Appendix B: Critical Peak Trigger Analysis

Ontario Smart Price Pilot

Recommended Temperature Triggers for Critical Peak Days

Objectives

- Define the maximum and minimum temperatures thresholds that will be used to trigger critical peak days for the Ontario Smart Price Pilot
- Define the hours to be called for a critical peak event
- Understand the historical temperature trends by week to be able to identify if action needs to be taken to change the thresholds during the pilot

Targets

- The target number of critical peak days are:
  - Summertime: 6 days
  - Wintertime: 3 days
- The thresholds should be designed to result in at least that many days being called. If a sufficient number of days have been called during the pilot, we can stop declaring them (Better to have too many callable days, than too few)
- Critical peak days are not called on weekends or holidays
- The number of consecutive days that a critical peak is declared is limited to three
- Critical peak periods may be called for either three hours or four hours

Analysis

- Historical data on the number of days equal or exceeding a specified threshold from the August 1 to December 31 period are provided in the tables on the following pages (Temperatures from other months are not relevant)
- The data are from Environment Canada for Ottawa International Airport
- The numbers in the tables include weekends and holidays. Assuming ⅔ (5/7 = 71%, less holidays) of high temperature days will occur on weekdays, the minimum number of expected days over the high temperature threshold should be 10, to achieve 6 weekdays.
- Similarly, the minimum number of expected days below the low temperature threshold should be 5, to achieve 3 weekdays.
- The critical peak period lengths should vary to provide feedback on the effect of having different critical peak period lengths.
- The higher (or lower in winter) the temperature, the greater the stress on the system; thus, the longer critical peak periods should be called on the hottest and coldest days.

