building?

Old Building vs. New Building

By Amelia Larson


PPCS Energy Costs for 2017-2019
2017/18
2018/19
2019/20
2500
2000
1500
1000
500
0
Energy Cost ($)
September
October
November
December
January
Month of Energy Use

Old Building (2017 and 2018 Average) and New Building (2019)

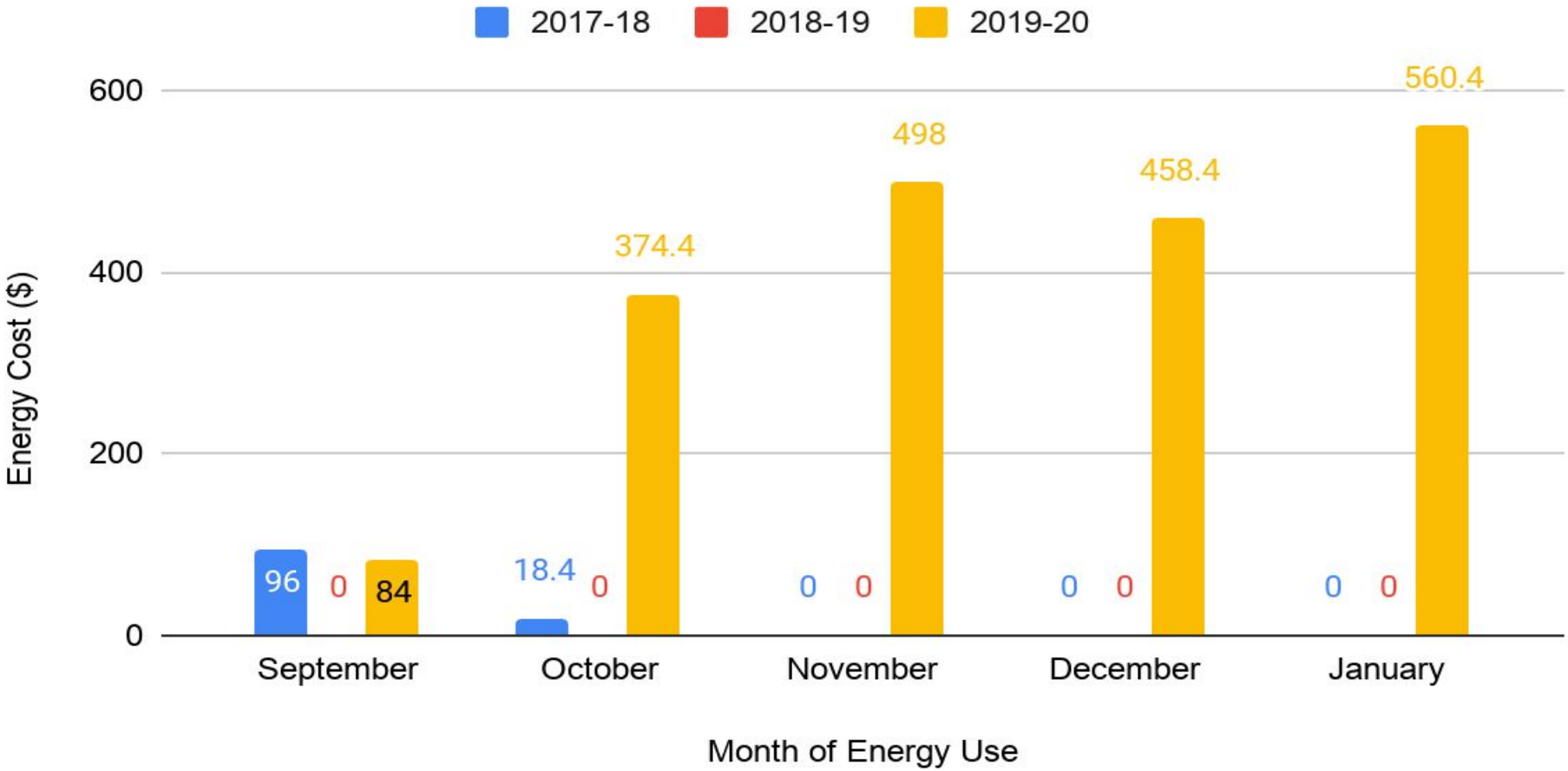


Why Are We Paying More for Less Energy?

1. Natural gas is cheaper

2. We have a higher demand charge

Demand Cost Comparisons

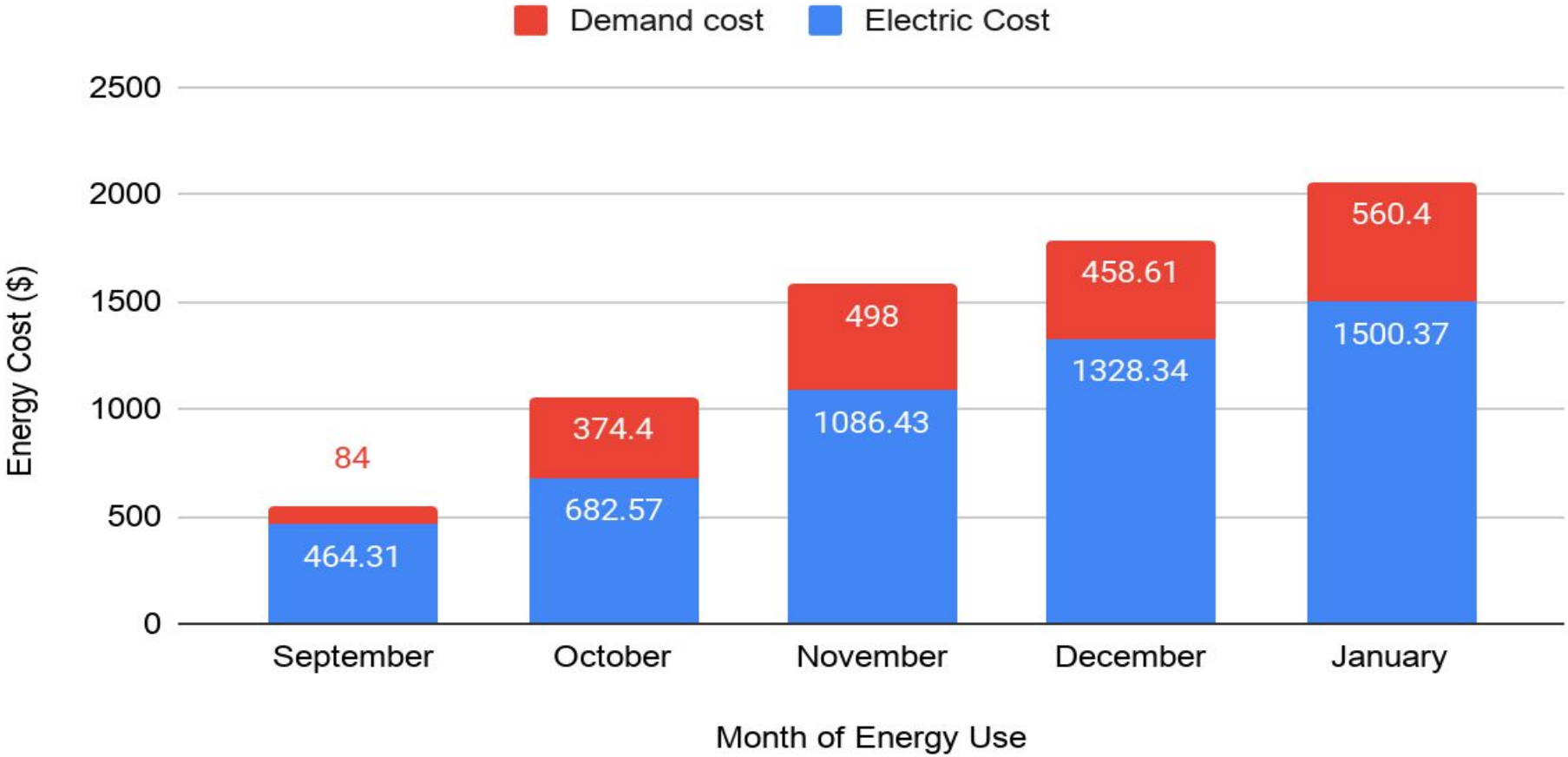


What is Demand on the Energy Bill?

- The total amount of energy used within a fifteen minute span
- The amount of electrical power that has to be generated at any given time


Like Water Going Through a Pipe

Demand Cost vs. Electric Cost 2019-20



Our Demand Charges

So far this year, demand has taken up an average of 28% of our energy bill every month

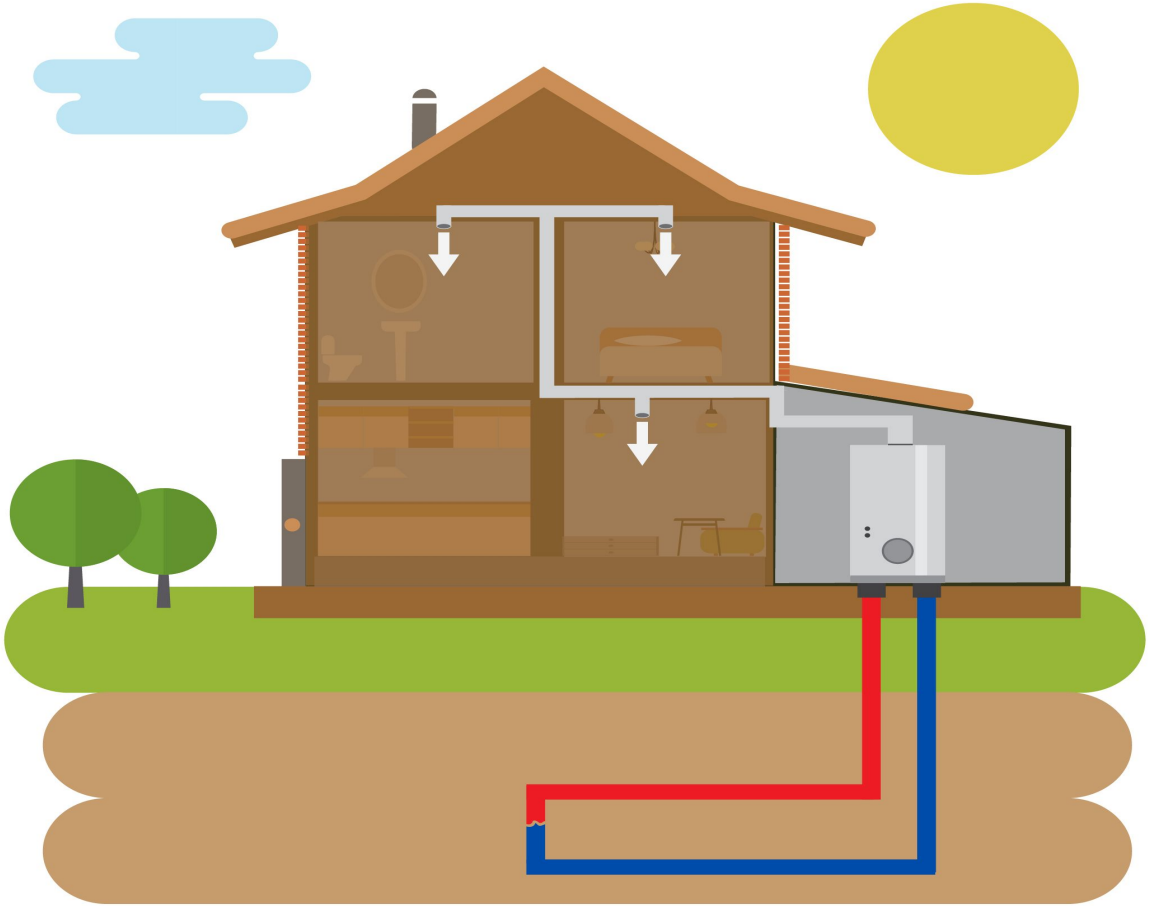
We have determined that heat pumps are the main contributing factor to our high demand, so what are heat pumps?

Heat Pumps

By Benjamin Schab

There are two kinds of heat pumps

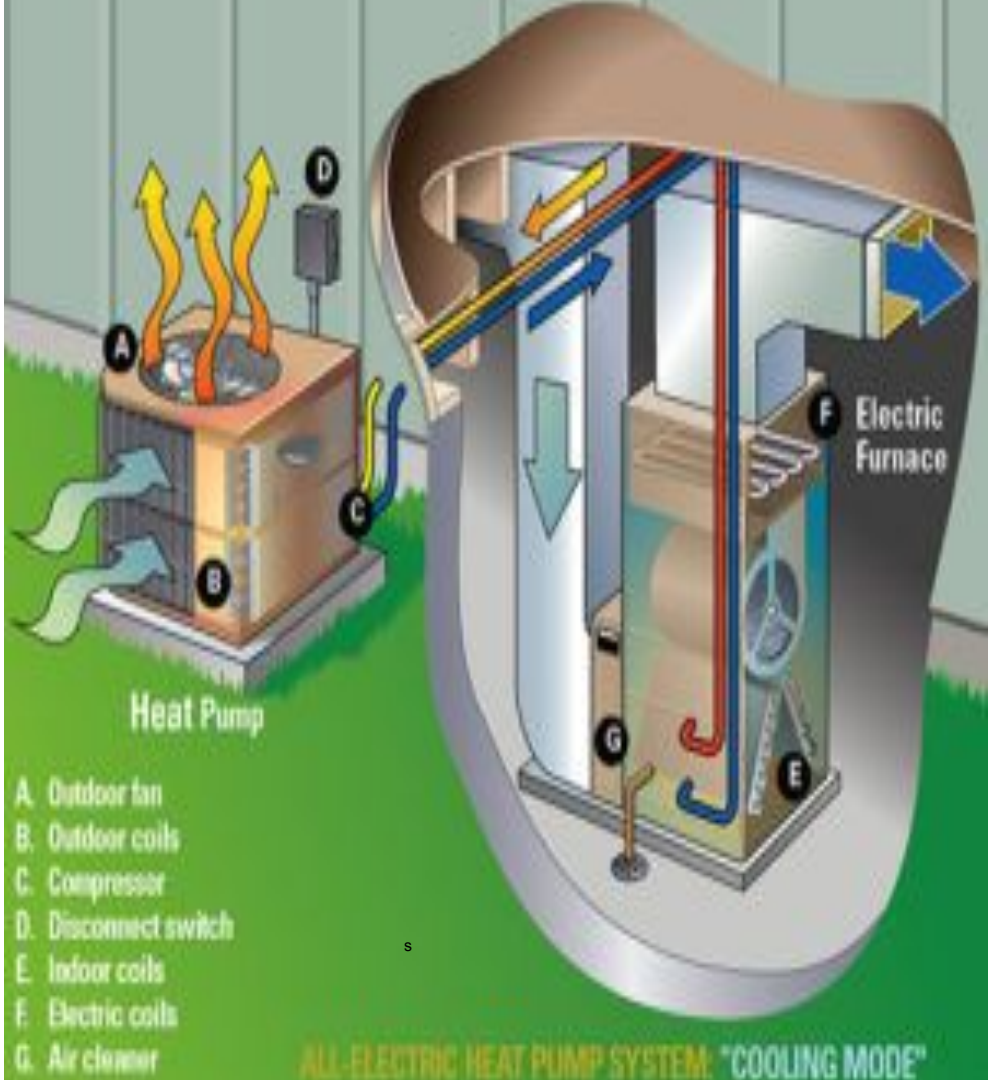
- There are two kinds of heat pumps, geothermal and electrical resistance heat pumps.
- Geothermal heat pumps are buried in the ground, drawing heat from the ground.
- We have electrical resistance heat pumps.



