Utility-scale power generation statistics in South Africa

2024

(1 January 2024 – 31 December 2024)

CSIR Energy Research Centre

17 March 2025

science, technology & innovation
Department:
Science, Technology and Innovation
REPUBLIC OF SOUTH AFRICA

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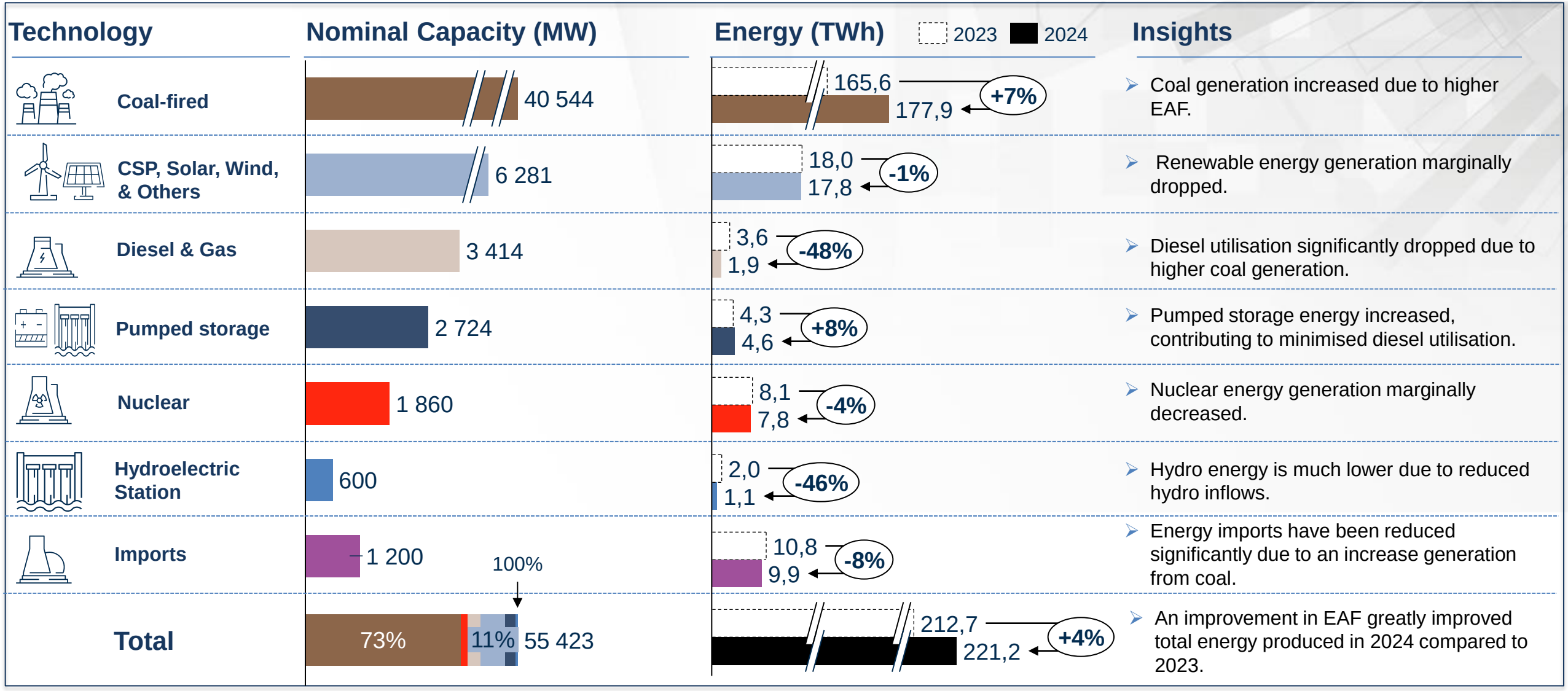
Improvements in Eskom fleet performance amid lower residual demand minimised loadshedding in 2024; No new generation installed capacity was added by Eskom and REIPPs in 2024, the proposed NERSA tariff increase of 12.74% takes the average tariff to c/kWh 195.93.

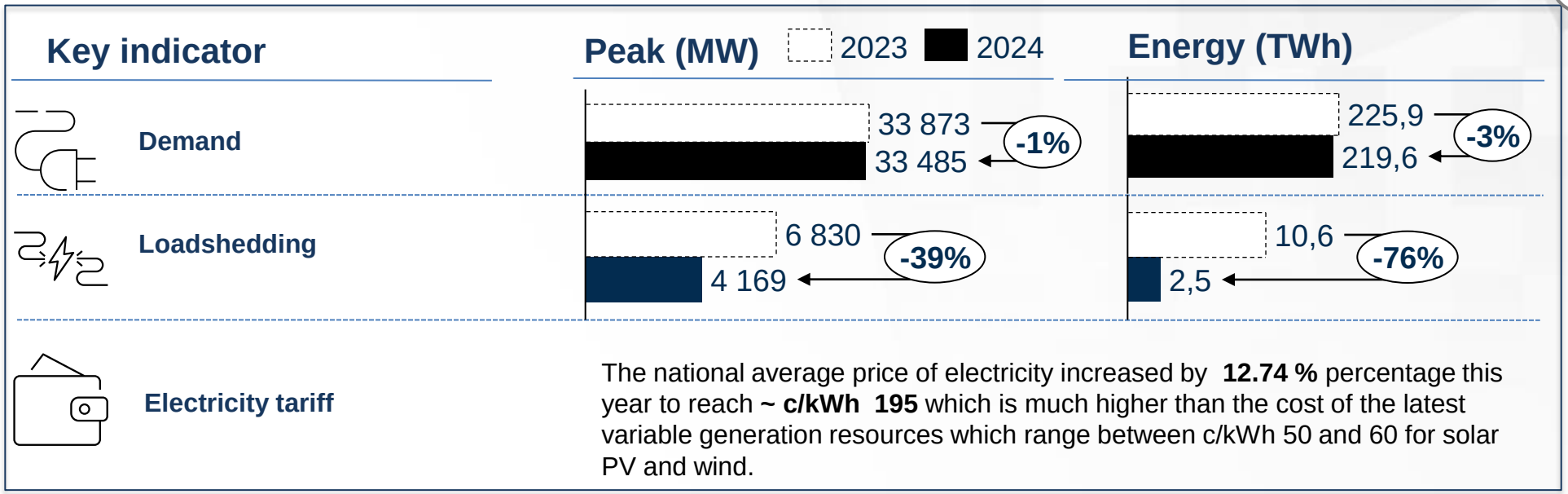
Theme	Key insights
Demand Analysis	➢ Demand for electricity continues to trend down, peak demand is 1% lower for this time of the year compared to the peak in 2023 due to rapid growth of the private sector embedded generation.
Generation Capacity	➢ Eskom fleet installed capacity remained unchanged in 2024 compared to 2023, energy generated from coal is relatively higher due to improved EAF. REIPPP energy contribution is marginally lower in 2024 compared to 2023.
EAF Analysis	➢ The Eskom fleet EAF significantly improved in 2024 and reached a weekly peak of 70% which is much higher than the 59.92% reached last year. The improvement helped to reduce significantly the utilisation of diesel generators.
Loadshedding statistics	➢ South Africa experienced a record amount of load shedding in 2023, however, improvements in the Eskom fleet performance.
Tariff Analysis	➢ The average national electricity tariff has increased by 190% since 2014; the increases are higher than inflation and may impact affordability.

Summary of 2024 statistics: Total energy production increased by 4% from 2023 to 2024, primarily due to higher coal energy availability

Coal generation increased by 7%, while pumped storage generation increased by 8%, leading to reduced diesel utilisation. No new generation capacity was added by Eskom and REIPPPs in 2024.



Summary of 2024 statistics: Actual loadshedding decreased by ~76% in 2024 compared to 2023 due to improvements in the energy availability factor (EAF) while energy demand decreased by 3% compared to 2023

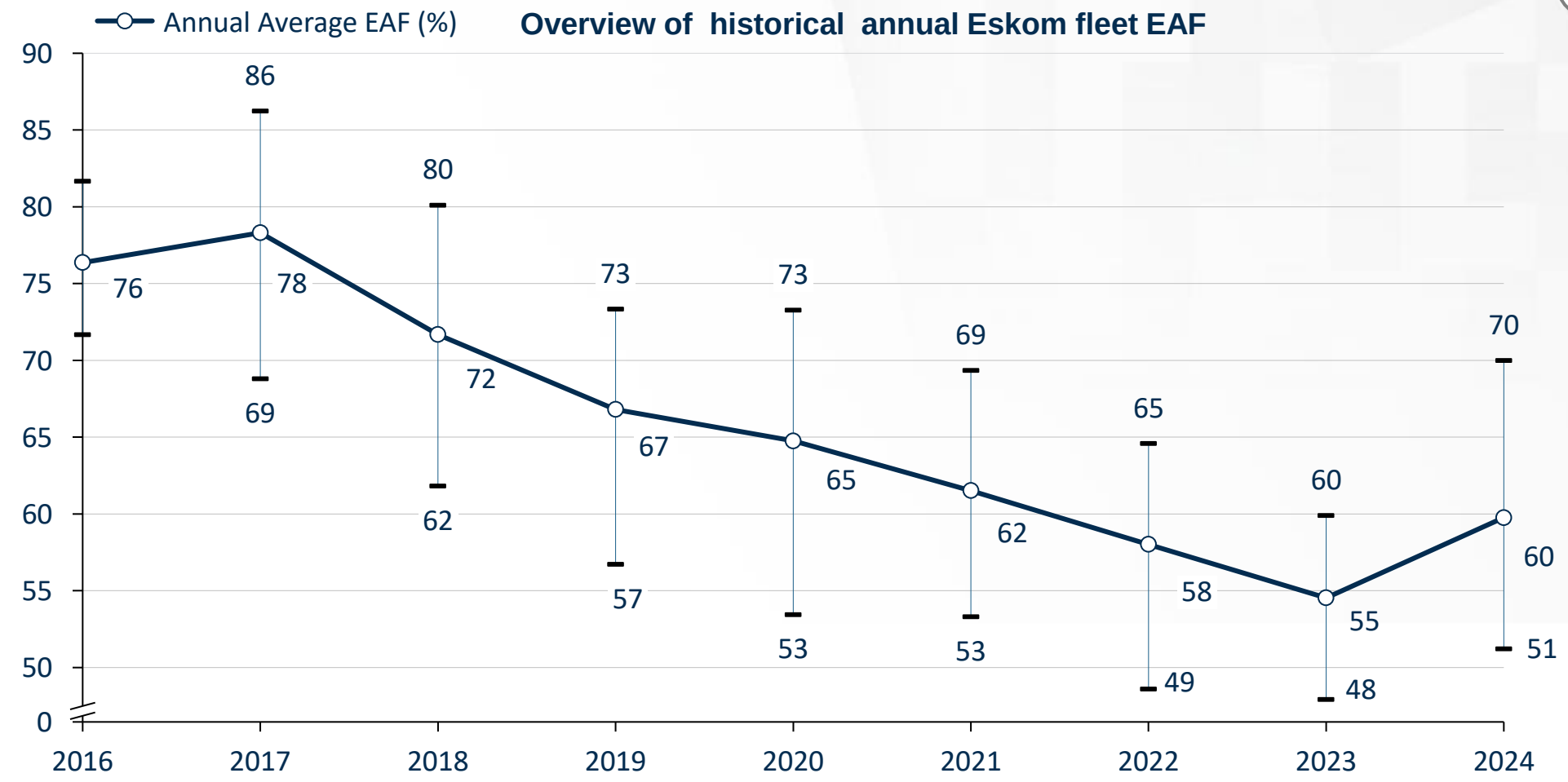


Insights

- Although energy production increased by 4% in 2024, South Africa's total energy demand declined by 3% compared to 2023.
- As of 31 December 2024, there have been 281 consecutive days without any loadshedding.
- The national average price of electricity increased annually by an average of **~11%** over the last ten years compared to the annual average inflation rate of **~5%**.

The EAF trajectory showed a positive upturn in 2024

The annual average fleet EAF of Eskom power plant increased by 5% to 60% in 2024, primary due to better performance of coal plants.



Notes: EAF - Energy Availability Factor. The average annual EAF is calculated as an average of the hourly EAF values.
Sources: Eskom; CSIR analysis

Insights

- Eskom fleet EAF has been trending down, the worst EAF was experienced in 2023.
- Eskom has since implemented a Generation Recovery Plan which targeted several coal stations to recover the EAF.
- The highest EAF observed in 2024 was 70**%** which is **10%** higher compared to 2023 where the highest EAF was **60%**.

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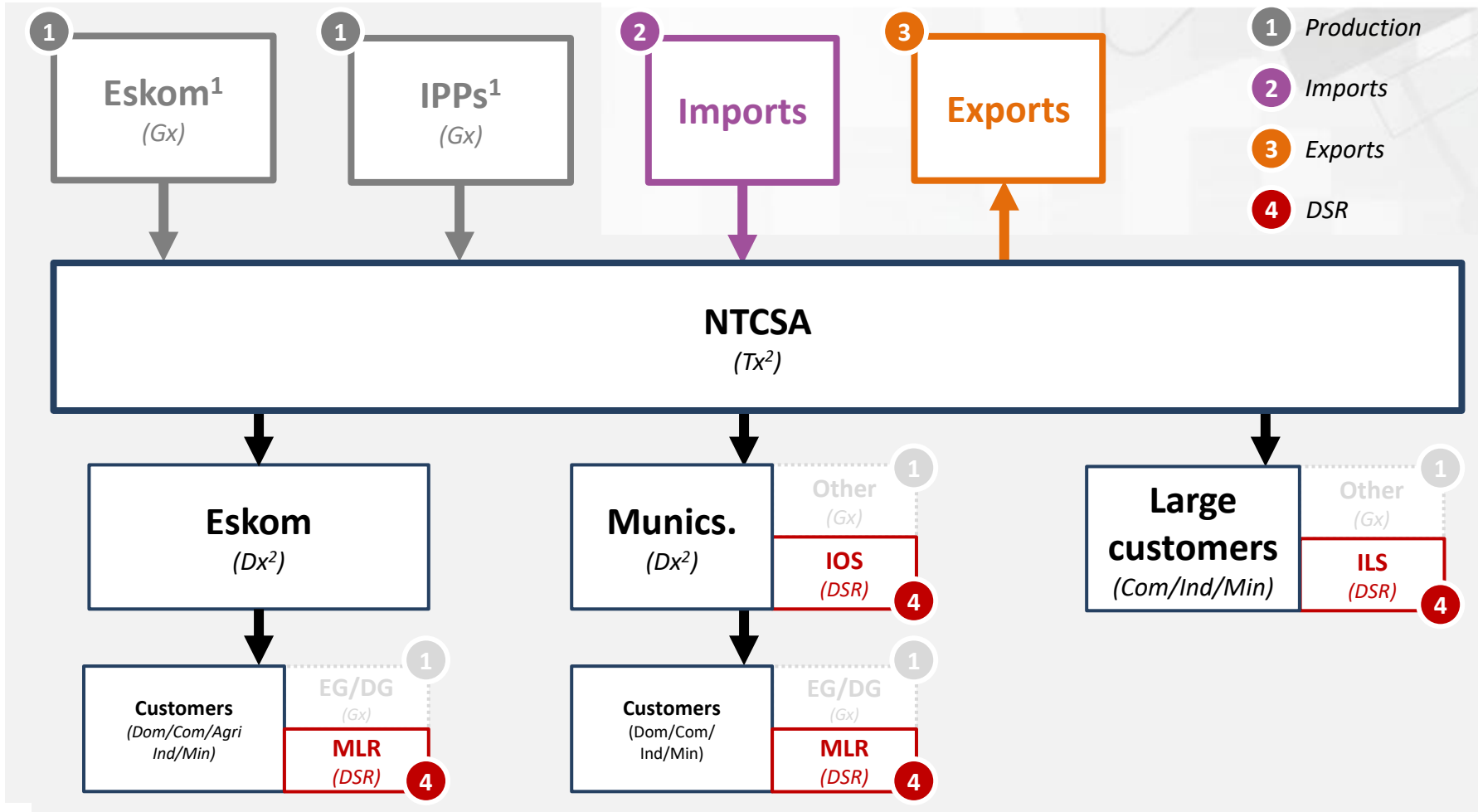
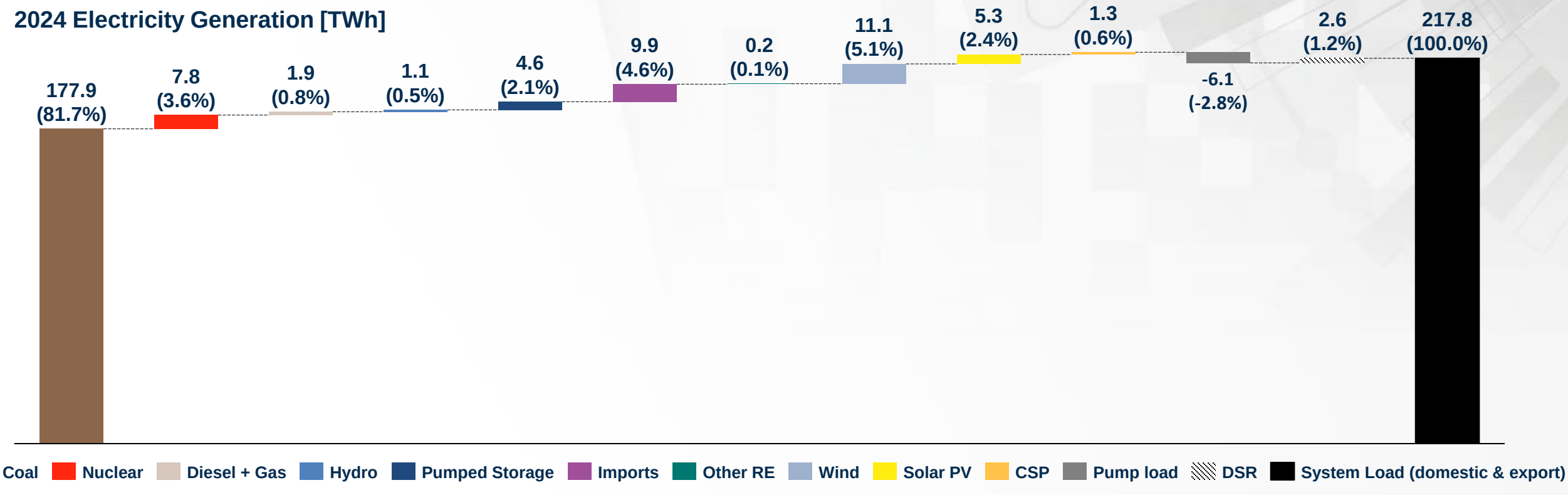
Equivalent wholesale electricity production and demand in South Africa, as measured and published by Eskom



EG = Embedded Generation; DG = Distributed Generation; Gx = Generation; Tx = Transmission; Dx = Distribution; Demand Side Response (DSR) = Manual Load Reduction (MLR) + Interruptible Load Supply (ILS) + Interruption of Supply (IOS); NOTES: Items in light faded gray are NOT included in statistics presented in this publication.[1] Power generated less power station load (auxillaries); Minus pumping load (Eskom owned pumped storage); [2] Transmission/distribution networks incur losses before delivery to customers

In 2024, coal generation increased by ~12 TWh compared to 2023, contributing 177.9 TWh of the ~220 TWh of total system load (including demand side response (DSR)) while hydro and diesel resources make up a small contribution to meeting the load.

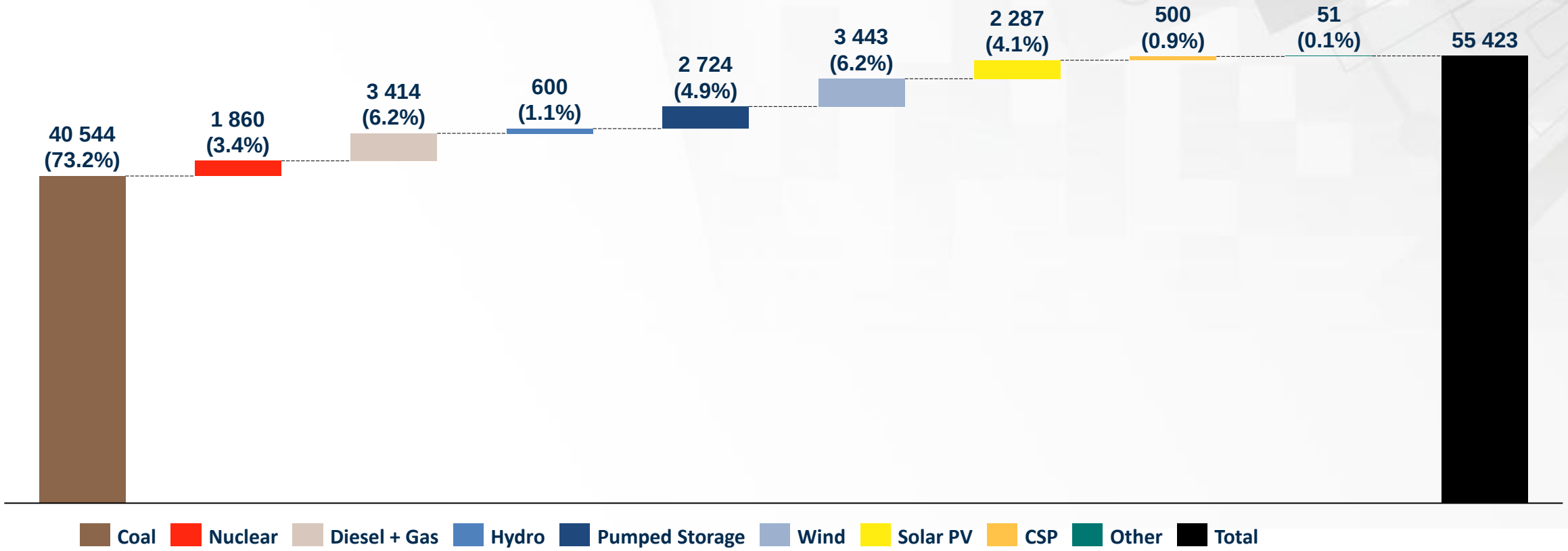


Year	Coal	Nuclear	Diesel + Gas	Hydro	Pumped Storage	Imports	Other RE	Wind	Solar PV	CSP	Pump Load	DSR	System Load
2023	165,6	8,1	3,6	2,0	4,3	10,8	0,2	11,6	5,0	1,4	-5,7	16,8	**223,7**
2024	177,9	7,8	1,9	1,1	4,6	9,9	0,2	11,1	5,3	1,3	-6,1	2,6	**217,8**

Notes: Wind includes Eskom's Sere wind farm (100 MW). Wind and solar PV energy excludes curtailment and is thus lower than actual wind and solar PV generation. PS = pumped storage. Demand Side Response (DSR) = Manual Load Reduction (MLR) + Interruptible Load Supply (ILS) + Interruption of Supply (IOS)
Sources: Eskom; CSIR analysis

Actual nominal installed capacity 31 December 2024 (excluding embedded generation capacity and private capacity). No additional generation capacity has been added in 2024 compared to 2023 .

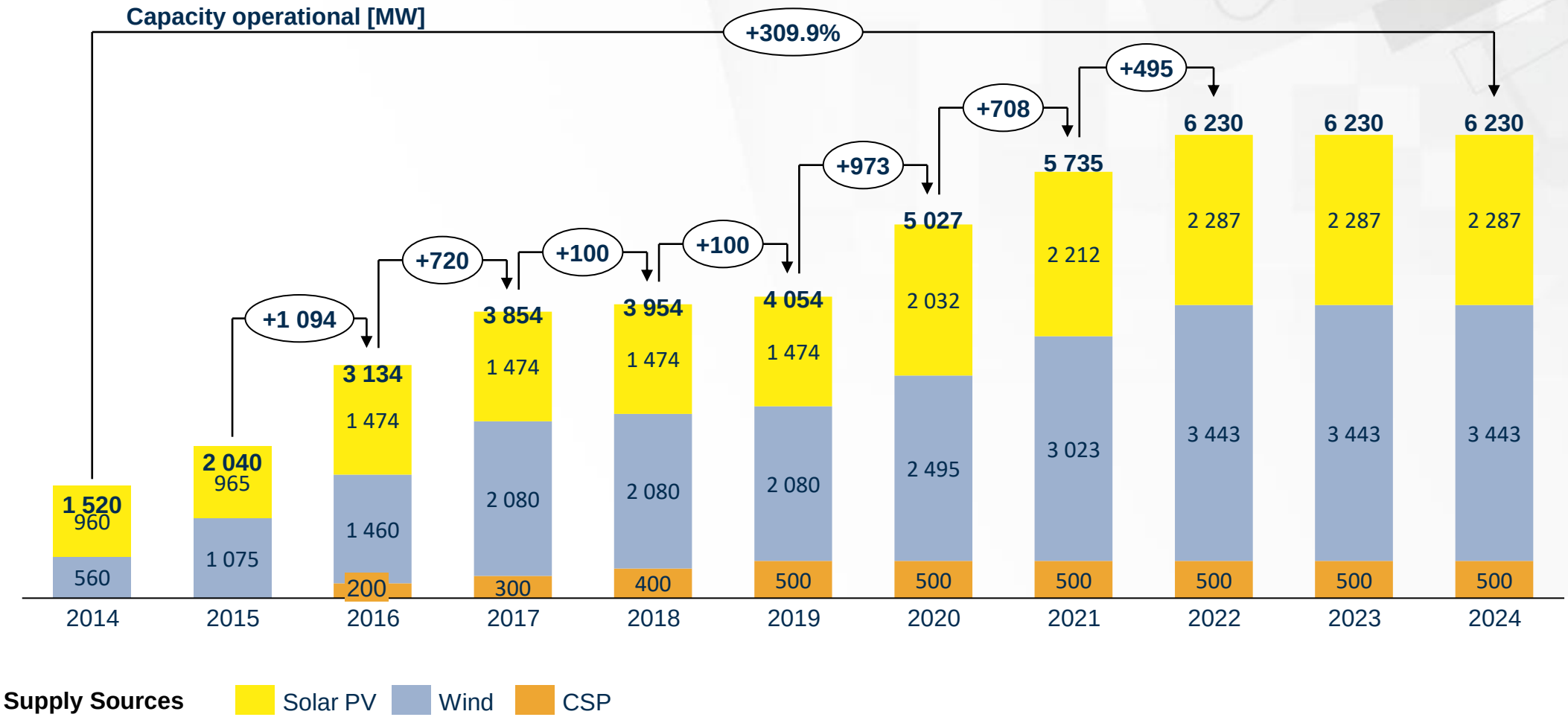
2024 Nominal capacity [MW]



Notes: RE = Renewable Energy; Total nominal installed capacity = Eskom capacity + IPPs; Embedded generation and municipal-owned capacity excluded
Sources: Eskom; CSIR analysis

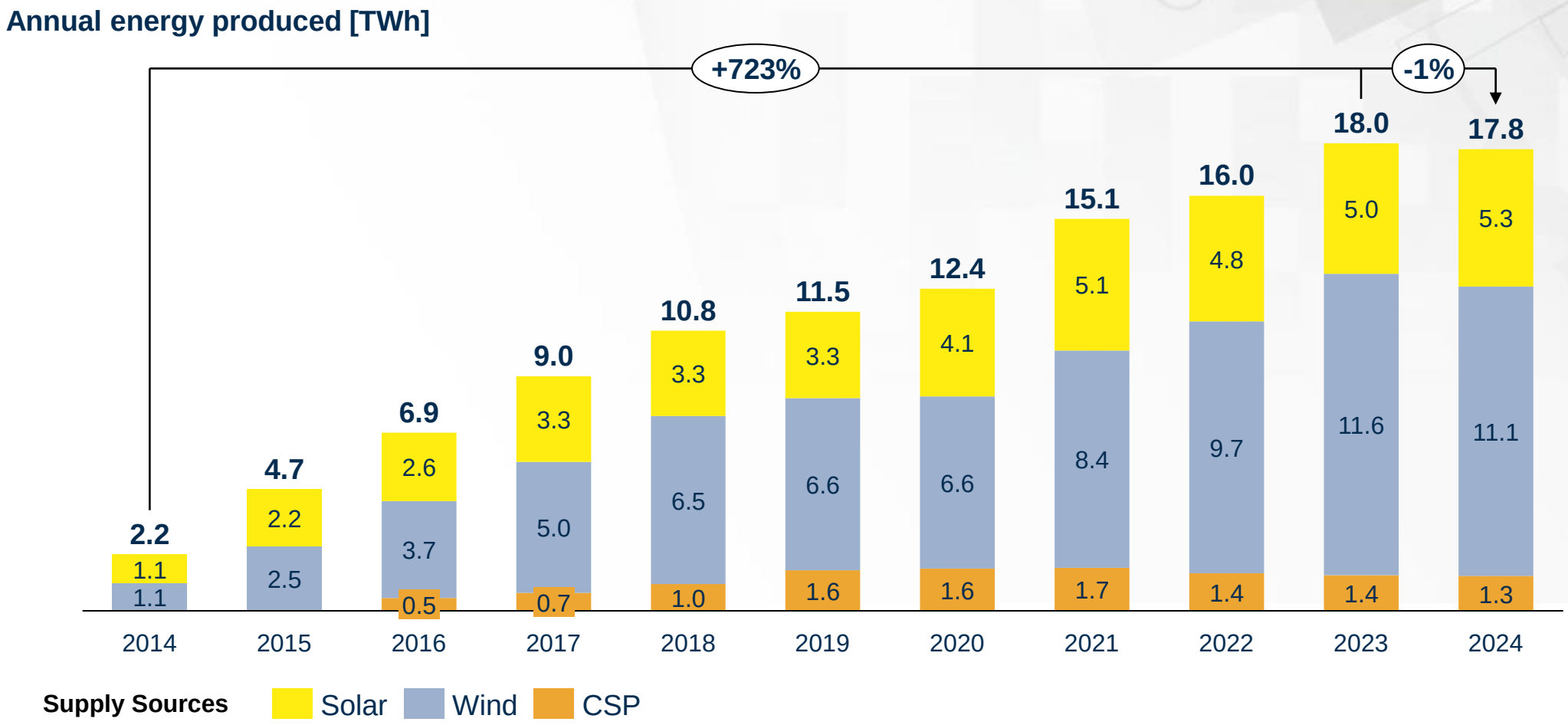
A decade growth of over 300% of total renewable energy installed capacity under REIPPPP.

From 1 January 2014 to 30 June 2024, 3 443 MW of wind, 2 287 MW of large-scale solar PV and 500 MW of CSP became operational in South Africa. No additional capacity in 2024 compared to 2023.



*Notes: RSA = Republic of South Africa. Solar PV capacity = capacity at point of common coupling. Wind includes Eskom's Sere wind farm.
Sources: Eskom; DoE IPP Office

Renewable energy generation from the REIPPP programme has grown by 723% since 2014, the energy generated last year is marginally lower compared to 2023.

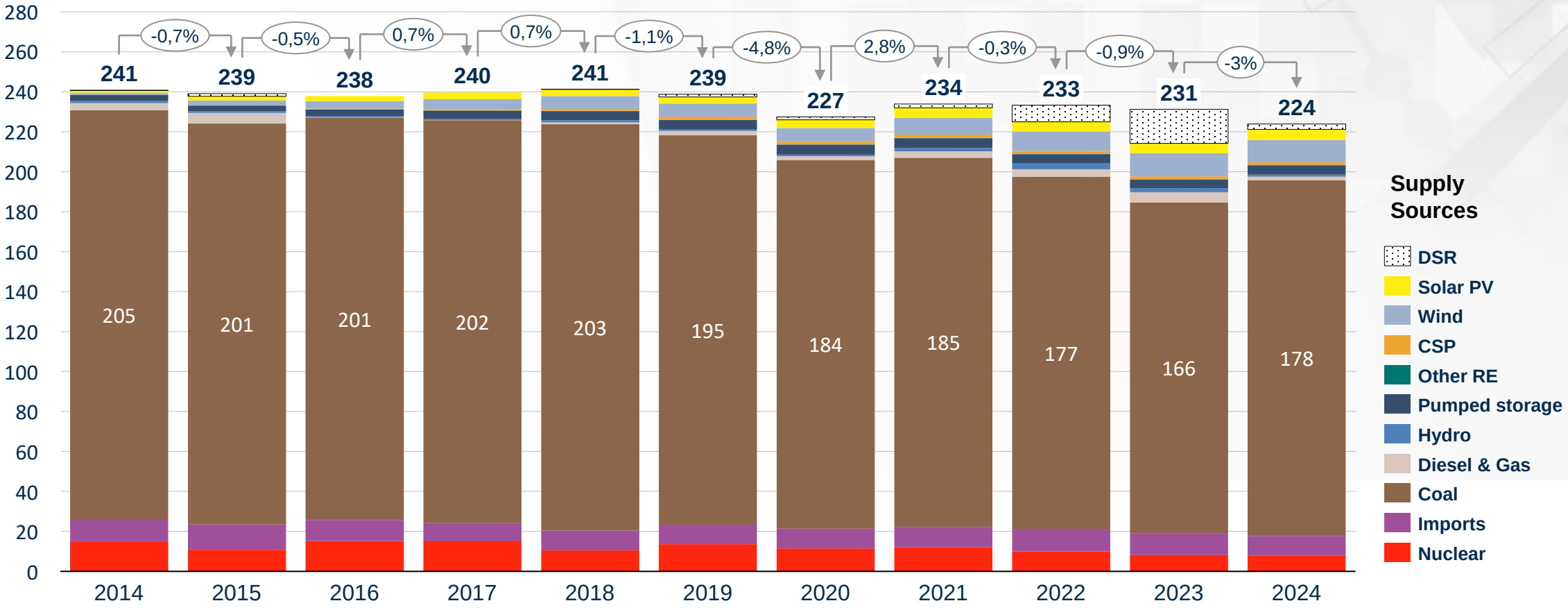


Notes: Wind includes Eskom's Sere wind farm (100 MW). CSP energy measured from date when more than two CSP plant were commissioned. Wind and solar PV energy excludes curtailment and is thus lower than actual wind and solar PV generation
Sources: Eskom; DoE IPP Office

An increase in baseload generation has led to a reduction in DSR in 2024 compared to 2023

Diesel utilisation has consequently reduced; total energy generated (including DSR) over time continues to trend downward due to declining residual demand.

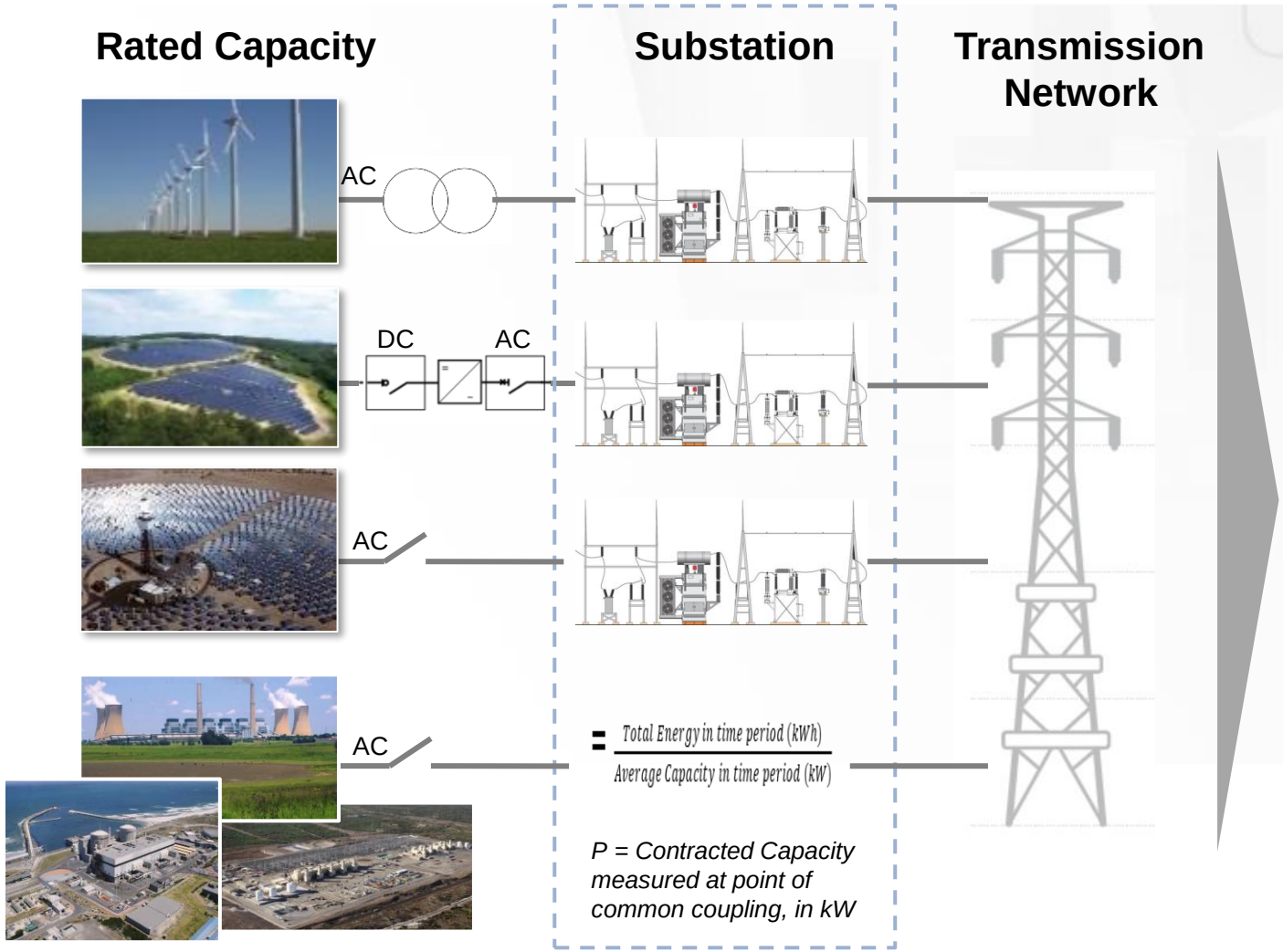
Annual electricity production [TWh]



NOTES: Demand Side Response (DSR) = Manual Load Reduction (MLR) + Interruptible Load Supply (ILS) + Interruption of Supply (IOS). DSR prior to 2018 has been estimated by the CSIR

Sources: Eskom; CSIR analysis

Illustration: Calculation of the average capacity factor of operational power plant categories in South Africa



Average Capacity Factor (CF)

$$CF = \frac{\sum_{t=1}^{n} E_t}{\frac{\sum_{t=1}^{n} P_t}{n}}$$

$$= \frac{Total\ Energy\ in\ time\ period\ (kWh)}{Average\ Capacity\ in\ time\ period\ (kW)}$$

Where:
P = Contracted Capacity, in kW
E = Energy production, in kWh
t = Time period
n = Number of time periods

Notes: RSA = Republic of South Africa. Simplified illustration of technology grid interconnections

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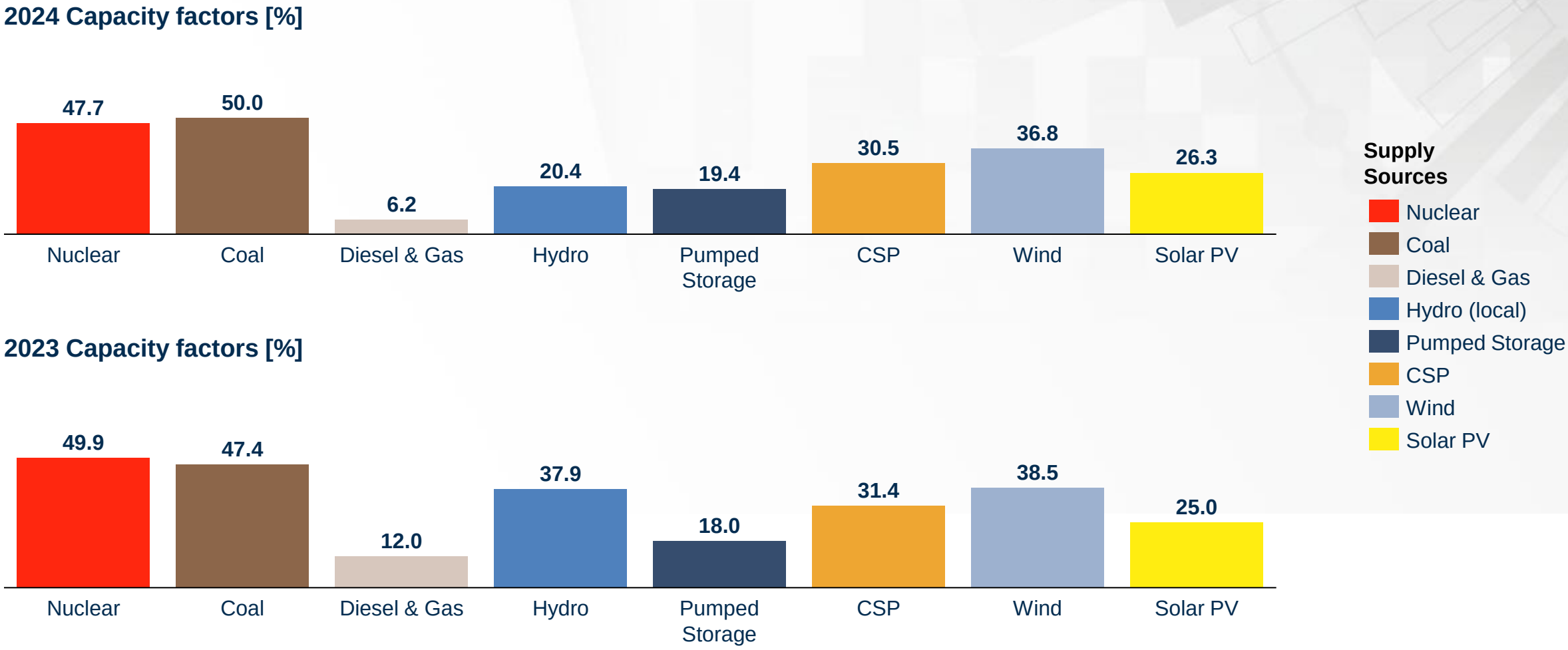
Coal utilisation: Annual capacity factors comparison by supply source

Diesel and gas utilisation reduced by almost 6% in 2024 compared to 2023 due to improvements in coal capacity factor.



