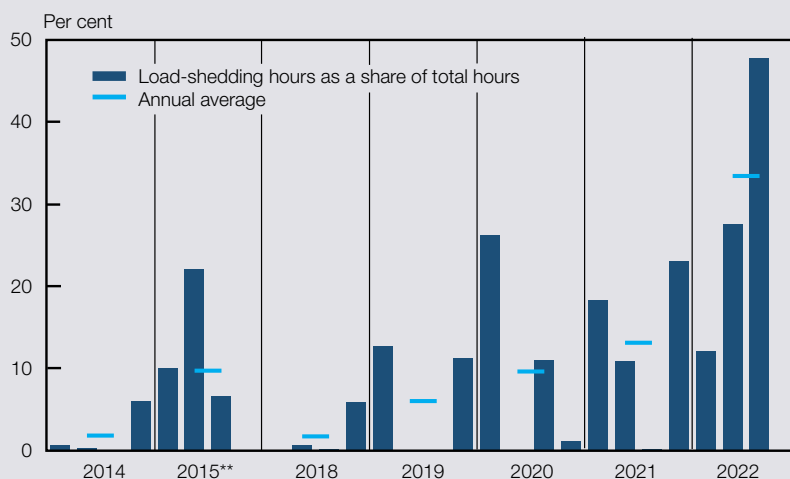


Box 1 Measures of electricity load-shedding

Electricity load-shedding in South Africa has been more frequent in recent years, increasing from 9.7% of the time (an average of 3 calendar days per month) in 2015 to 33.4% of the time (an average of 10.4 calendar days per month) in 2022 until the end of October. During the third quarter of 2022, load-shedding reached an all-time high of 1 054 hours, or 47.7% of the time (an average of 14.8 calendar days per month). This included a severe period of power outages when 187 hours of stages 5 and 6 load-shedding were implemented. By measuring the frequency (number of hours) and the intensity (number of gigawatt hours (GWh)) of load-shedding, this box presents an improved and refined electricity load-shedding intensity index, building on a previous *Quarterly Bulletin* box.¹

Frequency of electricity load-shedding*



* The annual average for 2022 includes data up to 31 October

** No load-shedding occurred during 2016 and 2017

Sources: Eskom and SARB

The previous intensity index measured load-shedding incidences to gauge the effect of load-shedding on total real gross domestic product (GDP) growth as well as on real gross value added (GVA) by subsector. The revised intensity index incorporates changes in both load-shedding stages and duration during the day, while also providing for the differentiation of the impact in terms of the type of day, for example, weekdays, weekends and public holidays as well as between the time of day with regard to conventional working and non-working hours (conventional hours are considered to be from 07:00 to 19:00). These refinements were possible with the incorporation of additional data sources² that provided information of load-shedding incidences per hour and per stage, thus allowing for an intensity measure in GWh.

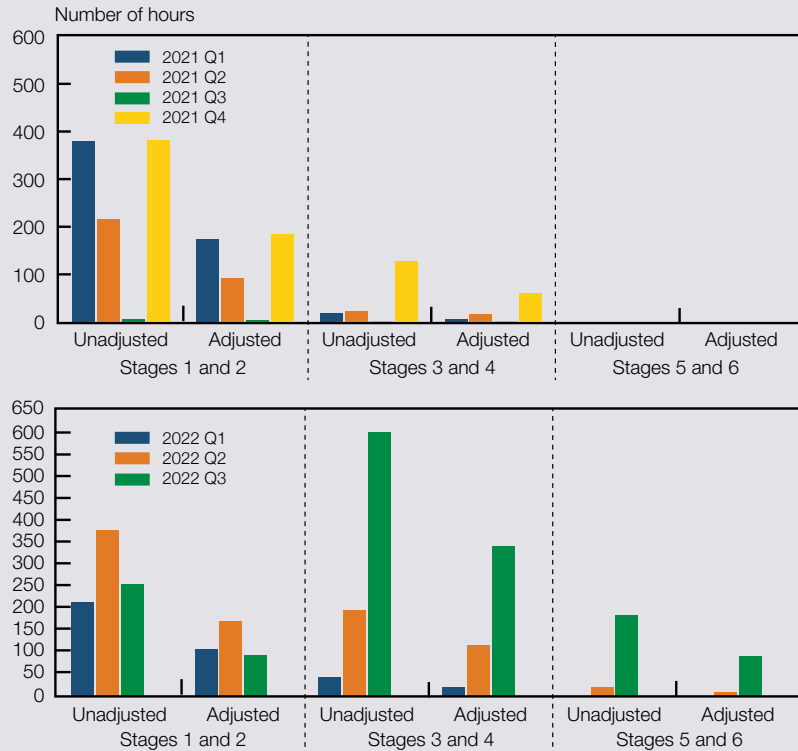
An updated intensity index was compiled by harnessing the newly acquired information and was complemented with two additional versions that consider the type (weekend or public holiday) and time of day on which the load-shedding occurred. It is presumed that the impact of load-shedding may be less severe if it occurs on a weekend or a public holiday than on a conventional workday. Similarly, the time of day that load-shedding occurs was also considered, with the impact assumed to be less if it occurs outside of conventional working hours. In principle, the adjustment for working hours refines the measurement of the impact on real GDP growth, and in related subsectors.