NC SUSTAINABLE ENERGY ASSOCIATION

Electrical resistance heat pumps.

- Electrical resistance heat pumps, unlike geothermal, are located above ground, getting their heat from the air rather than the ground.
- Using fans, heat pumps are able to take cool air on hot days and pump it into the building, and take warm air and pump it into the building on cold days. This is dependent on the outdoor temperature and the desired temperature of the building.



Controls or Modes

- There are three different modes on a thermostat: heat, cool, and auto.
- These controls help regulate the inside temperature based on your daily needs.

How Efficient?

- Heat pumps are 300% efficient. One penny of heat paid for, and three pennies of heat out.
- When the temperature drops below 35-30 degrees fahrenheit (depending on what kind of heat pumps you have) it becomes less than 100% efficient. When this does happen they use coils, like toasters, to heat the building; this is called AUX heat. This also happens when the thermostat is turned up 2 to 3 degrees.

Efficiency in heat pumps

There are two efficiencies when it comes to heat pumps.

The first, standard HP, which kicks in AUX heat at around 35 degrees fahrenheit.

The second, high EF, which turns AUX heat on at around -5 degrees fahrenheit. We have standard HP.

How to Stay Efficient

- The most effective way to keep your heat pumps working efficiently is to not use auto mode.
- Auto mode may sound like a good idea, but the frequent changing temperature may wear down the heat pumps and make them less efficient.
- We recommend using ‘Cool’ in the summer and ‘Heat’ in the winter.

Maintenance

To keep the heat pumps at peak efficiency, it is essential to keep up on maintenance. This is generally a quick process. “Consult your heat pumps user manual for details on cleaning and replacing cartridges. Keep the outdoor compressor unit free of debris, snow, and ice”.

-Efficiency Vermont

How does this affect the way we heat our building?

THERMOSTAT SETTINGS

Stagger Start and Zone Heating Protocol

By Raven DePhelps and Ella Soule

Data from Staff Summary

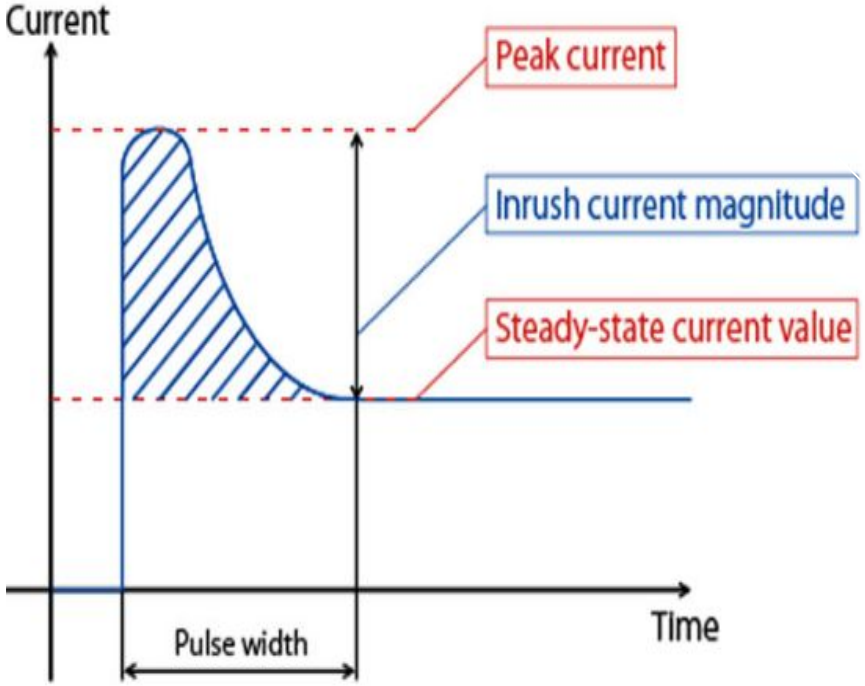
	Time Classroom is Entered	Prefered Temp.	Lowest Temp.	Highest Temp.
Multi-purpose	7:00 AM	70F	65F	75F
Kindergarten	7:30 AM	68F	65F	76F
1st	7:45 AM	70F	67F	72F
2nd	7:15 AM	68F	68F	74F
3rd	7:30 AM	67F	65F	72F
4th	8:00 AM	Not Sure	Not Sure	Highest possible
5th	7:00 AM	65F	63F	70F
Math	9:00 AM	68F	67F	72F
Science	8:00 AM	68F	68F	73F
Social Studies	8:00AM	68F	65F	72F
Humanities	8:00 AM	70F	68F	72F
Office	7:00 AM	69F	63F	73F
Special Ed.	7:00 AM	68F	67F	70F
Mrs. Branen	7:40 AM	70F	68F	72F
Hallway	7:00 AM	70F	65F	75F
*Default Temperature for all Rooms is 70F				

Data Summary

- The average prefered temperature is 68 degrees fahrenheit
- The average minimum temperature while still reaching comfortability is 66 degrees fahrenheit
- The average maximum temperature while still reaching comfortability is 73 degrees fahrenheit
- All rooms were programed at 70 degrees fahrenheit but we have already changed the thermostats
- There are fourteen different rooms connected to the heat pumps
- The Multi-purpose room is connected to two seperate heat pumps

Demand Spikes

- A demand spike is caused when every heat pump connected to the school turns on at the same time in the morning (our current setup). This results in using the backup AUX heating
- They are where most of the cost of heating goes to because once we reach our 20 kWh limit set by Avista, we pay $6 per kilowatt compared to it being free per kW below the limit
- If we stagger the start of the heat pumps, we can minimize how much we go over the limit, thus saving lots of money



*Graph sourced from Sunflower Electronics

AUX Heating

And the Stagger Start Solution

- AUX heating kicks in when the demand for energy becomes greater than the amount of energy a heat pump can supply, this usually happens when the demand spikes, which is why we need to stagger the heat pumps

- Staggering the start of the heat pumps is important because it minimizes use of backup AUX heating

- This backup AUX heat is way less sustainable, efficient, and cost effective compared to the heat pumps which is why we want to minimize our use of it

Zone Heating

- Zone heating is minimizing the time that a room is being heated when not in use
- To implement zone heating into our schedule, we looked at what time a teacher would enters their their classroom and made our schedule accordingly
- Zone heating is important because it minimizes energy use and thus is more sustainable and cheap

Morning Stagger Start Protocol

Morning	6:00am	6:20am	6:30am	6:40am	6:50am	7:00am	7:10am	7:20am	7:30am
Science room							Fully Heated		
P.E room	Fully Heated								
P.E room	Fully Heated								
1st grade							Fully Heated		
2nd grade					Fully Heated				
3rd grade					Fully Heated				
4th grade									Fully Heated
5th grade			Fully Heated						
Math room									
Special ed.			Fully Heated						
Office			Full Heated						
Hallway	Fully Heated								
Mrs. Branen							Fully Heated		
Kinder					Fully Heated				
Social studies									Fully Heated
Humanities									Fully Heated

Morning Stagger Start Protocol Cont.

7:40am	7:50am	8:00am	8:10am	8:20am	8:30am	8:40am	8:50am	9:00am	
								End Stagger	
								End Stagger	
								End Stagger	
								End Stagger	
								End Stagger	
								End Stagger	
								End Stagger	
								End Stagger	
					Fully Heated			End Stagger	
								End Stagger	
								End Stagger	
								End Stagger	
								End Stagger	
								End Stagger	
								End Stagger	

Full Week Heat

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
6:10am	Start Stagger	Start stagger	Start stagger	Start stagger	Start stagger		
6:20am							
6:30am							
6:40am							
6:50am							
7:00am							
7:10am							
7:20am							
7:30am							
7:40am							
7:50am							
8:00am							

Full Week Heat Continued

*Overnight cooling temperature would be 85F

*Overnight heating temperature would be 55F

8:10am							
8:20am							
8:30am							
8:40am							
8:50am							
9:00am	End Stagger	End stagger	End stagger	End stagger	End stagger		
Time Skip							
3:00pm							
3:10pm							
3:20pm							
3:30pm	Turn to 55F* Turn to 85F*	Turn to 55F Turn to 85F	Turn to 55F Turn to 85F	Turn to 55F Turn to 85F	Turn to 55F Turn to 85F		
3:40pm							
3:50pm							
4:00pm							

Stagger Start Day Night Cycle

- Overnight when the building is not in use we recommend turning the heat down to 55 degrees fahrenheit overnight and cooling up to 85 degrees fahrenheit.
- We would not turn the thermostats completely off overnight because otherwise we would have to fully reheat every thermostat every morning. This would cause a miniature inrush current over the three classrooms warming at a time
- Alternatively, we also can't leave the heat pumps fully on overnight because over the nine month school year, this would add up to waste a lot of energy and, because overnight in the winter, too low temperatures can freeze pipes

Thermostat Temperatures and When to Manually Switch Between Heating and Cooling

By Antonia Wulfhorst

Data from Staff Summary

	Time Classroom is Entered	Preferred Temp.	Lowest Temp.	Highest Temp.
Multi-purpose	7:00 AM	70F	65F	75F
Kindergarten	7:30 AM	68F	65F	76F
1st	7:45 AM	70F	67F	72F
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3rd	7:30 AM	67F	65F	72F
4th	8:00 AM	Not Sure	Not Sure	Highest possible
5th	7:00 AM	65F	63F	70F
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Special Ed.	7:00 AM	68F	67F	70F
Mrs. Branen	7:40 AM	70F	68F	72F
Hallway	7:00 AM	70F	65F	75F
*Default Temperature for all Rooms is 70F				

Preferred Temperatures According to Staff

- 68 degrees during heating months

- 73 degrees during cooling months

Best Temperatures for Learning Based on Research

Keeping the temperature at a certain temperature is important because the it can affect students learning.

“Whether it’s too hot or too cold, uncomfortable temperatures will cause a distraction to students. Temperature impacts student’s learning ability and also affects numerous other mental and physical activities. When temperatures are not ideal, the brain gets constant interruptions from the body signaling it to readjust to the temperature.”

How Temperature Affects Student Test Scores

- At 61 degrees Fahrenheit, students averaged a score of 76%
- At 72 degrees Fahrenheit, students averaged a score of 90%
- At 81 degrees Fahrenheit, students averaged a score of 72%.”

Recommended Heating and Cooling Temperatures Based on Research

- Heating temperatures should be between 68 and 75 degrees
- Cooling temperatures should be between 73 and 79 degrees

Final Temperature Settings Recommendations

- Heating Temperature of 68
- Cooling Temperature of 74

Manual vs Auto

There are two options for changing the heat on the thermostats

- Manually switch between Heating and Cooling
- Auto

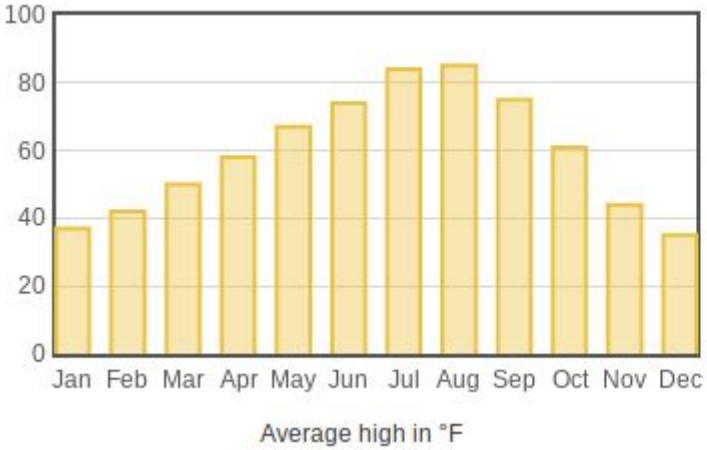
We’re recommending manually switching because our research has shown that it is more energy efficient because we avoid heating at night while cooling during the day.

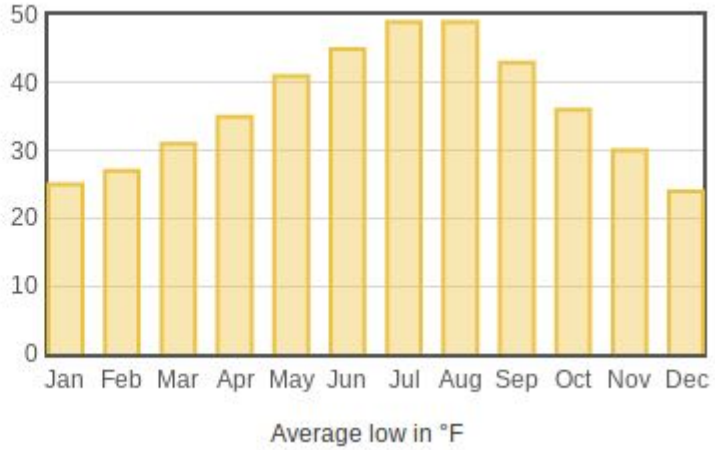
When should we manually change from heating to cooling?