Sources: Eskom; CSIR analysis
up to December 2024

Annual peak demand in 2024 decreased by 1% in comparison to 2023

Historical annual peak demand has been gradually declining over the past decade due to efficiency improvements and recent growth in embedded generation.

Notes: Peak demand includes Demand Side Response (DSR) = Manual Load Reduction (MLR) + Interruptible Load Supply (ILS) + Interruption of Supply (IOS).
Sources: Eskom; CSIR analysis

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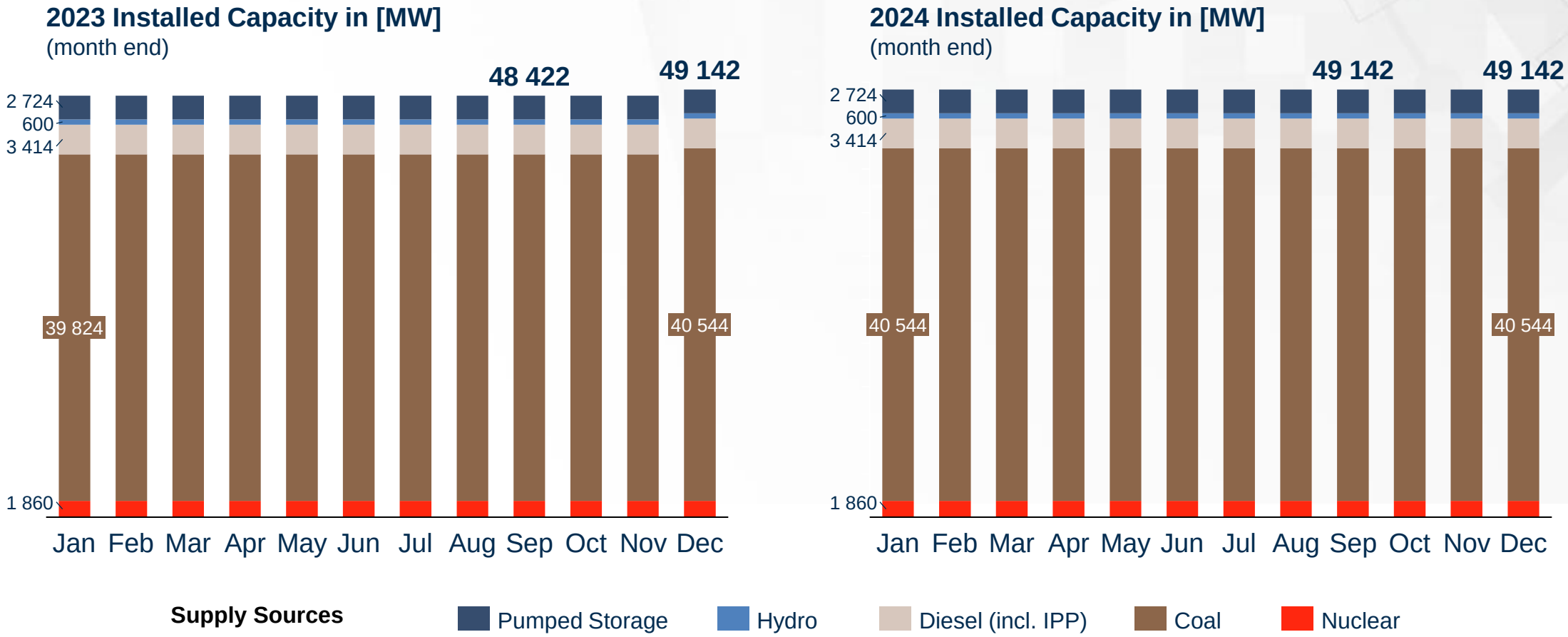
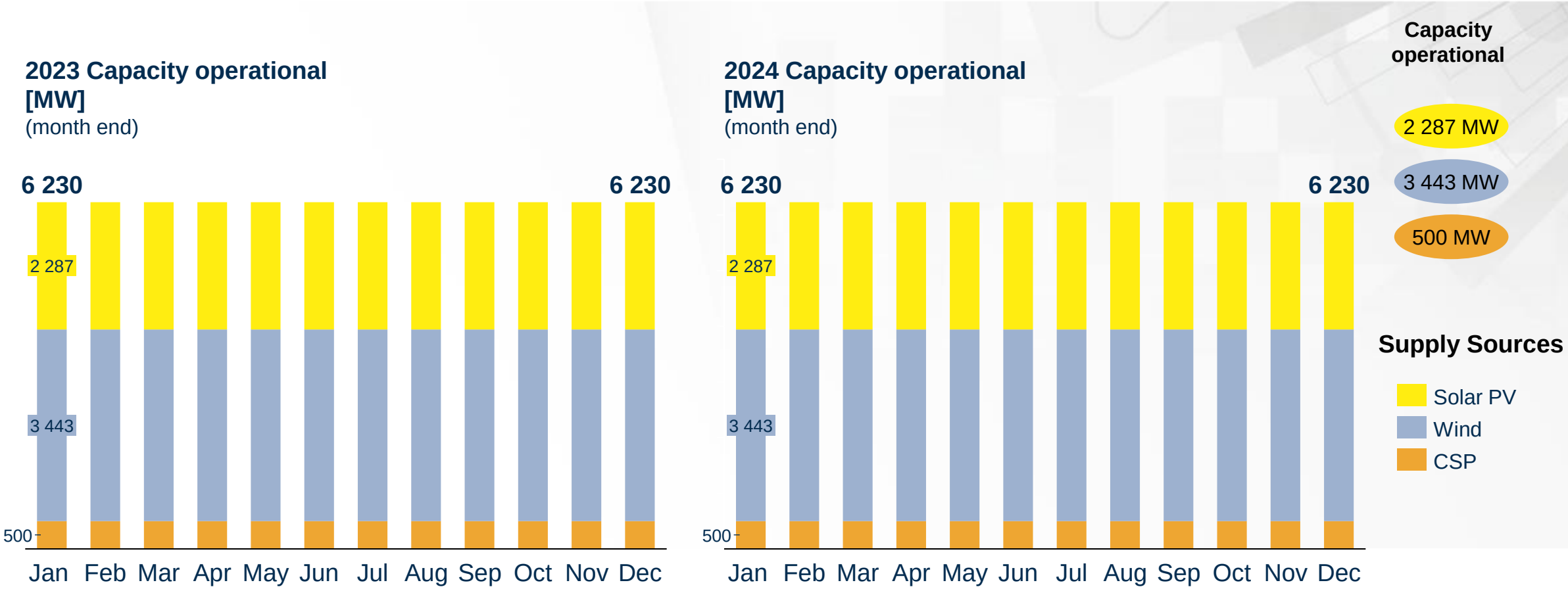
A comparison of Eskom power plants' monthly installed capacity shows that no new generation capacity was added to the power grid.



Sources: Eskom; CSIR analysis

A comparison of REIPPP capacity for 2024 and 2023 shows that no new generation capacity was added to the grid (utility-scale procured with government programmes)

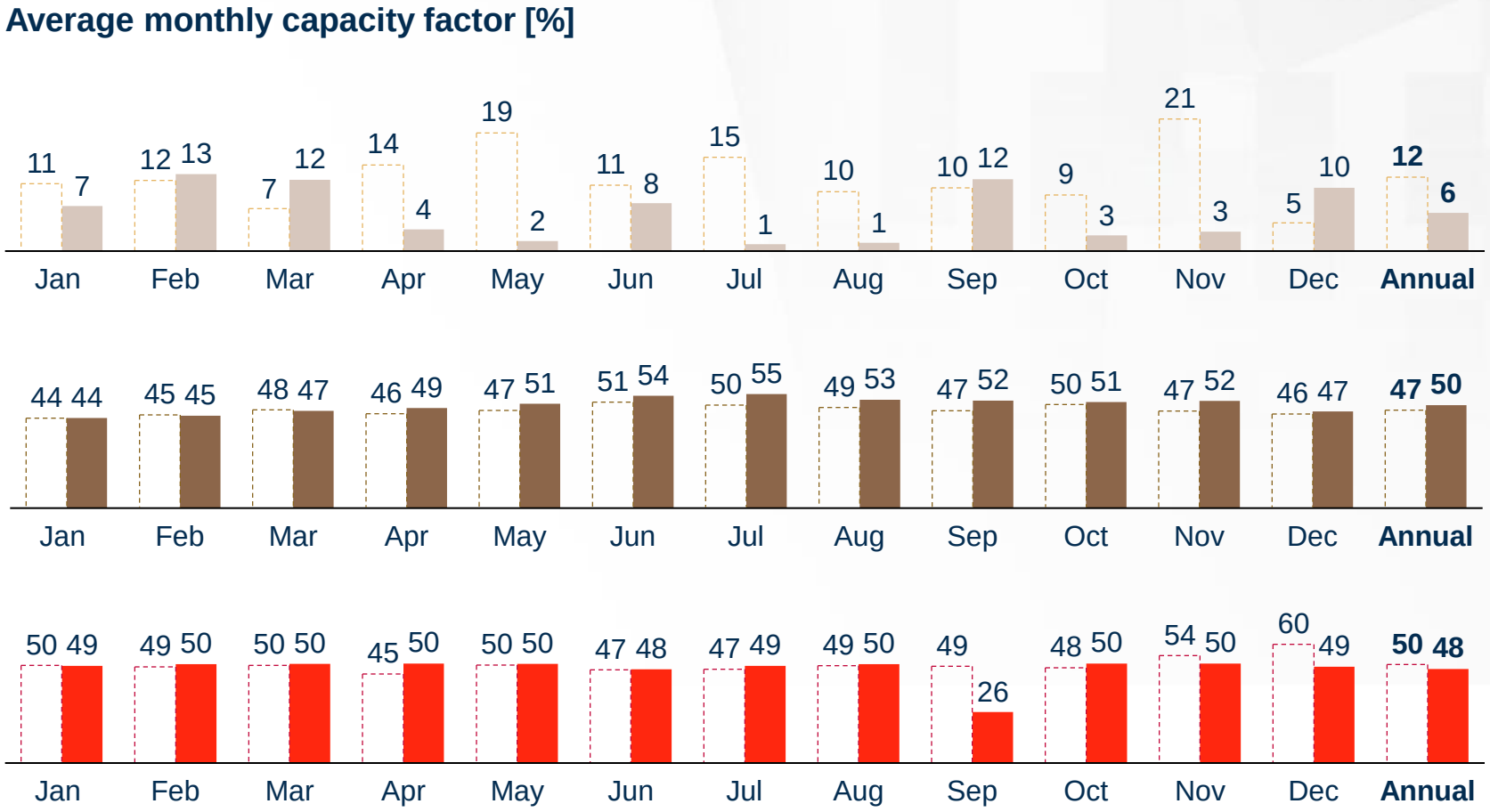
The total monthly installed capacity of utility-scale generation capacity in South Africa from January to December 2024.



Sources: Eskom; CSIR analysis

Average monthly capacity factors for conventional power plant

The coal monthly capacity factor increased from April 2024; this has led to a significant reduction in the diesel generator capacity factor compared to 2023.



Capacity operational

3 414 MW

40 544 MW

1 860 MW

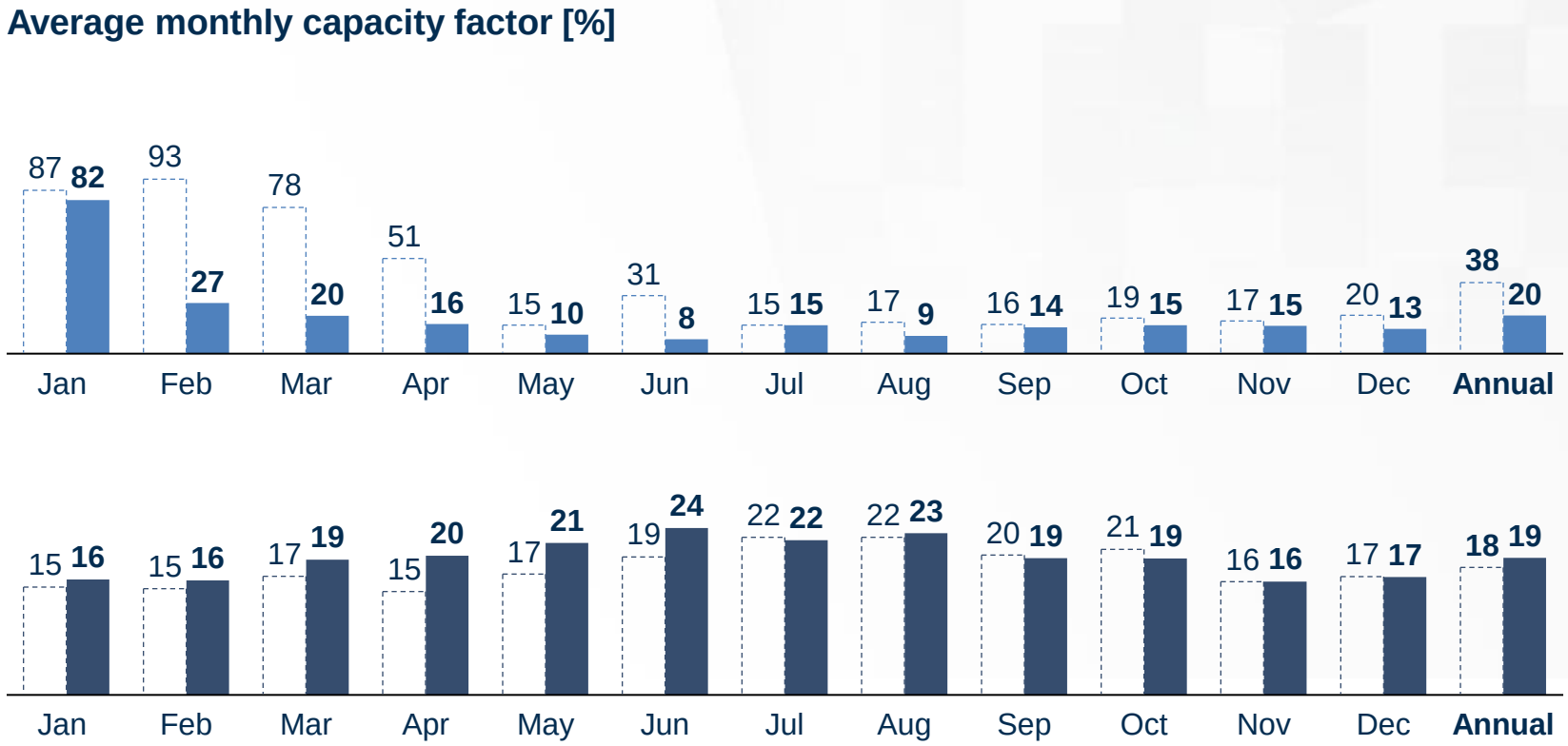
Supply Sources

- Diesel (incl. IPP)2023
- Diesel (incl. IPP) 2024
- Coal 2023
- Coal 2024
- Nuclear 2023
- Nuclear 2024

Sources: Eskom; CSIR analysis

Average monthly capacity factors for hydro and pumped storage plants

Hydro resources were utilised significantly less in 2024 compared to 2023 due to improved coal availability. Pumped storage capacity factor increased slightly to reduce the reliance on diesel generators.



Capacity operational (31 Dec)

600 MW

2 724 MW

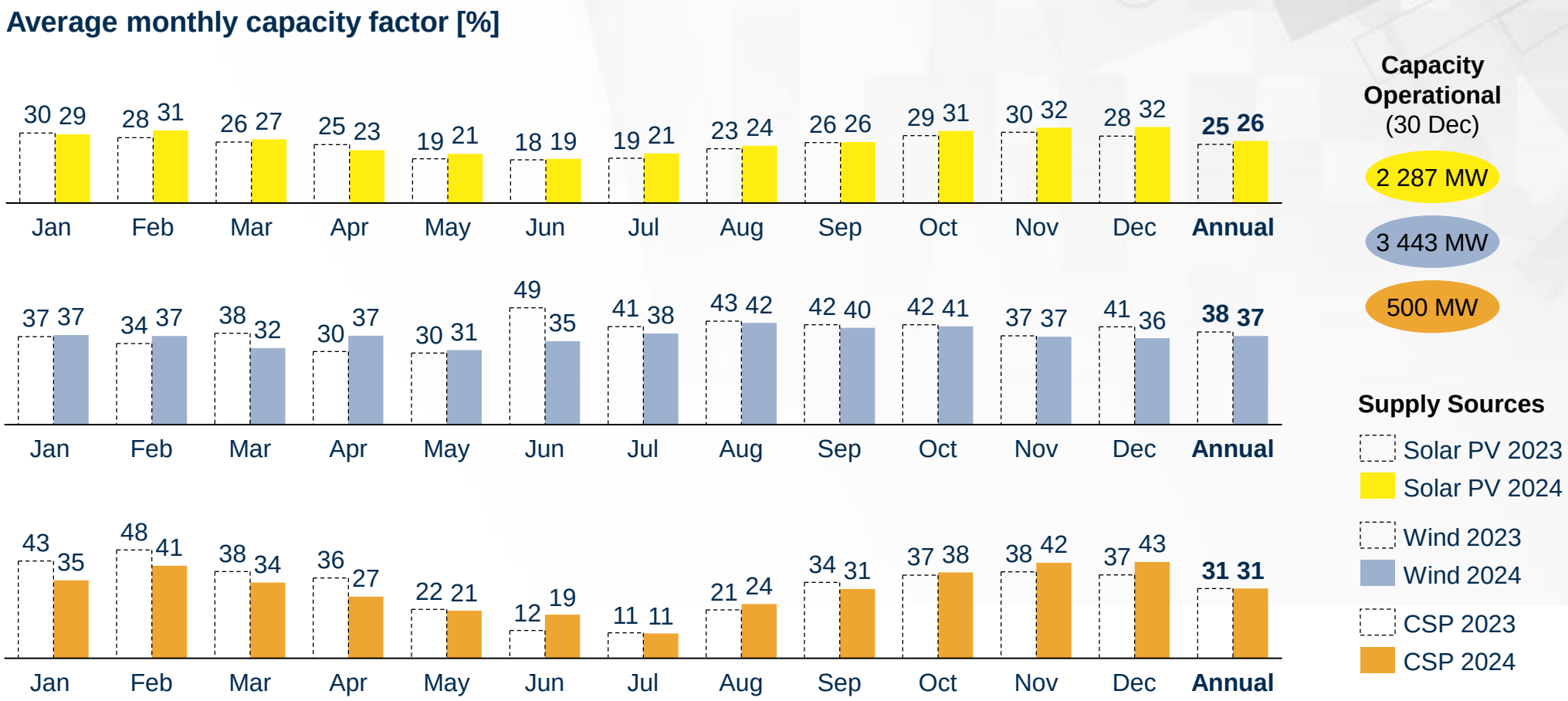
Supply Sources

- Hydro 2023
- Hydro 2024
- Pumped Storage 2023
- Pumped Storage 2024

Sources: Eskom; CSIR analysis

Average monthly capacity factors for solar PV, wind and CSP

The monthly capacity factors for solar PV, CSP and wind fluctuate throughout the year, reflecting seasonal variations.

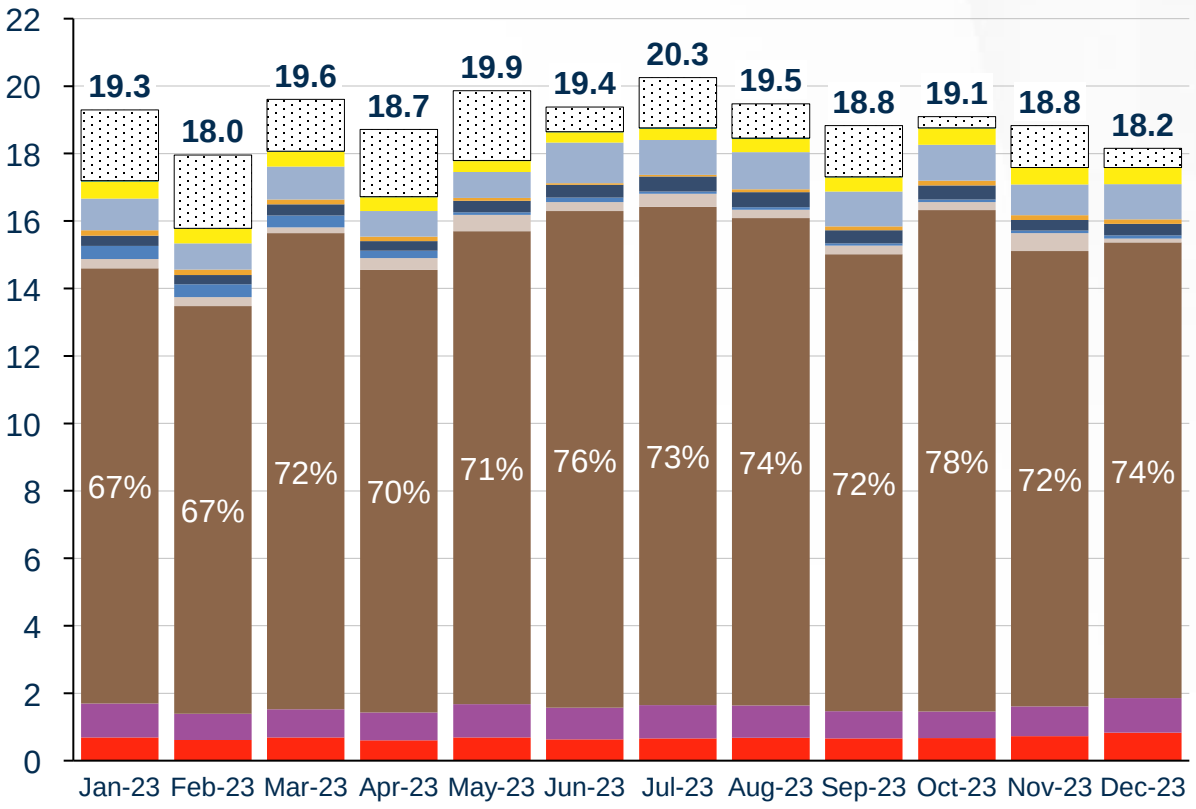


Notes: Capacity operational as per the actual start of operation (can differ from REIPPP contracted date).
Sources: Eskom; CSIR analysis

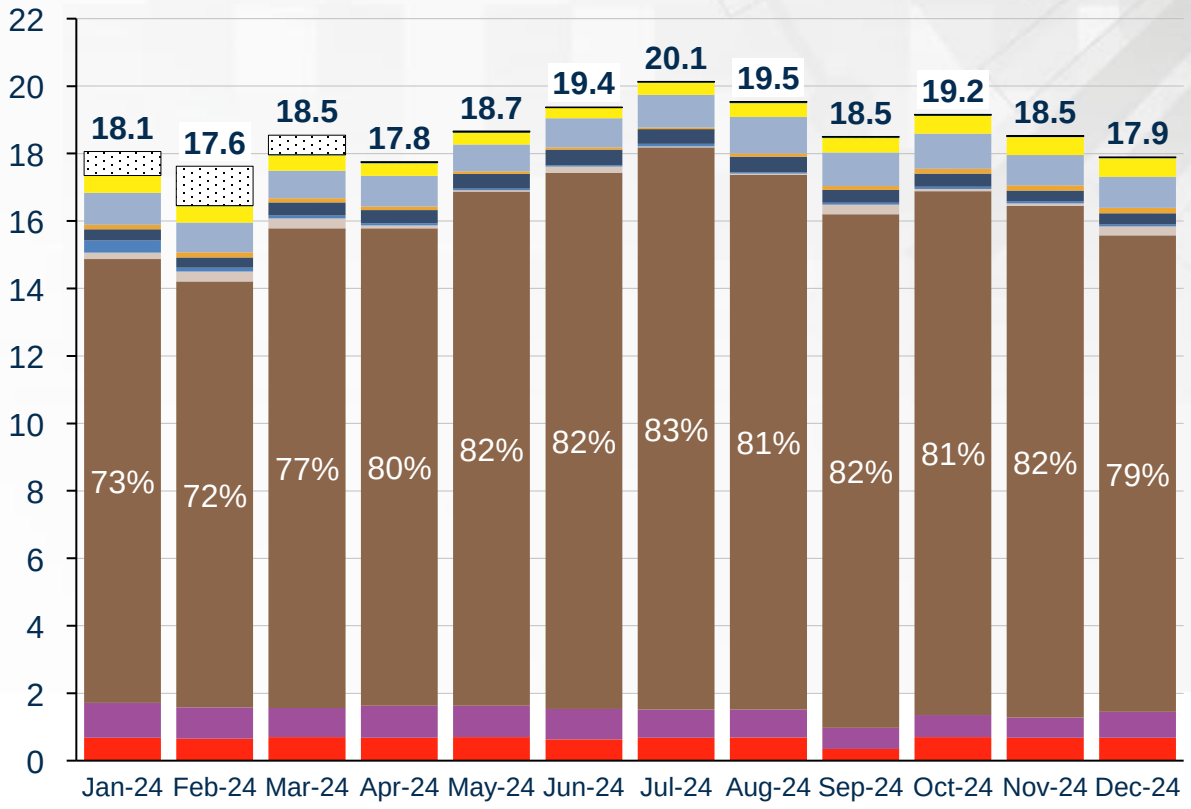
Monthly electricity production from all power supply sources

Energy generated from coal was higher from April to December 2024 compared to the same period in 2023 due to improvements in the energy availability factor.

Monthly electricity production 2023 [TWh]



Monthly electricity production 2024 [TWh]

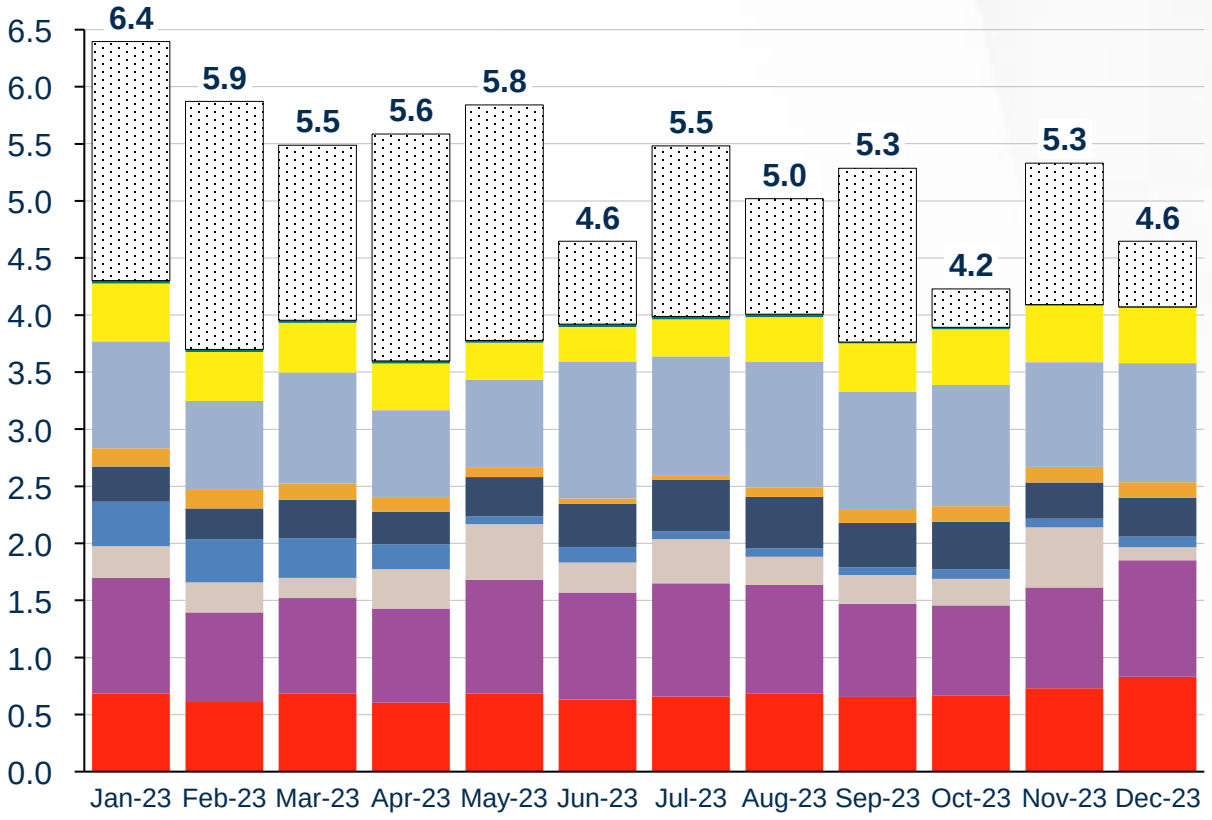


Supply Sources DSR | Other RE | Solar PV | Wind | CSP | Pumped Storage | Hydro | Diesel | Coal | Imports | Nuclear

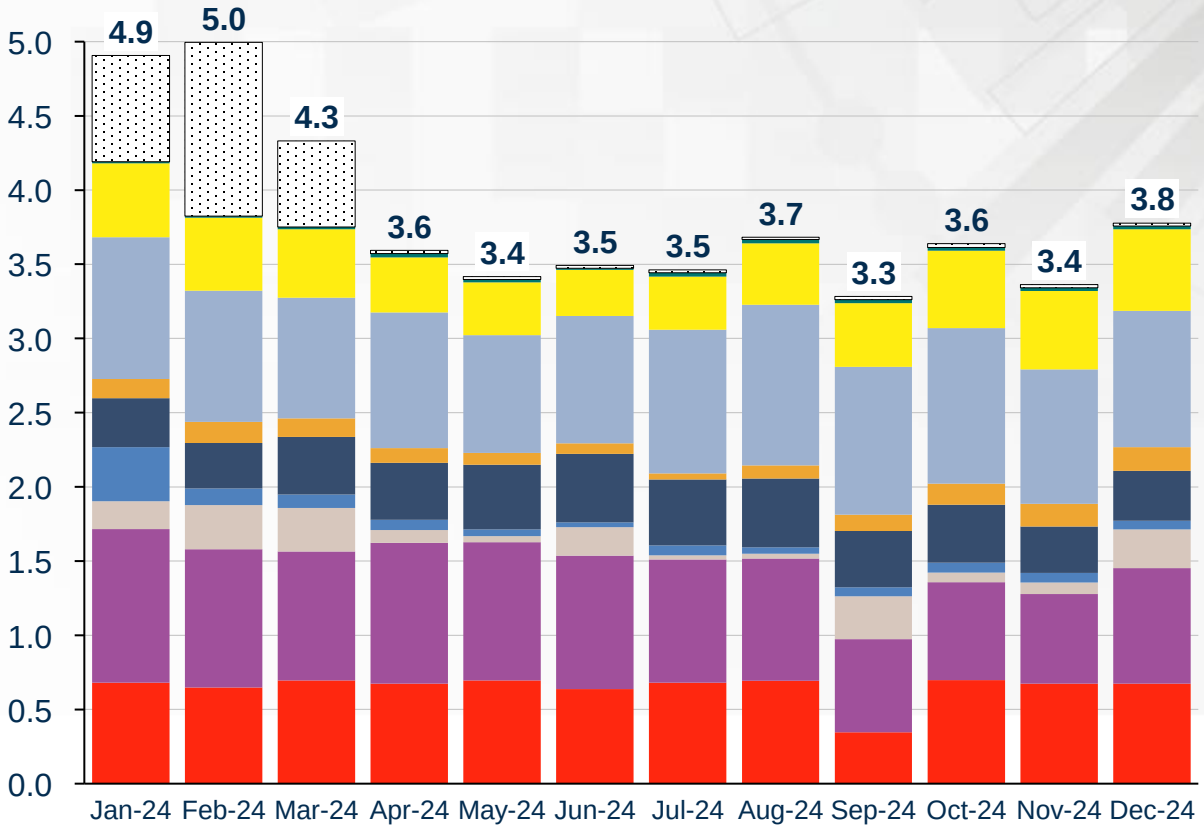
Notes: Demand Side Response (DSR) = Manual Load Reduction (MLR) + Interruptible Load Supply (ILS) + Interruption of Supply (IOS)
Sources: Eskom; CSIR analysis

Monthly electricity production from power supply sources, excluding coal, shows higher total production of energy in 2024 compared to 2023; DSR, on the other hand, was much lower in 2024 due to the improved energy availability factor.