1 See 'Box 1: Electricity load-shedding and economic activity' in the September 2019 edition of the *Quarterly Bulletin*, available at <https://www.resbank.co.za/en/home/publications/publication-detail-pages/quarterly-bulletins/boxes/2019/9517>.

2 The sources include Eskom's media and Twitter accounts, various load-shedding reports on the *Council for Scientific and Industrial Research* (CSIR) website, the EskomSePush mobile application, and various media articles to cross-validate entries.



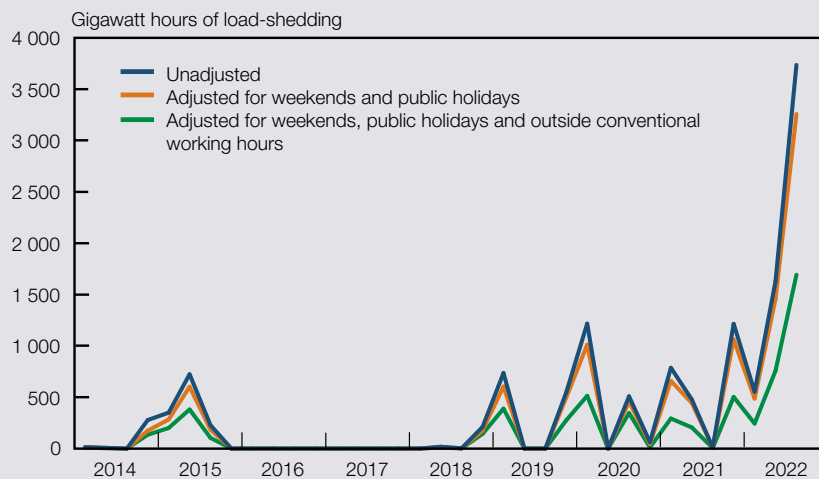
Frequency of electricity load-shedding* adjusted for working hours, by stage



* Measured as the total number of load-shedding hours and adjusted for non-working hours
Sources: Eskom and SARB

Three measures of load-shedding intensity were derived. The first is a measure of the total GWh³ of electricity taken off the grid, recorded at the specific time of day when the load-shedding occurred.⁴ The second measure differentiates between load-shedding on conventional workdays, weekends and public holidays, with weekends and public holidays scaled down by allocating a half weight. The third measure is a further adjustment of the second, by excluding all load-shedding outside of conventional working hours (07:00 to 19:00).

Intensity measures of electricity load-shedding*



* This represents the total electricity taken off the grid, taking into account the different stages and duration
Daily data were summed to a quarterly frequency

Sources: Eskom and SARB

3 GWh is a unit of measure of energy used per hour and is different to gigawatts.

4 One hour of load-shedding at stage 1 is less severe than one hour at a higher stage. The number of hours of a stage per day is multiplied by the GWh of energy taken off the grid.

The number of load-shedding hours often more than halved following the working-hour adjustment, implying that load-shedding frequently occurred after conventional working hours. In the third quarter of 2022 there were 259 hours of stages 1 and 2 load-shedding, but when adjusted for conventional working hours, this reduced to 94 hours.

All three daily intensity measures of load-shedding were aggregated into quarterly frequencies to facilitate the estimation of the impact on quarterly real GDP growth and on the subsectors, based on data collected from the first quarter of 2014 to the second quarter of 2022.⁵ The estimated equation frameworks are not exhaustive and hence the results are merely indicative and should be interpreted as such. It does not take other information into account, such as changes in the demand for electricity due to energy self-sufficiency.

The results show that load-shedding did have a statistically significant negative impact on total real GDP growth and on the subsectors. From the analysis, the subsectors most affected by electricity load-shedding were agriculture, forestry and fishing; manufacturing; mining; and transport, storage and communication. The unadjusted measure seems to overstate both the frequency, in terms of hours, and the intensity, in terms of GWh, specifically relevant for industries that operate only during conventional working hours, and hence the larger coefficients for the refined intensity index measures.