Average High and Low Temperatures for Moscow

Monthly Averages

	January	February	March	April	May	June	July	August	September	October	November	December
Average Monthly high in °F:	37°	42°	50°	58°	67°	74°	84°	85°	75°	61°	44°	35°
Average Monthly low in °F:	25°	27°	31°	35°	41°	45°	49°	49°	43°	36°	30°	24°





Time of Year to Change Heat

The best time to turn on the heat would be around the middle of October as the temperatures start to go into the fifties.

Towards the end of May would be the best time to start cooling the building, since the temperatures are starting to head into the seventies range.

PPCS THERMOSTATS

Kieran Hillyer McVey, Indigo Wulfhorst, Halie Bogden, and Avi Gibler

Bard and Honeywell Thermostats

~There are two different types of thermostats in the school

~The Bard thermostats and the Honeywell thermostats.

~The main building runs on Honeywell thermostats

~The Portables run on Bard

Thermostat Programming

(Main Building)

How to program, schedule, and add holidays to your thermostat

Main building thermostats

~The main building thermostats can create different schedules for different days, unlike the portable thermostats

~The main building thermostats are located in each classroom, the hallway, office, multipurpose room, and Mrs. Branen's office

~The main building thermostats can be programmed a year ahead, while the Bard can not.

SCHEDULING YOUR THERMOSTAT

Scheduling Your Thermostat

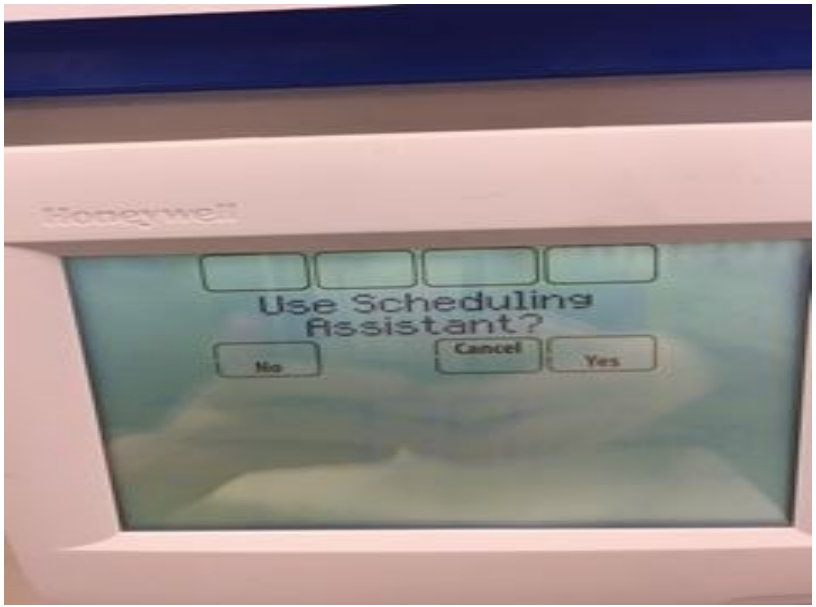
First click menu at the top of your thermostat

Scheduling Your Thermostat

Then select edit schedule

Scheduling Your Thermostat

Do not use the Scheduling Assistant, because it does not allow the flexibility that the scheduling manually does.

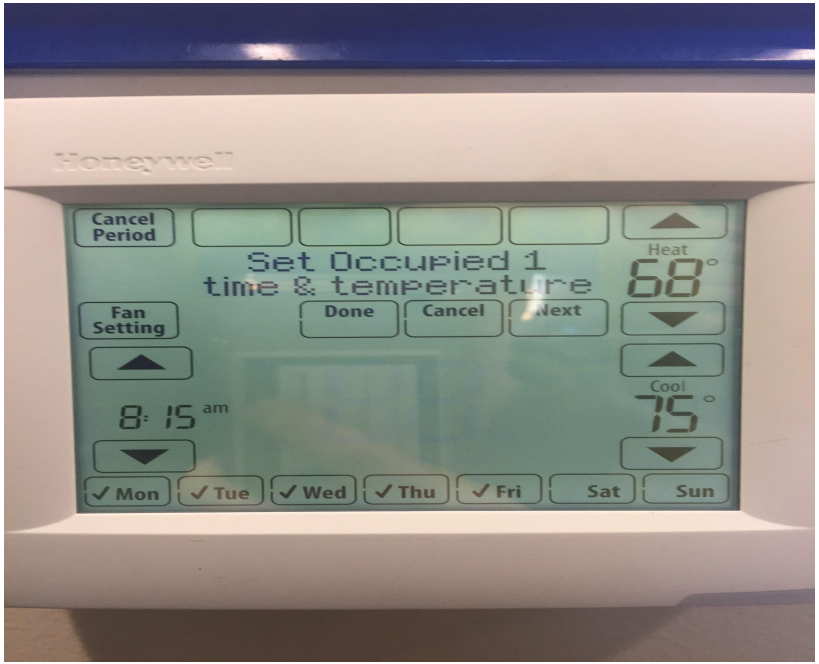


Scheduling Your Thermostat

Select Monday-Friday as days to schedule and press next

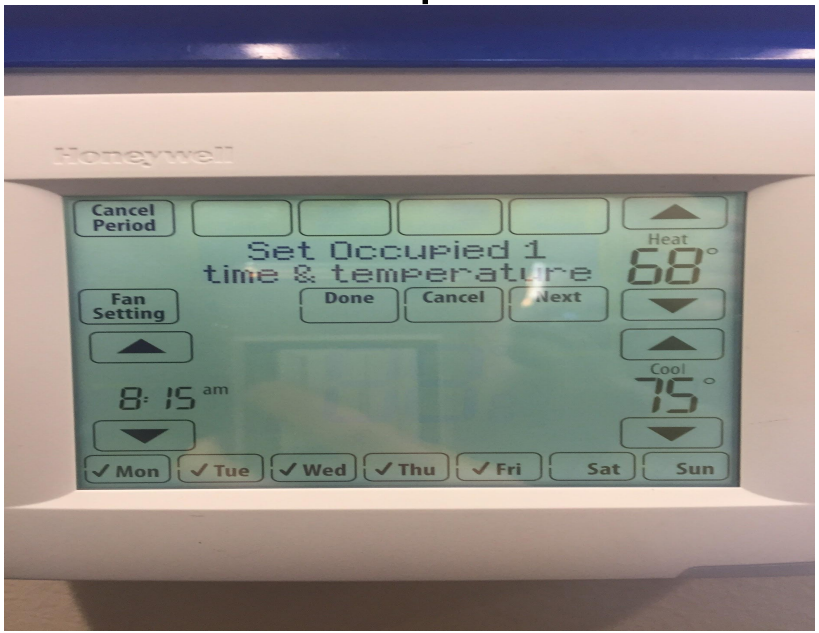
Scheduling Your Thermostat

Then select a time for your thermostat to turn on.



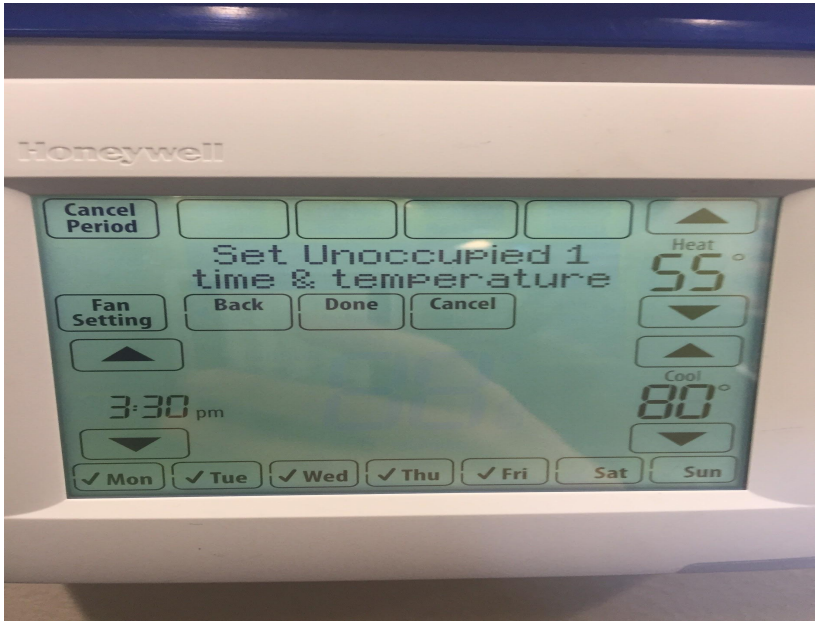
Scheduling Your Thermostat

Select temperatures to heat and cool at while room is occupied



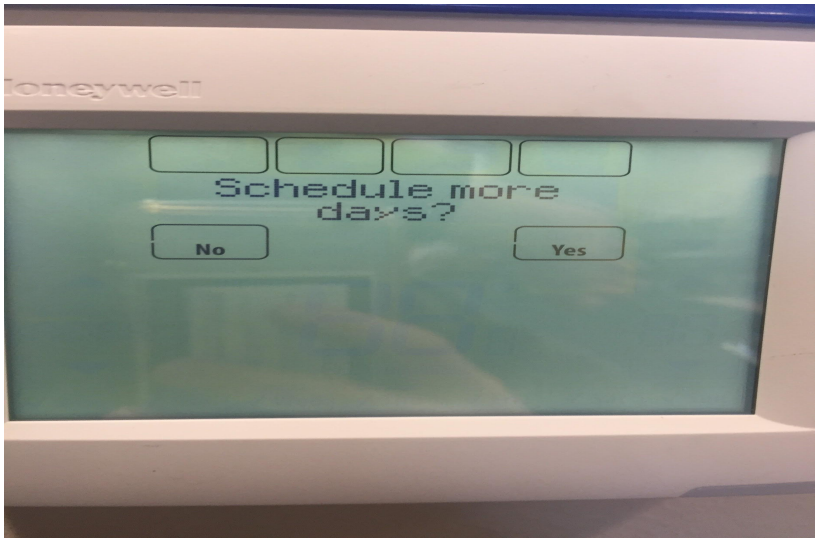
Scheduling Your Thermostat

Select temperatures to heat and cool at while room is unoccupied



Scheduling Your Thermostat

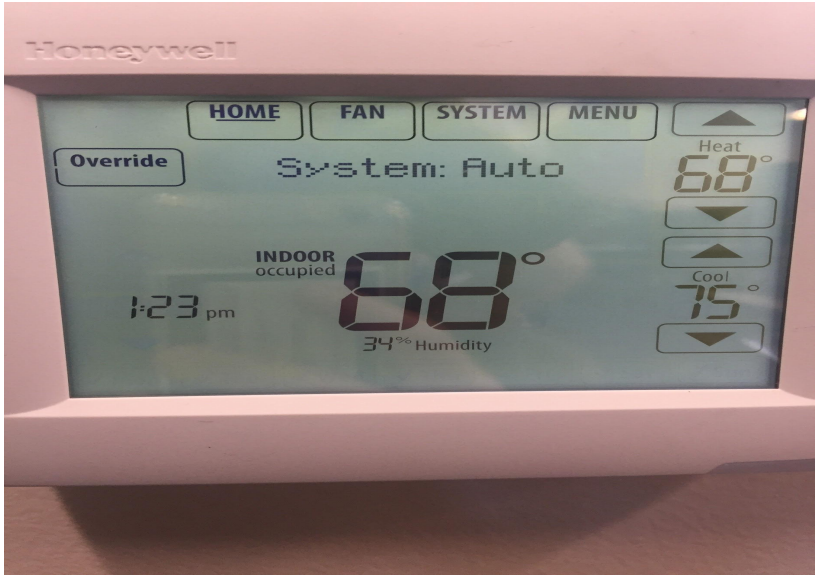
If needed, schedule more days. You have finished scheduling your thermostat. Using this function you can program the weekend