Monthly electricity production 2023 [TWh]



Monthly electricity production 2024 [TWh]

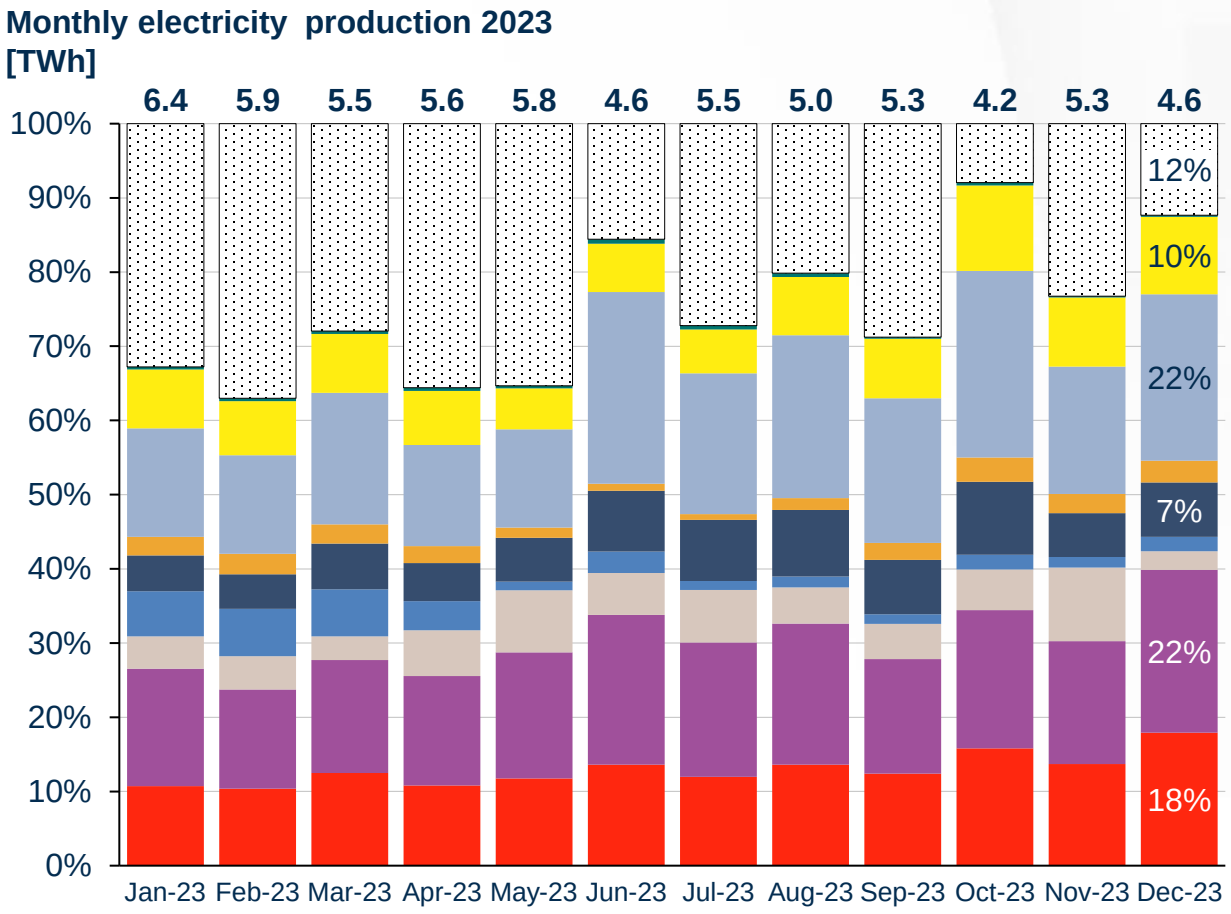


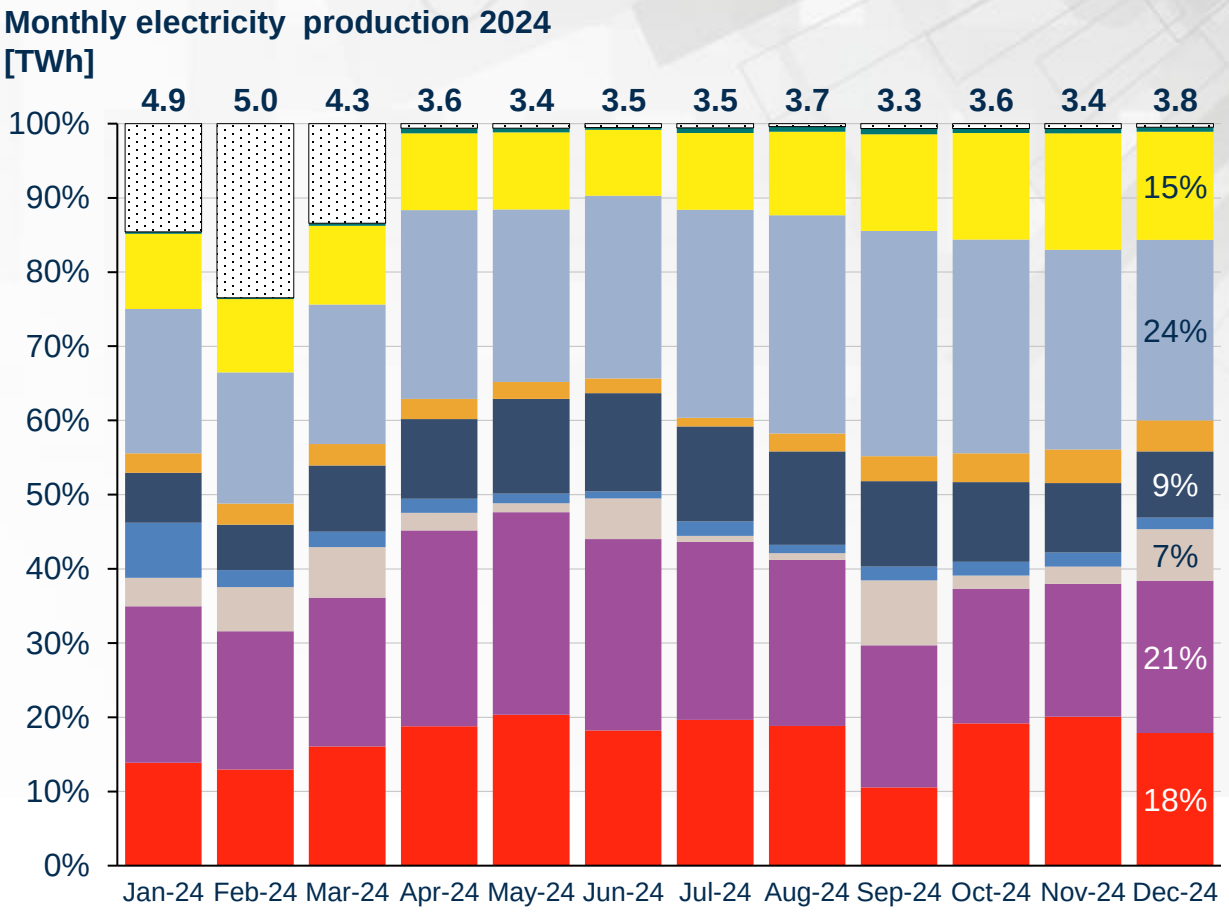
Supply Sources DSR | Other RE | Solar PV | Wind | CSP | Pumped Storage | Hydro | Diesel | Imports | Nuclear

Notes: Demand Side Response (DSR) = Manual Load Reduction (MLR) + Interruptible Load Supply (ILS) + Interruption of Supply (IOS)
Sources: Eskom; CSIR analysis

Monthly electricity production from power supply sources, excluding coal

Actual monthly electricity production for the period shows that there was less energy production from diesel throughout the months for 2024 compared to 2023 and much lower utilisation of DSR in 2024.

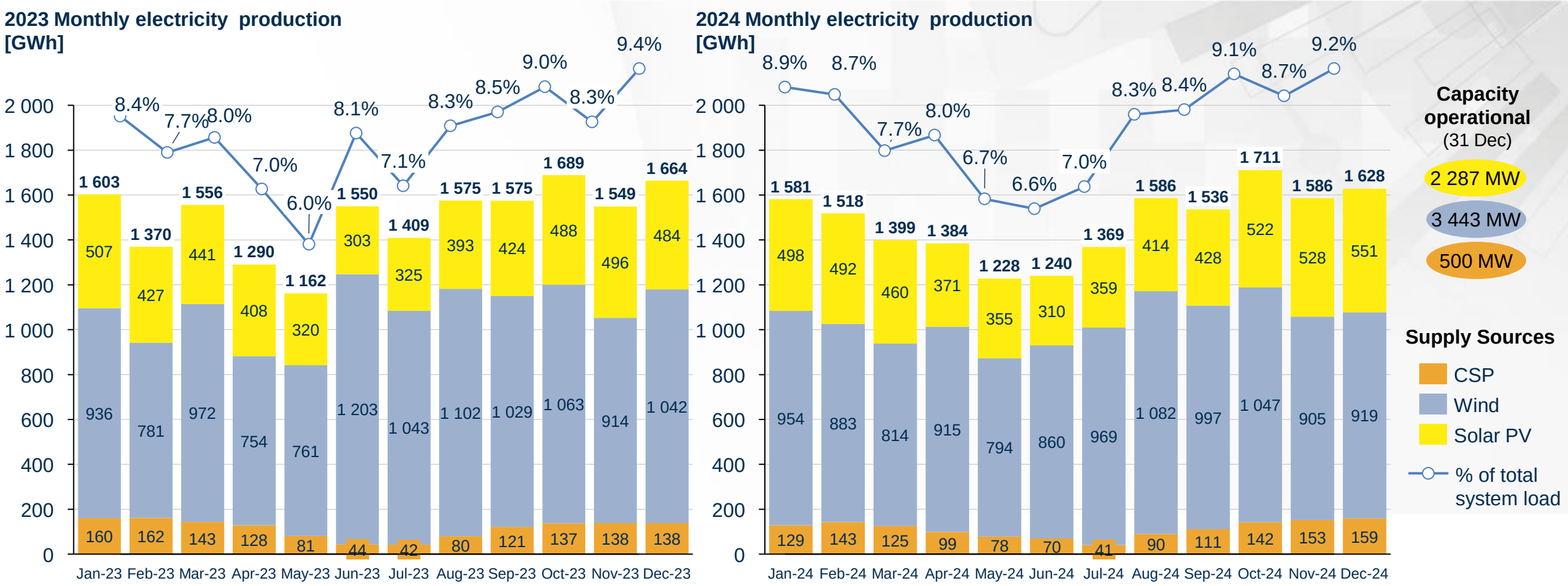




Notes: Demand Side Response (DSR) = Manual Load Reduction (MLR) + Interruptible Load Supply (ILS) + Interruption of Supply (IOS)
Sources: Eskom; CSIR analysis

Monthly electricity production of South Africa's REIPPP wind, solar PV and CSP fleet

Solar PV, wind and CSP contribute the least to system load during the winter months and the most during summer; overall, the energy produced in 2024 was marginally lower than in 2023.



Notes: Wind and solar PV energy excludes curtailment and is thus lower than actual wind and solar PV generation.
Sources: Eskom; CSIR analysis

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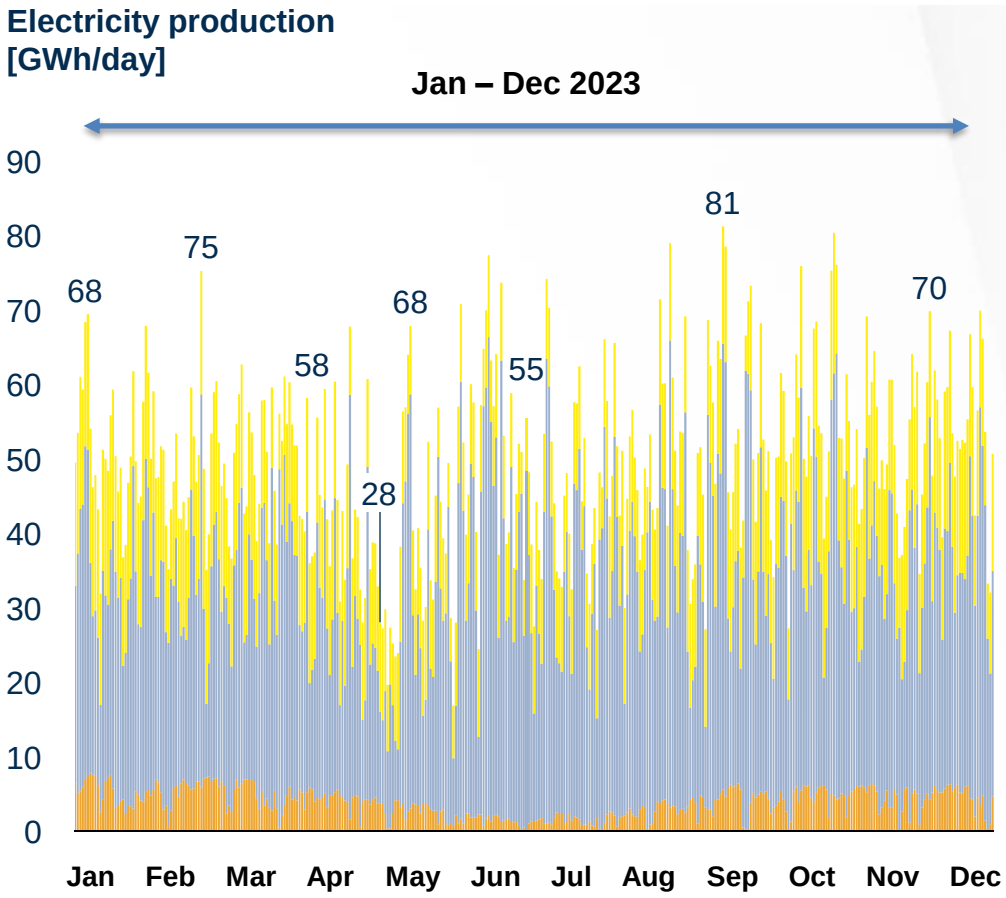
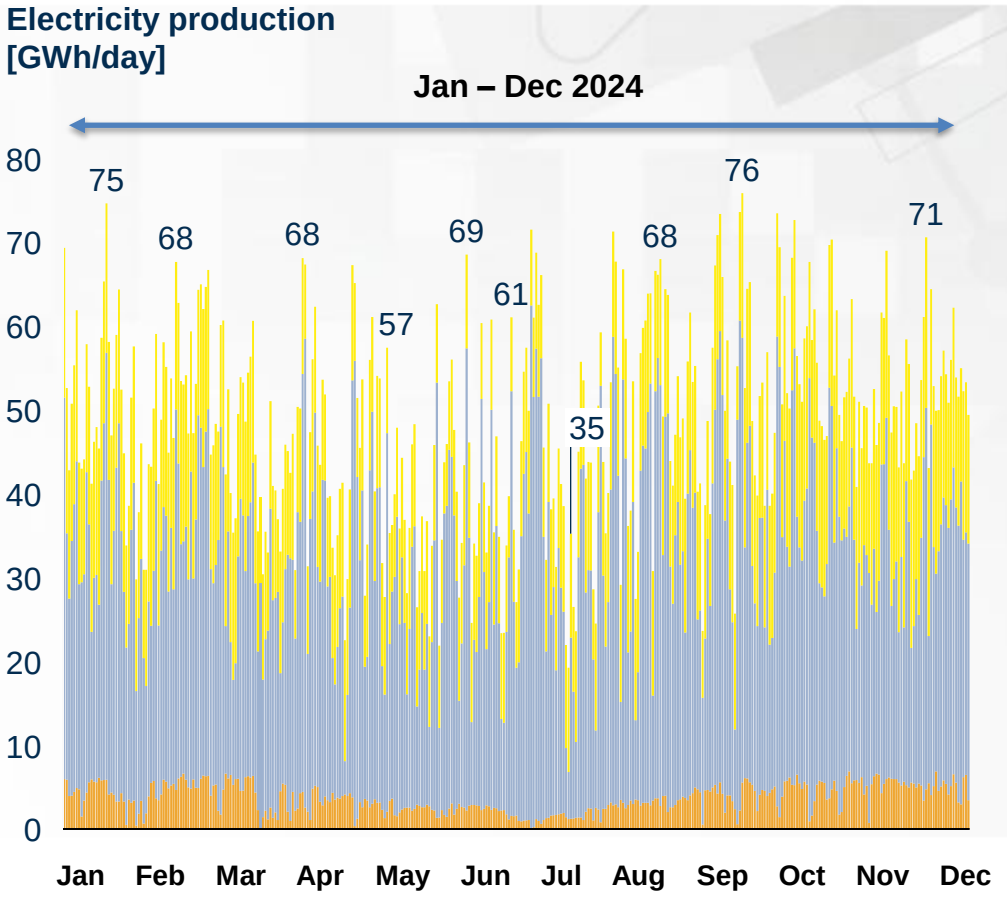
Daily electricity production of wind, solar PV and CSP fleet

Maximum daily production from large-scale solar PV, wind and CSP plants under the REI4P was recorded on 30 September 2024 whereas peak system demand occurred on 9 July 2024 where daily production was 69 GWh.



- Maximum daily production of 81 GWh on 15 Sep 2023 (Friday)
- Minimum daily production of 17 GWh on 31 May 2023 (Wednesday)

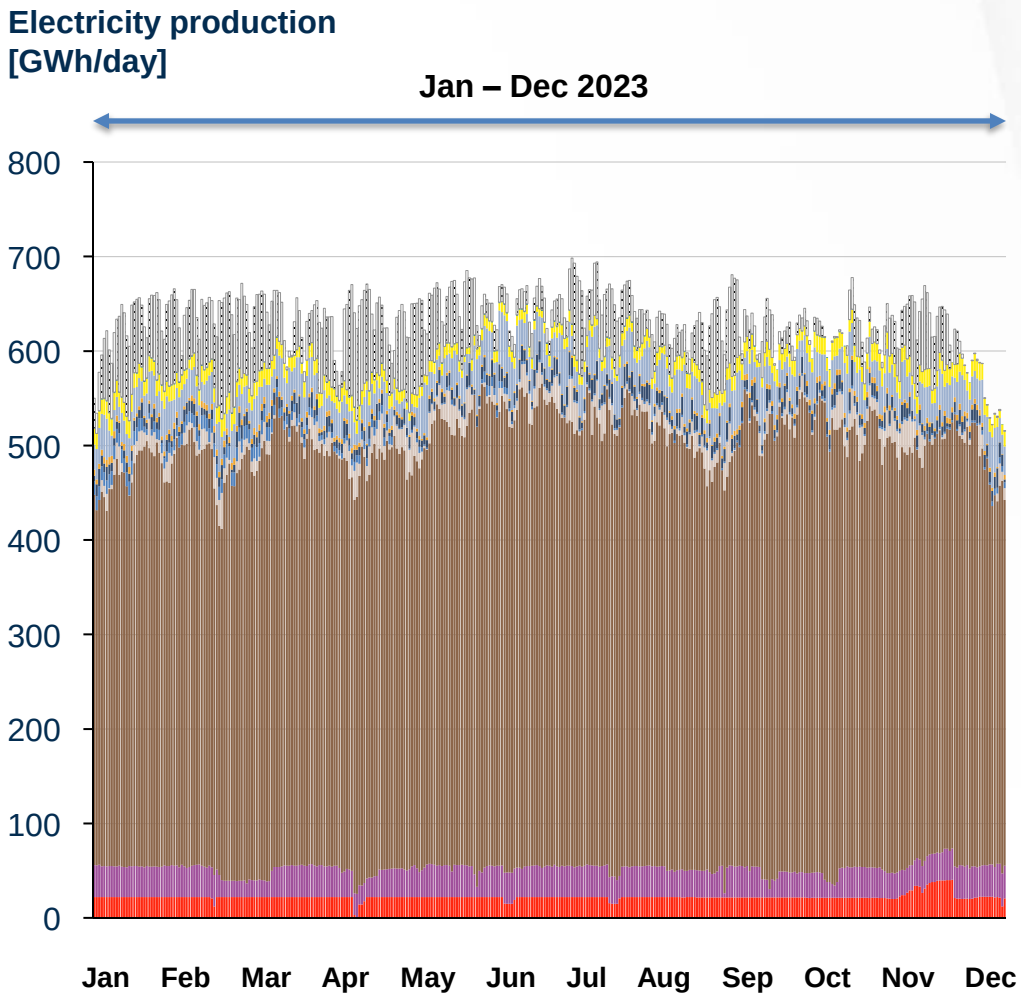


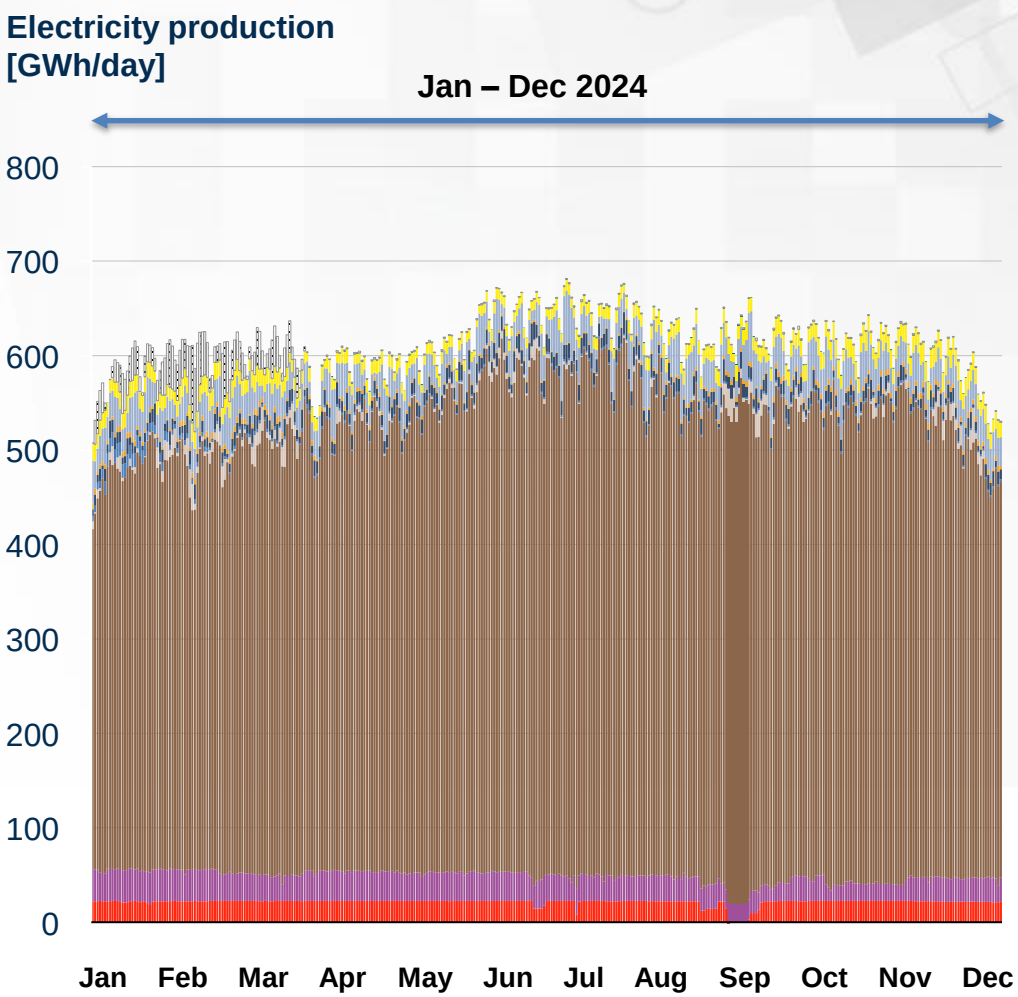
- Maximum daily production of 76 GWh on 30 Sep 2024 (Monday)
- Minimum daily production of 19 GWh on 22 Aug 2024 (Monday)

Sources: Eskom; CSIR analysis

Daily electricity production for all power supply sources

Diesel and gas maximum daily production of 33 TWh in 2024 compared to 45 TWh in 2023.





Capacity operational

2 287 MW	3 414 MW
3 443 MW	600 MW
500 MW	1 860 MW
40 544 MW	2 724 MW

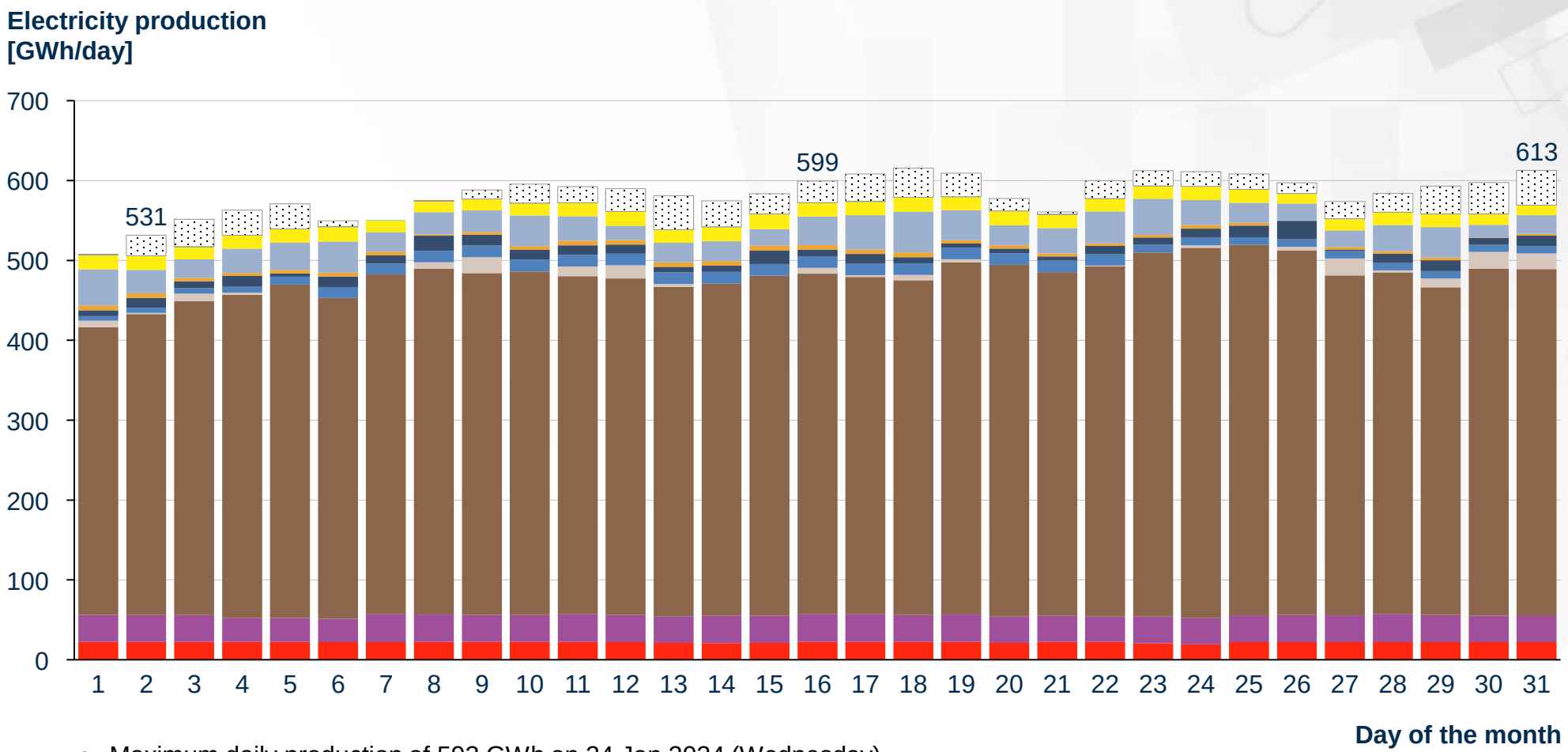
Supply Sources

- DSR
- Other
- Solar PV
- Wind
- CSP
- Pumped Storage
- Hydro
- Diesel & Gas
- Coal
- Imports
- Nuclear

Sources: Eskom; CSIR analysis

Daily electricity production between 506-593 GWh in January 2024

Actual daily production from all power supply sources in South Africa for January 2024.



- Maximum daily production of 593 GWh on 24 Jan 2024 (Wednesday)
- Minimum daily production of 506 GWh on 02 Jan 2024 (Tuesday)

Capacity Operational
(end of month)

2 287 MW	3 414 MW
3 443 MW	600 MW
500 MW	1 860 MW
40 544 MW	2 724 MW

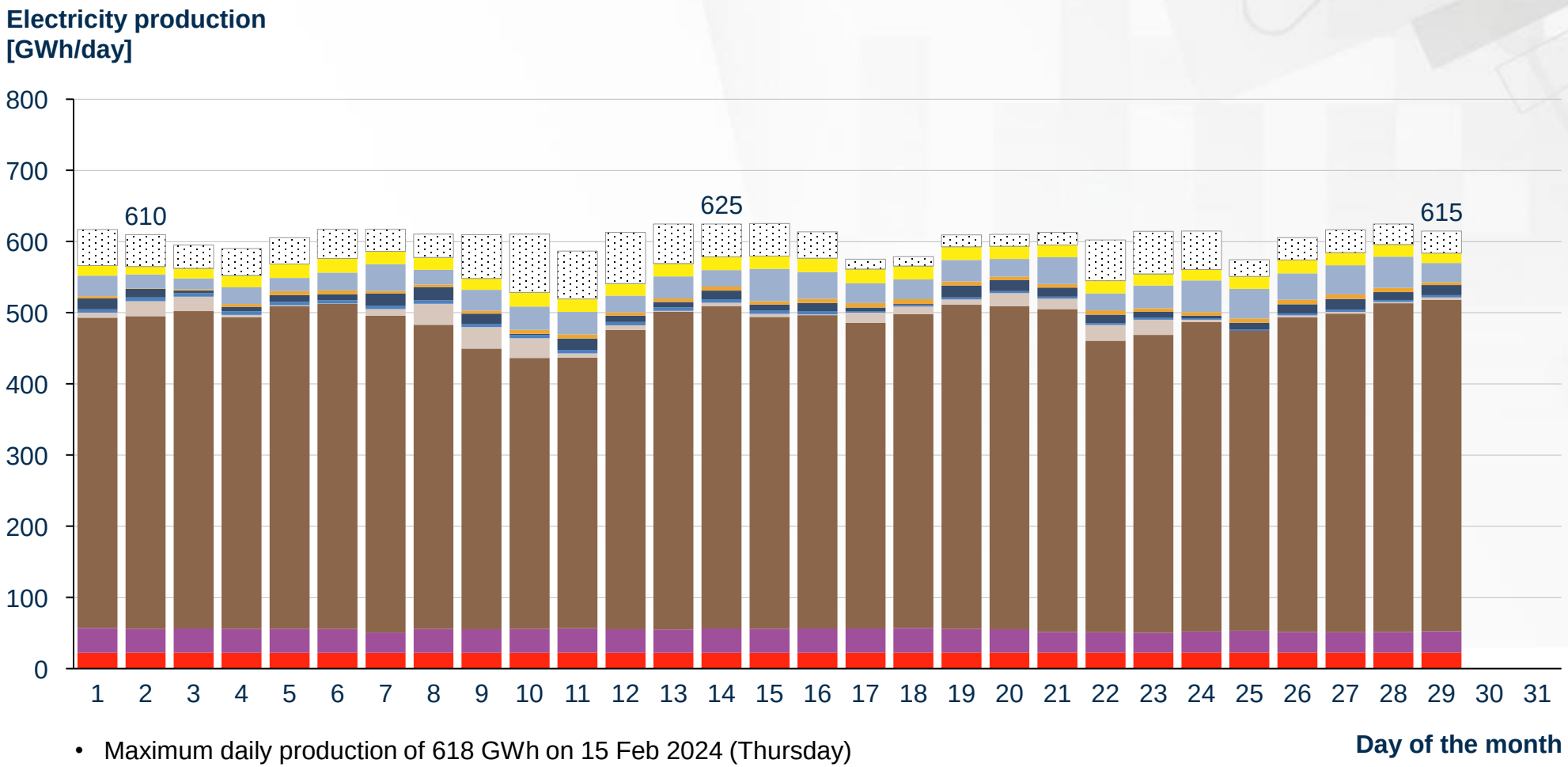
Supply Sources

- DSR
- Other RE
- Solar PV
- Wind
- CSP
- Pumped Storage
- Hydro
- Diesel & Gas
- Coal
- Imports
- Nuclear

Note: Daily production includes generation from pumped storage. Demand Side Response (DSR) = Manual Load Reduction (MLR) + Interruptible Load Supply (ILS) + Interruption of Supply (IOS)
Sources: Eskom; CSIR analysis

Daily electricity production between 558-618 GWh in February 2024

Actual daily production from all power supply sources in South Africa for February 2024.



- Maximum daily production of 618 GWh on 15 Feb 2024 (Thursday)
- Minimum daily production of 558 GWh on 18 Feb 2024 (Sunday)

Capacity Operational
(end of month)

2 287 MW	3 414 MW
3 443 MW	600 MW
500 MW	1 860 MW
40 544 MW	2 724 MW

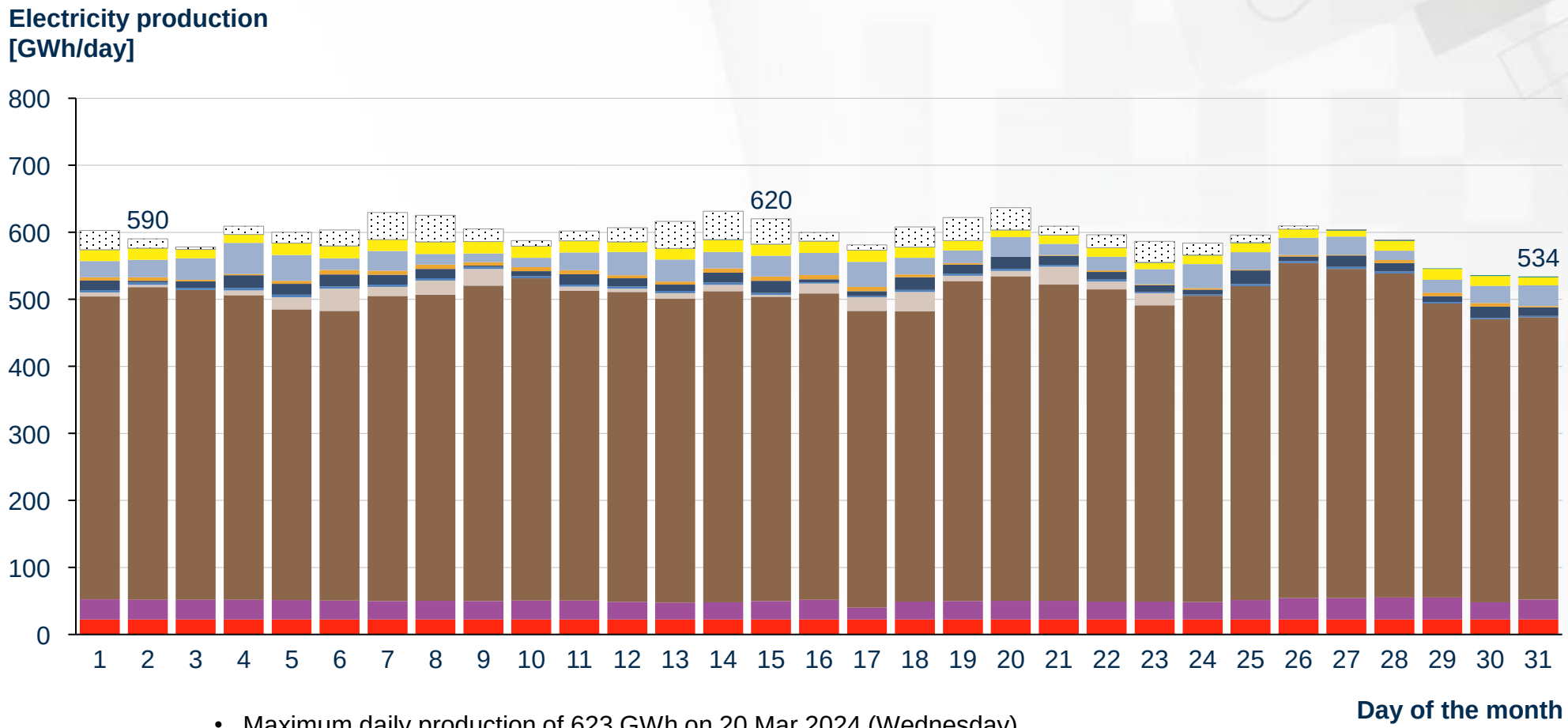
Supply Sources

- DSR
- Other RE
- Solar PV
- Wind
- CSP
- Pumped Storage
- Hydro
- Diesel & Gas
- Coal
- Imports
- Nuclear

Note: Daily production includes generation from pumped storage. Demand Side Response (DSR) = Manual Load Reduction (MLR) + Interruptible Load Supply (ILS) + Interruption of Supply (IOS)
Sources: Eskom; CSIR analysis

Daily electricity production between 519-623 GWh in March 2024

Actual daily production from all power supply sources in South Africa for March 2024.



- Maximum daily production of 623 GWh on 20 Mar 2024 (Wednesday)
- Minimum daily production of 519 GWh on 31 Mar 2024 (Sunday)

Capacity Operational
(end of month)

2 287 MW	3 414 MW
3 443 MW	600 MW
500 MW	1 860 MW
40 544 MW	2 724 MW

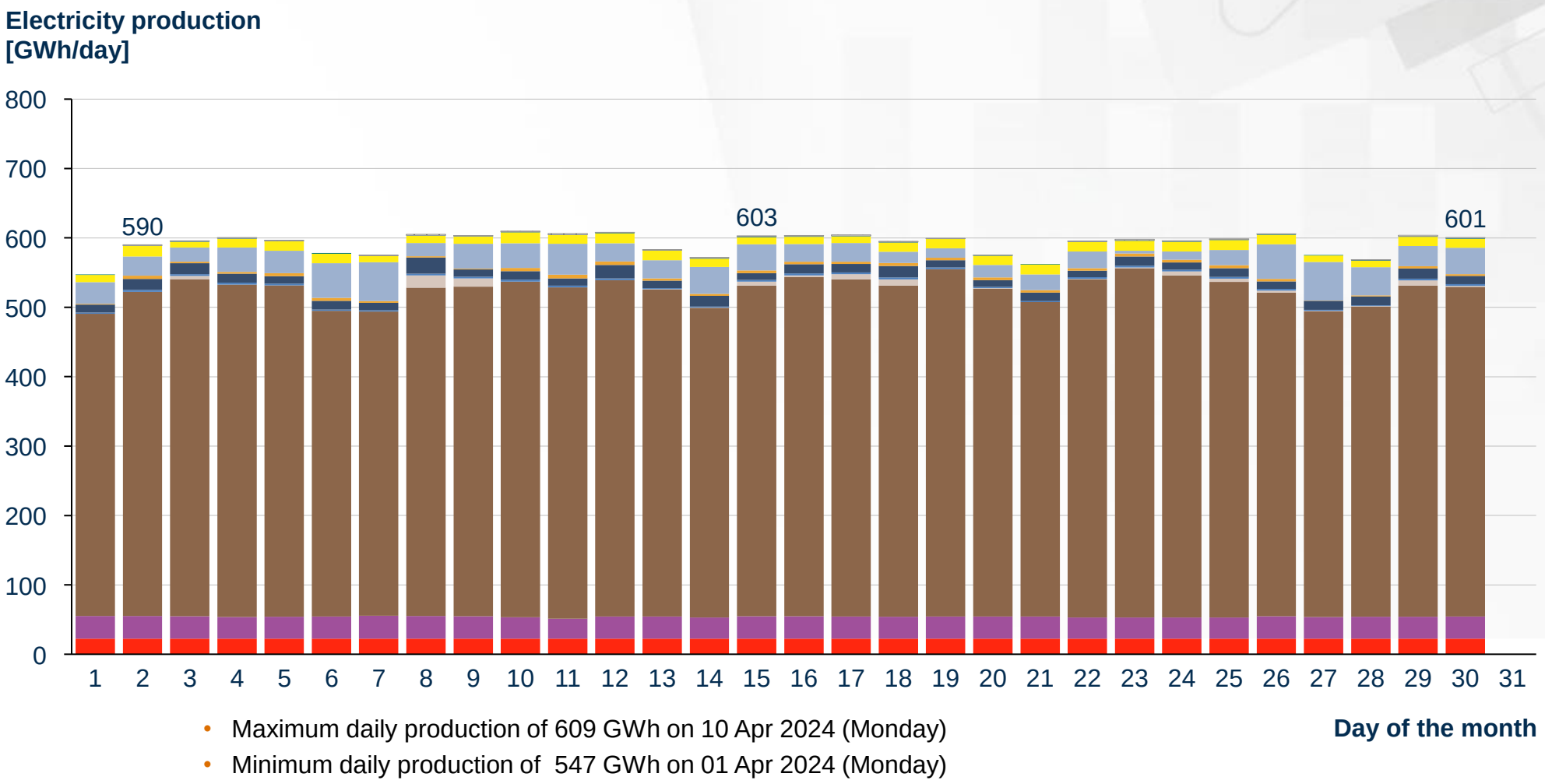
Supply Sources

- DSR
- Other RE
- Solar PV
- Wind
- CSP
- Pumped Storage
- Hydro
- Diesel & Gas
- Coal
- Imports
- Nuclear

Note: Daily production includes generation from pumped storage. Demand Side Response (DSR) = Manual Load Reduction (MLR) + Interruptible Load Supply (ILS) + Interruption of Supply (IOS)
Sources: Eskom; CSIR analysis

Daily electricity production between 547-609 GWh in April 2024

Actual daily production from all power supply sources in South Africa for April 2024.