Recommendation

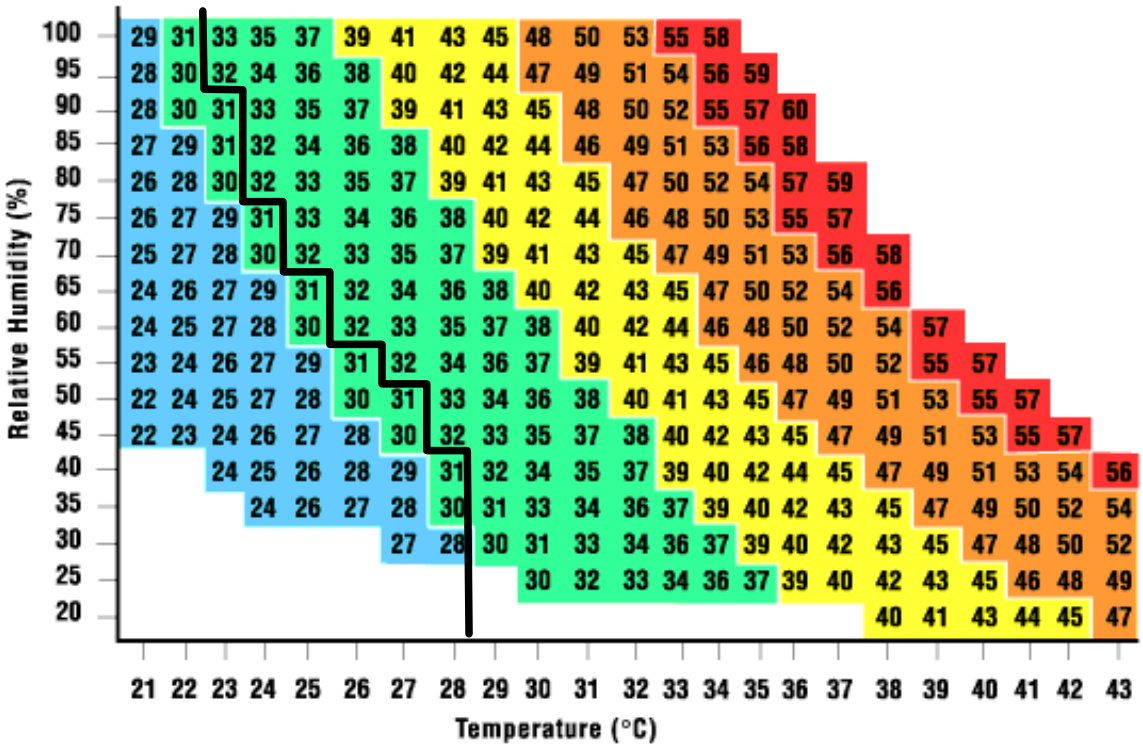
High Temperature Threshold

- A 28°C high temperature threshold is recommended
- Historically a minimum of 4 days (in 2004) and a maximum of 18 (in 2002) achieved this threshold.
- The median over the last five years was 16 days over this threshold
- In June and July of this year, Ottawa has experienced 18 days over the 28° threshold. However, past months temperatures are not a good indication of future months

- The high for Tuesday, July 25 was 27.2º, below the threshold
- When forecast temperatures are 30º or above, a four-hour critical peak should be called; for 28º to 29º, a three-hour critical peak should be called

Humidex Threshold

- Additionally, a Humidex threshold should be considered.
- The recommended Humidex threshold is 32 during peak times of the day[1], regardless of temperature[2].
- On two occasions in 2005, the Humidex in Ottawa exceed 32 during midday when the temperature during the day did not reach 28º.



Humidex from temperature and relative humidity (Source: Environment Canada)

Low Temperature Threshold

- A -14ºC low temperature threshold is recommended
- Historically a minimum of 0 days (in 2001) and a maximum of 15 (in 2004) achieved this threshold
- The median over the last five years was 8 days over this threshold
- When forecast temperatures are -16º or below, a four-hour critical peak should be called; for -14º to -15º, a three-hour critical peak should be called

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[1] Humidex can sometimes be high in the humid early morning hours but decline as the day progresses.

[2] Environment Canada issues Humidex Advisories as a “Special Weather Statement” (not a warning) when the Humidex will reach 40 or more with a dew-point temperature of 15°C or higher, and these conditions are expected to last for 1 hour or more.

Past High Temperature Distribution

Temperature Threshold (ºC)	Year 2001	2002	2003	2004	2005	
37.0						
36.5	1					
36.0	1					
35.5	2					
35.0	3	2				
34.5	3	3				
34.0	5	4				
33.5	5	5			2	
33.0	5	5			2	
32.5	5	7			3	
32.0	6	8			4	
31.5	7	9			5	
31.0	7	11	1		5	
30.5	7	11	3		7	
30.4	7	11	3		7	
30.3	10	12	4		10	↑
30.2	10	12	4		10	↑
30.1	10	12	5		10	**Recommended**
30.0	11	12	6		10	**4-hour Threshold**
29.5	15	14	8		11	↑
29.0	15	14	8		11	↑
28.5	15	17	12	4	16	**Recommended**
28.0	17	18	14	5	18	**3-hour Threshold**
27.5	18	24	16	5	22	
27.0	21	25	18	5	27	
26.5	25	28	21	7	28	
26.0	27	33	23	8	30	
25.5	30	34	25	12	32	

Number of days where the temperature reached at least the threshold in the left-hand column (Thresholds resulting in 10 or more days are shaded)

Past Low Temperature Distribution

Temperature Threshold (ºC)	Year 2001	2002	2003	2004	2005	
-10.5	6	13	16	21	16	
-11.0	4	13	15	21	16	
-11.5	4	12	14	19	16	
-12.0	1	11	13	19	14	
-12.5	1	8	12	19	13	
-13.0		8	11	17	13	
-13.5		8	7	15	12	
-14.0		8	5	15	11	**Recommended**
-14.5		8	4	13	10	**3-hour Threshold**
-15.0		7	4	12	9	↓
-15.5		7	3	11	9	
-16.0		4	1	11	8	**Recommended**
-16.5		4	1	11	7	**4-hour Threshold**
-17.0		4		10	6	↓
-17.5		3		9	5	
-18.0		3		9	4	
-18.5		3		8	3	
-19.0		3		6	3	
-19.5		2		3	2	
-20.0		2		3	1	
-20.5		1		3	1	
-21.0				3		
-21.5				3		
-22.0				3		
-22.5				3		
-23.0				3		
-23.5				3		
-24.0				3		
-24.5				3		
-25.0				3		
-25.5				3		
-26.0				1		
-26.5				1		
-27.0				1		
-27.5				1		
-28.0				1		
-28.5				1		
-29.0				1		
-29.5				1		
-30.0				1		
-30.5				1		
-31.0						