PROGRAMMING YOUR THERMOSTAT

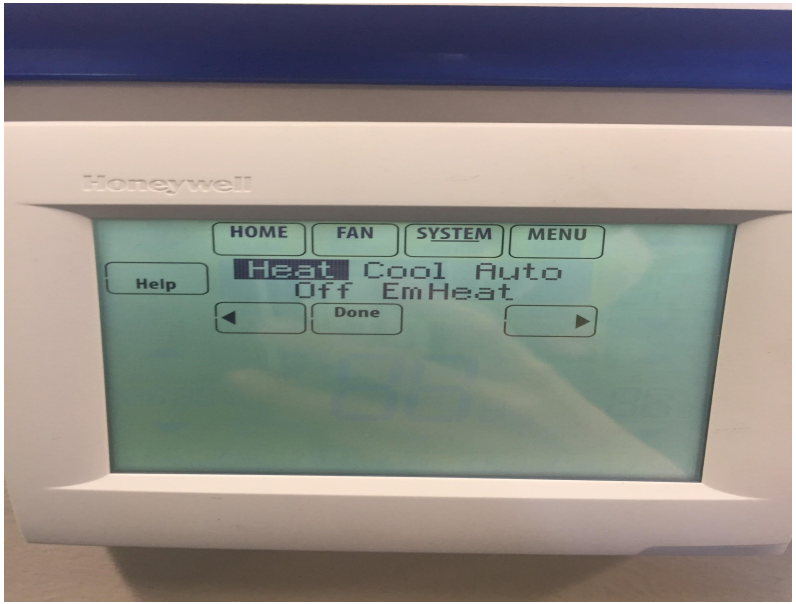
Programming Your Thermostat

How to access heating and cooling settings on the homepage of your thermostat



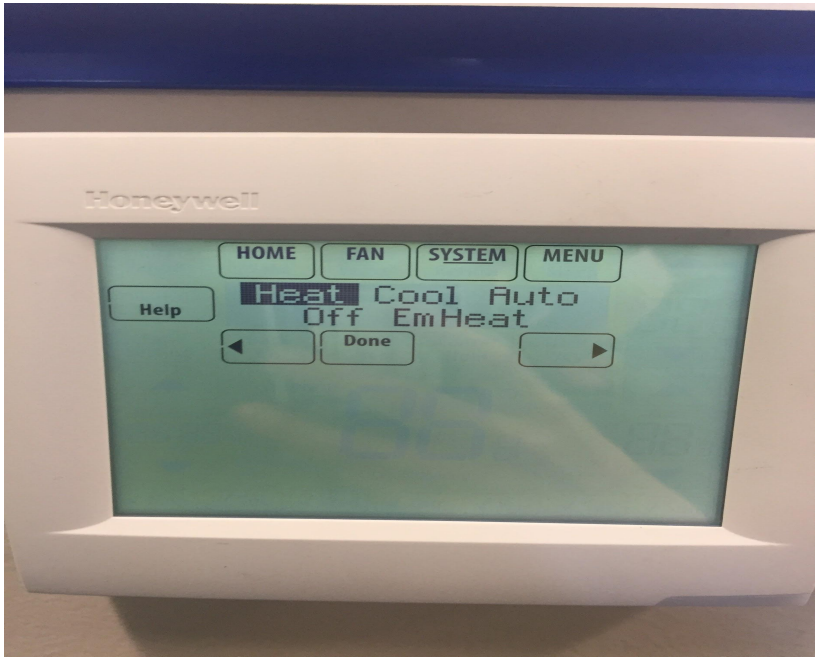
Programming Your Thermostat

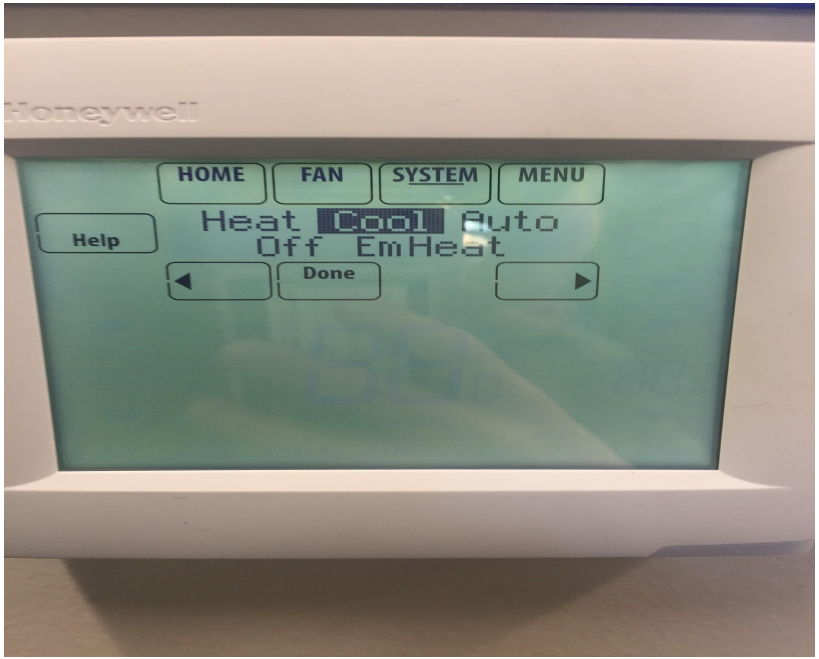
Click system



Programming Your Thermostat

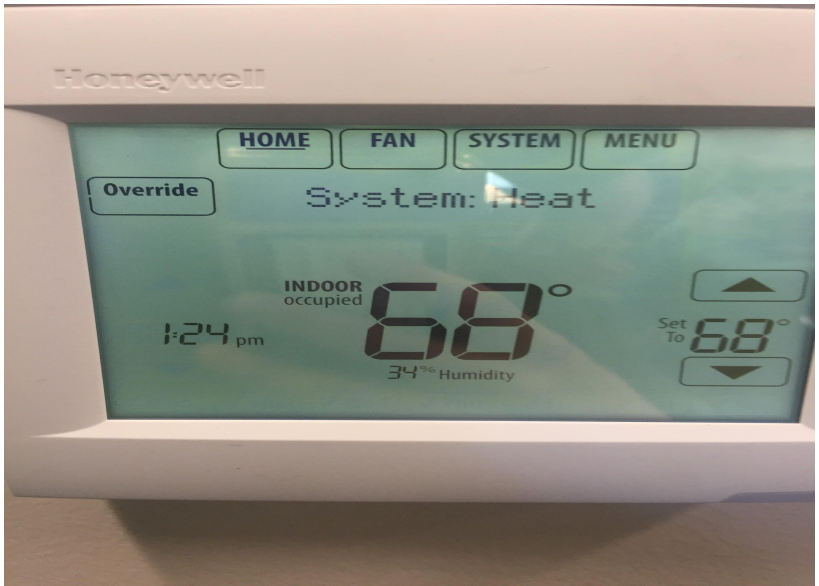
Then press the arrow until heat or cool is highlighted

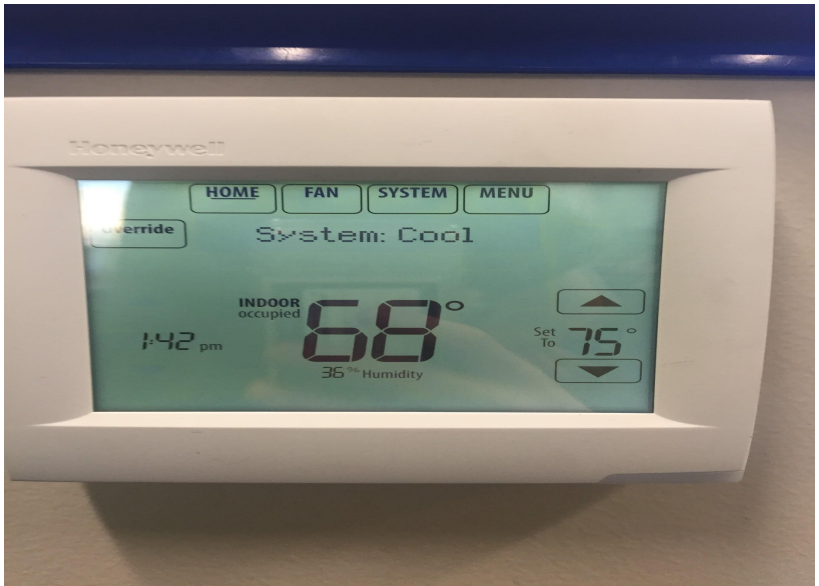




Programming Your Thermostat

Then press home to get back to your home screen. There should be either a heating temperature and a cooling temperature.