- Maximum daily production of 609 GWh on 10 Apr 2024 (Monday)
- Minimum daily production of 547 GWh on 01 Apr 2024 (Monday)

Capacity Operational
(end of month)

2 287 MW	3 414 MW
3 443 MW	600 MW
500 MW	1 860 MW
40 544 MW	2 724 MW

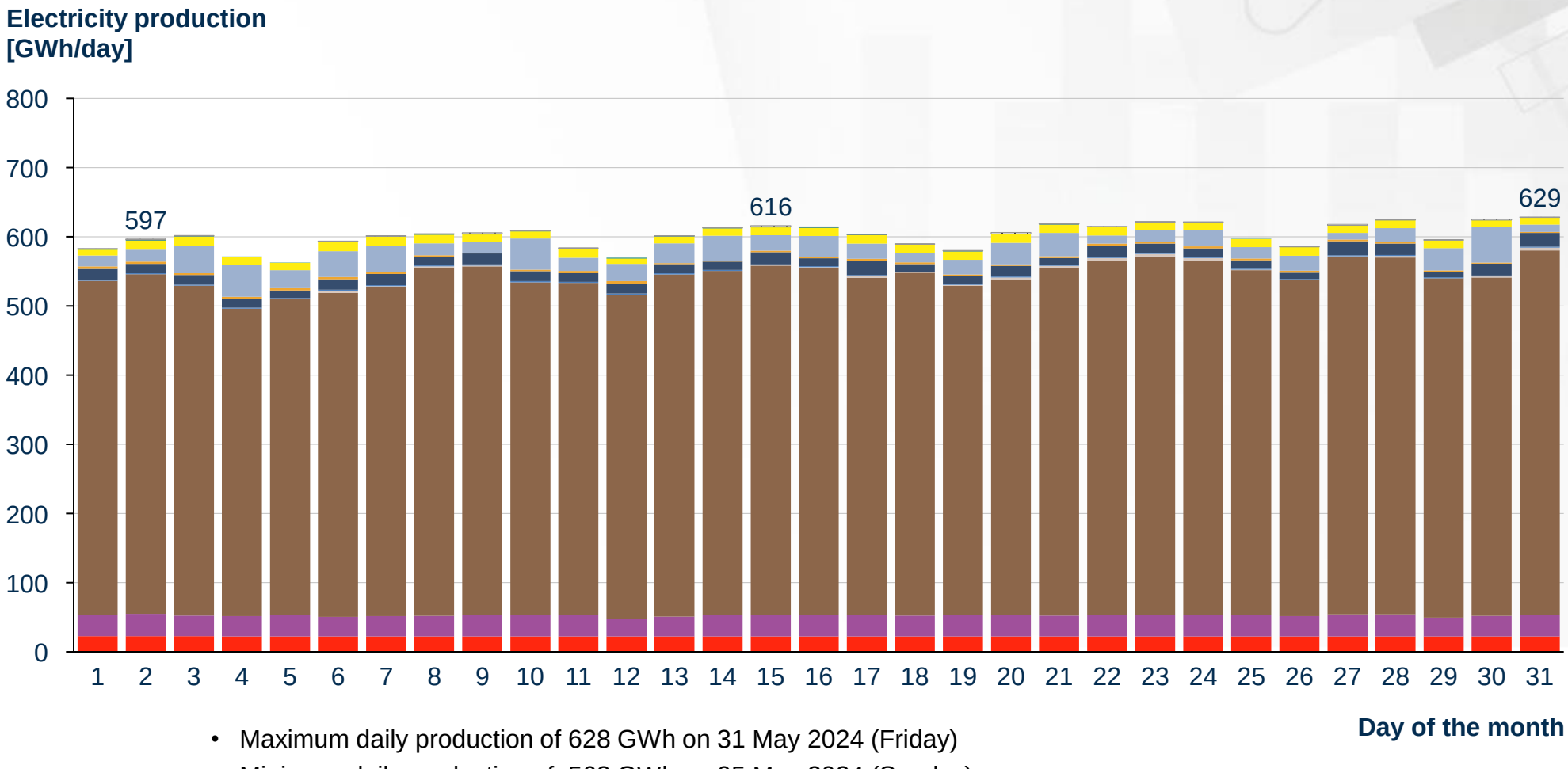
Supply Sources

- DSR
- Other RE
- Solar PV
- Wind
- CSP
- Pumped Storage
- Hydro
- Diesel & Gas
- Coal
- Imports
- Nuclear

Note: Daily production includes generation from pumped storage. Demand Side Response (DSR) = Manual Load Reduction (MLR) + Interruptible Load Supply (ILS) + Interruption of Supply (IOS).
Sources: Eskom; CSIR analysis

Daily electricity production between 563-628 GWh in May 2024

Actual daily production from all power supply sources in South Africa for May 2024.



- Maximum daily production of 628 GWh on 31 May 2024 (Friday)
- Minimum daily production of 563 GWh on 05 May 2024 (Sunday)

Capacity Operational
(end of month)

2 287 MW	3 414 MW
3 443 MW	600 MW
500 MW	1 860 MW
40 544 MW	2 724 MW

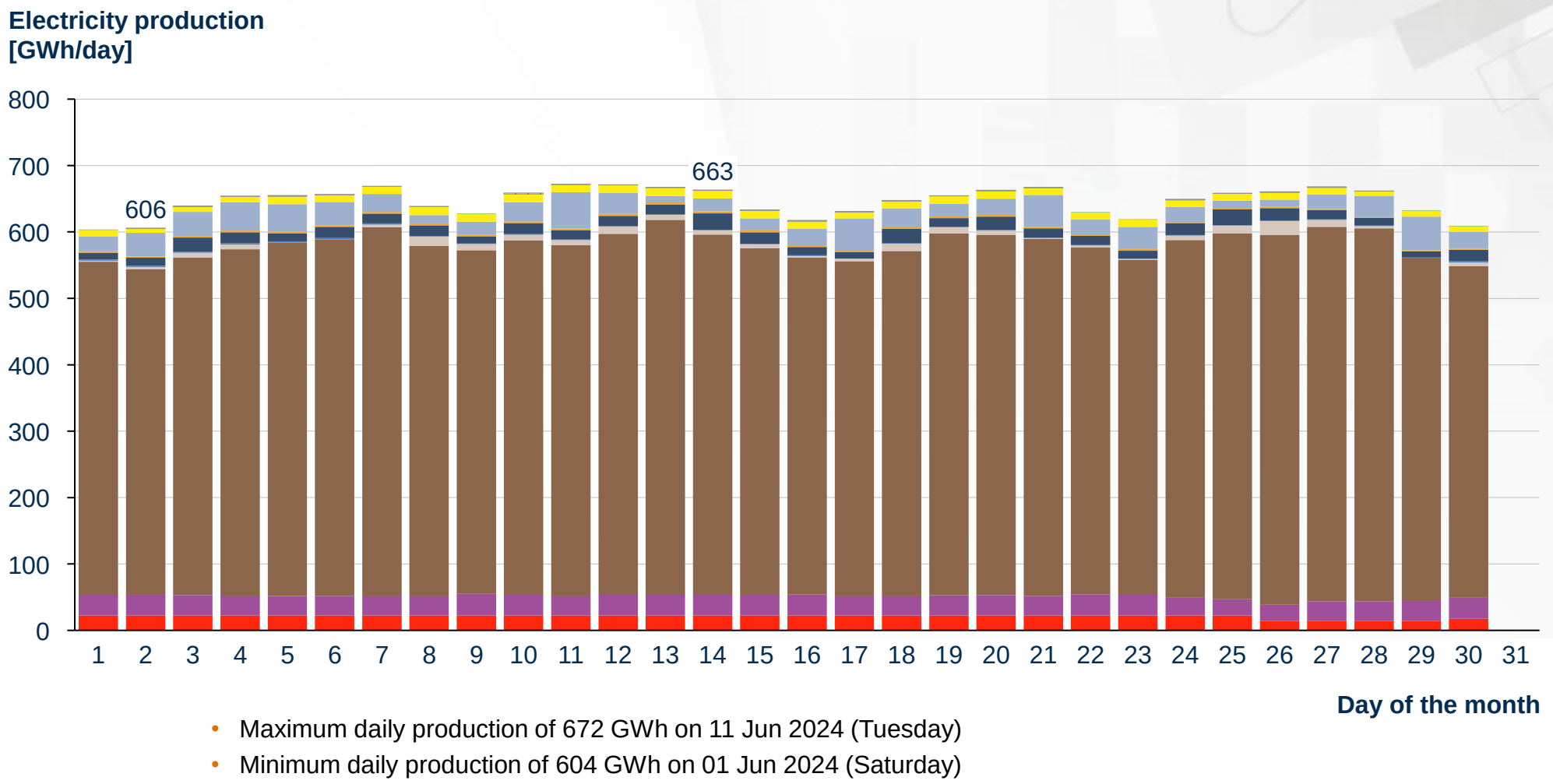
Supply Sources

- DSR
- Other RE
- Solar PV
- Wind
- CSP
- Pumped Storage
- Hydro
- Diesel & Gas
- Coal
- Imports
- Nuclear

Note: Daily production includes generation from pumped storage. Demand Side Response (DSR) = Manual Load Reduction (MLR) + Interruptible Load Supply (ILS) + Interruption of Supply (IOS).
Sources: Eskom; CSIR analysis

Daily electricity production between 604-672 GWh in June 2024

Actual daily production from all power supply sources in South Africa for June 2024.



- Maximum daily production of 672 GWh on 11 Jun 2024 (Tuesday)
- Minimum daily production of 604 GWh on 01 Jun 2024 (Saturday)

Capacity Operational
(end of month)

2 287 MW	3 414 MW
3 443 MW	600 MW
500 MW	1 860 MW
40 544 MW	2 724 MW

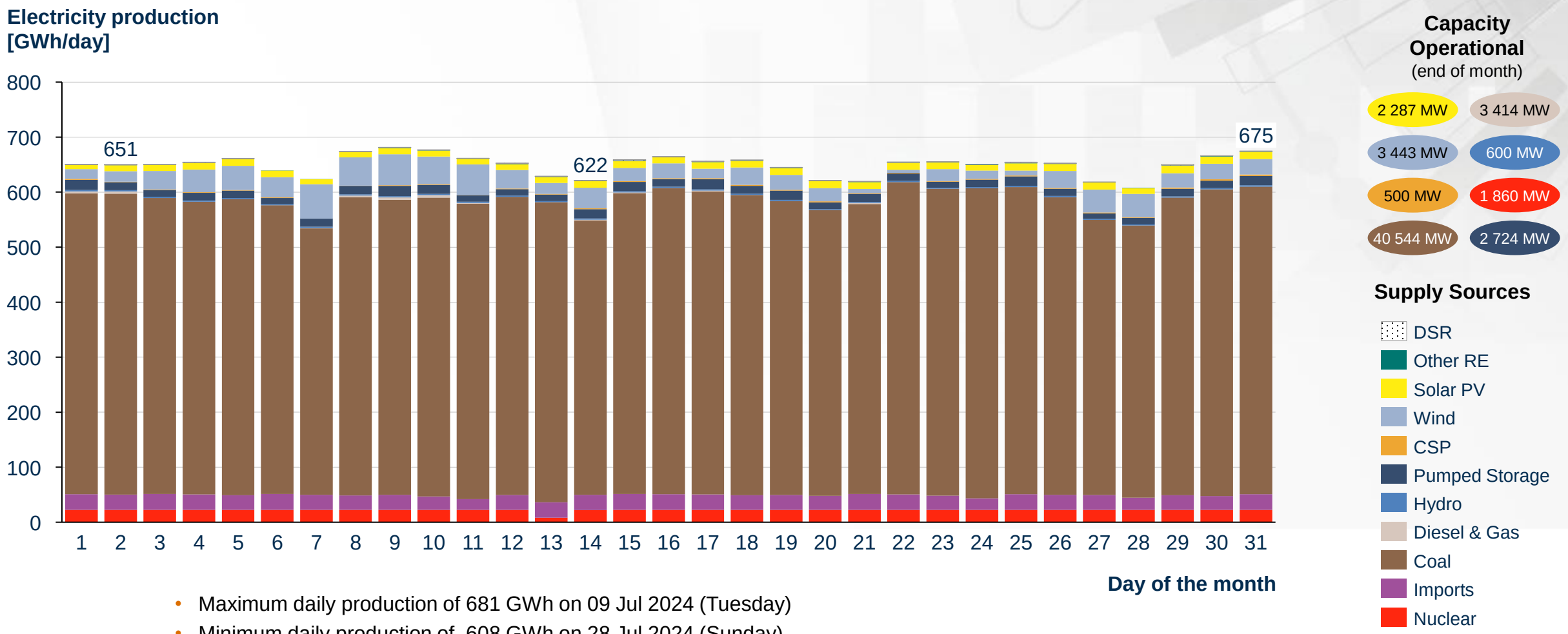
Supply Sources

- DSR
- Other RE
- Solar PV
- Wind
- CSP
- Pumped Storage
- Hydro
- Diesel & Gas
- Coal
- Imports
- Nuclear

Note: Daily production includes generation from pumped storage. Demand Side Response (DSR) = Manual Load Reduction (MLR) + Interruptible Load Supply (ILS) + Interruption of Supply (IOS)
Sources: Eskom; CSIR analysis

Daily electricity production between 608-681 GWh in July 2024

Actual daily production from all power supply sources in South Africa for July 2024.

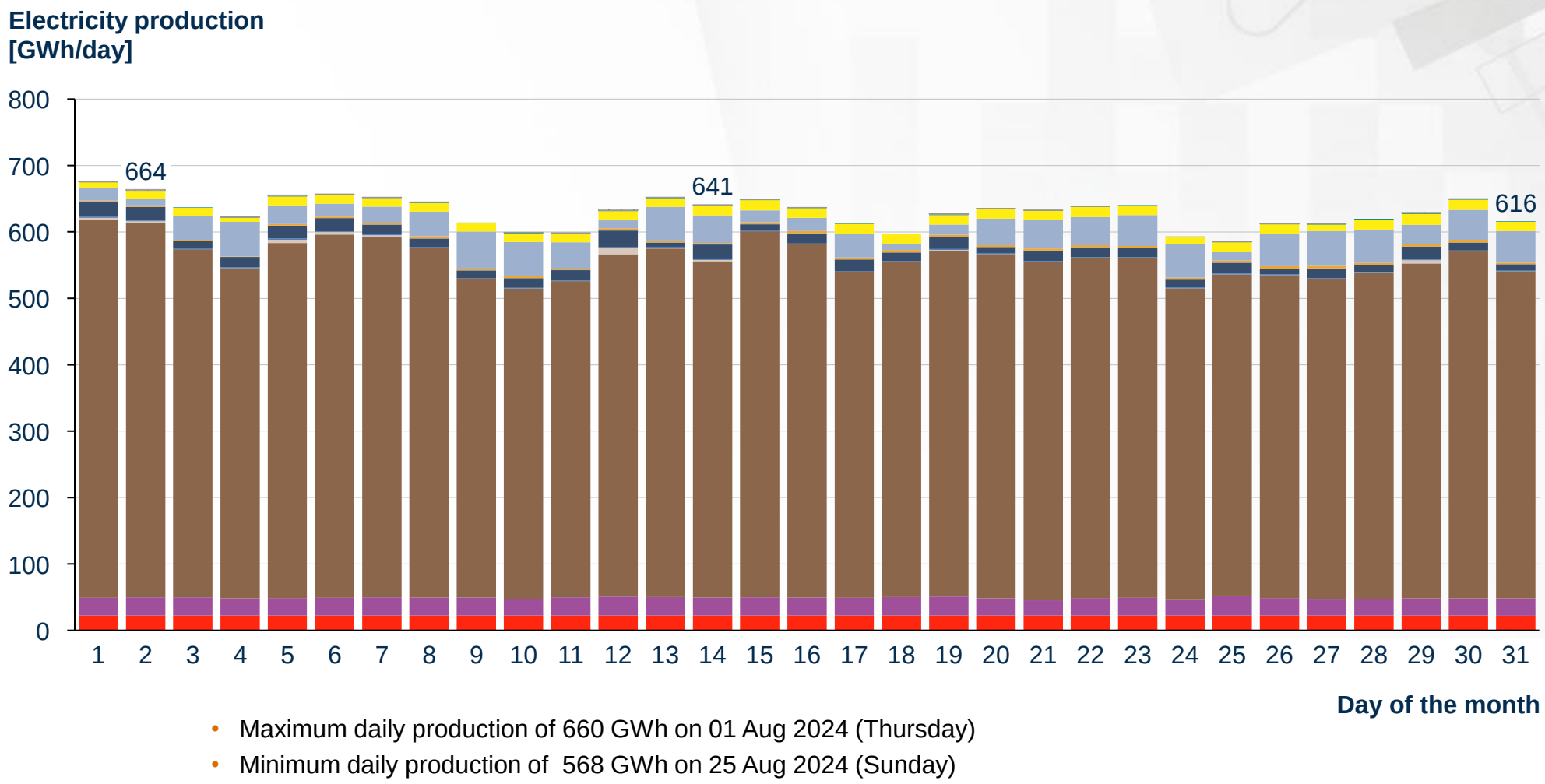


- Maximum daily production of 681 GWh on 09 Jul 2024 (Tuesday)
- Minimum daily production of 608 GWh on 28 Jul 2024 (Sunday)

Note: Daily production includes generation from pumped storage. Demand Side Response (DSR) = Manual Load Reduction (MLR) + Interruptible Load Supply (ILS) + Interruption of Supply (IOS)
Sources: Eskom; CSIR analysis

Daily electricity production between 568-660 GWh in August 2024

Actual daily production from all power supply sources in South Africa for August 2024.



- Maximum daily production of 660 GWh on 01 Aug 2024 (Thursday)
- Minimum daily production of 568 GWh on 25 Aug 2024 (Sunday)

Capacity Operational
(end of month)

2 287 MW	3 414 MW
3 443 MW	600 MW
500 MW	1 860 MW
40 544 MW	2 724 MW

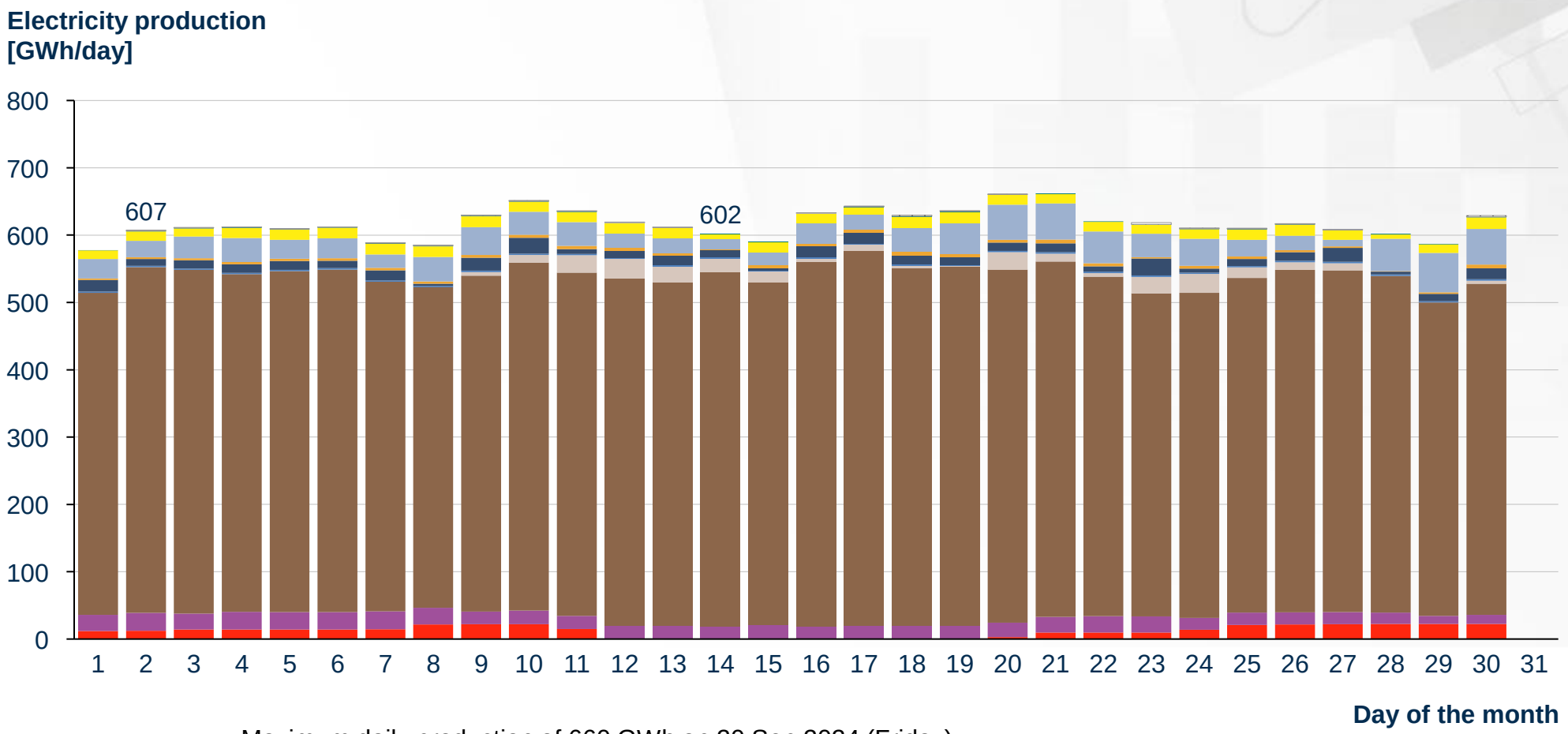
Supply Sources

- DSR
- Other RE
- Solar PV
- Wind
- CSP
- Pumped Storage
- Hydro
- Diesel & Gas
- Coal
- Imports
- Nuclear

Note: Daily production includes generation from pumped storage. Demand Side Response (DSR) = Manual Load Reduction (MLR) + Interruptible Load Supply (ILS) + Interruption of Supply (IOS)
Sources: Eskom; CSIR analysis

Daily electricity production between 565-660 GWh in September 2024

Actual daily production from all power supply sources in South Africa for September 2024.



- Maximum daily production of 660 GWh on 20 Sep 2024 (Friday)
- Minimum daily production of 565 GWh on 01 Sep 2024 (Sunday)

Capacity Operational
(end of month)

2 287 MW	3 414 MW
3 443 MW	600 MW
500 MW	1 860 MW
40 544 MW	2 724 MW

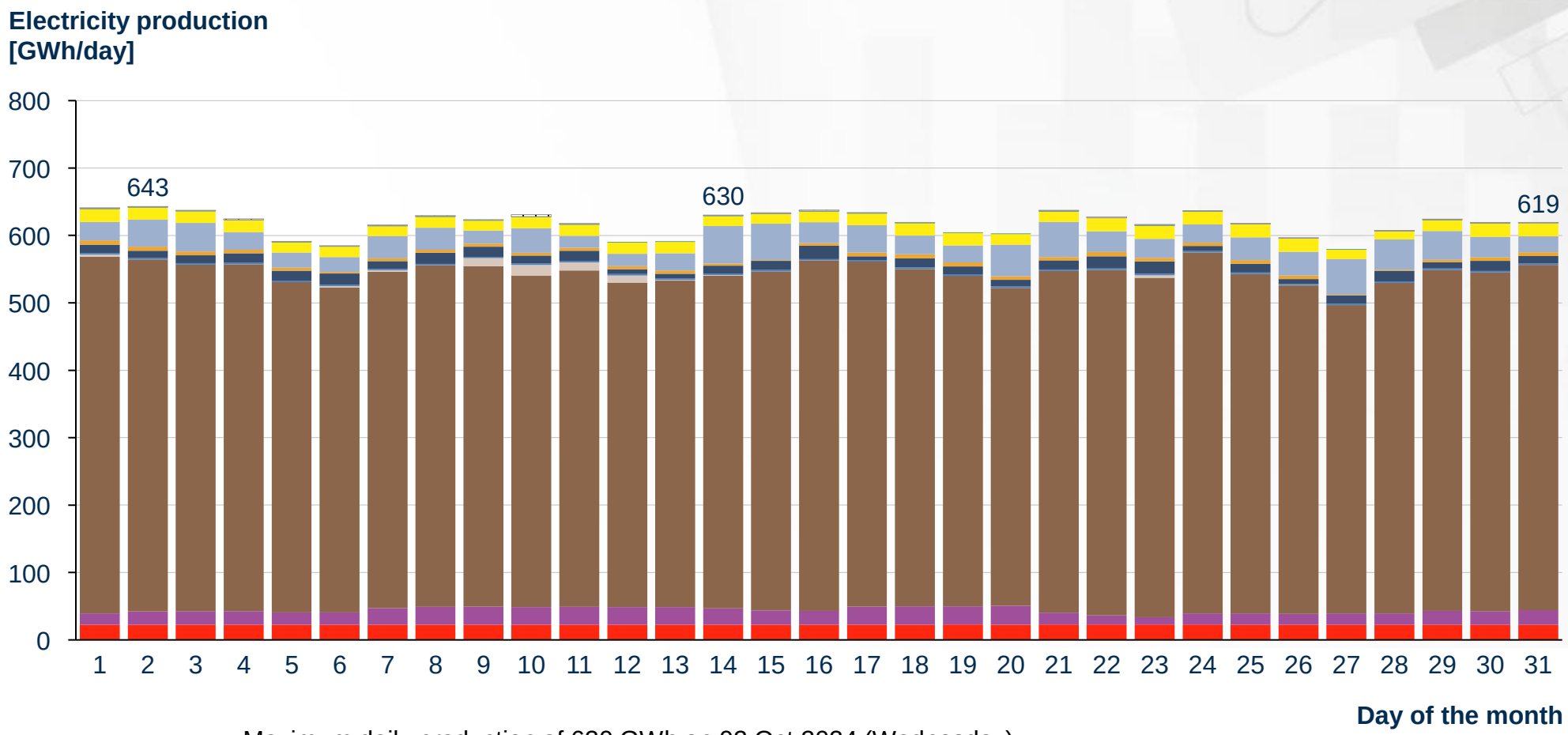
Supply Sources

- DSR
- Other RE
- Solar PV
- Wind
- CSP
- Pumped Storage
- Hydro
- Diesel & Gas
- Coal
- Imports
- Nuclear

Note: Daily production includes generation from pumped storage. Demand Side Response (DSR) = Manual Load Reduction (MLR) + Interruptible Load Supply (ILS) + Interruption of Supply (IOS)
Sources: Eskom; CSIR analysis

Daily electricity production between 560-630 GWh in October 2024

Actual daily production from all power supply sources in South Africa for October 2024.



- Maximum daily production of 630 GWh on 02 Oct 2024 (Wednesday)
- Minimum daily production of 560 GWh on 27 Oct 2024 (Sunday)

Capacity Operational
(end of month)

2 287 MW	3 414 MW
3 443 MW	600 MW
500 MW	1 860 MW
40 544 MW	2 724 MW

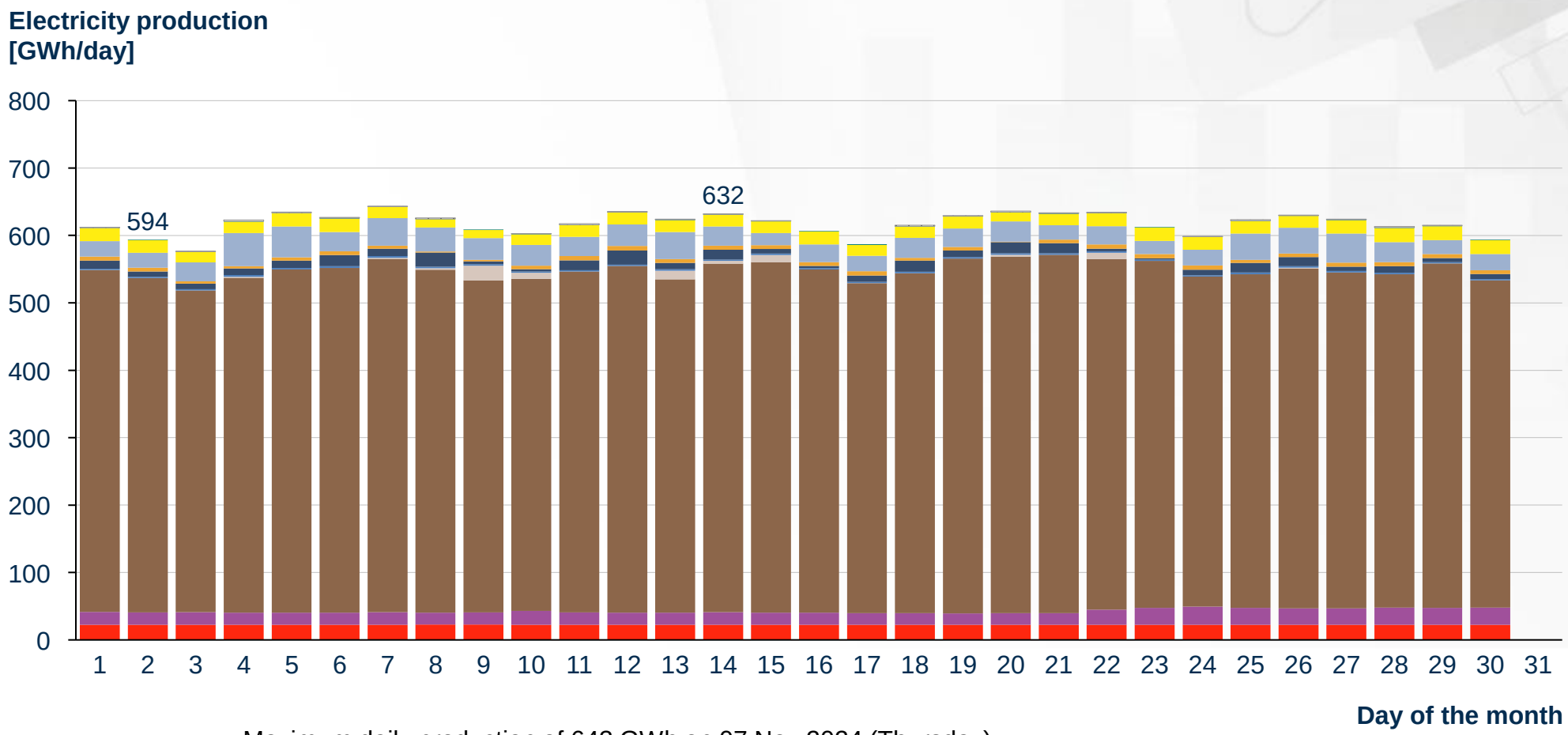
Supply Sources

- DSR
- Other RE
- Solar PV
- Wind
- CSP
- Pumped Storage
- Hydro
- Diesel & Gas
- Coal
- Imports
- Nuclear

Note: Daily production includes generation from pumped storage. Demand Side Response (DSR) = Manual Load Reduction (MLR) + Interruptible Load Supply (ILS) + Interruption of Supply (IOS)
Sources: Eskom; CSIR analysis

Daily electricity production between 569-632 GWh in November 2024

Actual daily production from all power supply sources in South Africa for November 2024.



- Maximum daily production of 643 GWh on 07 Nov 2024 (Thursday)
- Minimum daily production of 569 GWh on 03 Nov 2024 (Sunday)

Capacity Operational
(end of month)

2 287 MW	3 414 MW
3 443 MW	600 MW
500 MW	1 860 MW
40 544 MW	2 724 MW

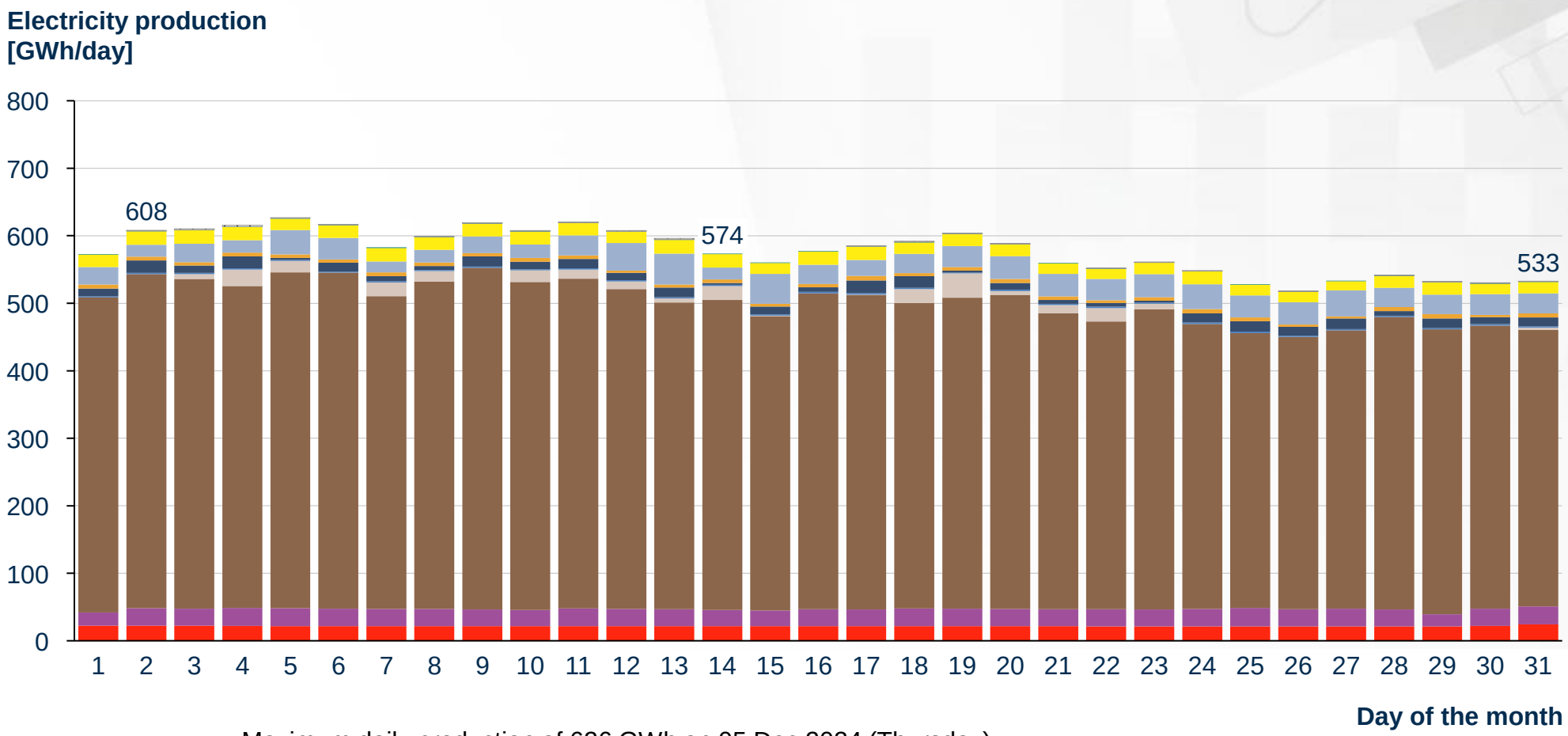
Supply Sources

- DSR
- Other RE
- Solar PV
- Wind
- CSP
- Pumped Storage
- Hydro
- Diesel & Gas
- Coal
- Imports
- Nuclear

Note: Daily production includes generation from pumped storage. Demand Side Response (DSR) = Manual Load Reduction (MLR) + Interruptible Load Supply (ILS) + Interruption of Supply (IOS)
Sources: Eskom; CSIR analysis

Daily electricity production between 518-626 GWh in December 2024

Actual daily production from all power supply sources in South Africa for December 2024.



- Maximum daily production of 626 GWh on 05 Dec 2024 (Thursday)
- Minimum daily production of 518 GWh on 26 Dec 2024 (Thursday)

Capacity Operational
(end of month)

2 287 MW	3 414 MW
3 443 MW	600 MW
500 MW	1 860 MW
40 544 MW	2 724 MW

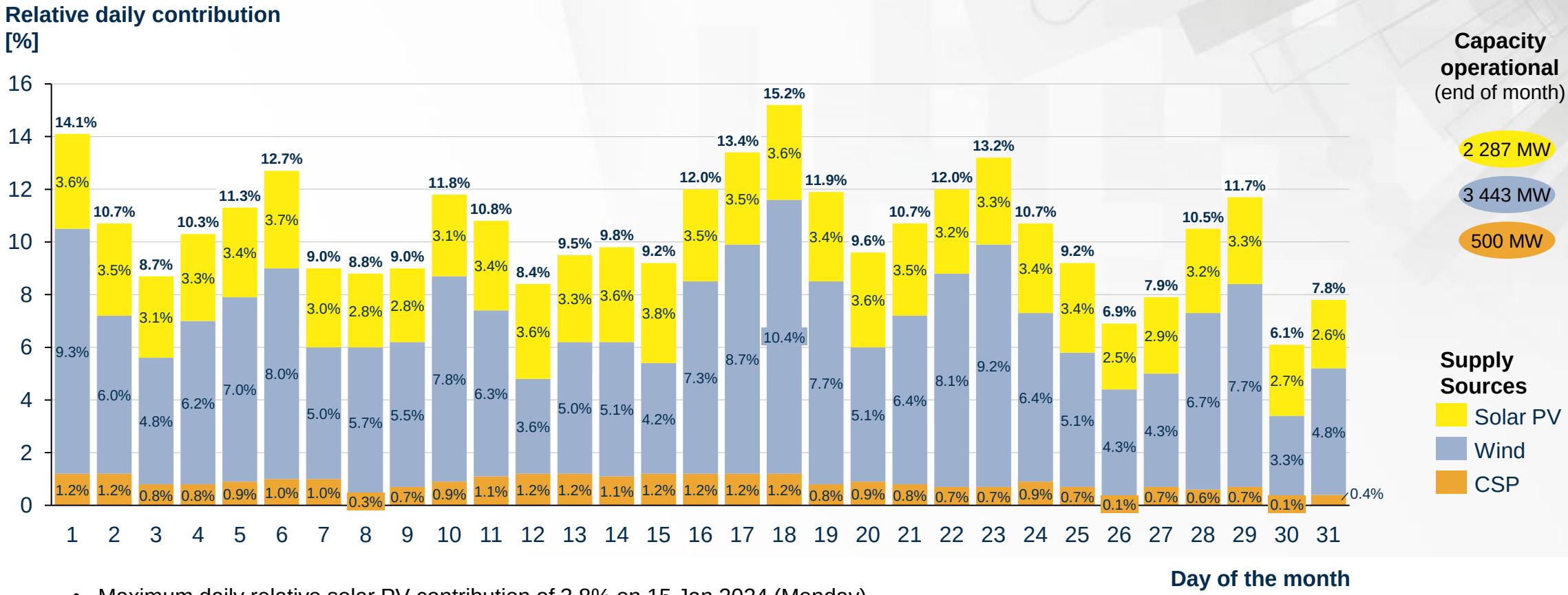
Supply Sources

- DSR
- Other RE
- Solar PV
- Wind
- CSP
- Pumped Storage
- Hydro
- Diesel & Gas
- Coal
- Imports
- Nuclear

Note: Daily production includes generation from pumped storage. Demand Side Response (DSR) = Manual Load Reduction (MLR) + Interruptible Load Supply (ILS) + Interruption of Supply (IOS)
Sources: Eskom; CSIR analysis

Daily solar PV, wind and CSP contribution of 1,2-10,4% in January 2024

Actual daily relative solar PV/wind/CSP contribution as a % of total supply in South Africa for January 2024.