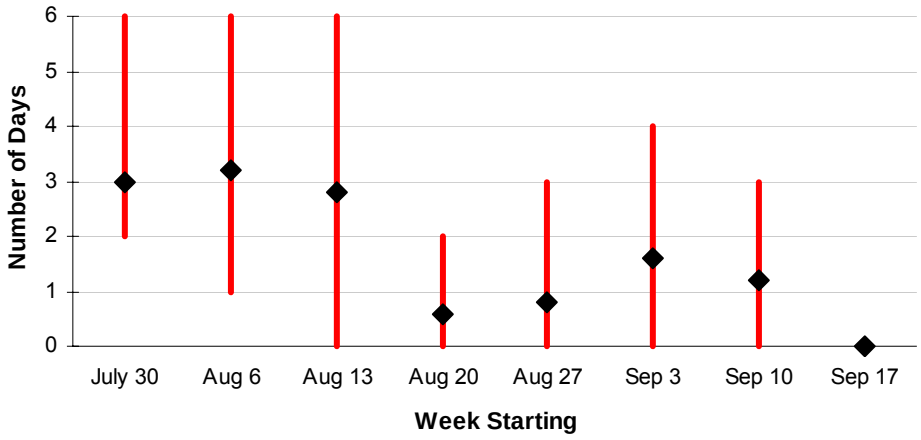
Number of days where the temperature was equal or below the threshold in the left-hand column (Thresholds resulting in 5 or more days are shaded)

Past Distribution of Critical Peak Days

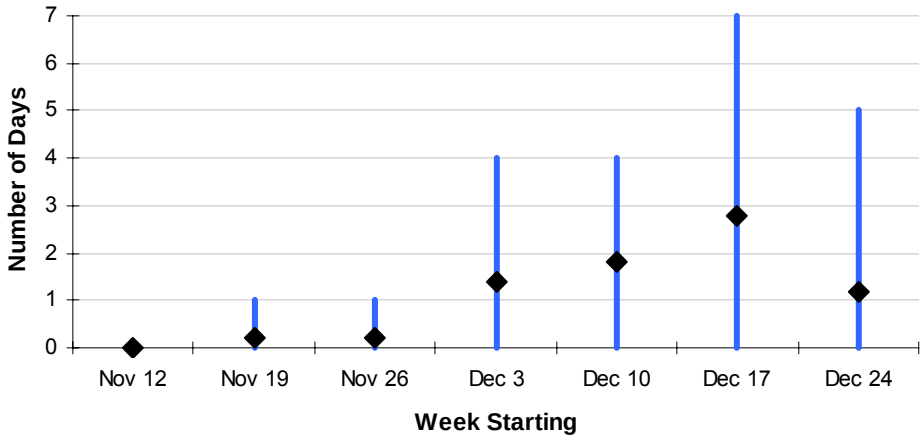
The charts below illustrate the number of days by week where the recommended threshold was achieved in the last five years. This is intended to help identify when we should expect critical peak days to be achieved and respond accordingly (In particular, how long we should wait in August before acting if the threshold is not reached.)

Conclusions

- We need to be ready to declare a critical peak day as soon as sufficient customers have been recruited for the pilot.
- Days exceeding the high threshold beyond the second week of September are extremely unlikely.
- It is unlikely that Ottawa will experience any days below the low threshold before December.



Number of days exceeding the high threshold of 28°C over the last five years (High, low and average)



Number of days below the low threshold of -14°C over the last five years (High, low and average)