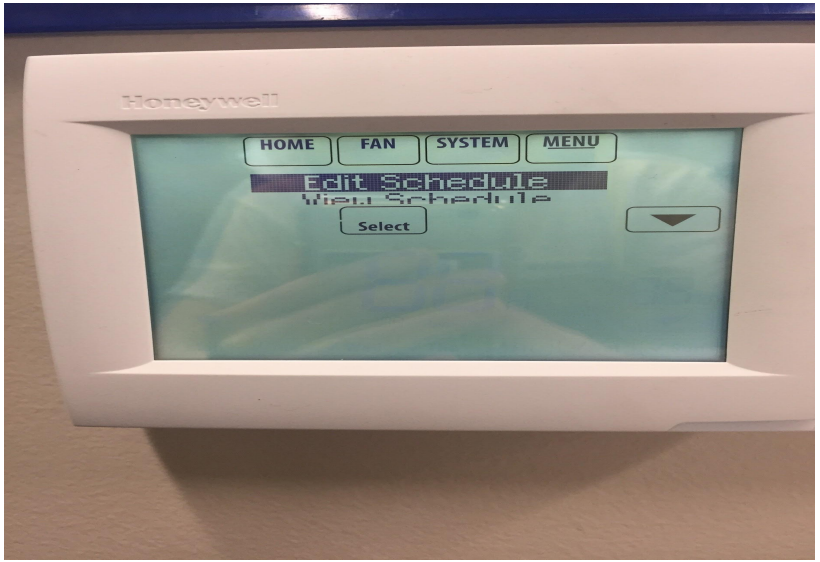




ADDING PRE-SCHEDULED HOLIDAYS TO YOUR THERMOSTAT

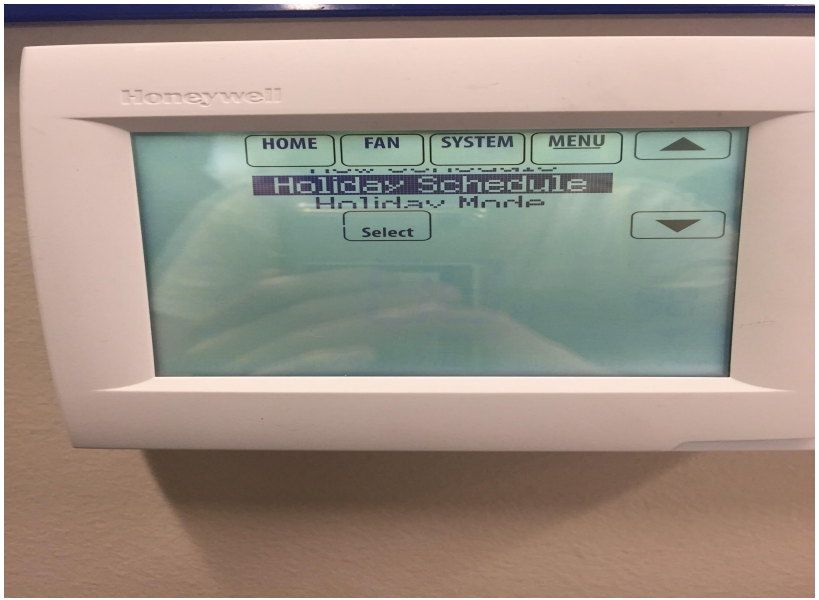
Adding Holidays To Your Thermostat

Go to menu



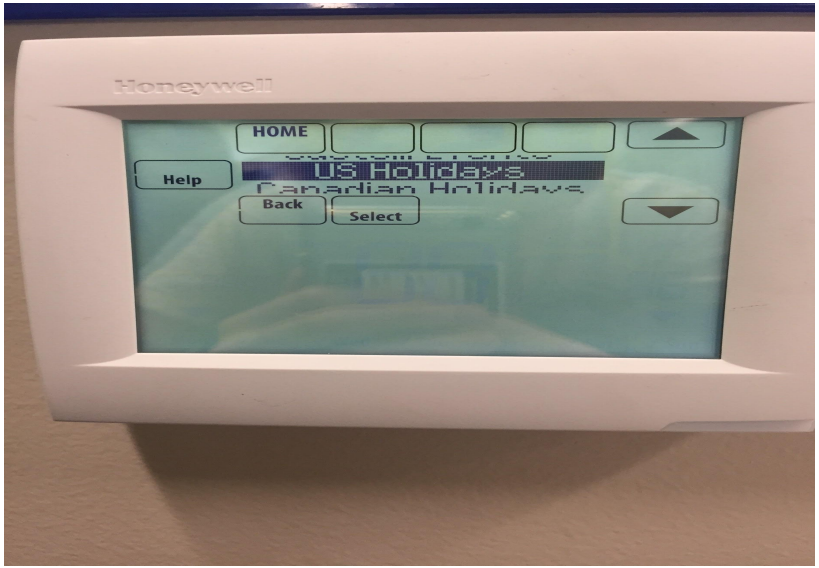
Adding Holidays To Your Thermostat

Then scroll down to Holiday Schedule



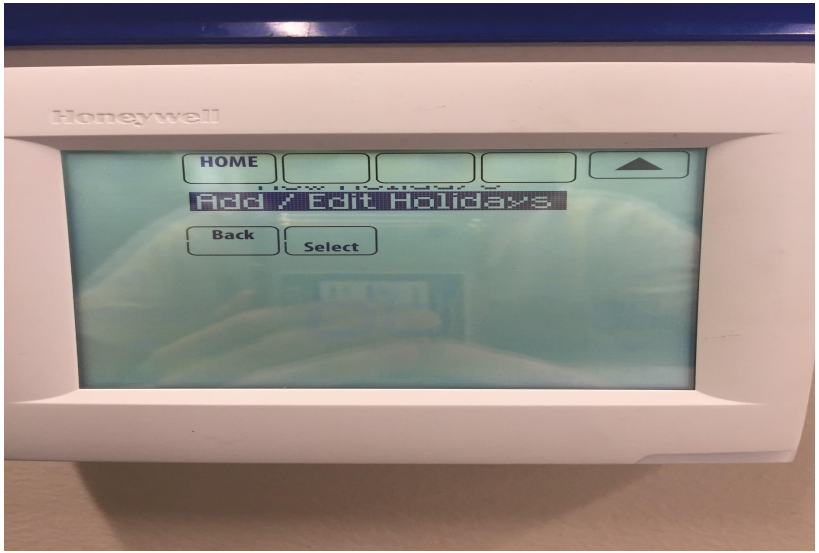
Adding Holidays To Your Thermostat

After selecting Holiday Schedule then select US holidays



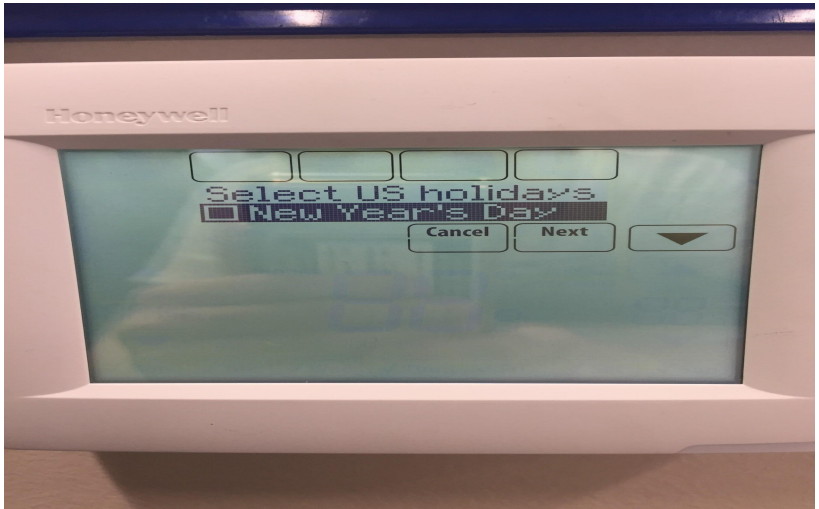
Adding Holidays To Your Thermostat

Then scroll down to Add/ Edit Holidays



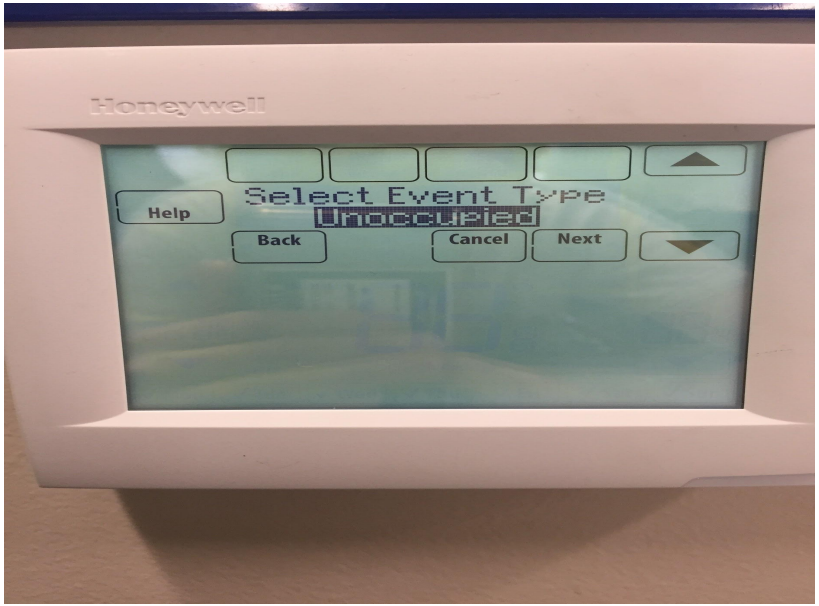
Adding Holidays To Your Thermostat

Select Add/ Edit Holidays and **select** Labor day, MLK day, Presidents day, and Memorial day. **Do not select** New years day/eve, Christmas day/eve, Thanksgiving day, Veterans day, Columbus day, or the 4th of July. Then press next.



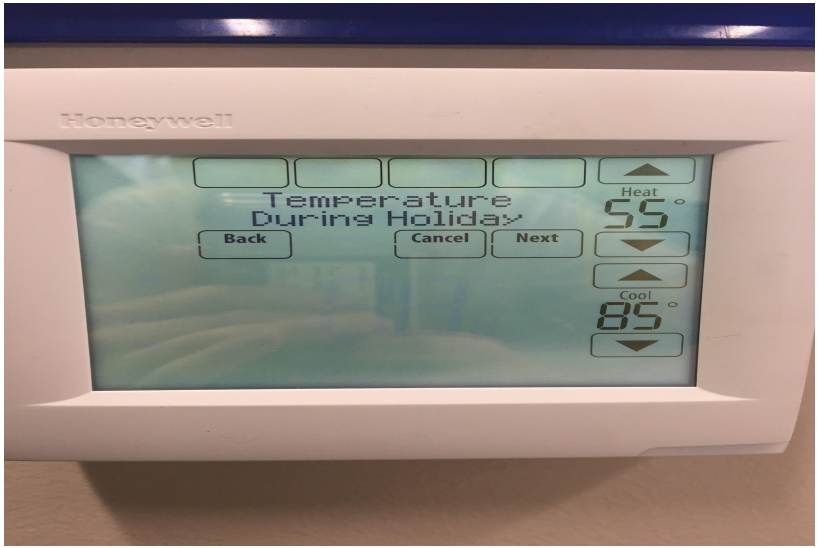
Adding Holidays To Your Thermostat

Select Unoccupied then press next.



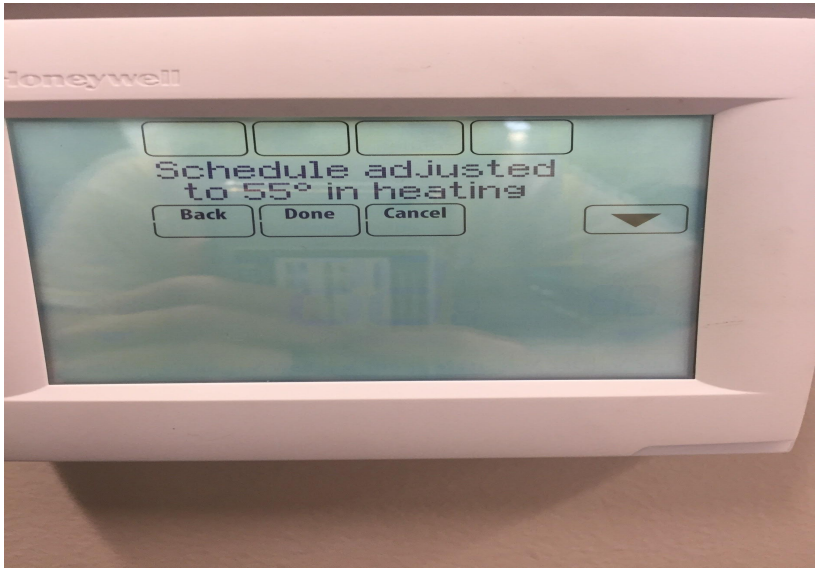
Adding Holidays To Your Thermostat

Then set the temperature of your room during the holidays to heating at 55℉ and cooling at 85℉. Keep in mind we might want to change these temperatures later. Press next.



Adding Holidays To Your Thermostat

Confirm the adjusted schedule then press done.



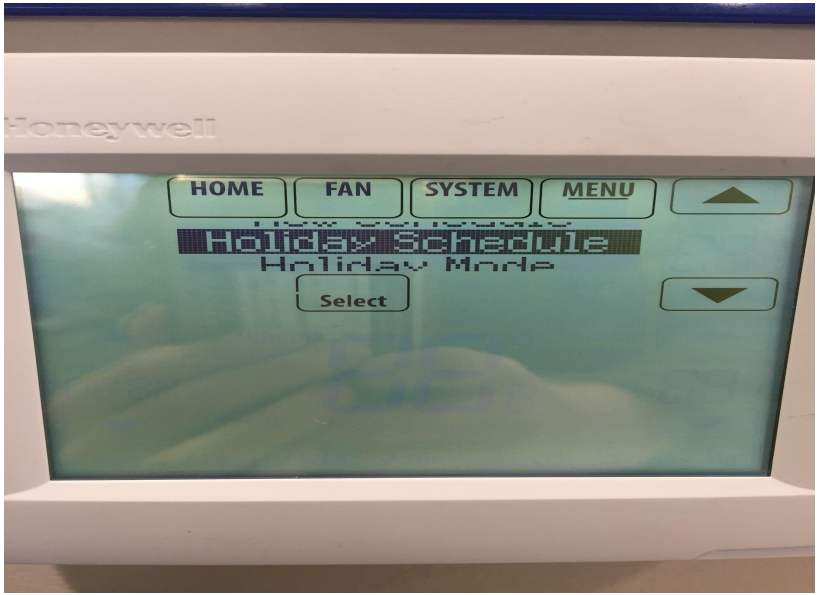
ADDING CUSTOM HOLIDAYS TO YOUR THERMOSTAT

Custom Holidays

These holidays are Thanksgiving break, Winter break, and Spring break. These holidays do not have a date in our thermostats and they are not the same every year. Therefore, we need to program custom days off into our thermostat.

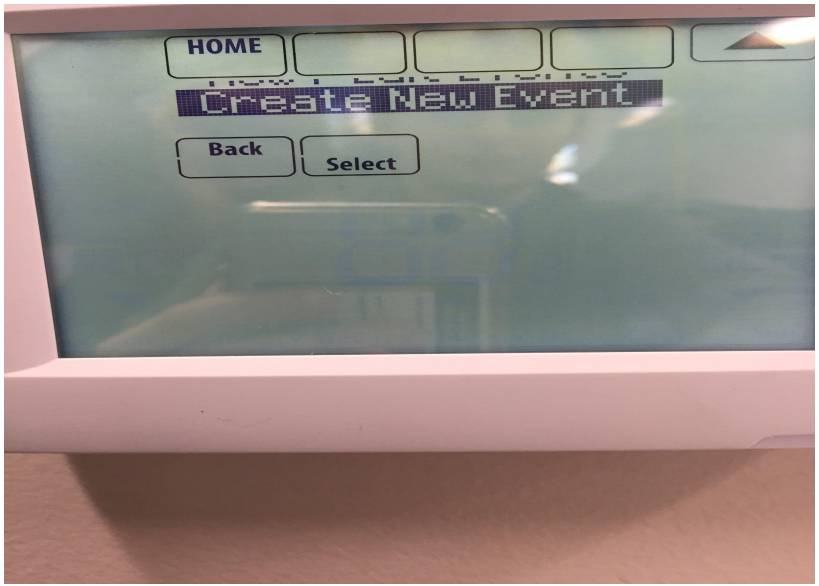
Adding Holidays To Your Thermostat (Custom Date)

Select menu and then scroll down and select holiday mode.



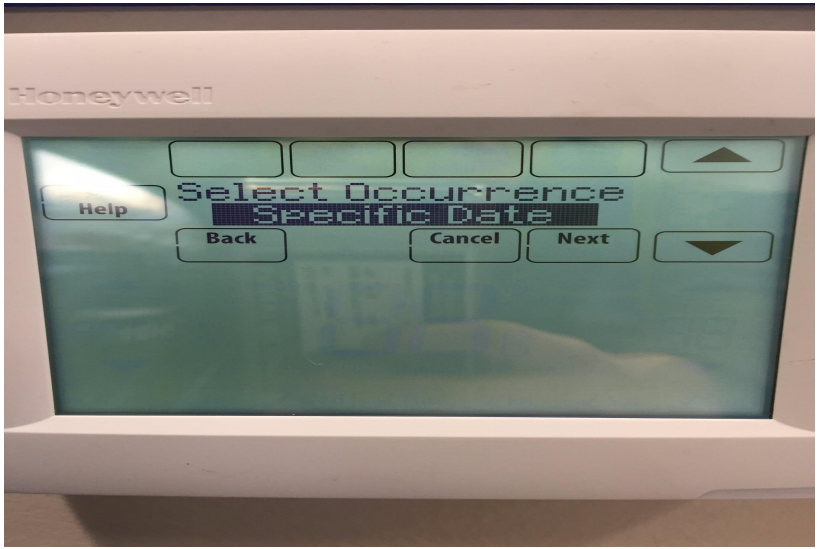
Adding Holidays to Your Thermostat (Custom Date)

Then scroll down and select Create New Event



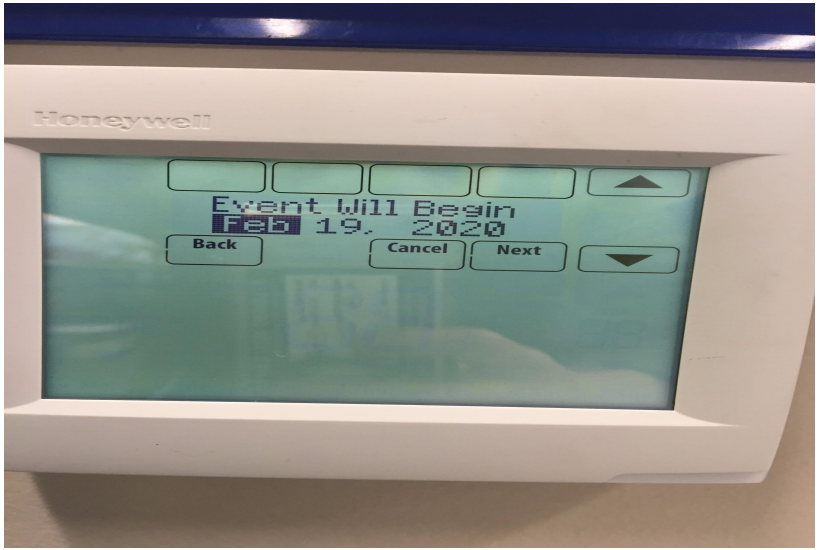
Adding Holidays To Your Thermostat (Custom Date)

After selecting Create New Event, select Specific Date, followed by unoccupied.



Adding Holidays To Your Thermostat (Custom Date)

Then select the starting date for the event (keep in mind this is just an example).

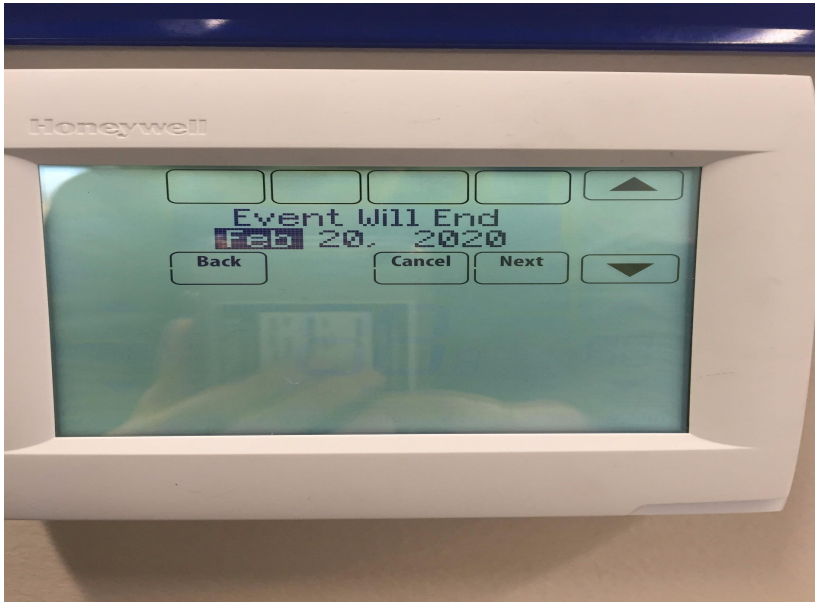


Adding Holidays To Your Thermostat (Custom Date)

Then select a temperature for the building during the day(s) off.