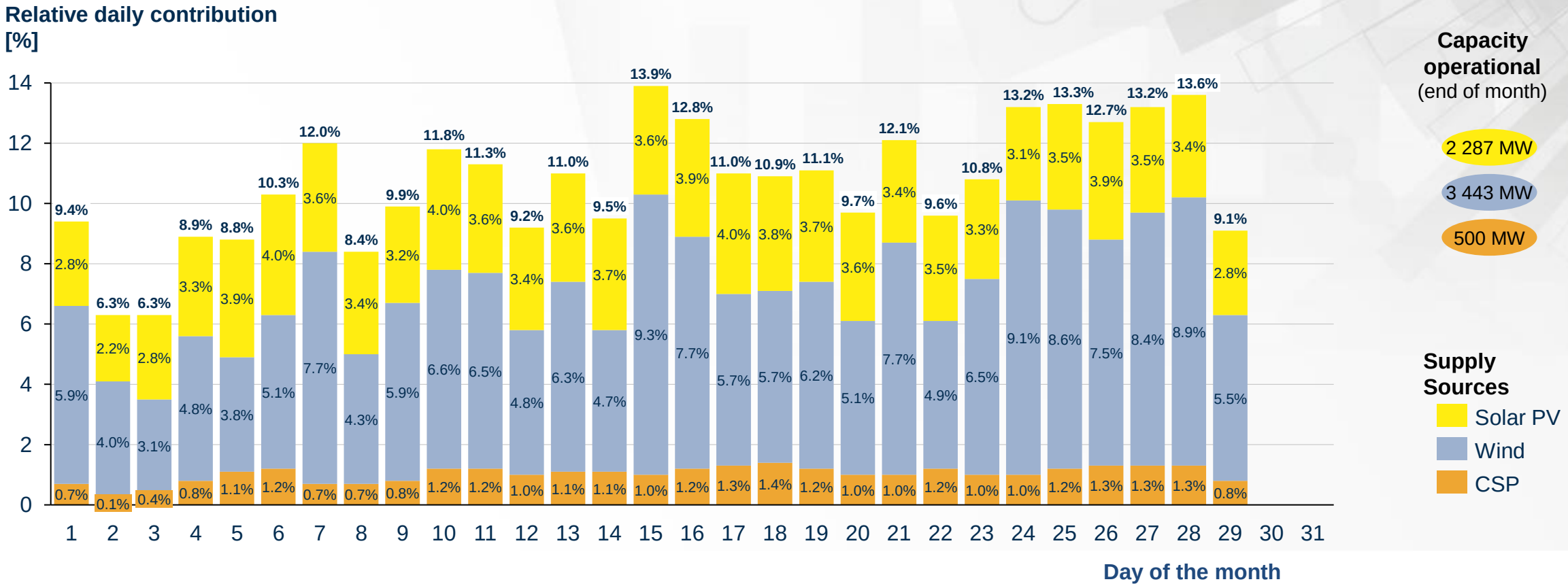


- Maximum daily relative solar PV contribution of 3.8% on 15 Jan 2024 (Monday)
- Maximum daily relative wind contribution of 10,4% on 18 Jan 2024 (Thursday)
- Maximum daily relative CSP contribution of 1,2% on 15 Jan 2024 (Monday)

Note: Total supply includes generation for pumping load
Sources: Eskom; CSIR analysis

Daily solar PV, wind & CSP contribution of 1,4-9,3% in February 2024

Actual daily relative solar PV/wind/CSP contribution as a % of total supply in South Africa for February 2024.

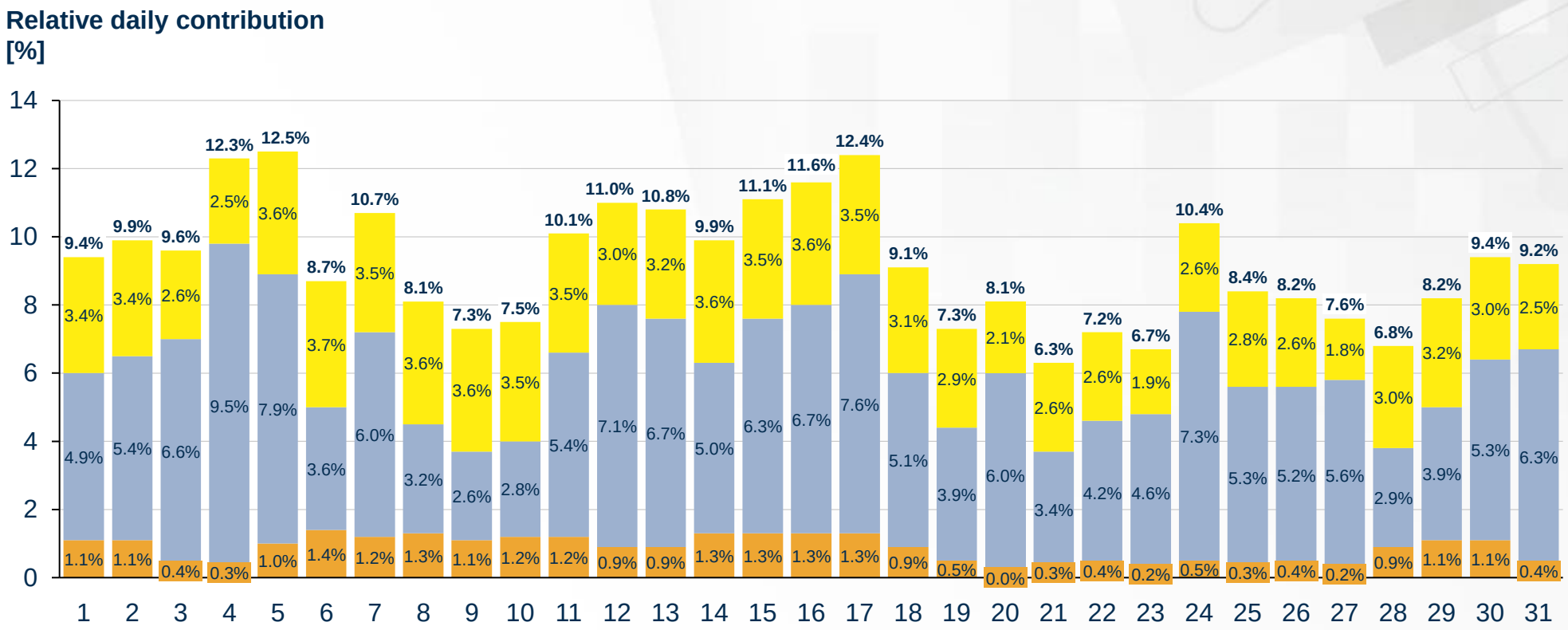


- Maximum daily relative solar PV contribution of 4,0% on 10 Feb 2024 (Saturday)
- Maximum daily relative wind contribution of 9,3% on 15 Feb 2024 (Thursday)
- Maximum daily relative CSP contribution of 1,4% on 18 Feb 2024 (Sunday)

Note: Total supply includes generation for pumping load
Sources: Eskom; CSIR analysis

Daily solar PV, wind and CSP contribution of 1,4-9,5% in March 2024

Actual daily relative solar PV/wind/CSP contribution as a % of total supply in South Africa for March 2024.



Capacity operational (end of month)

2 287 MW

3 443 MW

500 MW

Supply Sources

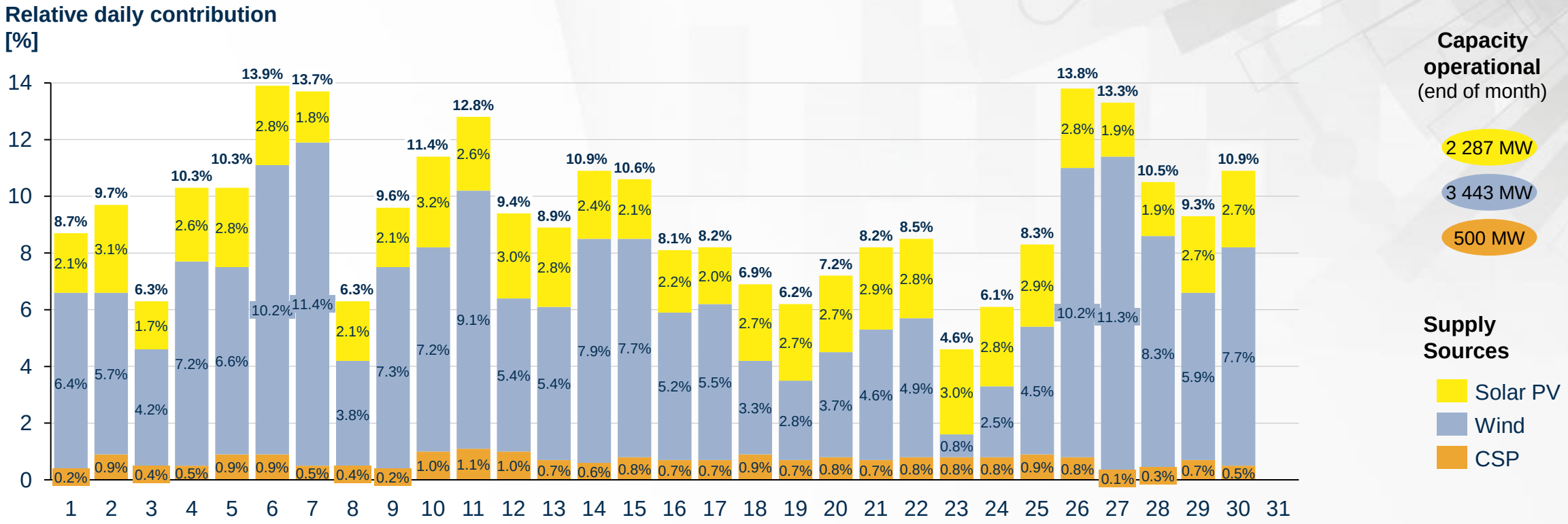
- Solar PV
- Wind
- CSP

- Maximum daily relative solar PV contribution of 3,7% on 6 Mar 2024 (Wednesday)
- Maximum daily relative wind contribution of 9,5% on 4 Mar 2024 (Monday)
- Maximum daily relative CSP contribution of 1,4% on 6 Mar 2024 (Wednesday)

Note: Total supply includes generation for pumping load
Sources: Eskom; CSIR analysis

Daily solar PV, wind and CSP contribution of 1,1-11,4% in April 2024

Actual daily relative solar PV/wind/CSP contribution as a % of total supply in South Africa for April 2024.

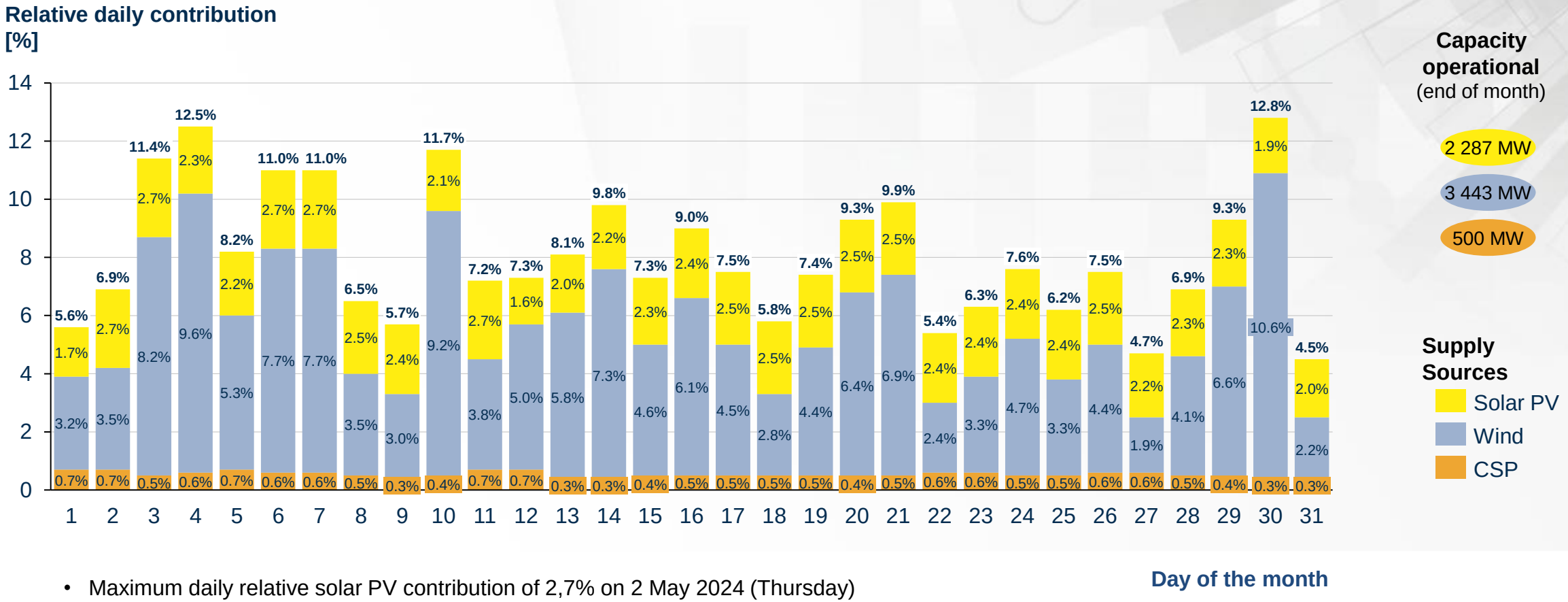


- Maximum daily relative solar PV contribution of 3,2% on 10 Apr 2024 (Wednesday)
- Maximum daily relative wind contribution of 11,4% on 7 Apr 2024 (Sunday)
- Maximum daily relative CSP contribution of 1,1% on 11 Apr 2024 (Thursday)

Note: Total supply includes generation for pumping load
Sources: Eskom; CSIR analysis

Daily solar PV, wind and CSP contribution of 0,7-10,6% in May 2024

Actual daily relative solar PV/wind/CSP contribution as a % of total supply in South Africa for May 2024.

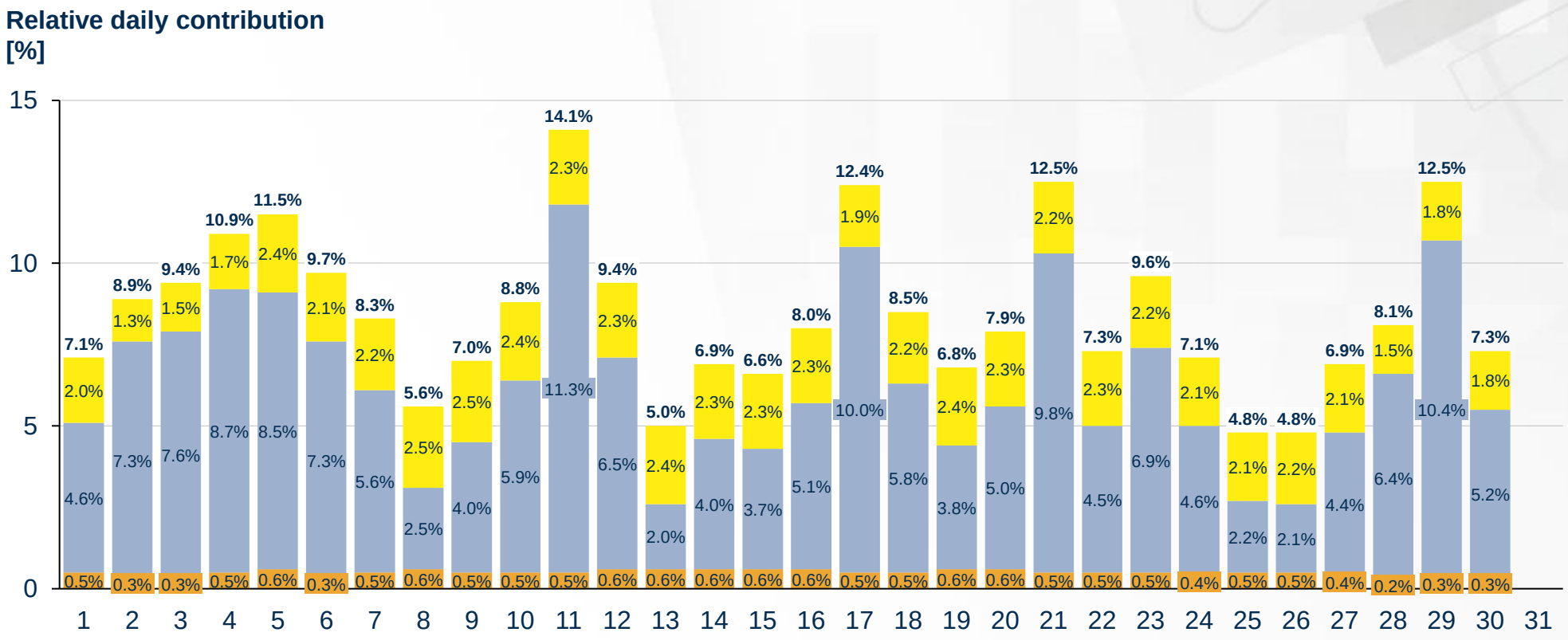


- Maximum daily relative solar PV contribution of 2,7% on 2 May 2024 (Thursday)
- Maximum daily relative wind contribution of 10,6% on 30 May 2024 (Thursday)
- Maximum daily relative CSP contribution of 0.7% on 12 May 2024 (Sunday)

Note: Total supply includes generation for pumping load
Sources: Eskom; CSIR analysis

Daily solar PV, wind and CSP contribution of 0,6-11,3% in June 2024

Actual daily relative solar PV/wind/CSP contribution as a % of total supply in outh Africa for June 2024.

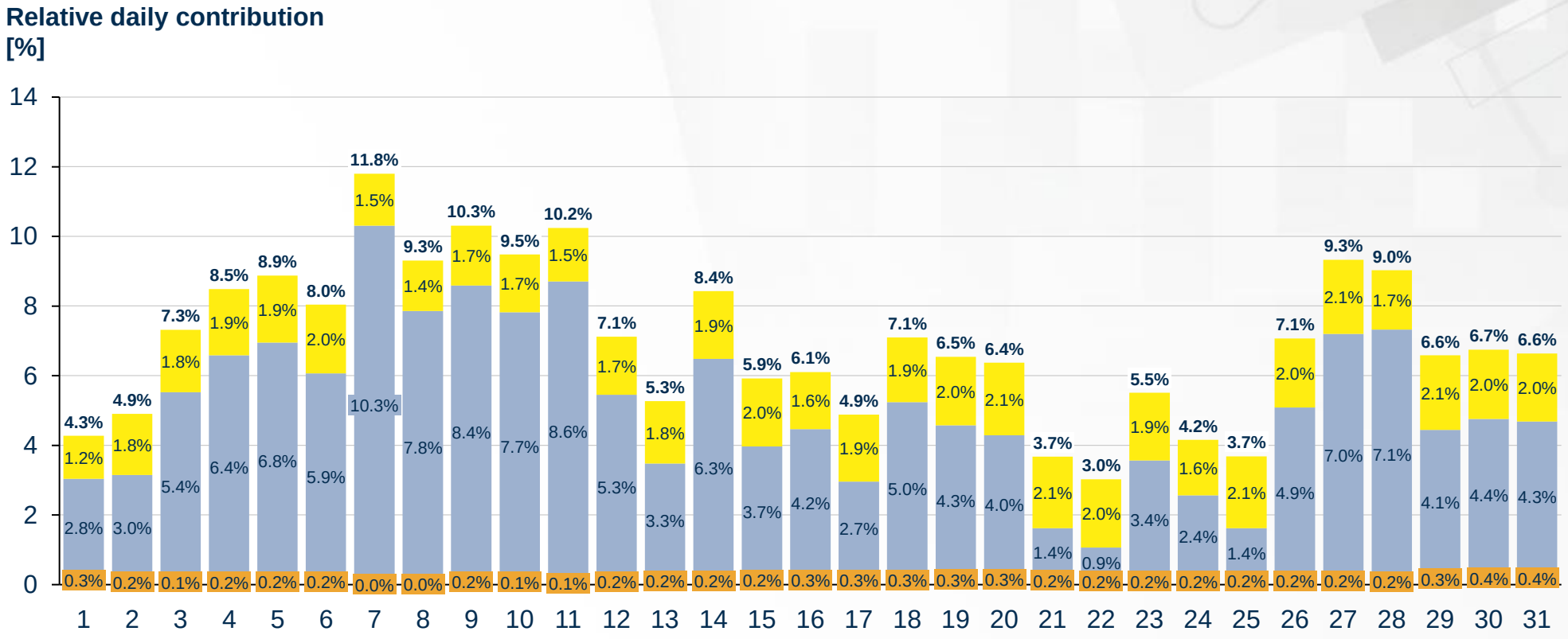


- Maximum daily relative solar PV contribution of 2,5% on 8 Jun 2024 (Sunday)
- Maximum daily relative wind contribution of 11,3% on 11 Jun 2024 (Wednesday)
- Maximum daily relative CSP contribution of 0,6% on 5 Jun 2024 (Sunday)

Note: Total supply includes generation for pumping load
Sources: Eskom; CSIR analysis

Daily solar PV, wind and CSP contribution of 0,4-10,3% in July 2024

Actual daily relative solar PV/wind/CSP contribution as a % of total supply in South Africa for July 2024.

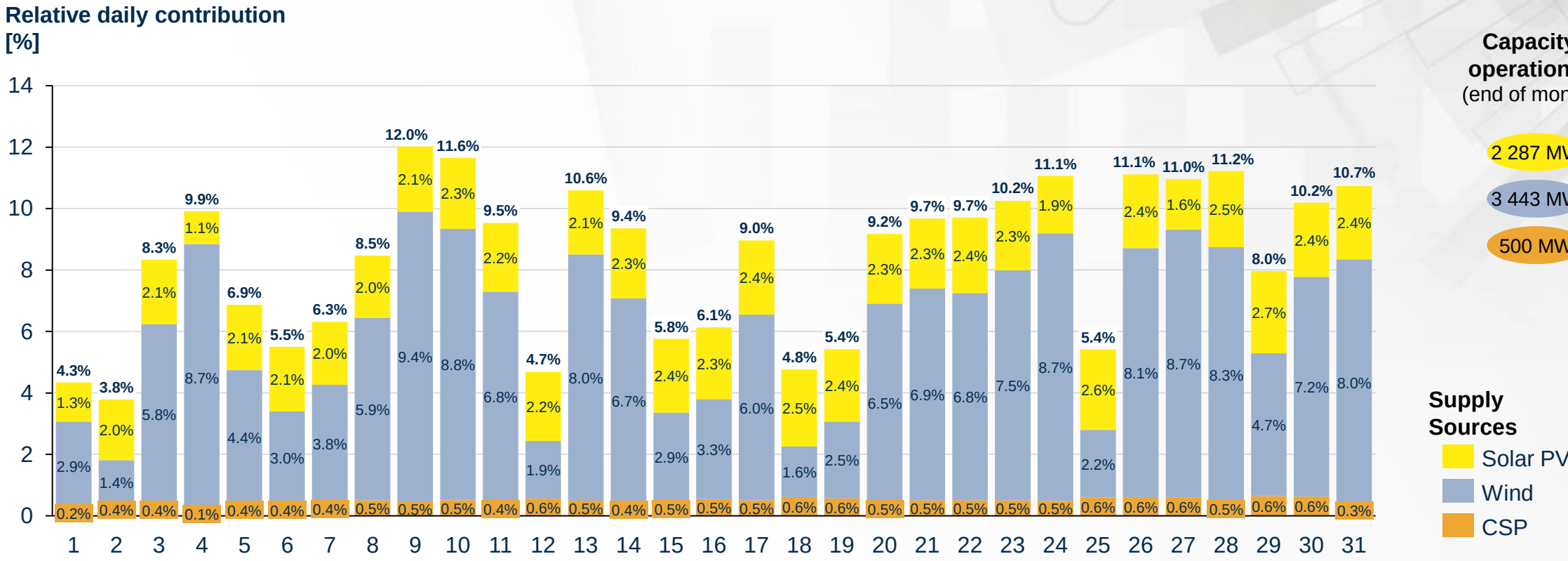


- Maximum daily relative solar PV contribution of 2,1% on 29 Jul 2024 (Monday)
- Maximum daily relative wind contribution of 10,3% on 07 Jul 2024 (Sunday)
- Maximum daily relative CSP contribution of 0,4% on 30 Jul 2024 (Tuesday)

Note: Total supply includes generation for pumping load
Sources: Eskom; CSIR analysis

Daily solar PV, wind and CSP contribution of 0,6-9,4% in August 2024

Actual daily relative solar PV/wind/CSP contribution as a % of total supply in South Africa for August 2024.

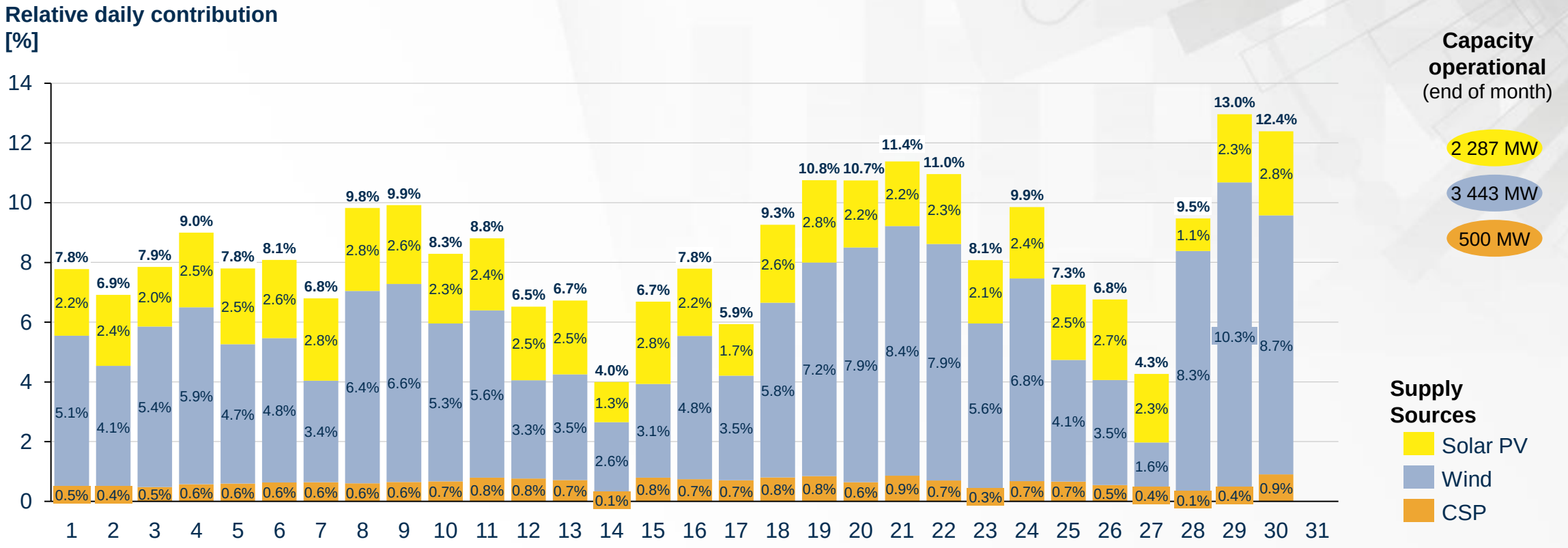


- Maximum daily relative solar PV contribution of 2,7% on 29 Aug 2024 (Thursday)
- Maximum daily relative wind contribution of 9,4% on 09 Aug 2024 (Sunday)
- Maximum daily relative CSP contribution of 0,6% on 30 Aug 2024 (Thursday)

Note: Total supply includes generation for pumping load
Sources: Eskom; CSIR analysis

Daily solar PV, wind and CSP contribution of 0,9-10,3% in September 2024

Actual daily relative solar PV/wind/CSP contribution as a % of total supply in South Africa for September 2024.

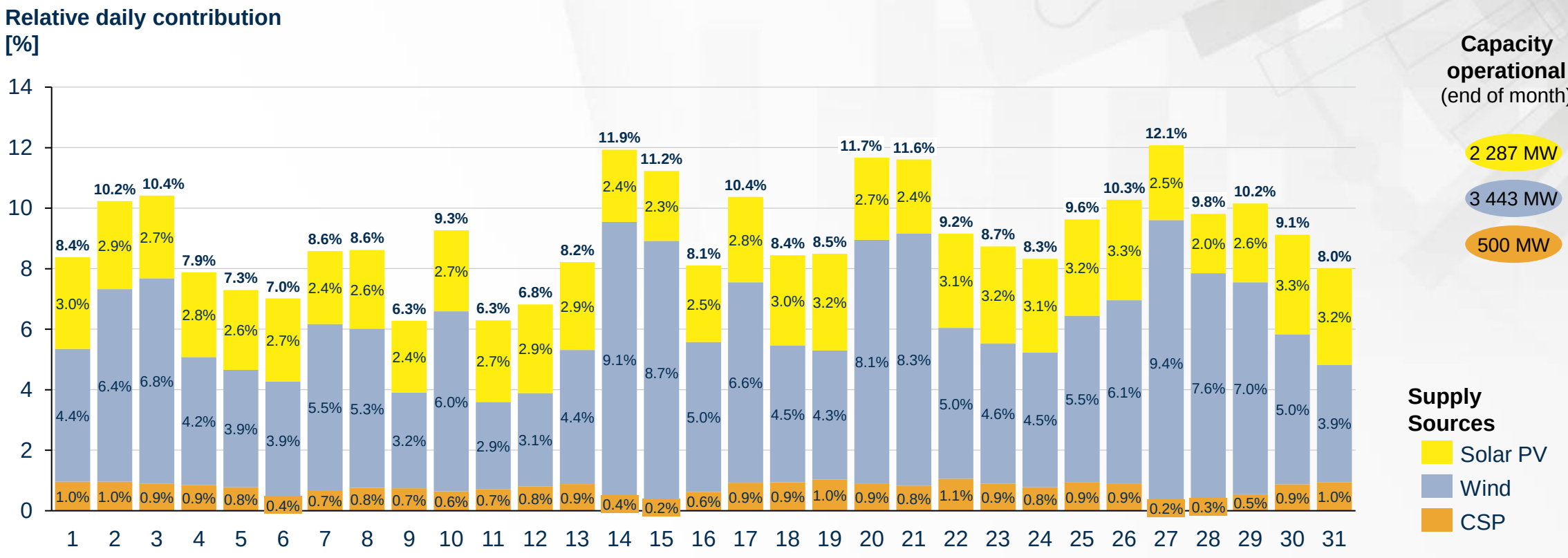


- Maximum daily relative solar PV contribution of 2,8% on 30 Sep 2024 (Monday)
- Maximum daily relative wind contribution of 10,3% on 29 Sep 2024 (Sunday)
- Maximum daily relative CSP contribution of 0,9% on 30 Sep 2024 (Monday)

Note: Total supply includes generation for pumping load
Sources: Eskom; CSIR analysis

Daily solar PV, wind and CSP contribution of 1,1-9,4% in October 2024

Actual daily relative solar PV/wind/CSP contribution as a % of total supply in South Africa for October 2024.

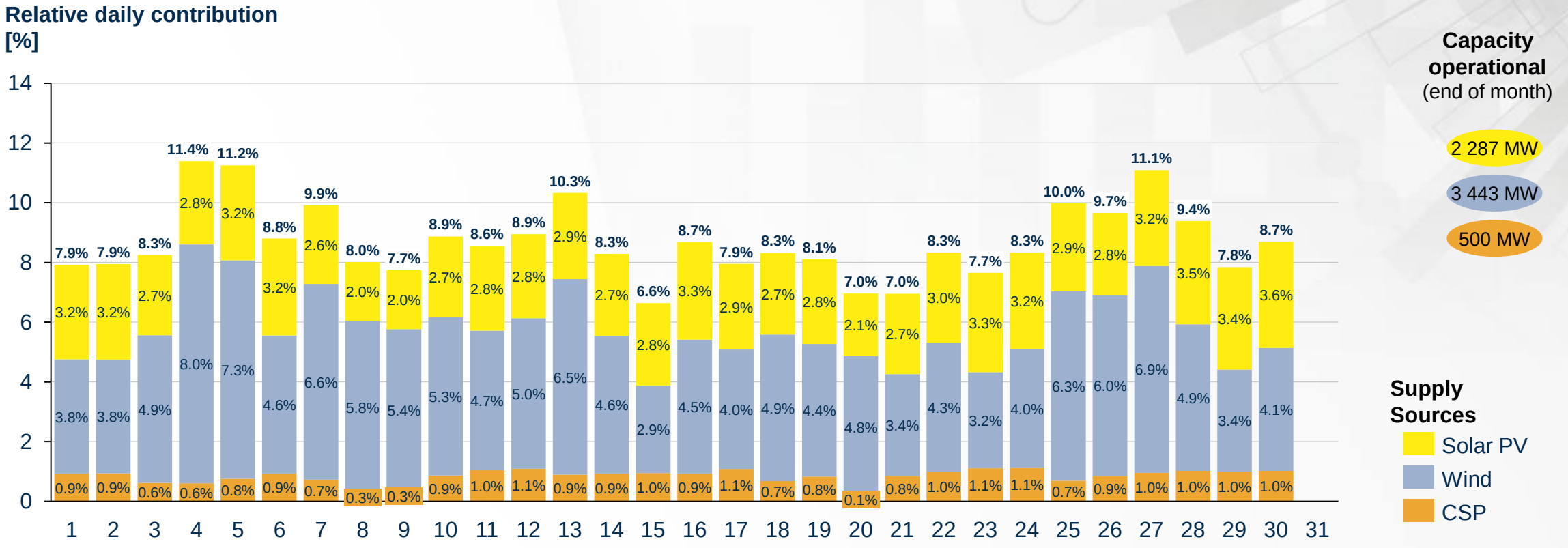


- Maximum daily relative solar PV contribution of 3,3% on 29 Oct 2024 (Saturday)
- Maximum daily relative wind contribution of 9,4% on 27 Oct 2024 (Sunday)
- Maximum daily relative CSP contribution of 1,1% on 22 Oct 2024 (Tuesday)

Note: Total supply includes generation for pumping load
Sources: Eskom; CSIR analysis

Daily solar PV, wind and CSP contribution of 1,1-8,0% in November 2024

Actual daily relative solar PV/wind/CSP contribution as a % of total supply in South Africa for November 2024.

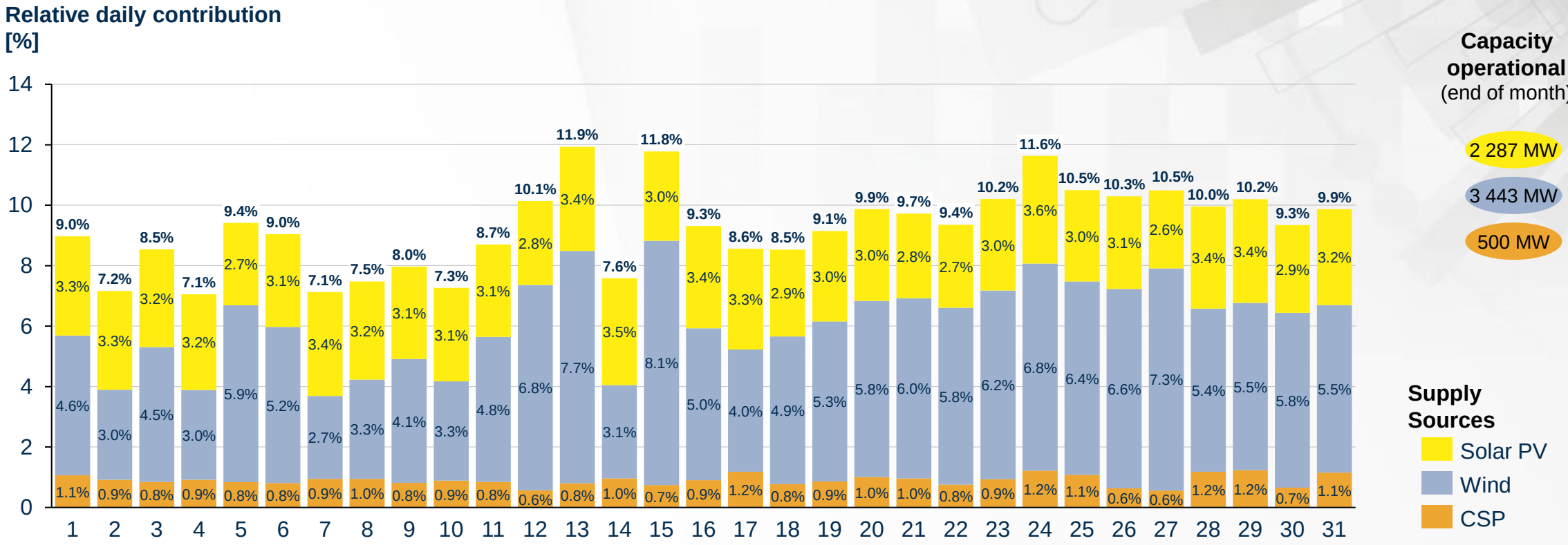


- Maximum daily relative solar PV contribution of 3,6% on 30 Nov 2024 (Saturday)
- Maximum daily relative wind contribution of 8,0% on 04 Nov 2024 (Monday)
- Maximum daily relative CSP contribution of 1,1% on 24 Nov 2024 (Sunday)

Note: Total supply includes generation for pumping load
Sources: Eskom; CSIR analysis

Daily solar PV, wind and CSP contribution of 1,2-8,1% in December 2024

Actual daily relative solar PV/wind/CSP contribution as a % of total supply in South Africa for December 2024.



