

# Commentary

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## Is Saudi Arabia Getting Warmer?

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**The average temperature in 2018 was higher than the 29-year historical average**



**Both summer and winter seasons were hotter than the historical average**

## Is Saudi Arabia getting warmer?

According to NASA, the world is getting warmer. Warmer weather increases the demand for cooling, which subsequently increases the demand for electricity. Is Saudi Arabia getting warmer? And how might this impact the demand for electricity in the Kingdom? To answer these questions, KAPSARC examined temperature data<sup>1</sup> for 13 cities spread across Saudi Arabia over 29 years (from 1990 to 2018). The cities included Riyadh, Jeddah, Dhahran, Madinah, Arar, Sakaka, Tabuk, Hail, Buraydah, Albaha, Abha, Jazan, and Najran.

Except for Albaha, all cities in Saudi Arabia were warmer in 2018 compared with the national 29-year average. The average temperature across all cities during this year was 26.1 degrees Celsius (°C), 1.0 degree °C higher than the 29-year average of 25.1 °C. There were also more hours in 2018 when the hourly temperature was between 30 and 40 °C than in 1990.

In the sample of cities studied, the coolest city in Saudi Arabia in 2018 was the southern city of Abha (20.1 C) with its dense Juniper forests. The warmest city was the port city of Jazan (31.2 C) in the southwestern part of the country.

## Winter and summer temperature variations

The average temperature metric, though useful, masks variations across the summer and winter seasons.<sup>2</sup> Over the last 29 years, the temperature has varied from -8 °C in winter (Sakaka) to 51 °C in summer (Jeddah). We obtained interesting insights when we compared the winter and summer temperatures in the 13 cities.

The summer months saw temperatures rise in all cities except for Arar, and Albaha. The average summer temperature in these cities in 2018 was 32.6 °C, 0.7 °C higher than their 29-year average. The hottest city during the summer was Madinah, registering an average temperature of 36.5 °C in 2018.

The average temperature of the 13 cities during the 2018 winter was 18 °C, 0.5 °C higher than their 29-year average for this period. All cities had a higher average temperature during the 2018 winter except Albaha and Madinah. The northern city of Arar saw temperatures rise above the 13 cities' 29-year average during winter 2018 and fall below it in the summer. Madinah experienced the reverse effect.

Overall, the 13 cities experienced warmer winter and summer months than their 29-year average. However, looking at the variations between the temperatures in the day and nighttime gives a more complex picture.

## Day and night temperature variations

It was warmer, on average, in the 13 cities in 2018 during the nighttime and cooler during the afternoon<sup>3</sup> than their 29-year average temperature. The

<sup>1</sup>Temperature data used in this report are from the National Oceanic and Atmospheric Administration (NOAA).

<sup>2</sup> Summer months are the months from May to August. Winter months are from November to February.

<sup>3</sup>Early morning hours are from midnight to 6 a.m. The morning hours are from 7 a.m. to 12 p.m. Afternoon hours are from 1 p.m. to 6 p.m. Nighttime hours are from 7 p.m. to midnight.

average nighttime temperature was 23.9 °C, 1.1 °C higher than the 29-year average. The average temperature during the afternoon was 28.6 °C, 0.7 °C higher than the historical average.

Several interesting trends also emerge across the seasons. During the summer, the morning and nighttime hours were hotter than the 29-year average and cooler than average during the afternoon. In Riyadh, for example, the average summer temperature in 2018 during afternoon hours was 38.6 °C, 3.8 °C higher than the 13 cities' 29-year average. Similarly, the average temperature during the nighttime was 32.5 °C, 3.1 °C higher than the 13 cities' 29-year average.

During winter 2018, several cities, including Jeddah, Buraydah, Tabuk, and Madinah, registered lower temperatures during the afternoon than the 29-year average for the 13 cities. In Jeddah, for example, the average winter afternoon temperature was 26.7 °C, 0.04 °C lower than the 29-year average. In contrast, the average temperature in Jeddah during the nighttime was 24.4 °C, 0.8 °C, higher than the historical average for this time of day. The usually cooler northern cities of Tabuk and Arar also experienced warmer than average winter nights and days.

### Need for cooling

The number of hours where the hourly temperature exceeds 21 °C is a common metric<sup>4</sup> often used to assess when consumers require air conditioning in hot regions. There were 124,162 more cooling degree hours in 2005-2018 than in 1991-2004, indicating more cooling was required in 2005-2018.

The northern city of Tabuk recorded the largest increase in the number of hours where the temperature exceeded 21 °C. This can be explained by the general observation that seasons are getting warmer in Saudi Arabia.

### Impact on electricity demand

The trend toward Saudi Arabia becoming warmer has important implications for future electricity demand. All other things being equal, the increases in temperature will bolster the demand for cooling, which will increase the country's demand for electricity. The incremental electricity demand growth during the summer could be tempered by more energy-efficient air conditioning equipment, more effective home insulation, and better-informed consumers. Warmer winters would increase the asset utilization of otherwise idle electricity generation capacity during off-peak hours. A comprehensive and integrated approach to policy and regulatory design can help to mitigate demand growth and reduce the power sector's operating costs.

**Cooler summer  
afternoons in  
Riyadh and  
warmer winter  
nights in Jeddah**

**There were more  
cooling degree  
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<sup>4</sup>Cooling degree hours (CDH) is a metric that is used to compute the number of hours where the hourly temperature exceeded 21 degrees Celsius in the Kingdom.

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