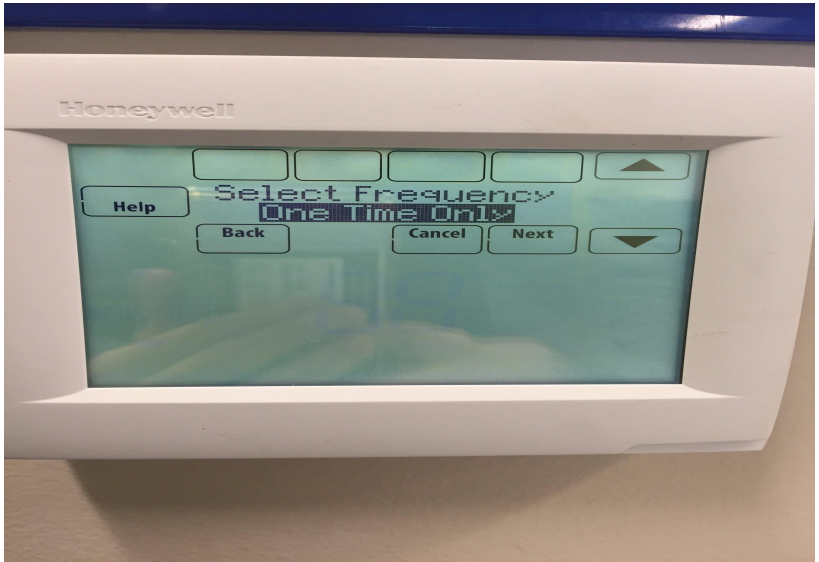
Adding Holidays To Your Thermostat (Custom Date)

Select a day the the event will end



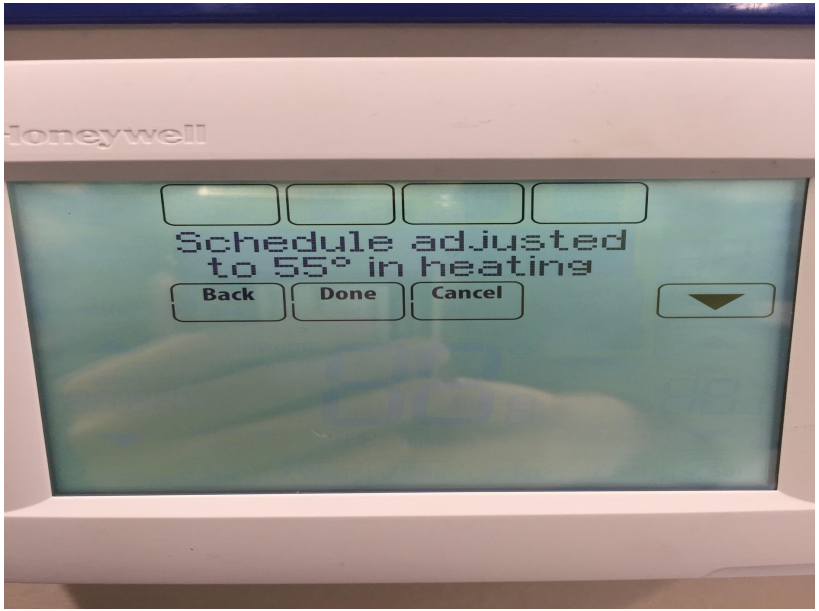
Adding Holidays To Your Thermostat (Custom Date)

Select a frequency. If you have an annual event on that same date you should make the event yearly. If not, select one time only.



Adding Holidays To Your Thermostat (Custom Date)

Confirm the new event by pressing done



RECOMMENDED TEMPERATURE

~We recommend that you keep your room at an average temperature of 68℉.

~Your thermostats should be set to heat at 68℉ and to cool at 74℉.

~This temperature may vary from season to season

~You thermostat should be set to heat at 55℉ and cool at 85℉ on the weekends and during the night

Thermostat Programming

(Portables)

How to program and schedule your thermostat

By Halie Bogden and Avi Gibler

Portable Thermostats

~The Portable thermostats are Bard

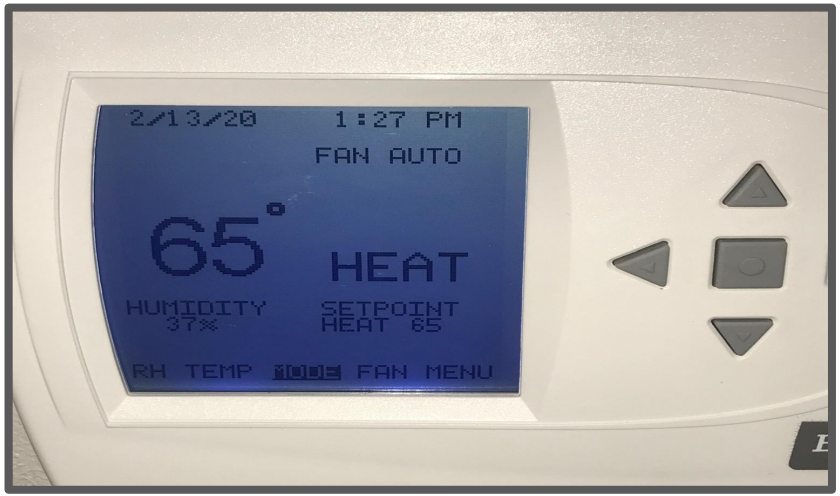
~They can only be programmed per week, so before each vacation, somebody has to select the temperature to hold the room at

~There is a thermostat in each class room, but none in the bathrooms

Changing the Temperature on Your Thermostat

Changing the Temperature on Your Thermostat

Use the side arrows to get to Mode and click the center square button.



Changing the Temperature on Your Thermostat

Using the up and down arrows, select heating or cooling with the square button.

Changing the Temperature on Your Thermostat

Using the up and down arrows, select the desired temperature. Once selected, click the center button to save.

Programming the Thermostat for a Vacation

Programming the Thermostat for a Vacation

When leaving on vacation, change your temperature by clicking MENU on the main screen.

Programming the Thermostat for a Vacation

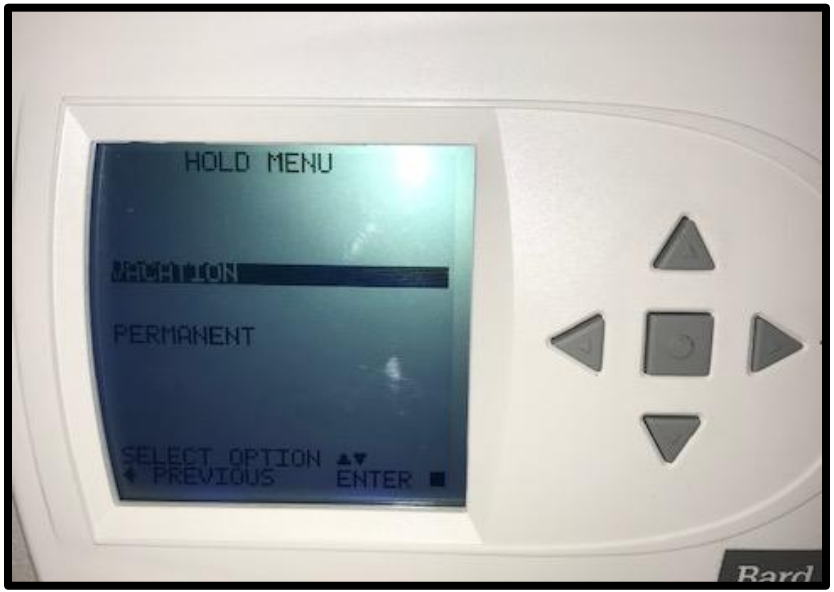
Vacations can not be programmed ahead of time, so right before each vacation, somebody has to set the temperature to hold the room at until the date and time specified. Once that specified date and time have been reached, the thermostat will return to its programmed schedule.

Programming the Thermostat for a Vacation

From the main menu, select HOLD.

Programming the Thermostat for a Vacation

Select vacation.



Programming the Thermostat for a Vacation

Using the up and down arrows, select what temperature you want your room to be held at during your vacation.

Programming the Thermostat for a Vacation

Once you have selected the desired temperature, set when to revert back to the programmed temperature. First, you will select the date.

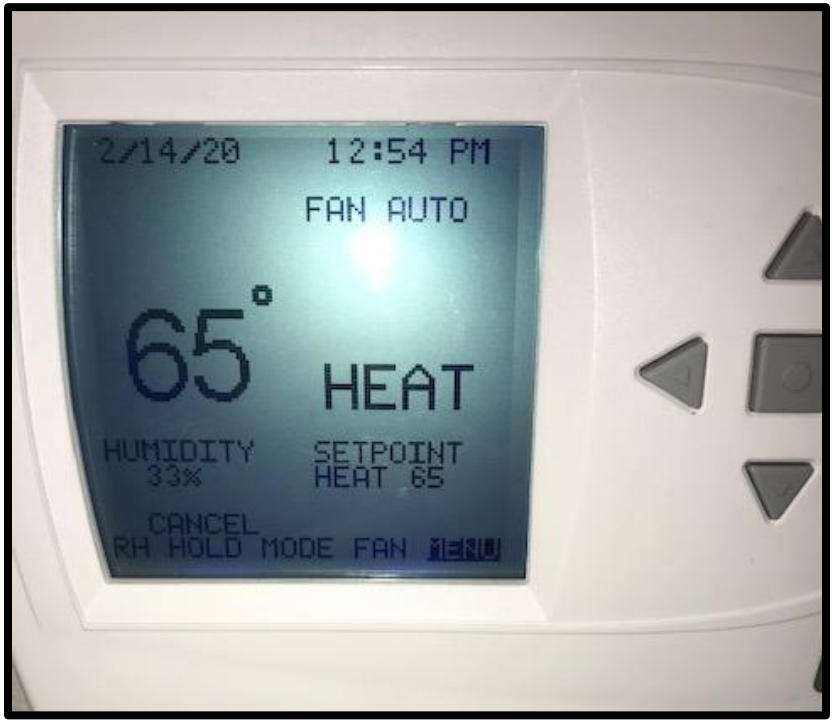
Programming the Thermostat for a Vacation

Next, you will need to select the time to revert.

Programming the Fan

Programming the Fan

Go to MENU and click the square button.



Programming the Fan

To program when the fan turns on, select MENU from the main menu, and scroll down to FAN.

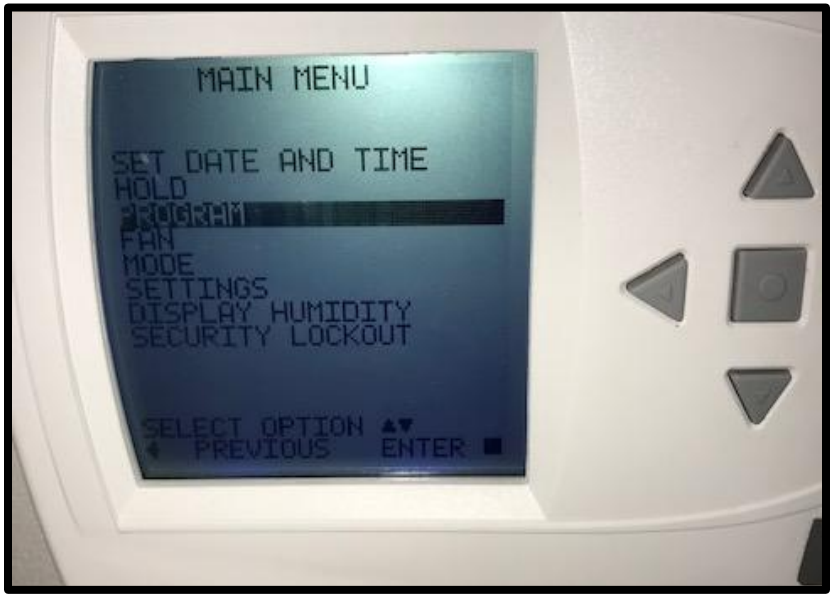
Programming the Fan

Select AUTO for the fan to turn on when heating or cooling. If you want the fan on always, select ON. If you want to program the fan, select PROGRAMMED FAN.

Scheduling Your Thermostat

Scheduling Your Thermostat

From the MENU, use the up and down arrows to select PROGRAM.

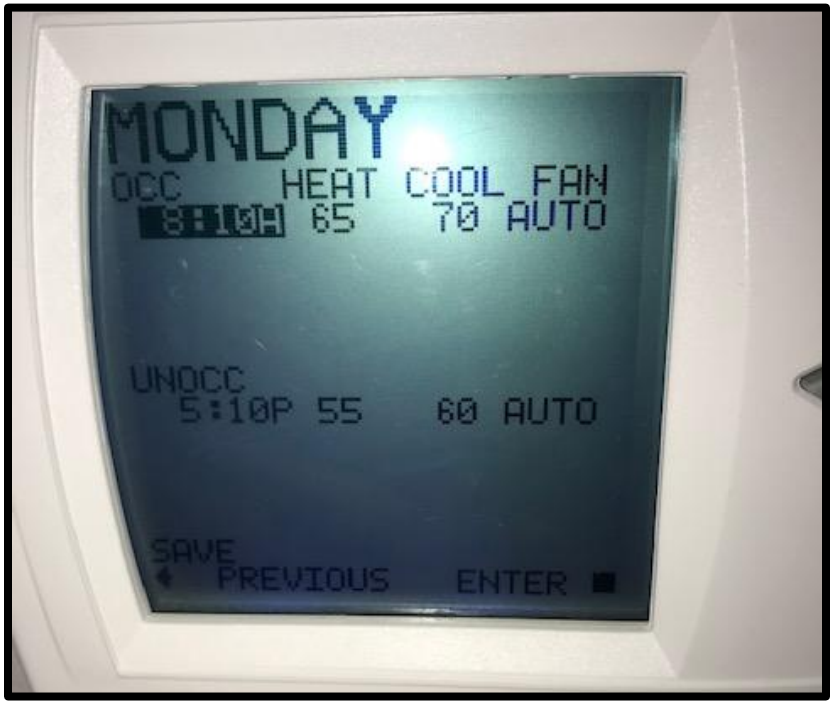


Scheduling Your Thermostat

Next, select the day you want to program.