- Maximum daily relative solar PV contribution of 3,6% on 24 Dec 2024 (Tuesday)
- Maximum daily relative wind contribution of 8,1% on 15 Dec 2024 (Sunday)
- Maximum daily relative CSP contribution of 1,2% on 29 Dec 2024 (Sunday)

Note: Total supply includes generation for pumping load
Sources: Eskom; CSIR analysis

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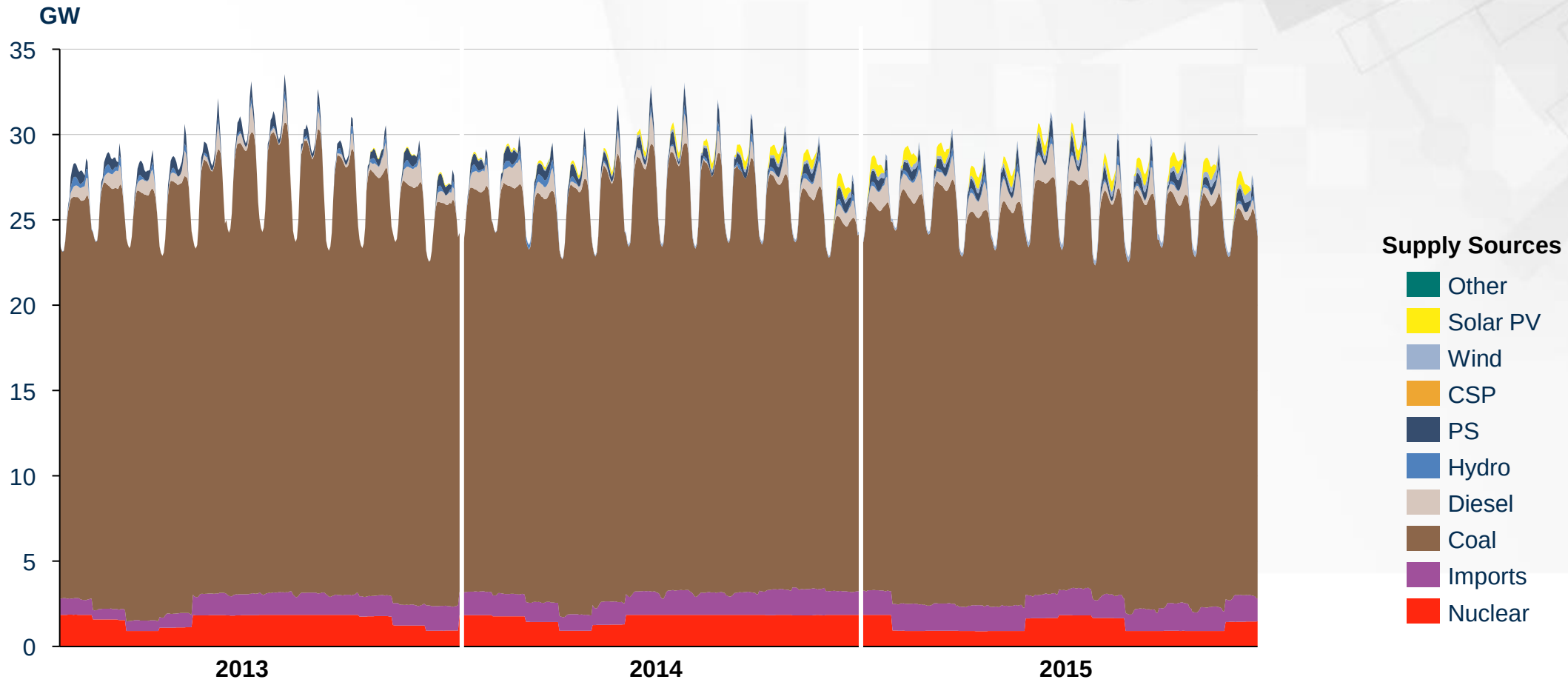
Diurnal courses of electricity supply sources in South Africa

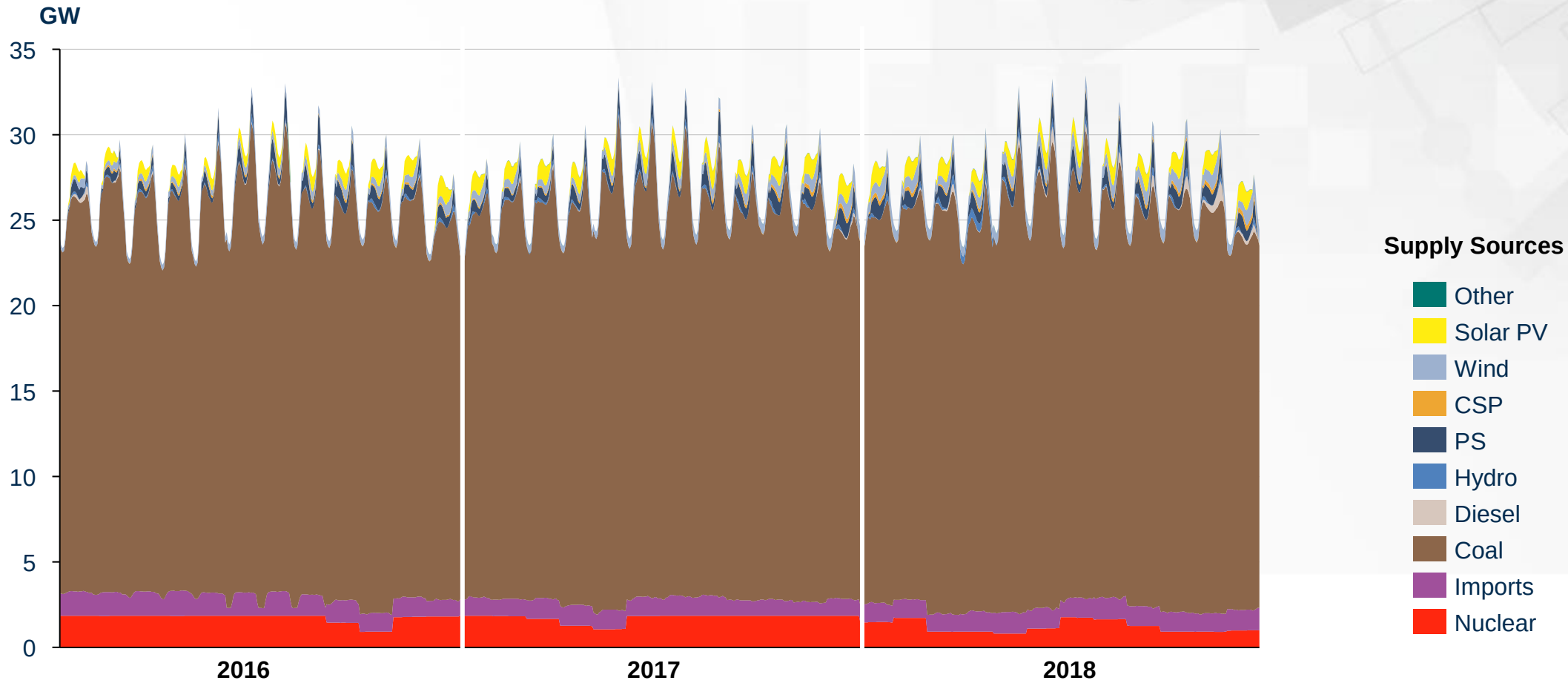
Actual monthly average diurnal courses of total power supply in South Africa January 2013 - December 2015.



Note: Design as per Fraunhofer ISE.
Sources: Eskom; CSIR analysis

Diurnal courses of electricity supply sources in South Africa

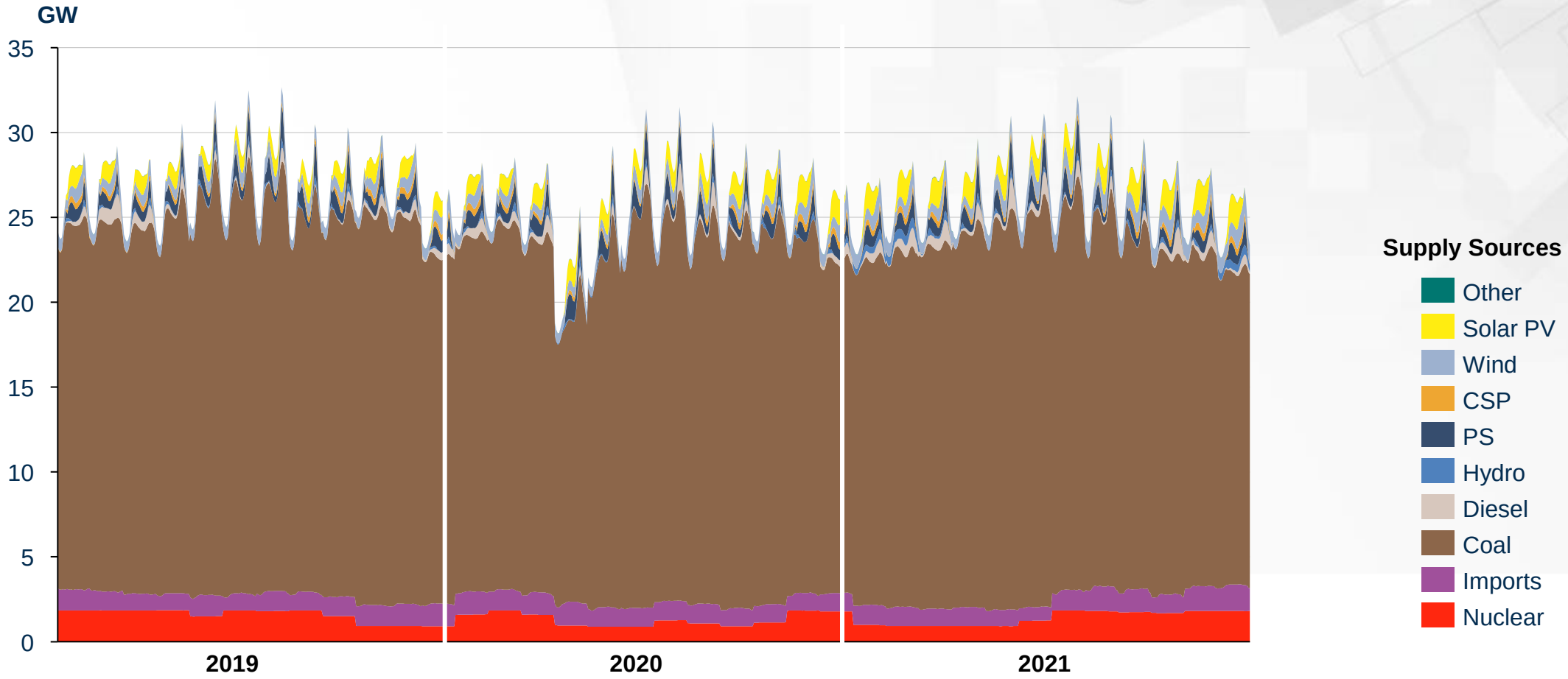
Actual monthly average diurnal courses of total power supply in South Africa January 2016 - December 2018.



Note: Design as per Fraunhofer ISE.
Sources: Eskom; CSIR analysis

Diurnal courses of electricity supply sources in South Africa

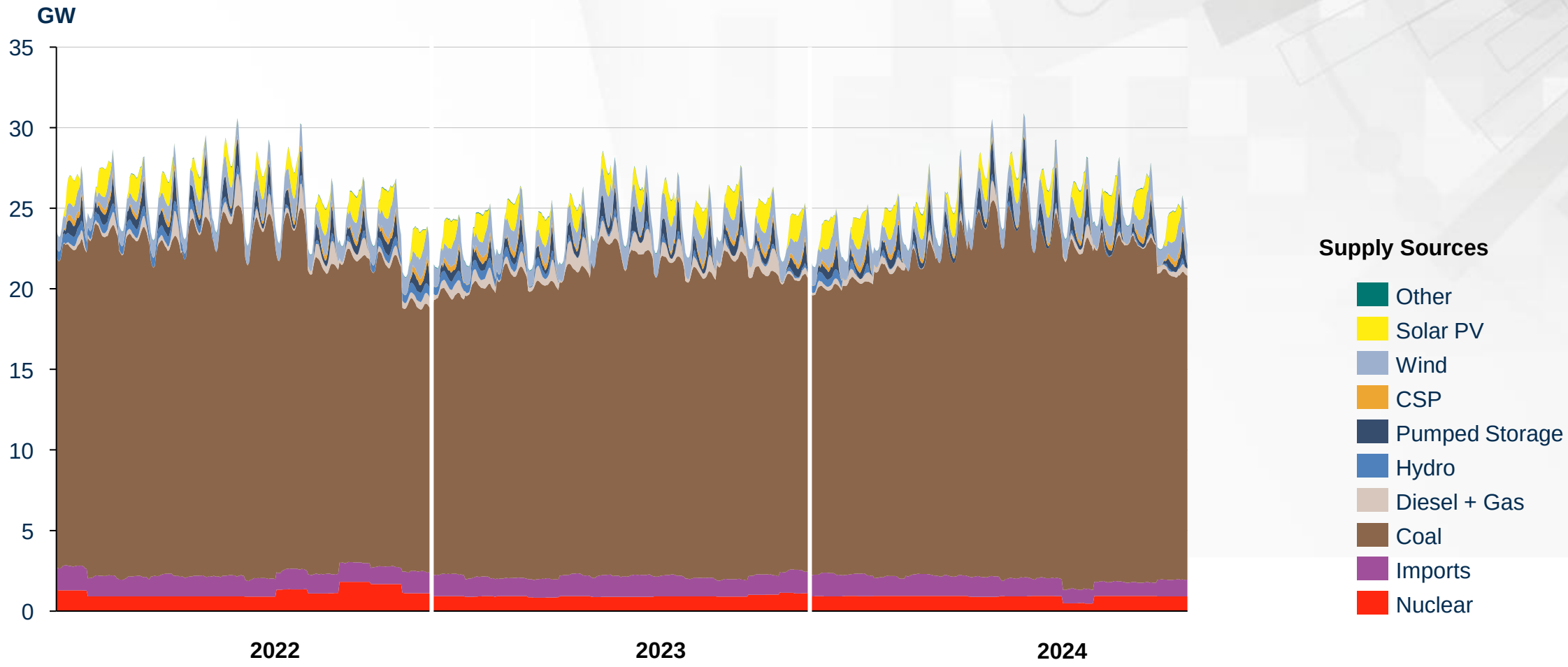
Actual monthly average diurnal courses of total power supply in South Africa January 2019 - December 2021.



Note: Design as per Fraunhofer ISE.
Sources: Eskom; CSIR analysis

Diurnal courses of electricity supply sources in South Africa

Actual monthly average diurnal courses of total power supply show high ramping rate for solar PV and wind relative to coal. There was significant wind capacity during evening peak hours. Coal capacity ramps down significantly during off-peak hours due to high production from wind.

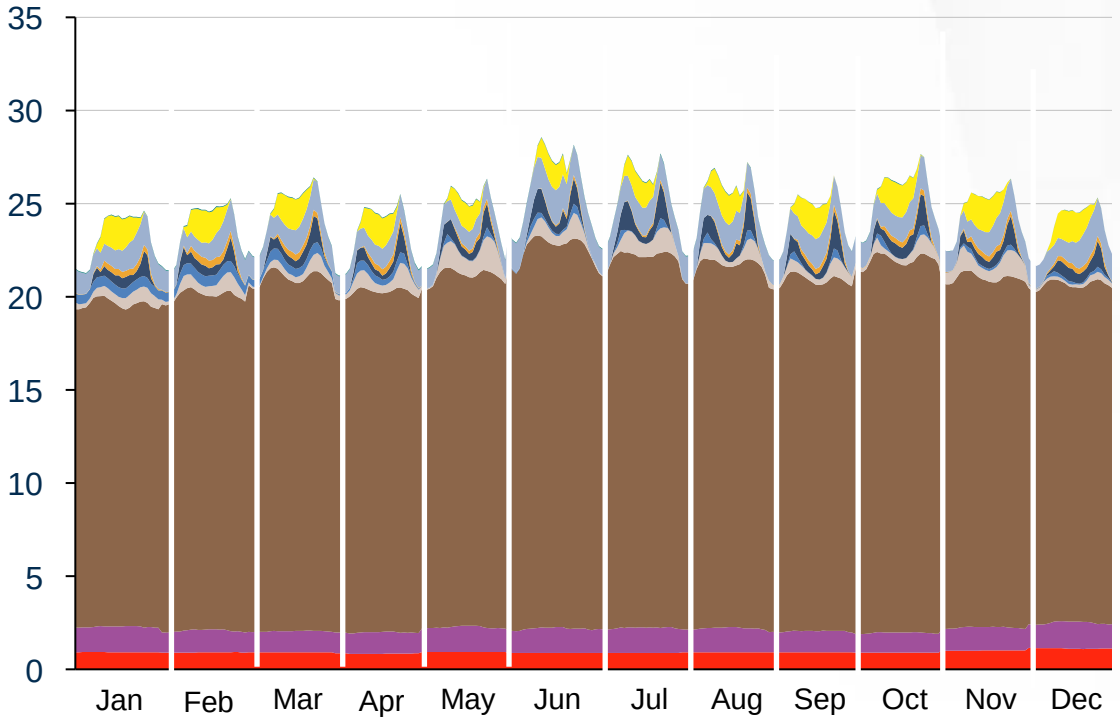


Note: Design as per Fraunhofer ISE.
Sources: Eskom; CSIR analysis

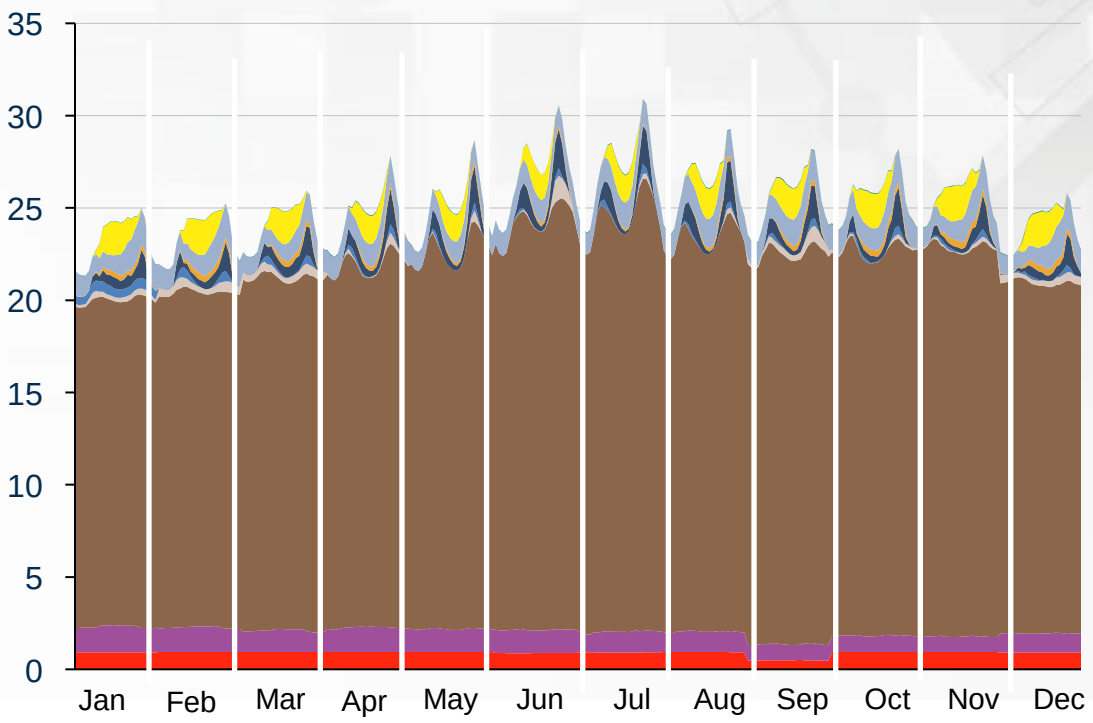
Diurnal courses of electricity supply sources in South Africa in 2023 vs 2024

Monthly average coal generation increased from March to June compared to the same period last year due to improved energy availability factor, while diesel energy production reduced substantially.

2023 Diurnal course of electricity [GW]



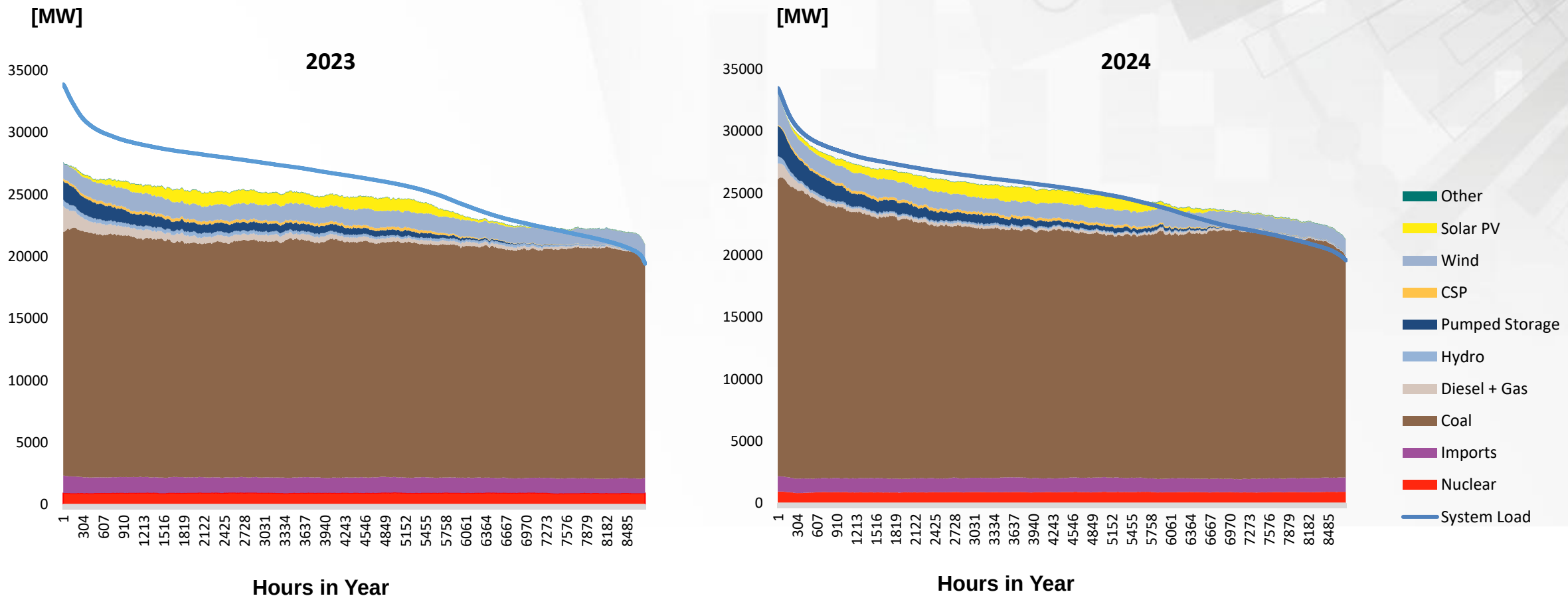
2024 Diurnal course of electricity [GW]



Supply Sources Nuclear | Imports | Coal | Diesel | Hydro | PS | CSP | Wind | Solar PV | Other

Sources: Eskom; CSIR analysis

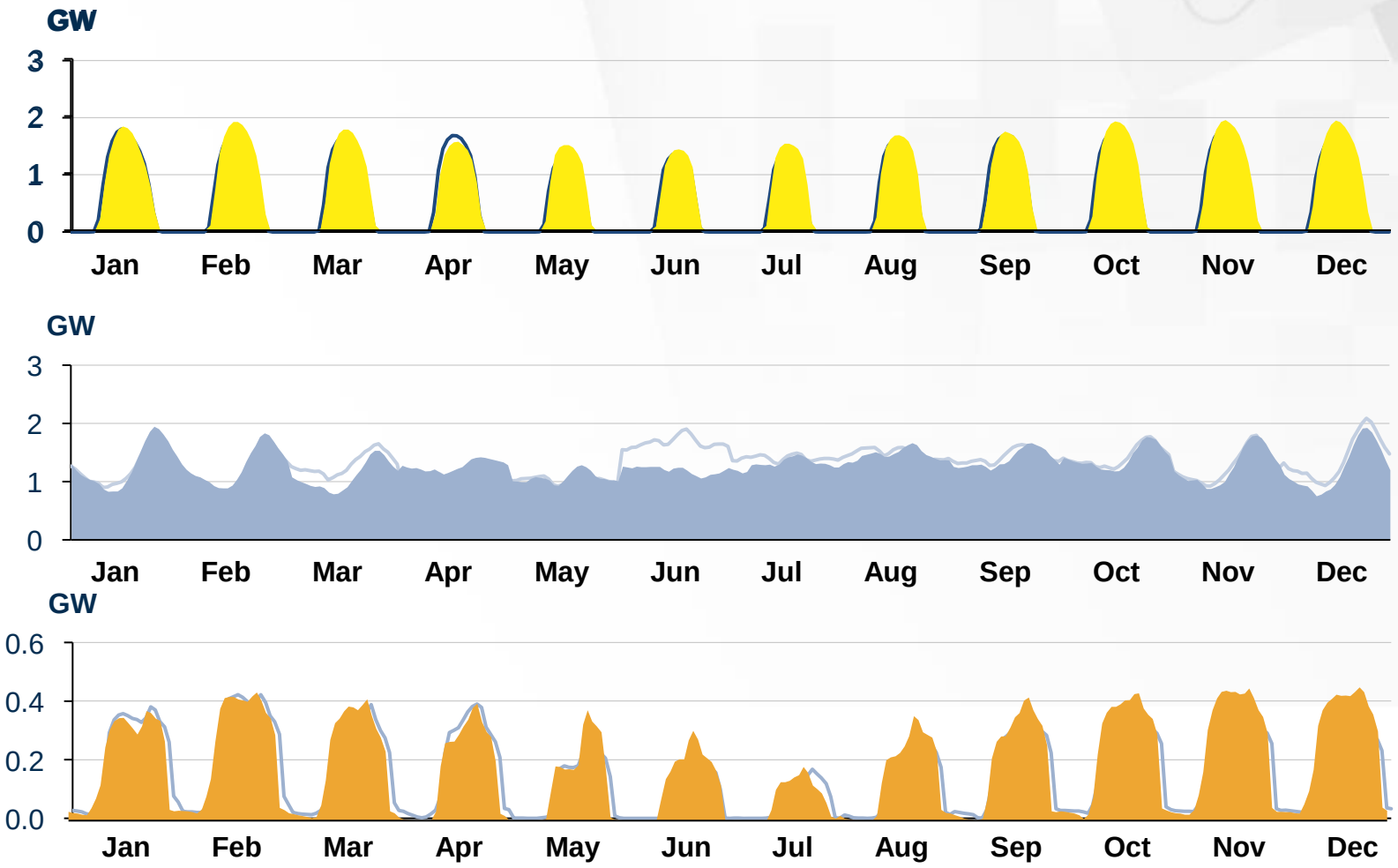
Approximately 4.7 TWh of electricity was exported/curtailed in 2024 compared to 1.9 TWh in 2023. This highlights flexibility limitations and an increasing opportunity for system cost optimisation.



Notes. Eskom fleet in the context of residual load includes REIPPP generation resources. RSA Contracted demand includes pump load.
Sources: Eskom; CSIR analysis

Diurnal courses for renewable energy supply in the REIPPP programme

Actual monthly average diurnal courses of solar PV, wind and CSP comparison show seasonal generation production, that 2024 values alternate with 2023, solar PV production was mostly higher compared to 2023, however, wind and CSP trended lower last year than 2023.



Capacity operational (30 Jun)

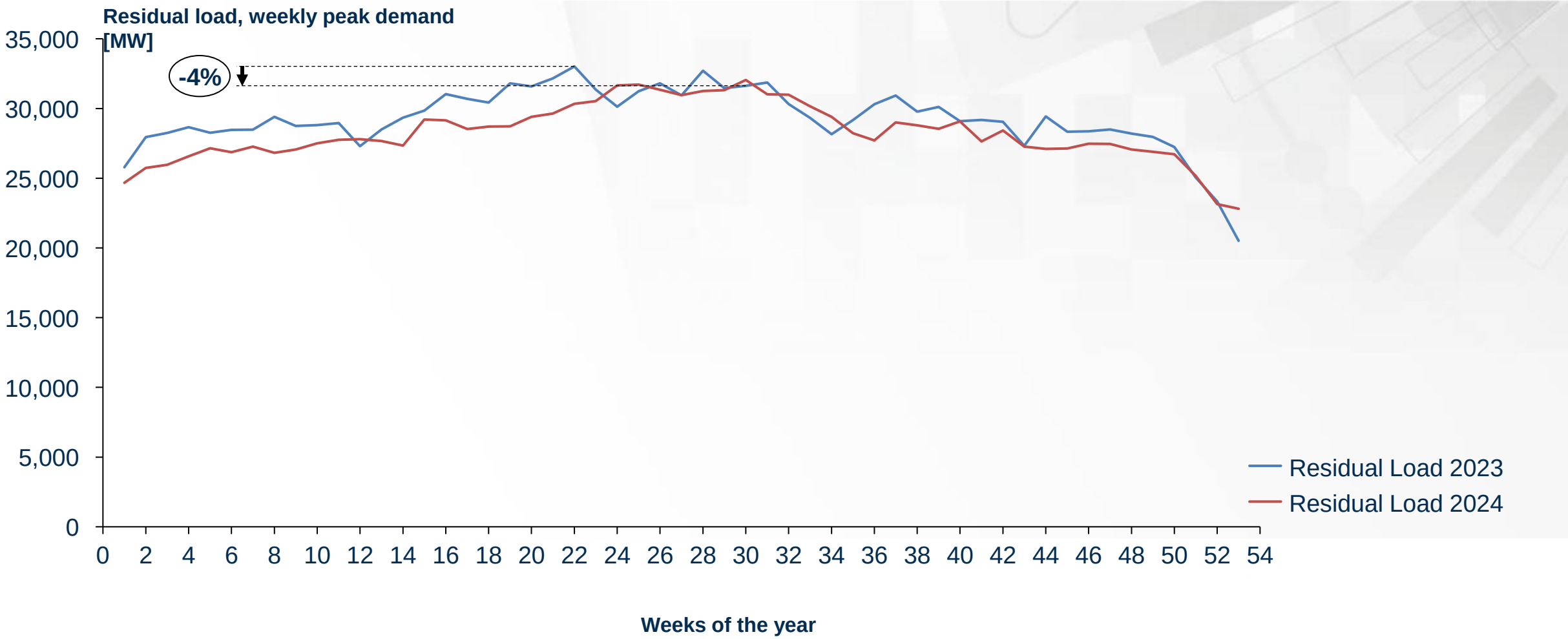
- 2 287 MW
- 3 443 MW
- 500 MW

Supply Sources

- 2023 Solar PV
- 2024 Solar PV
- 2023 Wind
- 2024 Wind
- 2023 CSP
- 2024 CSP

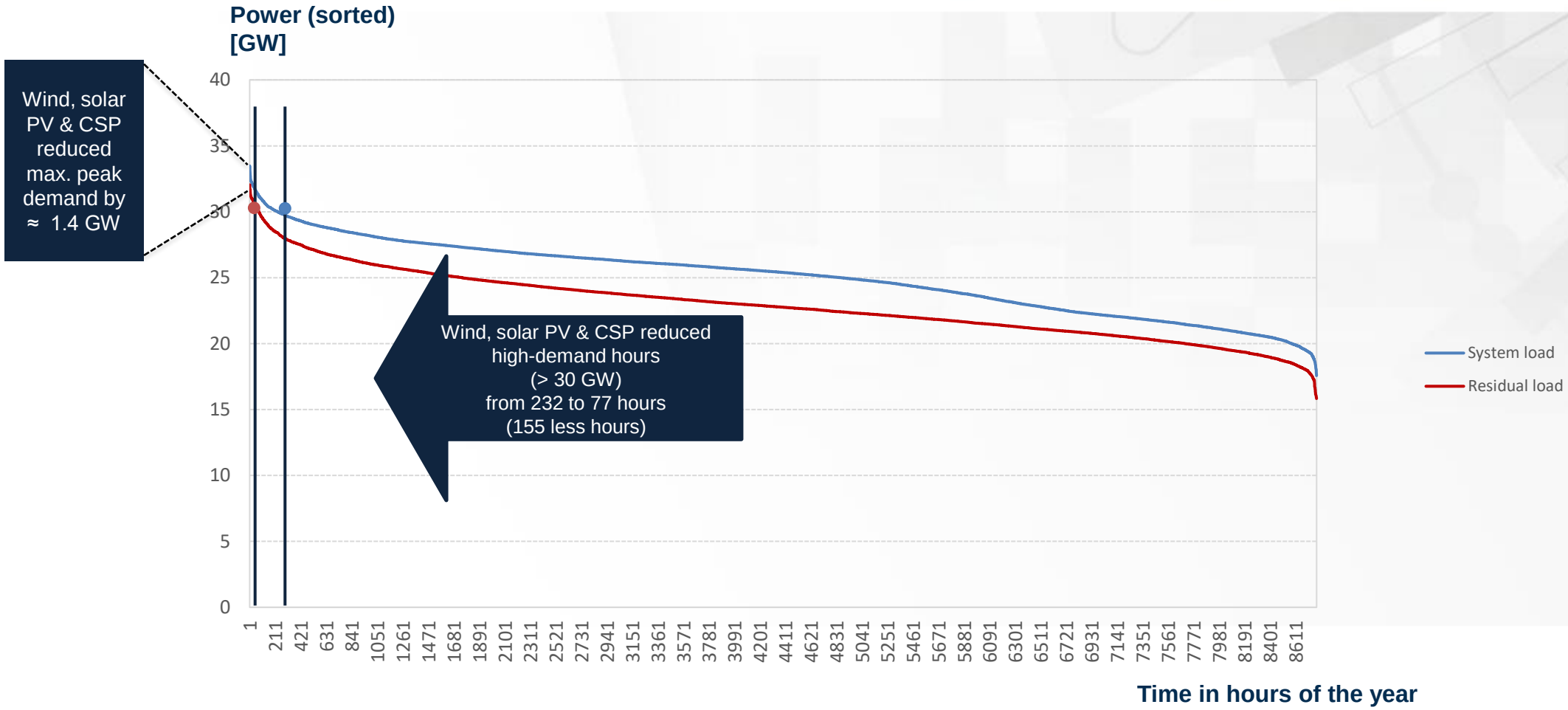
Note: Design as per Fraunhofer ISE
Sources: Eskom; CSIR analysis

The residual load (load met by Eskom fleet after accounting for other private sector generation) was 4% lower in 2024 compared to 2023



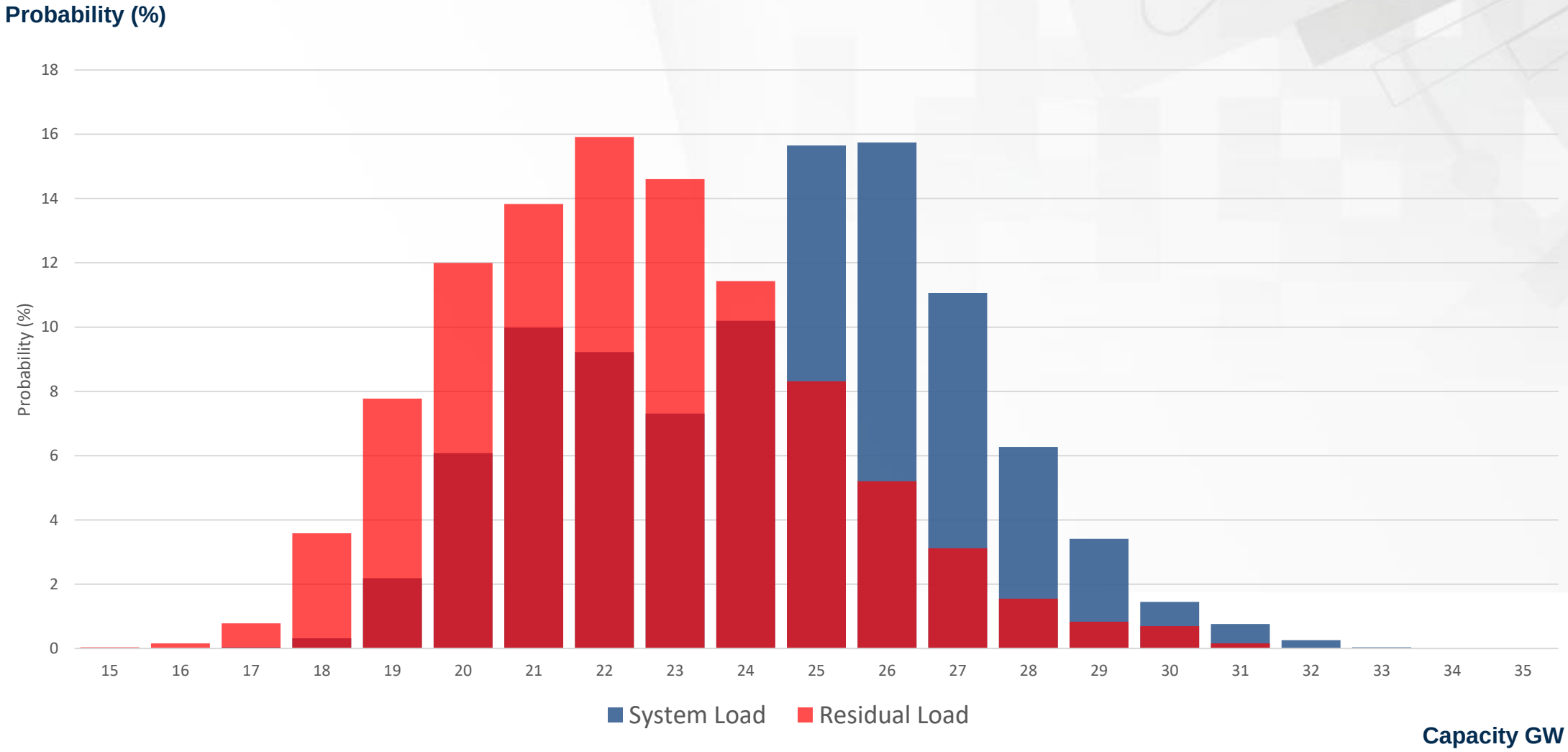
Notes: Residual Load = System Load - wind - Solar PV - CSP
Eskom fleet in the context of residual load includes REIPPP generation resources
Sources: Eskom; CSIR analysis

In 2024 wind, solar PV and CSP reduced the number of hours with >30 GW total load by 50% (155 fewer hours)



Notes: Residual Load = System Load - wind - Solar PV - CSP
Sources: Eskom; CSIR analysis