Estimated impact of load-shedding on quarterly growth in real gross domestic product

Percentage points

Economic sector	Unadjusted	Adjusted for weekends and public holidays	Adjusted for weekends, public holidays and outside conventional working hours	Previous estimate*
Total GDP	-0.00056	-0.00066	-0.00135	-0.00059
Agriculture, forestry and fishing	-0.00588	-0.00640	-0.01341	-0.00303
Mining	-0.00206	-0.00241	-0.00447	-0.00158
Manufacturing	-0.00252	-0.00301	-0.00566	-0.00092
Construction.....	-0.00114	-0.00134	-0.00240	-0.00191
Transport, storage and communication services.....	-0.00214	-0.00259	-0.00429	-0.00047
Trade, catering and accommodation services.....	-0.00084	-0.00099	-0.00193	-0.00026
Finance, insurance, real estate and business services	-0.00068	-0.00085	-0.00165	-0.00003
General government services	-0.00029	-0.00035	-0.00061	-0.00025
Personal services	-0.00019	-0.00023	-0.00043	-0.00021

Shaded areas indicate results that were not statistically significant

* As published in the September 2019 edition of the *Quarterly Bulletin*.

Source: SARB

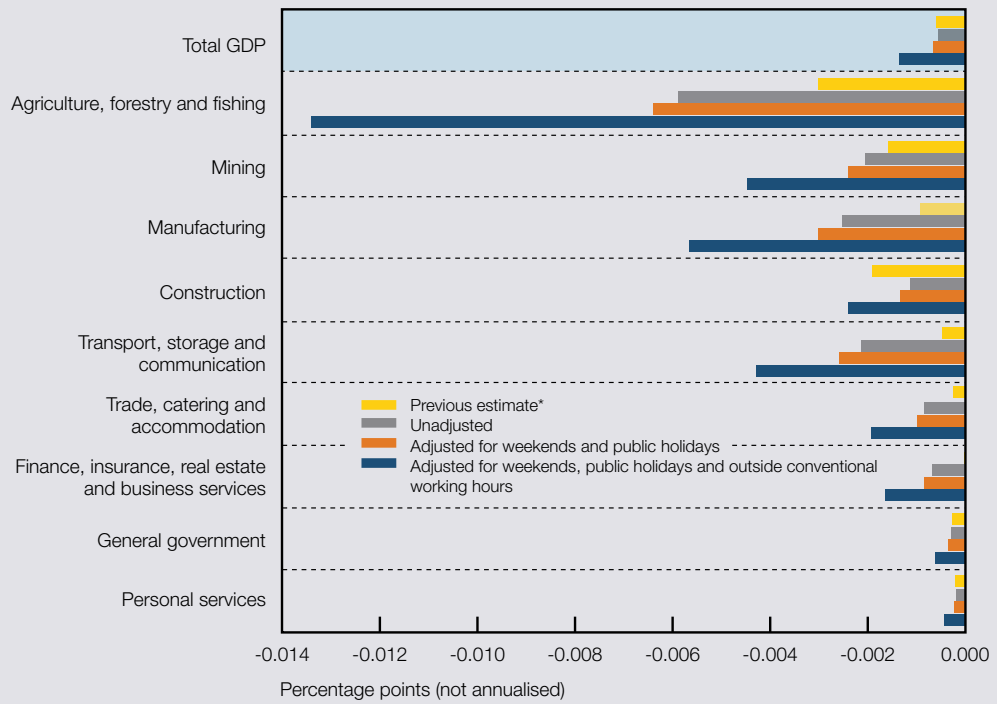
When adjusted for weekends, public holidays and non-conventional working hours, one additional GWh of load-shedding was estimated to lower quarterly growth in real GDP by -0.0014 percentage points, on average. Based on the unadjusted intensity index, the impact is lower at -0.00056 percentage points. During the third quarter of 2022, the unadjusted load-shedding intensity index was at a record high of 3 736 GWh, which implies that load-shedding likely lowered quarterly real GDP growth by 2.1 percentage points. When considering weekends, public holidays and non-conventional working hours, the load-shedding intensity index was at 1 692.5 GWh, implying a 2.3 percentage point reduction in quarterly real GDP growth for the third quarter of 2022.

5 This period differs from that used in a previous box on load-shedding (see 'Box 1: Electricity load-shedding and economic activity' in the September 2019 edition of the *Quarterly Bulletin*), where annualised real GDP growth rates were used for the period from the first quarter of 2008 to the first quarter of 2019. No load-shedding occurred from the second quarter of 2008 to the fourth quarter of 2013, prompting the shortening of the sample in the current analysis.





The estimated impact of 1 GWh of electricity load-shedding on quarter-to-quarter seasonally adjusted not-annualised growth in real gross domestic product



* As published in the September 2019 Quarterly Bulletin
Source: SARB