Scheduling Your Thermostat

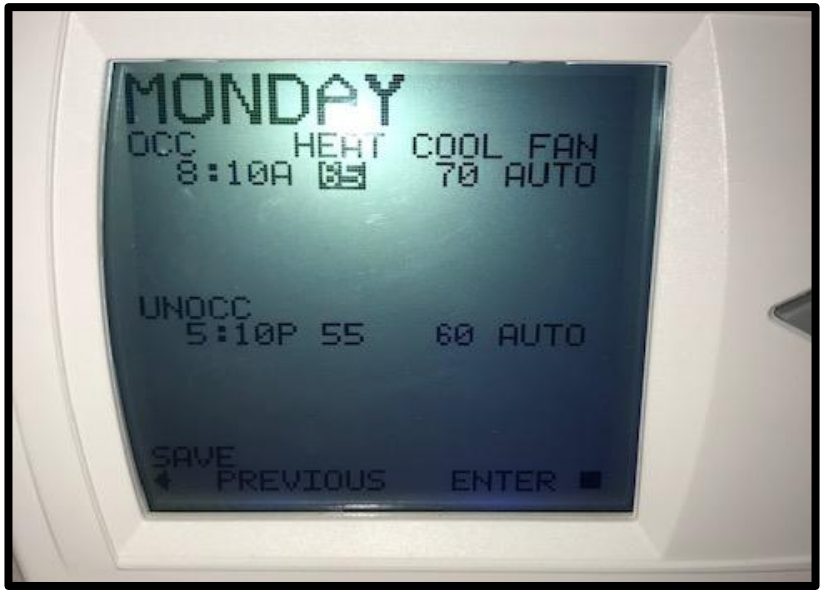
You now select what time to heat up in the morning.



Scheduling Your Thermostat

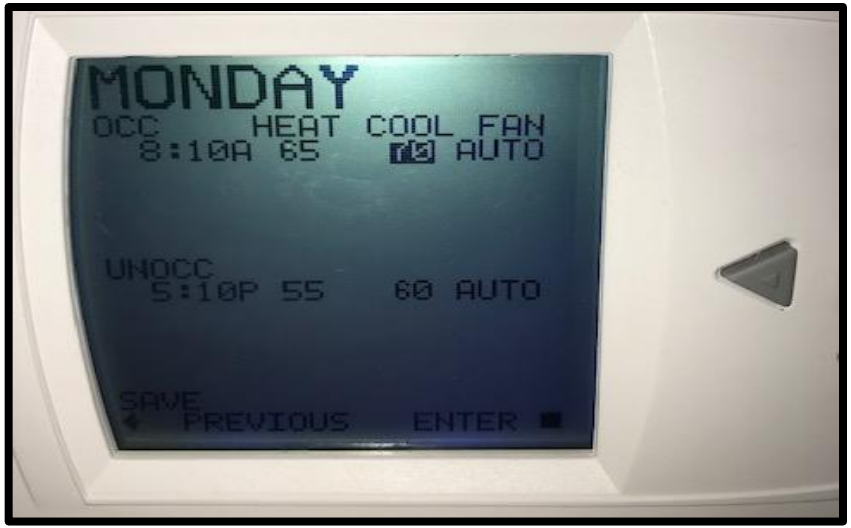
Adjust the heating and cooling with the up and down arrows.

The HEAT is what temperature it starts heating up at.



Scheduling Your Thermostat

Next, you will select the maximum temperature you want your room at, as COOL. The COOL is what temperature it will be when it starts to cool down.



Scheduling Your Thermostat

You will now select the time you want it to cool down for the night.

Scheduling Your Thermostat

Once again, you will select the lowest temperature - what temperature you want the room to start heating at.

Scheduling Your Thermostat

Now you will select the highest temperature you want your room at during the night.

Scheduling Your Thermostat

Now that you have selected desired temperatures for the day and for the night, select SAVE.

Scheduling Your Thermostat

You can program each day separately, or use the COPY option to copy from the day you programmed to any other day of the week.

Scheduling Your Thermostat

When using the COPY option, you use the up and down arrows to select the day to copy from.

Scheduling Your Thermostat

Next, you have to select which day to copy to. You can only copy to one day at a time, so if you want to copy to multiple days, you have to do them each separately.

Smartboards/ Chromebooks

And how to use them efficiently

By Addie Branen, Morgan Deming, Mia Heinlein, Kieran Long, and Leyna Venzke

Kill-A-Watt energy measuring instrument

- We used a Kill-a-watt to measure each smartboard. A Kill-a-watt plugs into the wall so you can plug in a cord, and it will tell you how much energy is being used.

- We went around to most of the classrooms with smart boards and measured them using the Kill-a-watt, discovering that the smart boards generally read the same.

- We tested each board on sleep, full sleep, high brightness, and low brightness. In the more accessible rooms where we could easily turn the lights on and off, we tested high auto brightness and auto low brightness.

- We interviewed the teachers about their energy use, and we used that information figure out how long they used the smartboards daily.

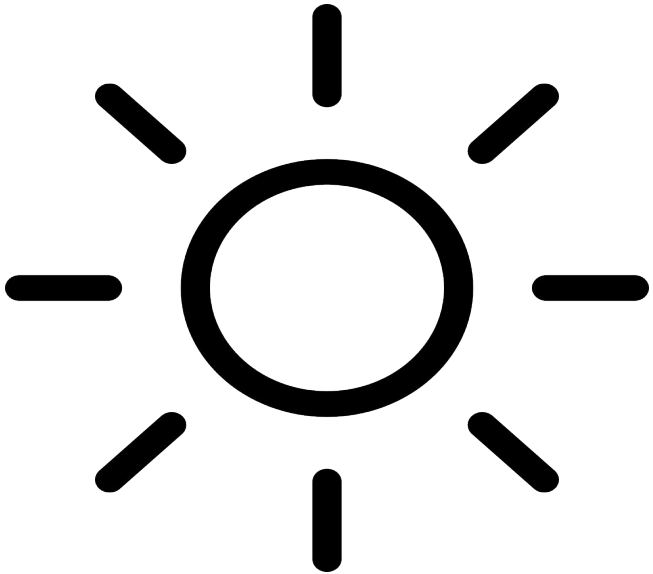
- We analyzed the data to create recommendations about the most energy and cost efficient ways to use the smartboards.

Data Calculations:

- To calculate our data we used the mean to find averages for all of the rooms we had data for. All of our raw data was measured in watts, although watts have been converted to kWh in some cases.

- To calculate the cost for each board per day we used the PPCS Avista energy bill summary to find the average cost per kWh and compared that to our data findings.

Smartboard Brightness Data Summary



Data Summary:

Classroom:	Sleep Mode	Max Bright:	Low Bright:	Room Max-Auto:	Room Low-Auto:	Full off:	Energy reduction 100-50%:	
Kuhle	39.5	295	57	172	119	1.7		
Corwine	39	290	60	230	177	n/a		
5th		300	60			1.8		
3rd	38	298	58			n/a		
2nd		293	60			1.7		
1st	38	300	56			n/a		
Pierce		300	50			1.9		
Average	39	297	57	172	119	1.8	57%	(169 watts)

There are two different brightness settings:

- Auto Brightness
- Manual Brightness

Auto Brightness

- Auto brightness self regulates based on the brightness of the room

- The brightness in Auto generally hovers around 50% brightness

- Most smart boards are already on auto brightness, and boards automatically turn to auto brightness.

Manual Brightness

- Manual allows the person to personally regulate the brightness of the smart board

- When changed to manual, the smart board automatically goes to 70% brightness

- Manual tends to be brighter than necessary, resulting in energy waste.

Brightness Recommendations

- Set smartboards to auto as it is the most energy efficient option for our uses

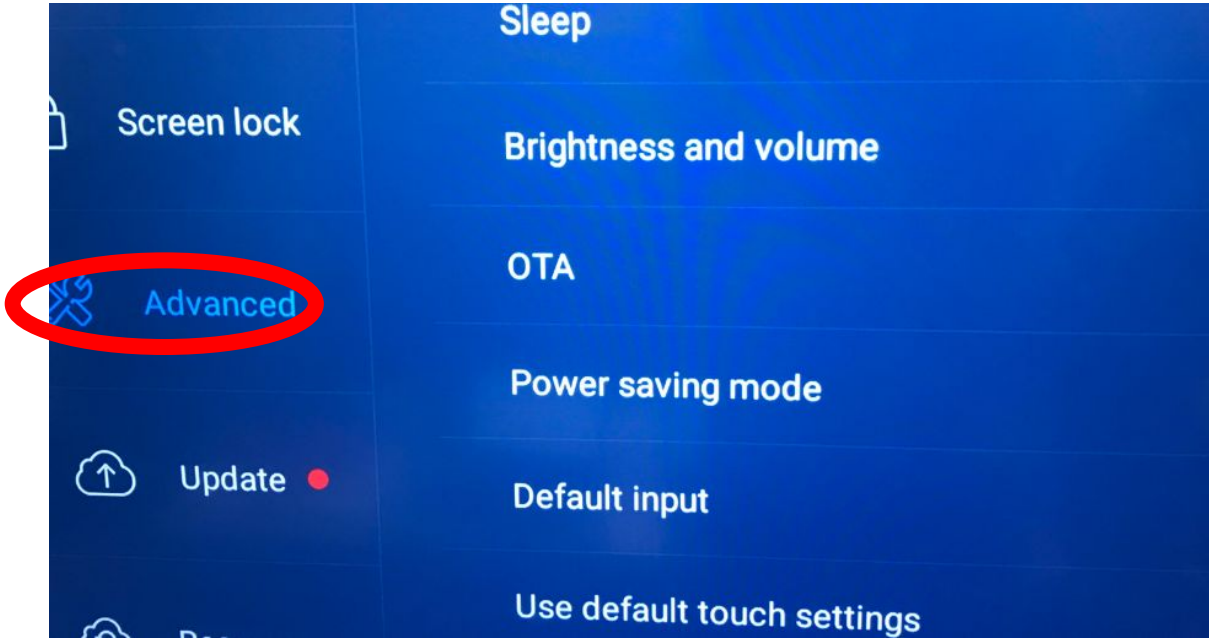
- A board on auto uses around 57% less energy than a board on maximum manual brightness

How to Turn Your Smartboard to Auto Brightness

First, press the button with three lines on it to get to the advanced settings.

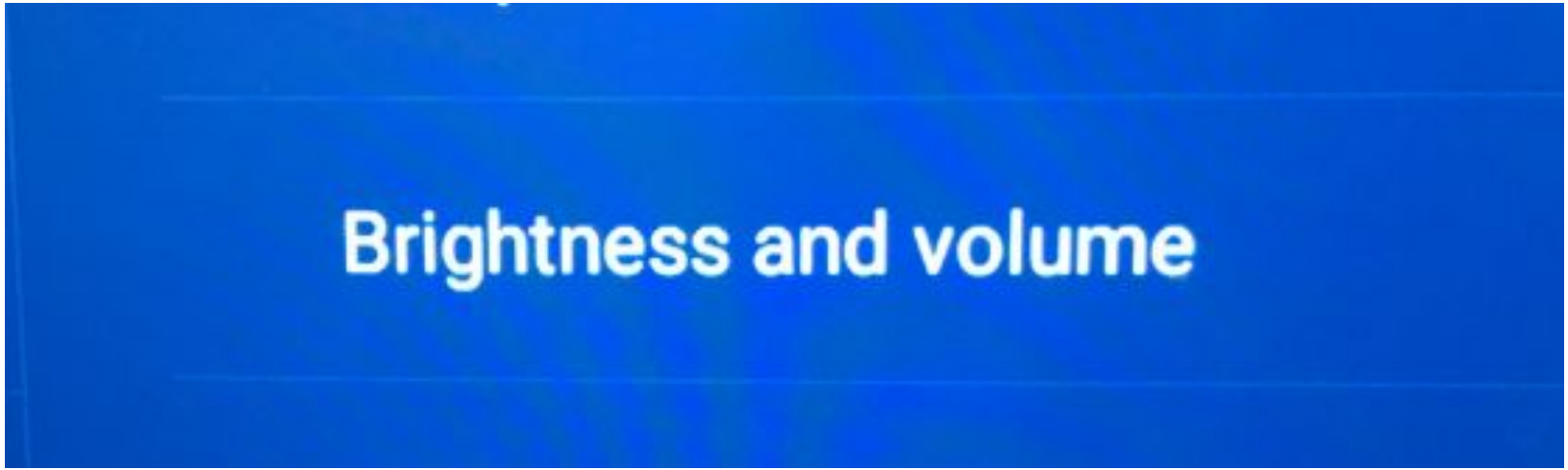
How to Turn Your Smartboard to Auto Brightness

Tap on the “Advanced settings” option



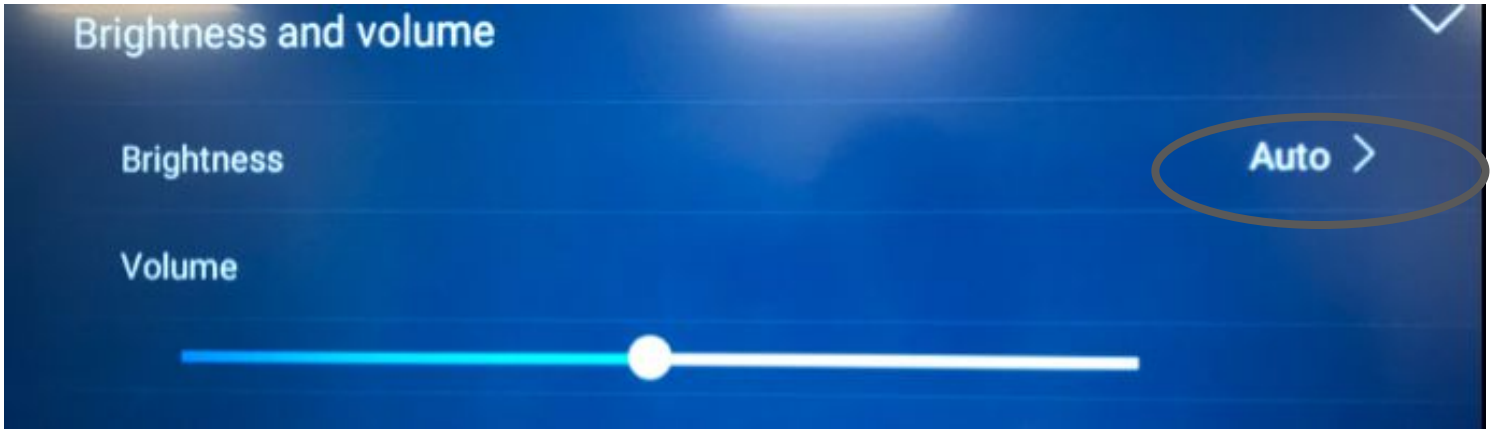
How to Turn Your Smartboard to Auto Brightness

Next, click on “brightness and volume” option



How to Turn Your Smartboard to Auto Brightness

Then click brightness



How to Turn Your Smartboard to Auto Brightness

From here, select auto brightness

Turning Smartboards Off

Smartboard Power Modes

- When turning off your smartboard, hold the power button for about 15 seconds, and you should hear a quiet click and the green light will turn red.