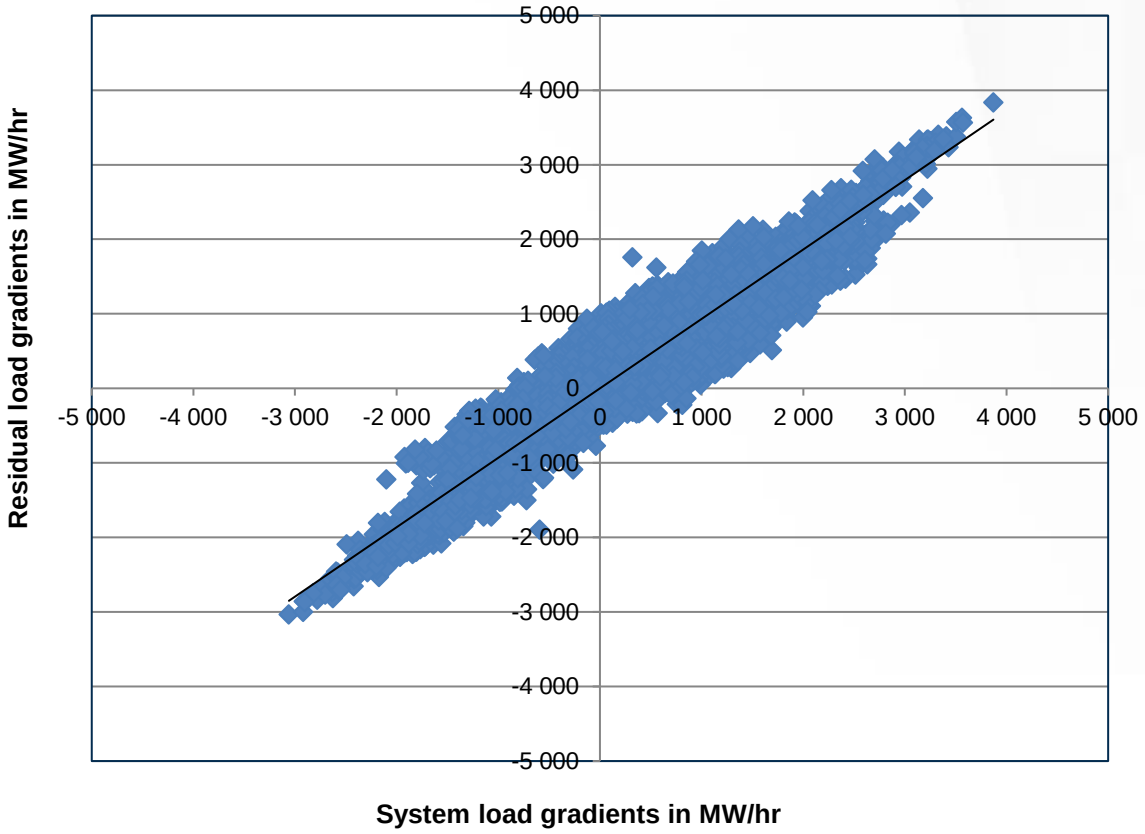
Residual demand is skewed towards lower system demand levels as VRE contributes during those demand hours. No VRE generation during peak hours



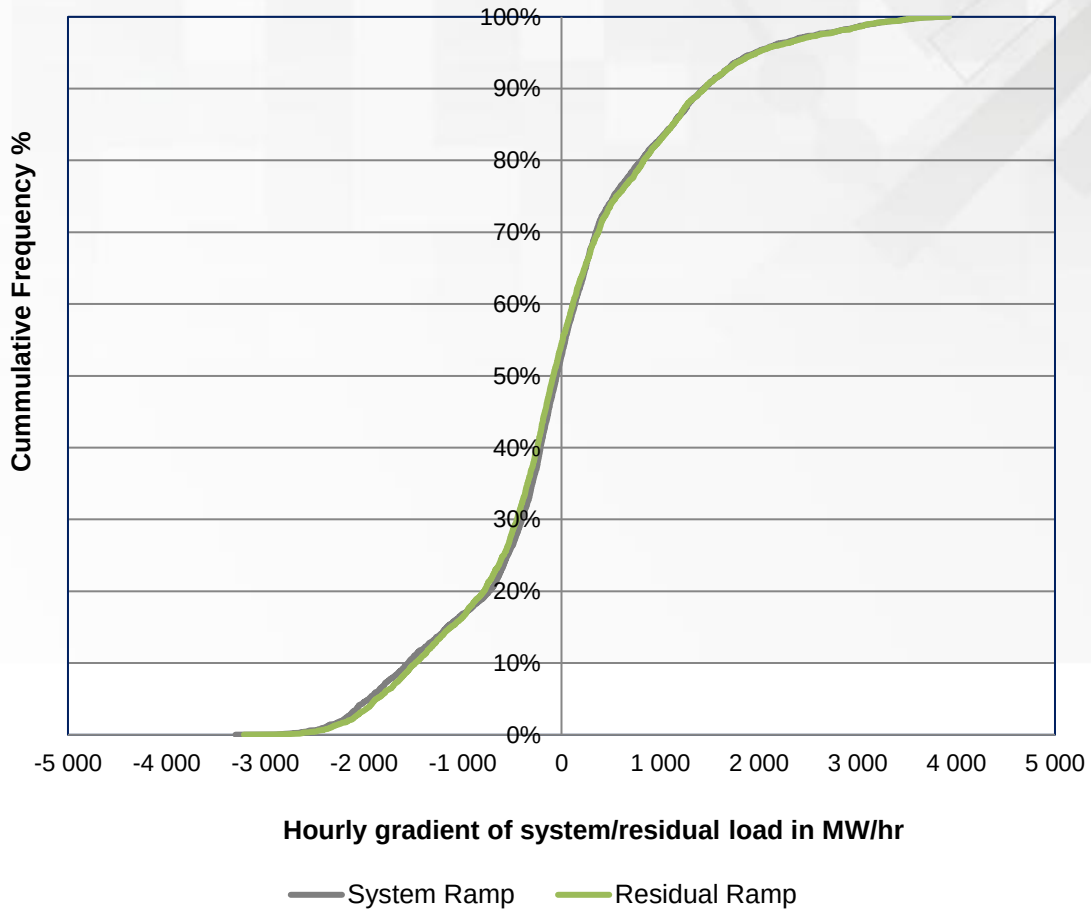
Sources: Eskom; CSIR analysis

2024: One-hour gradients did not significantly increase due to collective 6.2 GW of wind, solar PV and CSP

System load 1-hour gradients vs. residual load 1-hour gradients for all hours in 2024

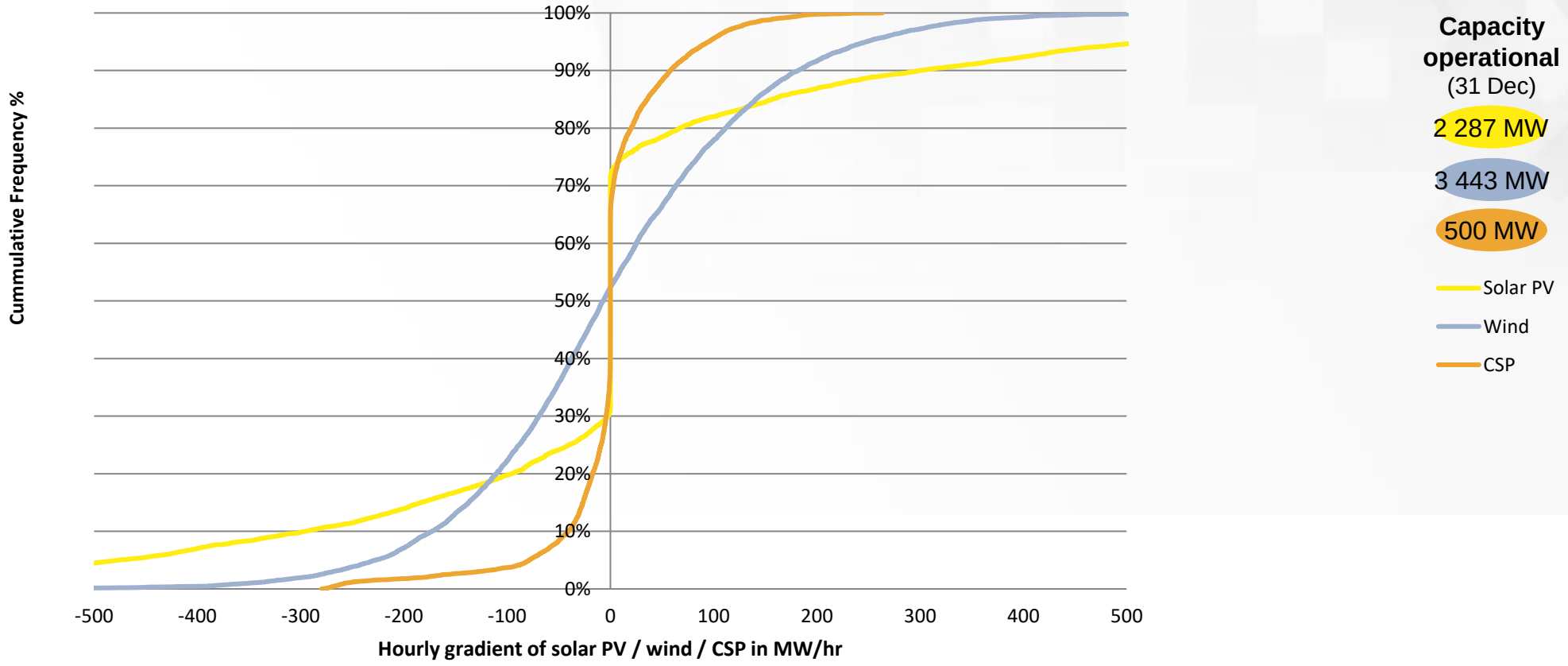


Cumulative frequency distribution of 1-hour gradients for all hours in 2024



Notes: System and Residual load excludes pumping load for all data points throughout the year
Sources: Eskom; CSIR analysis

Wind, solar PV and CSP frequency distribution of one-hour gradients in 2024 there are no major changes in the variability of wind, solar PV and CSP.



Sources: Eskom; CSIR analysis

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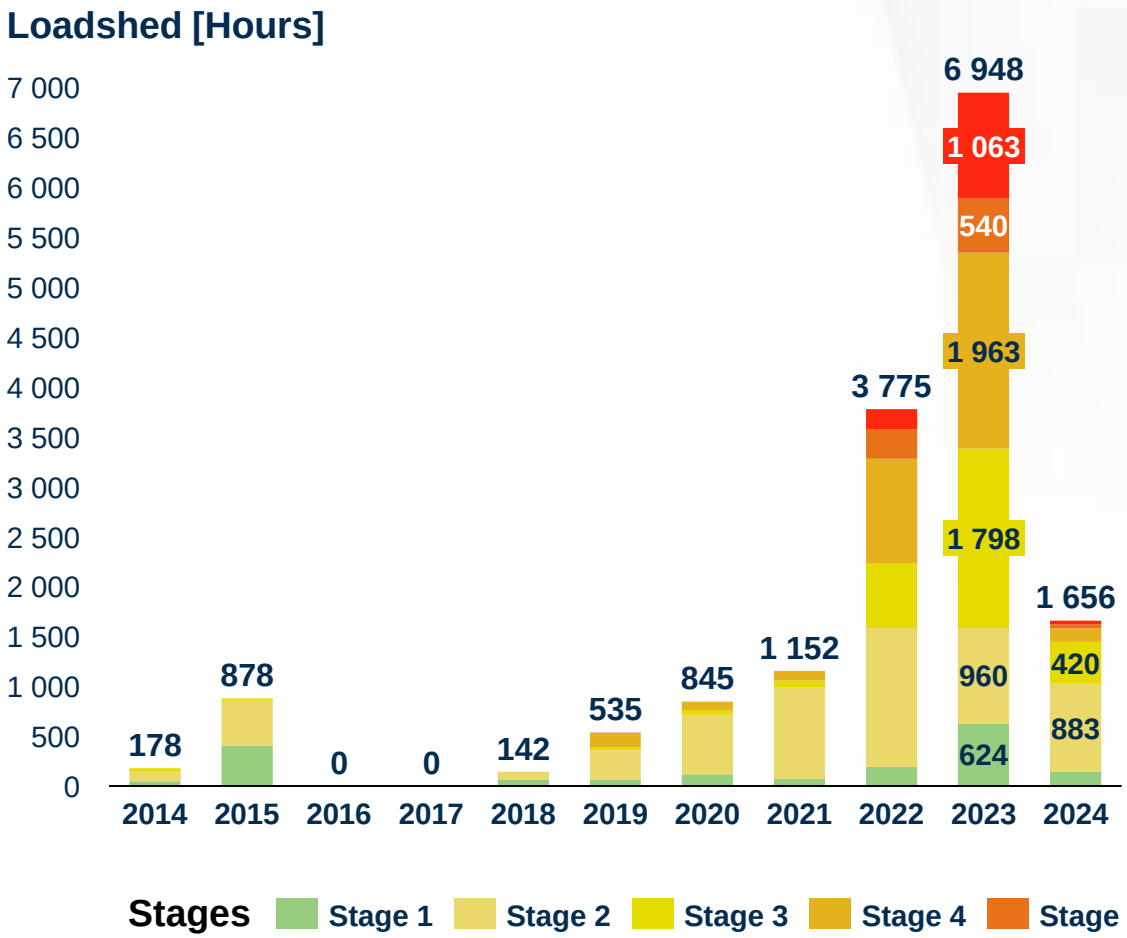
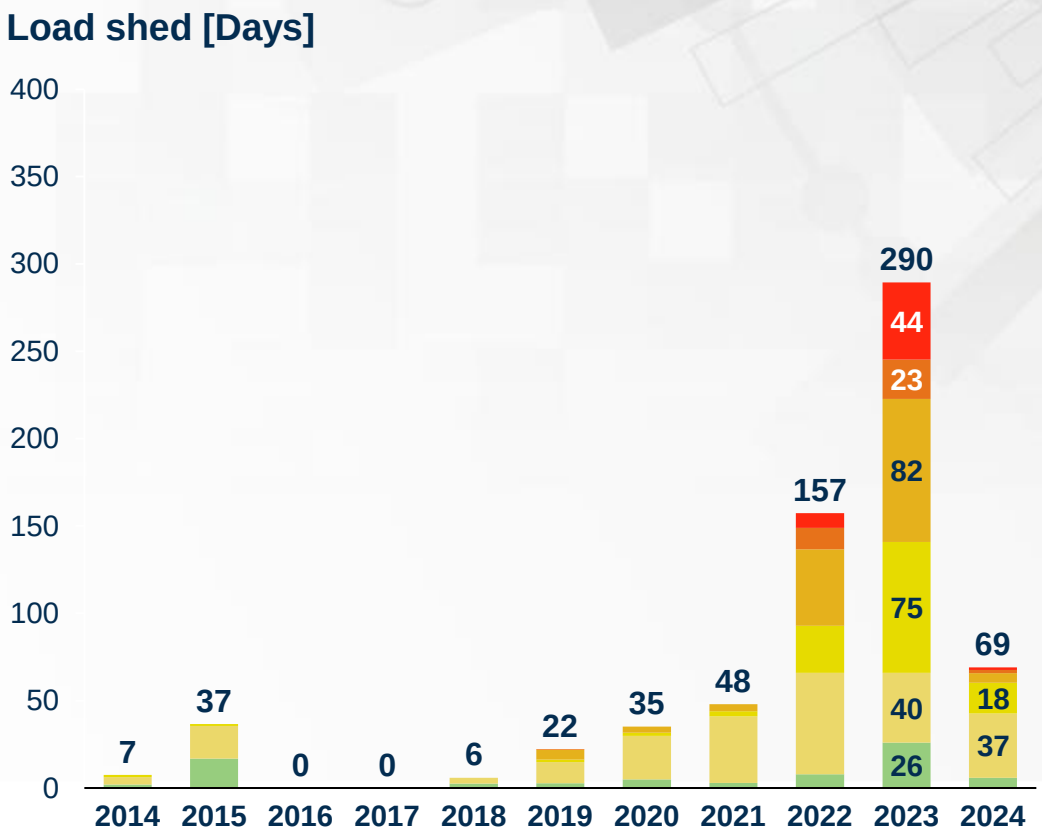
Monitoring days of uninterrupted power supply; As of December 2024, the country has experienced over 300 consecutive days without load shedding, no loadshedding materialised from April to December 2024.

Notes: Loadshedding assumed to have taken place for the full hours in which it was implemented. Practically, load shedding (and the Stage) may occassionally change/ end during a particular hour; Total GWh calculated assuming Stage 1 = 1 000 MW, Stage 2 = 2 000 MW, Stage 3 = 3 000 MW, Stage 4 = 4 000 MW, Stage 5 = 5 000 MW, Stage 6 = 6 000 MW. Demand Side Response (DSR) = Manual Load Reduction (MLR) + Interruptible Load Supply (ILS) + Interruption of Supply (IOS);
Sources: Eskom Twitter account; Eskom Hld SOC Ltd FaceBook page; Eskom se Push (mobile app); Nersa; The Outlier; CSIR analysis

Significant reduction in loadshedding hours; South Africa experienced higher stages of loadshedding for more days in 2023 than in any other year, loadshedding was last experienced in March 2024, consequently fewer load shedding days/hours in 2024 compared to 2023.



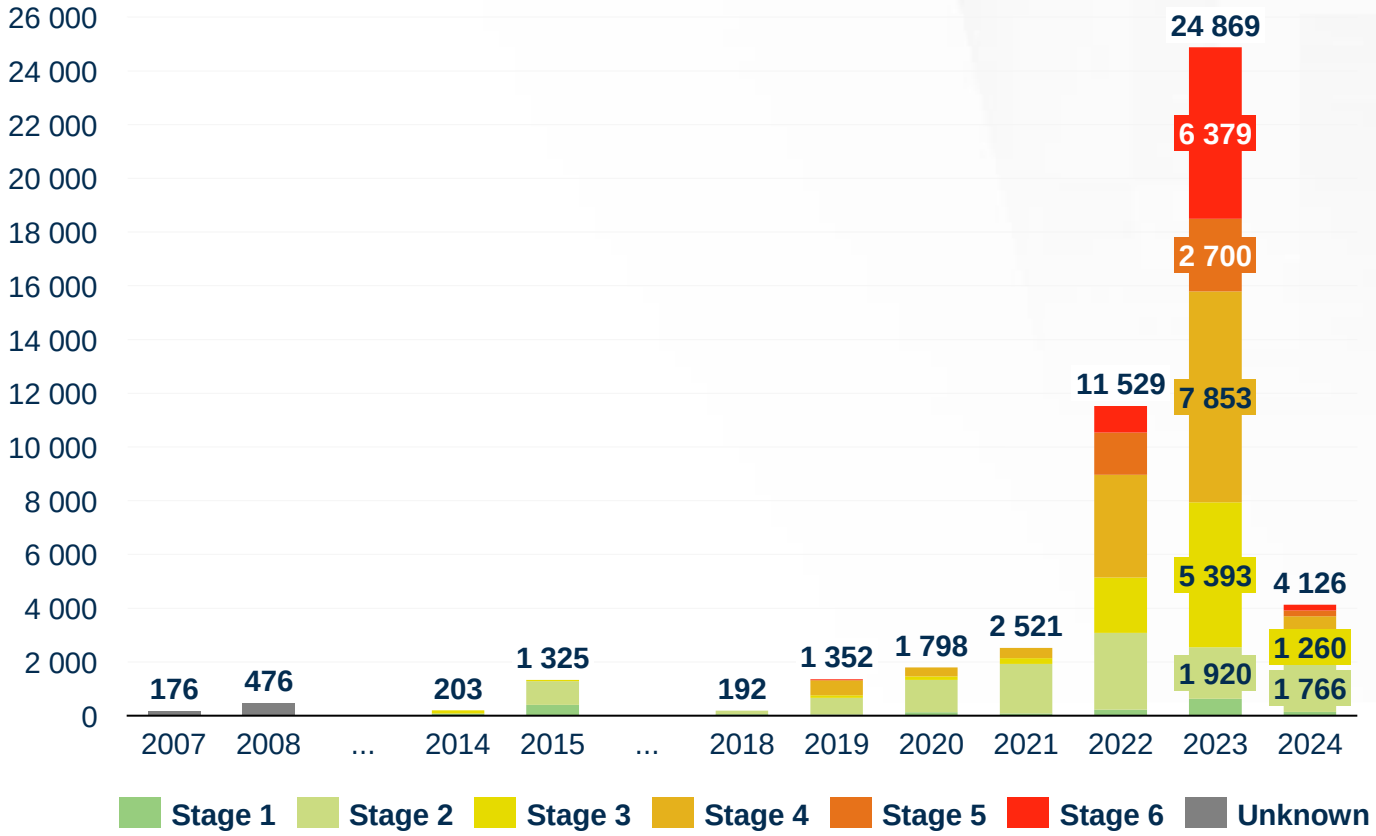


Notes: Loadshedding assumed to have taken place for the full hours in which it was implemented. Practically, load shedding (and the Stage) may occassionally change/ end during a particular hour; Total GWh calculated assuming Stage 1 = 1 000 MW, Stage 2 = 2 000 MW, Stage 3 = 3 000 MW, Stage 4 = 4 000 MW, Stage 5 = 5 000 MW, Stage 6 = 6 000 MW. Demand Side Response (DSR) = Manual Load Reduction (MLR) + Interruptible Load Supply (ILS) + Interruption of Supply (IOS);
Sources: Eskom Twitter account; Eskom Hld SOC Ltd FaceBook page; Eskom se Push (mobile app); Nersa; CSIR analysis

South Africa experienced the highest loadshedding in 2023 than any other year, however,

loadshedding reduced substantially in 2024 due to improvements in the EAF and lower residual load in 2024 compared to 2023. Private sector embedded solar PV generation of 5.8 GW generated ~2.3 TWh in the first three months of 2024 where we had loadshedding and contributed to minimising loadshedding.

Load shed [GWh]

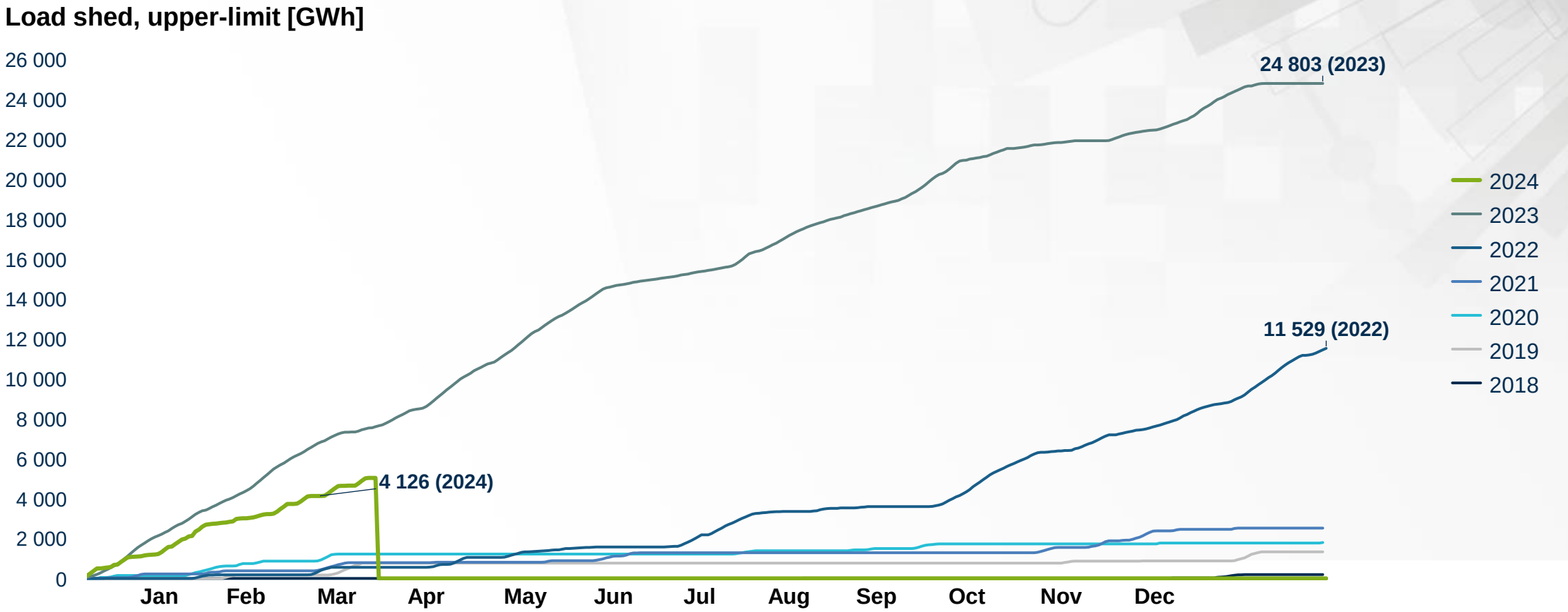


Year	Duration of Outages (hours)	Energy Shed (GWh)	DSR (GWh)
2007	-	176	Not Available
2008	-	476	Not Available
…	…	…	…
2014	121	203	Not Available
2015	852	1 325	Not Available
…	…	…	…
2018	127	192	392
2019	530	1 352	1 362
2020	859	1 798	1 426
2021	1 169	2 521	1 936
2022	3 773	11 529	8 301
2023	6 948	24 869	16 755
2024	1 656	4 126	2 530

Notes: Loadshedding assumed to have taken place for the full hours in which it was implemented. Practically, load shedding (and the Stage) may occassionally change/ end during a particular hour; Total GWh calculated assuming Stage 1 = 1 000 MW, Stage 2 = 2 000 MW, Stage 3 = 3 000 MW, Stage 4 = 4 000 MW, Stage 5 = 5 000 MW, Stage 6 = 6 000 MW. Demand Side Response (DSR) = Manual Load Reduction (MLR) + Interruptible Load Supply (ILS) + Interruption of Supply (IOS); CF assumption of 19% for Private sector Embedded Generation

Sources: Eskom Twitter account; Eskom Hld SOC Ltd FaceBook page; Eskom se Push (mobile app); Nersa; CSIR analysis 2024* actuals are up to the end of June, The Outlier

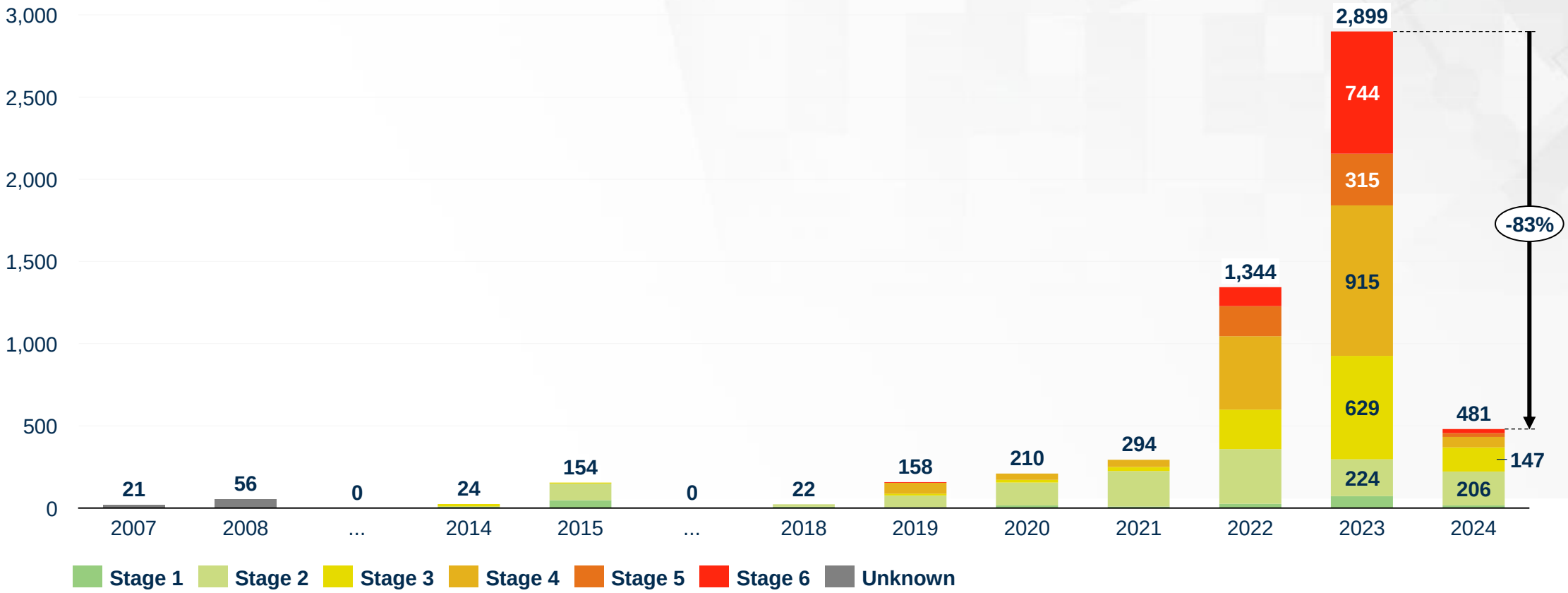
2018-2024: Upper limit of cumulative loadshedding; The last occurrence of loadshedding on 26 March 2024.



Notes: Loadshedding assumed to have taken place for the full hours in which it was implemented. Practically, load shedding (and the Stage) may occassionally change/ end during a particular hour; Total GWh calculated assuming Stage 1 = 1 000 MW, Stage 2 = 2 000 MW, Stage 3 = 3 000 MW, Stage 4 = 4 000 MW, Stage 5 = 5 000 MW, Stage 6 = 6 000 MW;
Sources: Eskom Twitter account; Eskom Hld SOC Ltd FaceBook page; Eskom se Push (mobile app); Nersa; CSIR analysis

The South African economy lost approximately R’tril 2.899 in 2023 as an upper limit due to rotational loadshedding; Due to improved performance at Eskom plants, the cost of load shedding decreased by approximately 83% in 2024 compared to 2023.

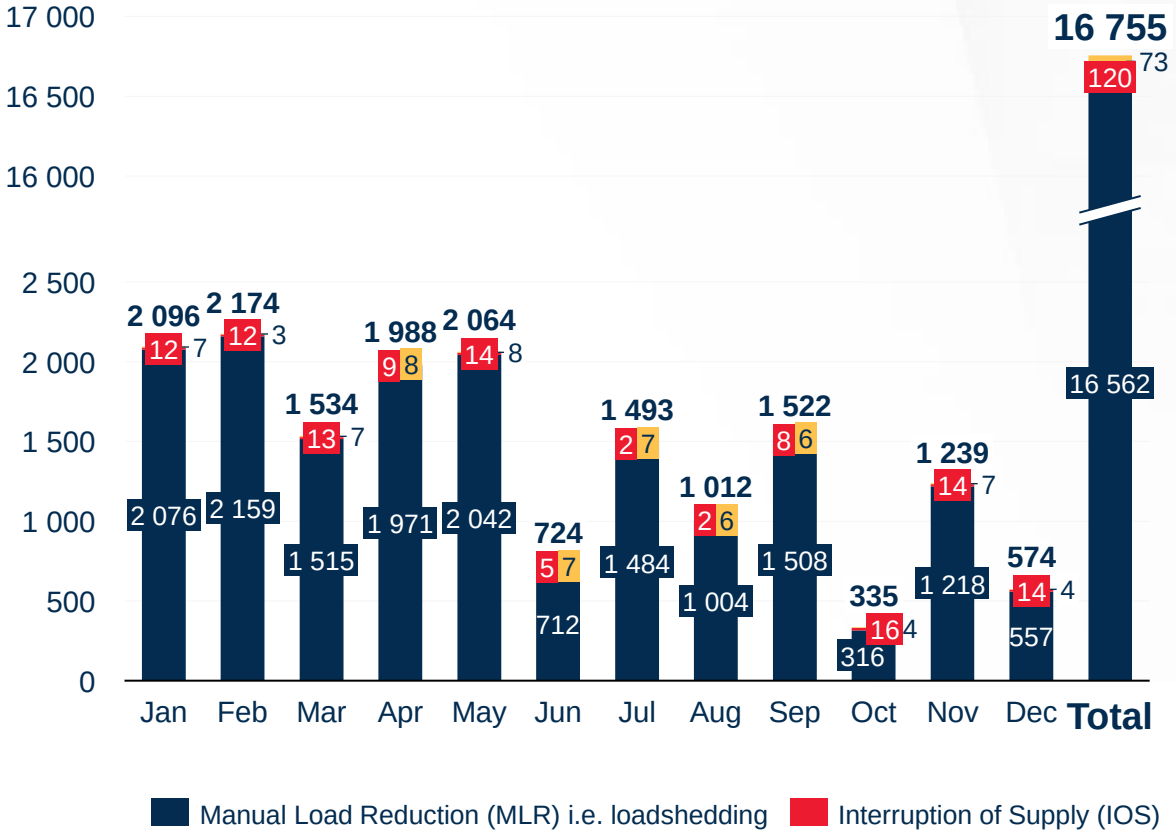
Cost of Load shedding [R’ Billion]



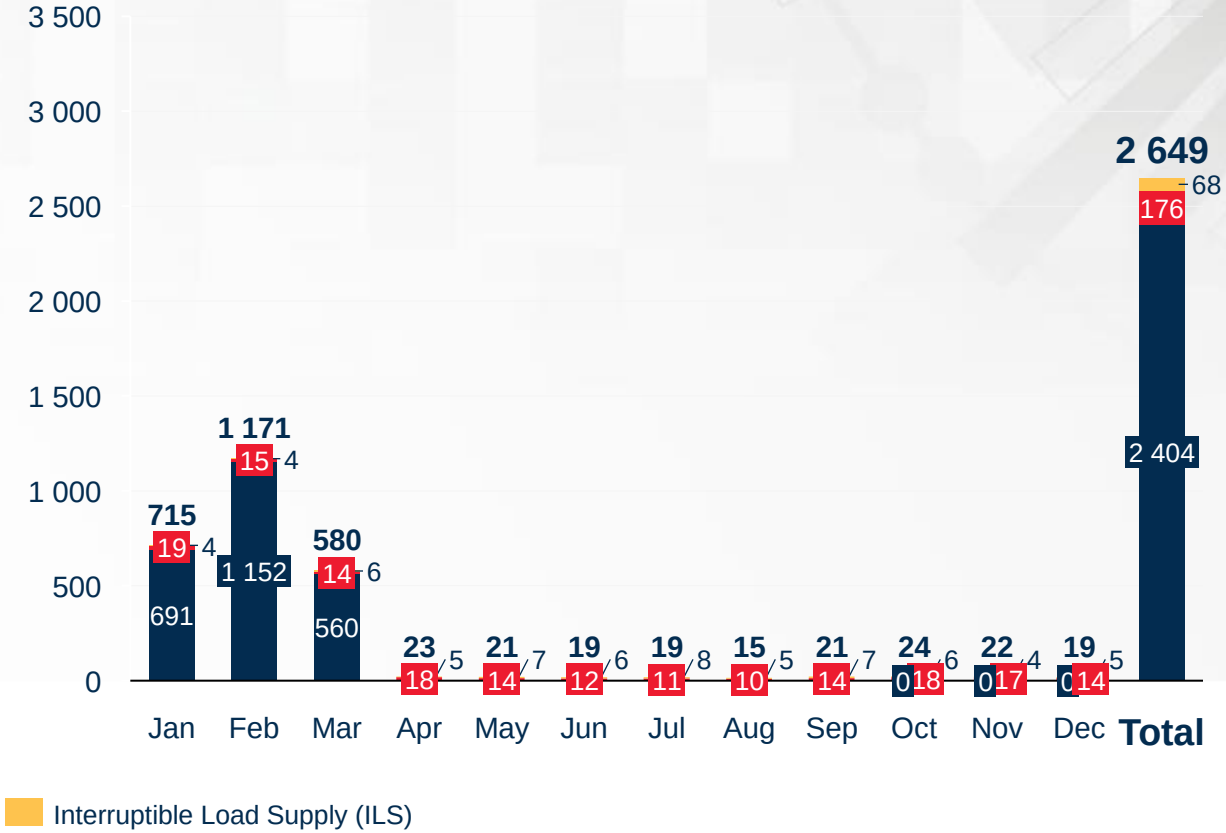
Notes: Loadshedding assumed to have taken place for the full hours in which it was implemented. Practically, load shedding (and the Stage) may occassionally change/ end during a particular hour; Total GWh calculated assuming Stage 1 = 1 000 MW, Stage 2 = 2 000 MW, Stage 3 = 3 000 MW, Stage 4 = 4 000 MW, Stage 5 = 5 000 MW, Stage 6 = 6 000 MW2024* actuals are up to the end of June. Cost of load shedding estimated using the high-level load shedding energy estimates Used the cost of unserved energy of 116 570 R/MWh, the cost of unserved represents a national average, the actual cost of power interruptions will vary for different sectors based on how electric utilisation is monetised and time of day of supply interruptions. Sources: Eskom Twitter account; Eskom Hld SOC Ltd FaceBook page; Eskom se Push (mobile app); Nersa; CSIR analysis

Actual DSR in 2024 reveals how actual MLR (loadshedding) dominated over other DSR interventions but with lower volumes compared to 2023

2023 Monthly demand side response (DSR) [GWh]



2024 Monthly demand side response (DSR) [GWh]

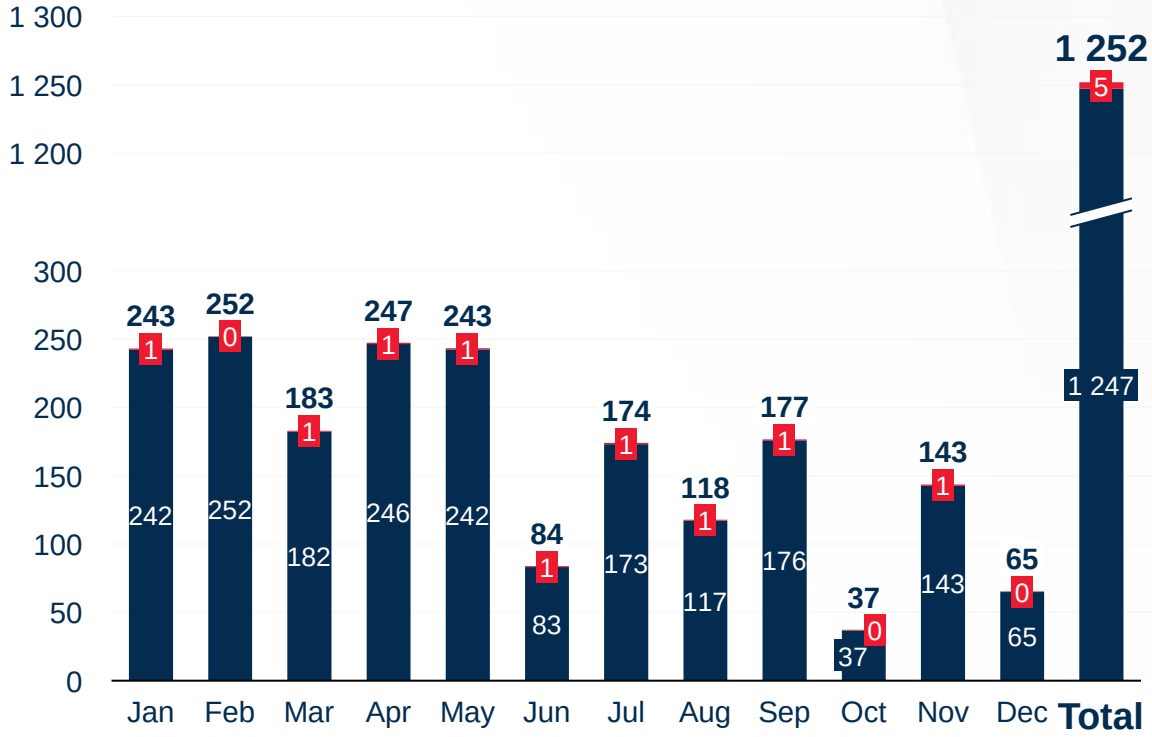


Manual Load Reduction (MLR) i.e. loadshedding
Interruption of Supply (IOS)
Interruptible Load Supply (ILS)