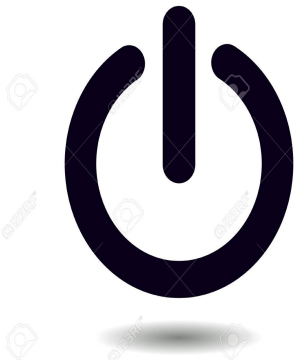
- Manual sleep mode is activated when the power button is pressed for 2 seconds and then released.

- A slight downside to completely powering them off is that they take about 30 seconds to turn back on again.

Smartboard Power Modes

- When the smartboard is completely off it uses just 1.8 watts, compared to about 39 watts when in manual sleep mode

- There is an auto sleep mode that supposedly turns the board off after fifteen minutes of inactivity, but is extremely intermittent



Sleep Mode/Off Data Summary

Classroom:	Smartboard Use (hours)		kWh Use	Cost (Jan Data, ($))		Full Off kWh	Sleep kWh	Sleep ($) p/d	Full off ($) p/d
Corwine	1		0.172	0.0154		0.0018	0.039	0.00351	0.000162
Boysen-Taylor	4		0.688	0.06192		0.0072	0.156	0.01404	0.000648
Sorenson	6		1.032	0.09		0.0108	0.234	0.02106	0.000972
Klemencic	8		1.376	0.123		0.0144	0.312	0.02808	0.001296
Kuhle	8		1.376	0.12384		0.0144	0.312	0.02808	0.001296
Job	1.5		0.2625	0.023625		0.0027	0.0585	0.005265	0.000243
Schierman	5		0.86	0.0774		0.009	0.195	0.01755	0.00081
Schneider	4		0.68	0.0612		0.0072	0.156	0.01404	0.000648
Hill	2		0.344	0.0309		0.0036	0.078	0.00702	0.000324
Greg	2.250		0.3825	0.065025		0.006885	0.08775	0.0078975	0.00061965
Average	4.175		0.5797	0.06197		0.0077985	0.1628525	0.0165425	0.000701865
Total	41.75		5.797	0.67197		0.077985	1.62825	0.1465425	0.00701865

Calculations for Sleep and Full Off Savings

- For our calculations, we converted watts per day in sleep mode to kWh per day

- We then multiplied that by the average $0.09 cost per kWh to find the average cost of a sleeping smartboard per day

- We then multiplied by school days and non-school days in a year accordingly to find the sleep mode cost per year

- Full off mode uses 4.6% of the energy that sleep mode does

- We subtracted 4.6% of the sleep mode yearly cost and got $261

- If every smartboard is always turned fully off instead of always put in sleep mode when not in use we can save up to $261 per year.

Cost/Savings Summary

- To monitor that smart boards are being fully turned off every time, wall socket timers are a recommended investment.

- Ten timers are needed, one for each smartboard, bringing the total cost to 100-250 dollars depending on what the school buys. This is a reasonable price considering how much we will save over the next couple years.

- If we kept this new system in place for ten years, we could save up to $2510

Sleep/Full Off Recommendations

- Use Full Off Mode instead of Sleep Mode as often as possible because it uses far less energy.

- If you are leaving the room for more than 30 minutes or so, turn the Smartboard completely off.

Chromebook Cart Energy

- Our chromebook carts are very energy efficient, and use only about 2 watts of electricity at any given moment.

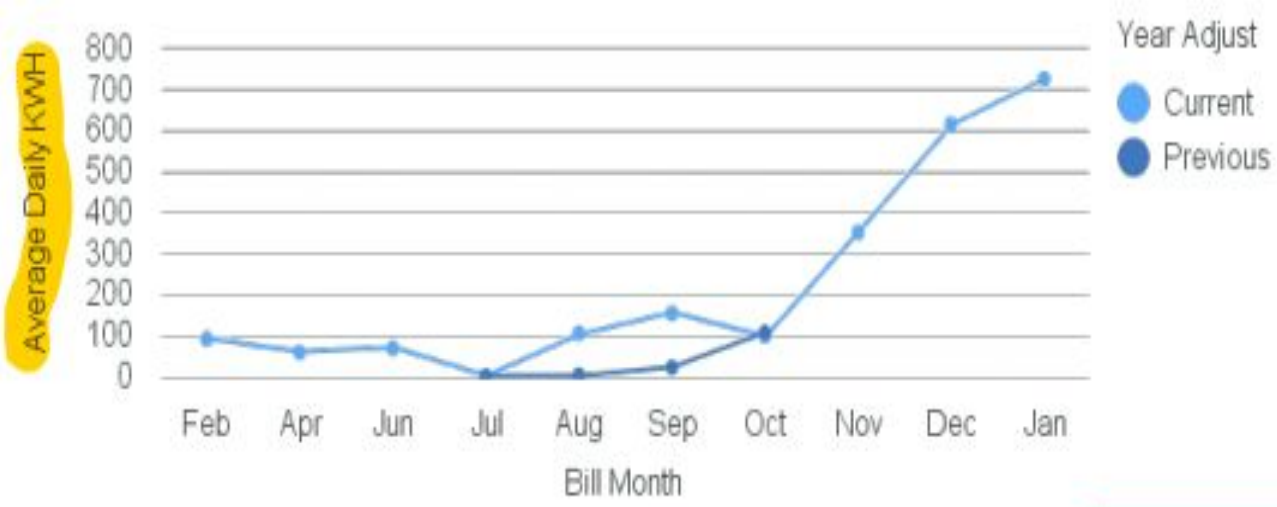
- Our chromebooks also charge very quickly, so the periods of energy use are quite brief.

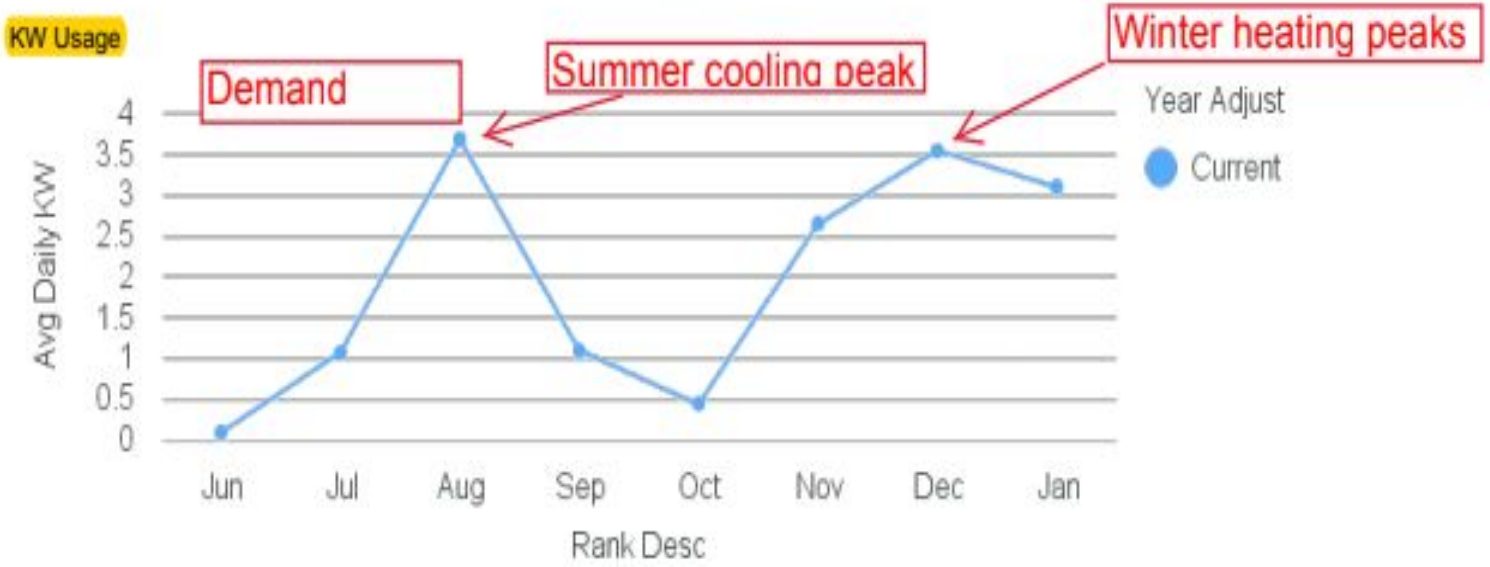
- It would be unwise to unplug the carts as it could leave some devices uncharged and unable to be used.

- Our recommendation for chromebook carts is to simply them be, as they don’t have a huge impact on our energy usage.

Should PPCS Consider Renewable Energy to Reduce Energy Costs?

By Tripena DeWitt


Average Daily KWH
800
700
600
500
400
300
200
100
0
Feb
Apr
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Bill Month
Year Adjust
Current
Previous


KW Usage
Demand
Summer cooling peak
Winter heating peaks
Avg Daily KW
4
3.5
3
2.5
2
1.5
1
0.5
0
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Rank Desc
Year Adjust
Current


Solar and Wind
Energy

Wind Energy

We would need to find a technical liaison to work within the EPA Wind for Schools Program

Where would we get it?

- Parent is willing to donate a residential-size wind turbine and pole

Residential

- **10,932 kwhs per year**
- **911 kwhs per month**
- **Savings of about $90 per month**

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Solar Energy

Solar panels:

- Produce power based on the amount of sunlight
- Unaffected by temperature
- Works better in cold weather
- Sunny yet cold days still produce energy
- No matter how cold or hot It will always be able to generate energy

Net Metering

- Net metering is a system for the owner of a renewable source of energy such as solar power
- Avista would put the energy we produced back into energy grids
- Net metering would be the least expensive and most convenient program to sign up for energy sources to use.

Why or Why Not Have Solar Power at Palouse Prairie

- We should have Solar power because it supplies both in the winter and in the summer
- Solar power like solar panels or windmills then it be able to supply energy

- We will be able to make money because we are supplying avista with enough energy even when we have breaks off of school.

- Solar power would be the most effective and renewable source of energy
- The cost especially in winter and summer would lower a lot more
- It saves the energy we don’t use and puts it back into the environment for other people to use too.

Final Recommendations

Thermostats/ Heat Pumps:

- The reason were paying so much is because of the demand charge when we're using too much energy

- We recommend implementing a staggered start protocol, and keeping the building around 68 degrees during the day and 55 degrees fahrenheit at night. Turn the cooling up to 85 degrees at night as well

- Also, switch them to manual heating and cooling so we can change them to heating and cooling or vice versa in april and october

- Always remember to set the portable thermostats before break

Smartboards:

- Use auto brightness, and turn smartboards fully off every time they are not in use for more than 20-30 minutes.
- Don’t unplug chromebook carts, because it would not save a significant amount of energy.
- During the summer all electronics should be unplugged because there is no need for them.
- Purchase a timer system to make sure the smartboard is always turned fully off.

Solar and Wind:

- We could save a lot of money in the long run if we converted to solar and wind

- A parent has offered to donate a wind turbine, but it would cost money to install and maintain it

- Roughly, it would cost us about $17,000 to implement solar panels all over our roof, and those would generate 52% of the energy for our school

Recommendations for Future Years:

- For the next years eighth graders, recheck the bills to see if we actually lowered our demand charge and if we are saving a significant amount of money
- If we are saving money, look into how much
- See if the staggered start protocol is actually working
- Also for future classes, look into the pricing and possible loan options for getting renewable energy
- We also recommend a future class do a solar feasibility study to see if solar could be a viable option

More Recommendations for Future Years

- Look into implementing a wind turbine that has been donated to us
- Make sure we are still keeping our smartboards at the auto brightness setting at the beginning of every year
- Keep up on heat pump maintenance
- Make sure we are continuing to implement our stagger start protocol
- Unplug our chromebook carts and other electronic devices over breaks.

  Run a cost analysis on whether solar energy will be a viable option for our school

Possible Grant Options For Renewable Energy

- American Solar Energy Society
- National Education Development Project
- US Department of Energy

Thank You

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Bard

SINCE 1914

User's Manual

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Portables:

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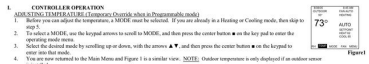
(Mechanical Operation & Maintenance Manual)

Menu Driven Display

1120-445


1. CONTROLLER OPERATION

ADJUSTING TEMPERATURE (Temporary Override when in Programmable mode)

1. Before you can adjust the temperature, a MODE must be selected. If you are already in a Heating or Cooling mode, then skip to step 3.
2. To select a MODE, use the keypad arrows to scroll to MODE, and then press the center button ■ on the key pad to enter the operating mode menu.
3. Select the desired mode by scrolling up or down, with the arrows ▲▼, and then press the center button ■ on the keypad to enter into that mode.
4. You are now returned to the Main Menu and Figure 1 is a similar view. NOTE: Outdoor temperature is only displayed if an outdoor sensor is installed.
5. To increase the temperature set point, use the arrow up button ▲. To decrease the set point, use the arrow down button ▼. Press the center button ■ on the key pad for the new set point to be effective.

SETTING DATE AND TIME

1. From the Main Menu, scroll to MENU and press the center button ■ on the keypad.

Figure1

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Smartboards and Chromebooks

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