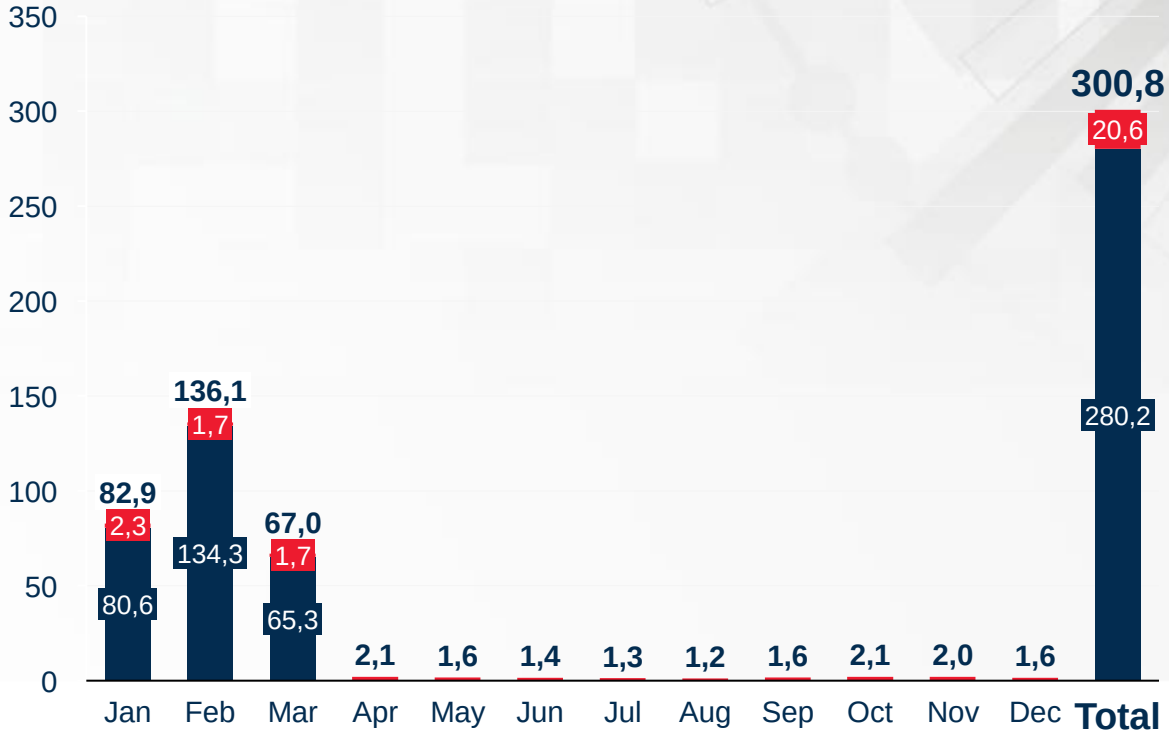
Notes:Demand Side Response (DSR) = Manual Load Reduction (MLR) + Interruptible Load Supply (ILS) + Interruption of Supply (IOS);
Used the cost of unserved energy of R/MWh of R 116 570, the cost of unserved represents a national average, the actual cost of power interruptions will vary for different sectors based on how electric utilisation is monetised and time of day of supply interruptions.
Sources: Eskom; CSIR analysis

The actual cost of loadshedding based on the actual DSR from Eskom is ~R‘bil 300 for 2024 compared to R‘tril 1.25 in 2023

2023 Cost of loadshedding (DSR) [R’Billion]



2024 Cost of loadshedding (DSR) [R’Billion]



Manual Load Reduction (MLR) i.e. loadshedding

Interruption of Supply (IOS)

Notes:actual cost of unserved energy excludes ILS since those participants are commercial contracted to be interrupted and receive financial incentives for each interruption
Used the cost of unserved energy of R/MWh of R 116 570
Sources: Eskom; CSIR analysis

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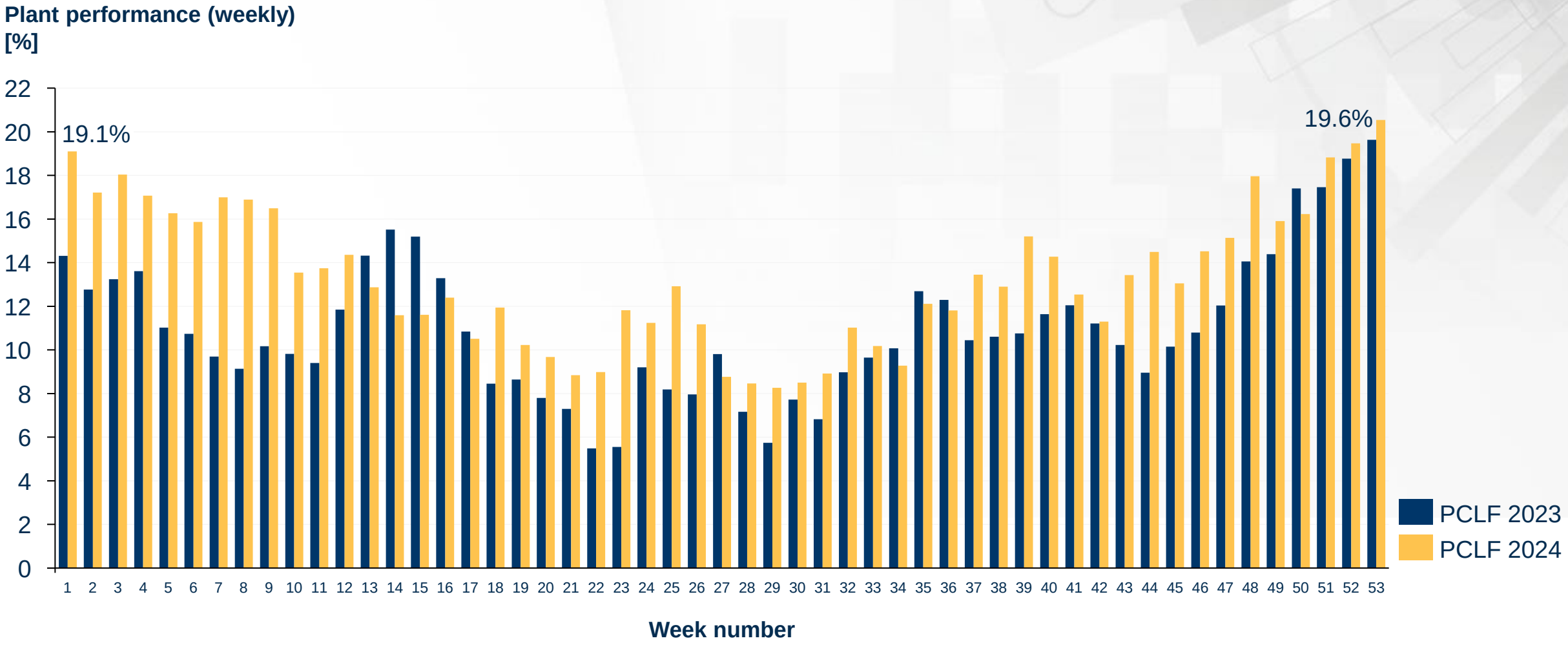
Planned capacity loss factor (planned maintenance) was much higher in 2024 compared to 2023

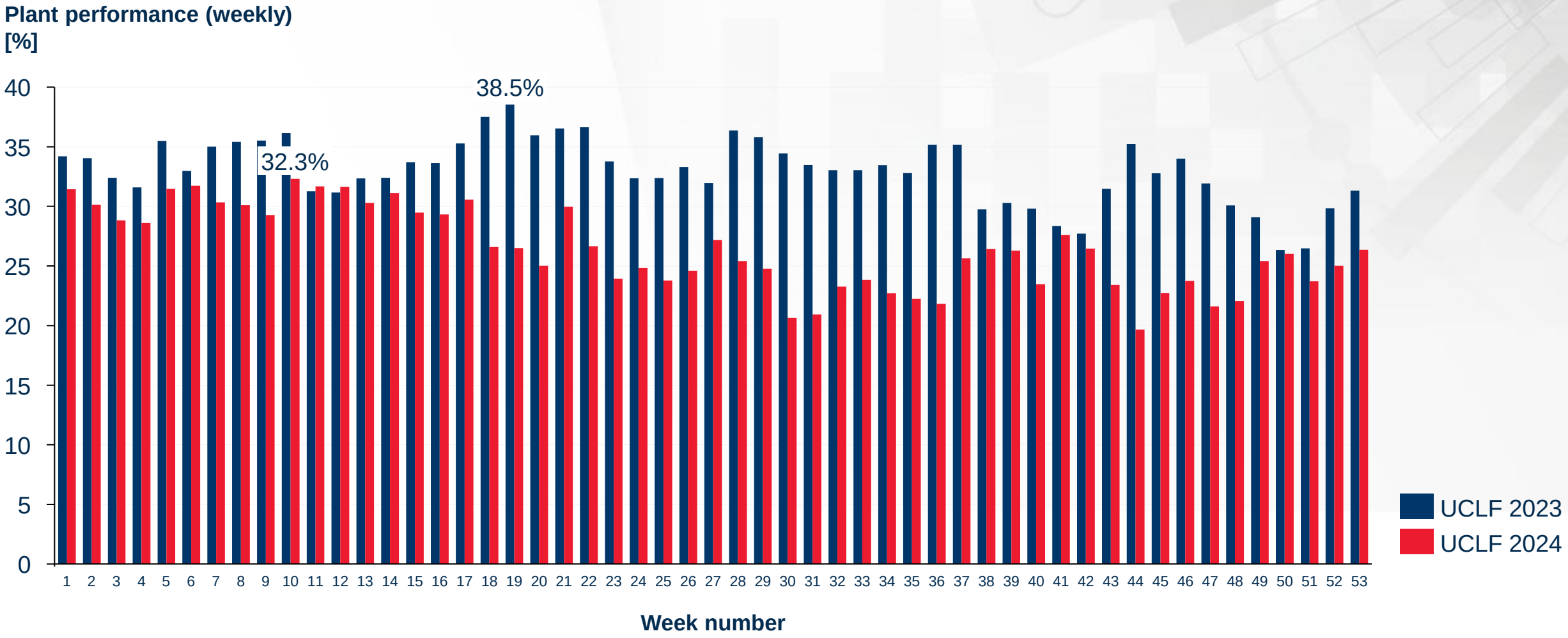
Planned maintenance was seasonally higher in January and expectedly reduced leading up to winter months where demand is higher; however, despite the season trend, the magnitude of planned maintenance was much higher this year.



NOTES: EAF - Energy Availability Factor; PCLF - Planned capability Loss Factor; UCLF – Unplanned Capability Loss Factor; OCLF – Other Capability Loss Factor
Sources: Eskom; CSIR analysis

The unplanned capacity loss factor (unplanned outages) was much lower in 2024 towards the winter month compared to 2023

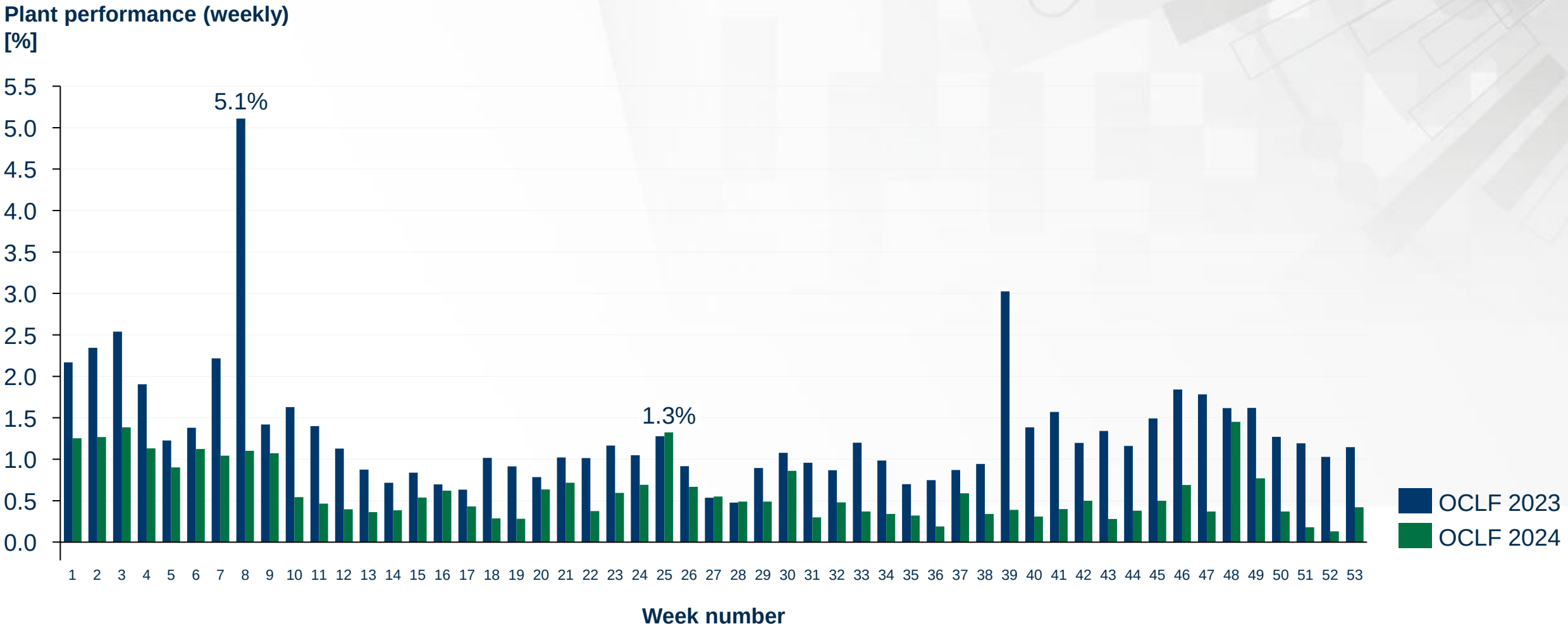
Although unplanned maintenance trended lower in 2024 compared to 2023, the differential between the two years is much larger from week 18 onwards.



NOTES: EAF - Energy Availability Factor; PCLF - Planned capability Loss Factor; UCLF – Unplanned Capability Loss Factor; OCLF – Other Capability Loss Factor
Sources: Eskom; CSIR analysis

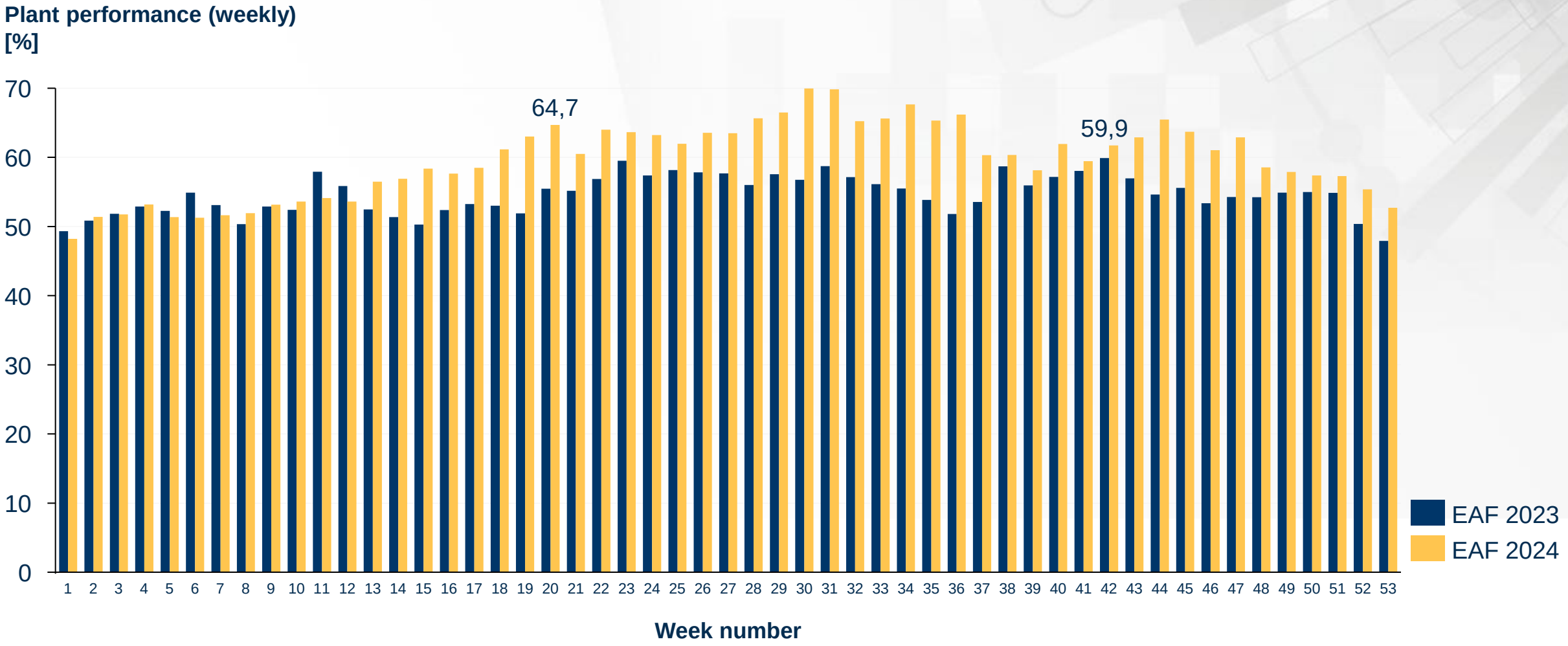
Other capacity loss factor (OCLF, generation capacity that is offline due to uncontrollable constraints) was much lower in 2024 compared to 2023

The OCLF remained below 1.5% throughout the year.



NOTES: EAF - Energy Availability Factor; PCLF - Planned capability Loss Factor; UCLF – Unplanned Capability Loss Factor; OCLF – Other Capability Loss Factor
Sources: Eskom; CSIR analysis

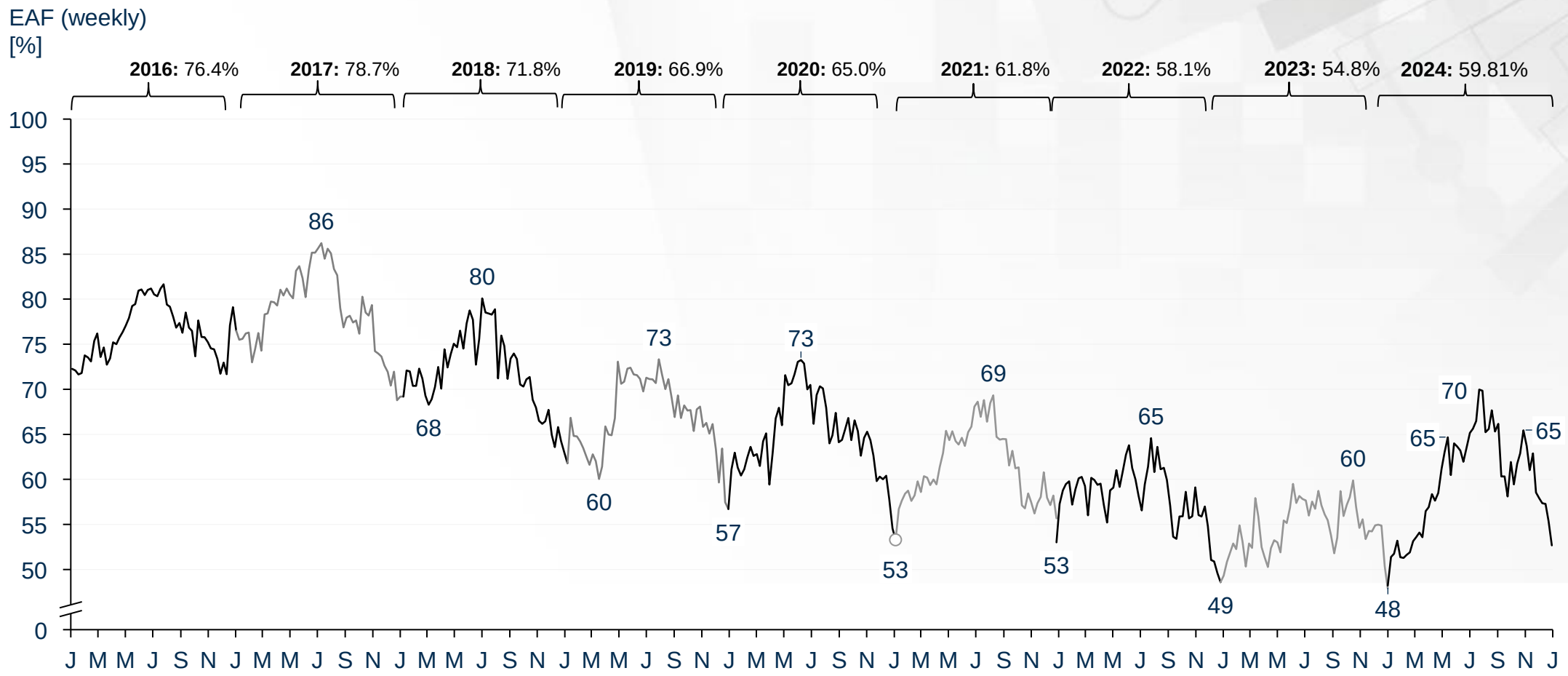
The EAF: Eskom fleet's availability improved due to reduced unplanned outages, the EAF exceeded 60% from week 18 onwards and reached of a weekly high of 64.7% compared to the high of 59.9% last year.



NOTES: EAF - Energy Availability Factor; PCLF - Planned capability Loss Factor; UCLF – Unplanned Capability Loss Factor; OCLF – Other Capability Loss Factor
Sources: Eskom; CSIR analysis

EAF trend in 2024 increased to an annual average of ~60 %

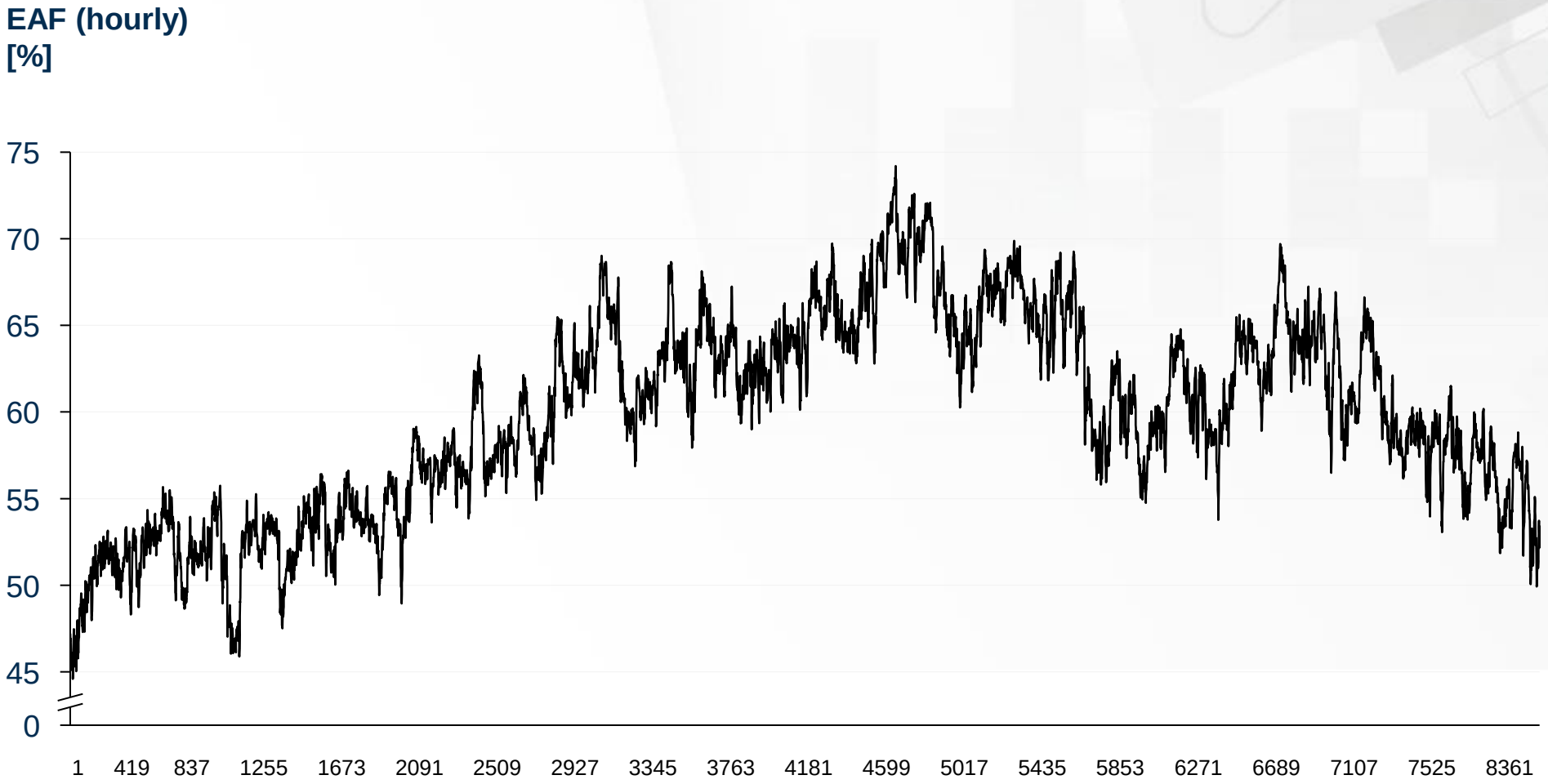
The weekly EAF hit a high of 70% in 2024 compared to 60% in 2023.



Notes: EAF - Energy Availability Factor. Average annual EAF is calculated as an average of the hourly EAF values.
Sources: Eskom; CSIR analysis

EAF exhibits similar seasonality as in other years

The trend shows that the EAF peaks in the winter months to meet higher demand and drops in summer where demand reduces.



Notes: EAF - Energy Availability Factor. Average annual EAF is calculated as an average of the hourly EAF values.
Sources: Eskom; CSIR analysis

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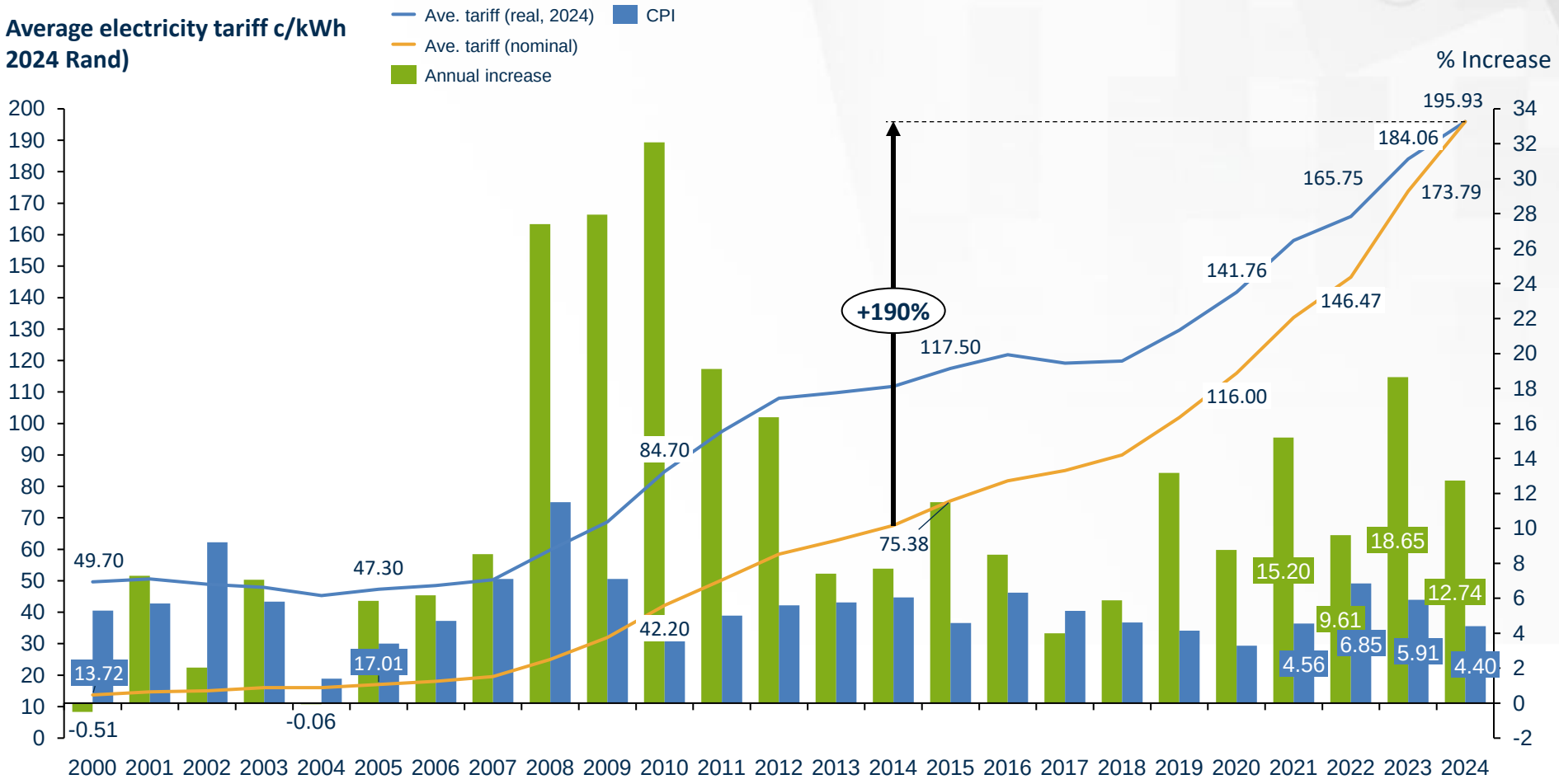
Eskom's aggregated tariffs increased by 190% since 2014, which is much higher than the average annual inflation rate of 5.2% over the same period.

Electricity prices are already above utility-scale solar PV LCOE of R/kWh 0.5, the proposed NERSA tariff increase of 12.74% pushes the average tariff to c/kWh 195.93.

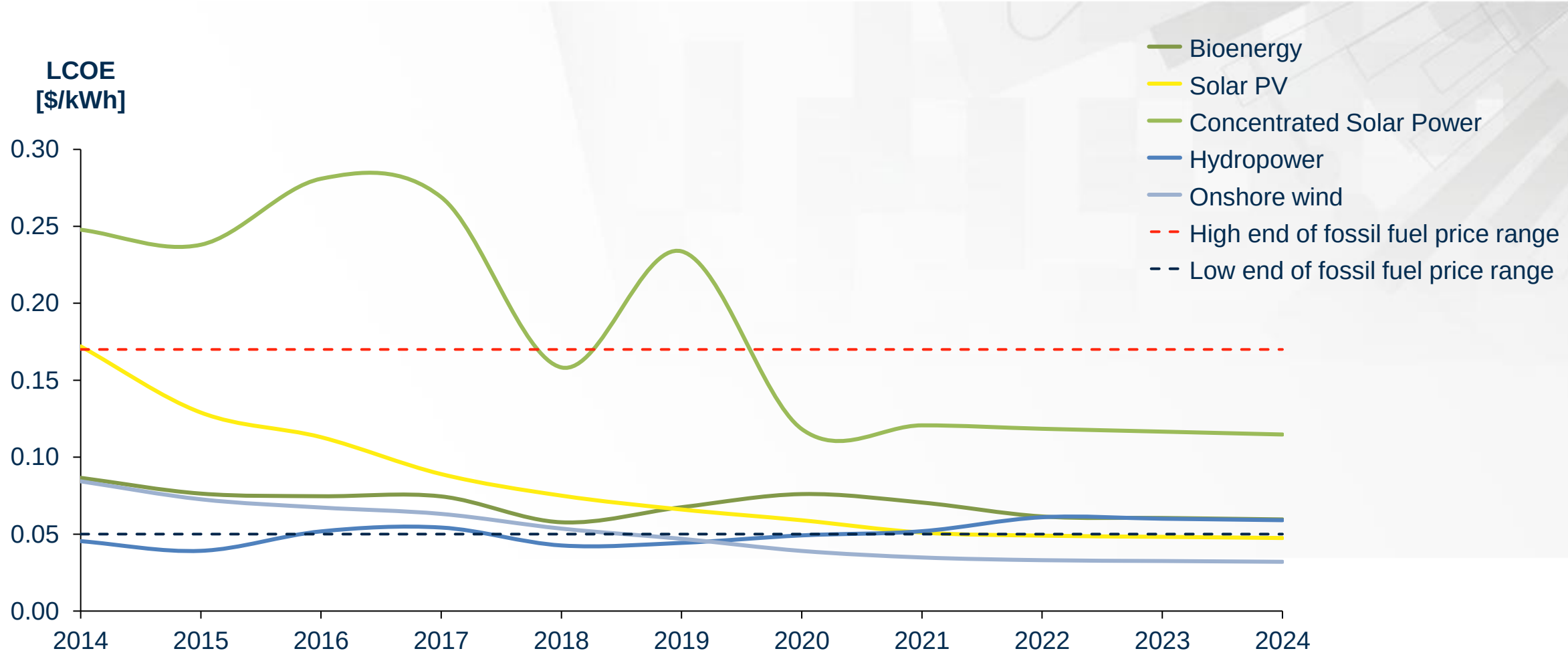


- The graph on the left shows the national average electricity tariff, individual electricity prices will differ.
- The graph shows that increases in the price of electricity prior to 2008 were mostly below inflation.
- Electricity prices increased significantly in 2008 which coincided with the start of load shedding.
- The NERSA proposed electricity tariff increase of 12.74% is above the expected inflation of 4.4% for 2024.
- The national average price of electricity is now above the levelised cost of renewable generation resources which range between R/kWh 0.5 and 0.6 for solar PV and wind utility scale power plants in the REIPPP programmes.

Sources: Eskom MYPD 5 and integrated reports 2022/2023, StatSA, poweroptimal.com/2021-update-Eskom-tariff-increases-vs-inflation-since-1988, Greencape's 2022 LARGE-SCALE RENEWABLE ENERGY MARKET INTELLIGENCE REPORT

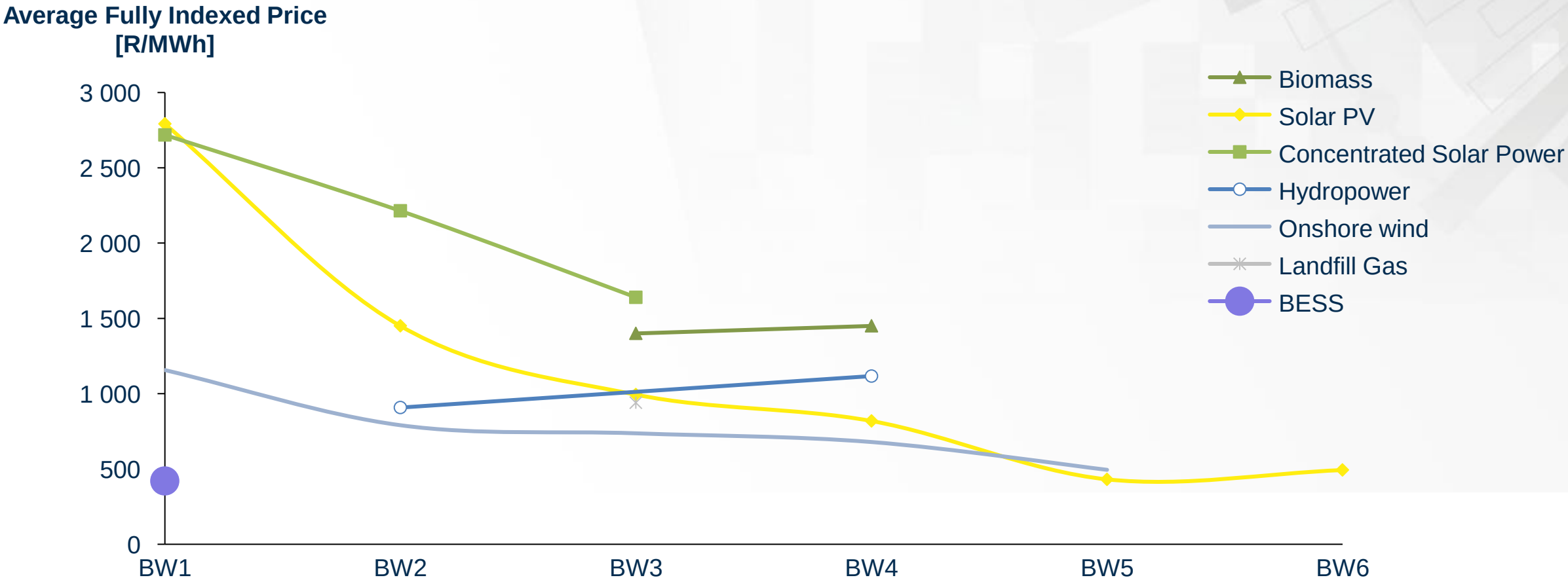
Global Grid Connected Technology Trends Levelised Cost Of Electricity(2014 – 2024).

Declining LCOE of renewable energy technologies highlights their increasing economic viability. LCOE for solar PV and onshore wind is now below the low-end range of fossil fuel prices.



Notes: LCOE: Levelised cost of energy, Low Learning Rate for technology cost forecasting
Sources: Levelized cost of energy by technology, World.

Grid-connected RE technology cost reduction trends – Fully indexed price according to Bid Windows 1-6.Solar PV, CSP, and onshore wind prices have decreased across bid windows, while biomass and landfill gas still face cost challenges.



Notes: BW=Bid Window, BESS=Battery Energy Storage System
Sources: REIPPPP

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Improvements in Eskom fleet performance amid lower residual demand minimised loadshedding in 2024; No new generation installed capacity was added by Eskom and REIPPs in 2024, the proposed NERSA tariff increase of 12.74% takes the average tariff to c/kWh 195.93.

Theme	Key insights
Demand Analysis	➢ Demand for electricity continues to trend down, peak demand is 1% lower for this time of the year compared to the peak in 2023 due to rapid growth of the private sector embedded generation.
Generation Capacity	➢ Eskom fleet installed capacity remained unchanged in 2024 compared to 2023, energy generated from coal is relatively higher due to improved EAF. REIPPP energy contribution is marginally lower in 2024 compared to 2023.
EAF Analysis	➢ The Eskom fleet EAF significantly improved in 2024 and reached a weekly peak of 70% which is much higher than the 59.92% reached last year. The improvement helped to reduce significantly the utilisation of diesel generators.
Loadshedding statistics	➢ South Africa experienced a record amount of load shedding in 2023, however, improvements in the Eskom fleet performance.
Tariff Analysis	➢ The average national electricity tariff has increased by 190% since 2014; the increases are higher than inflation and may impact affordability.

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