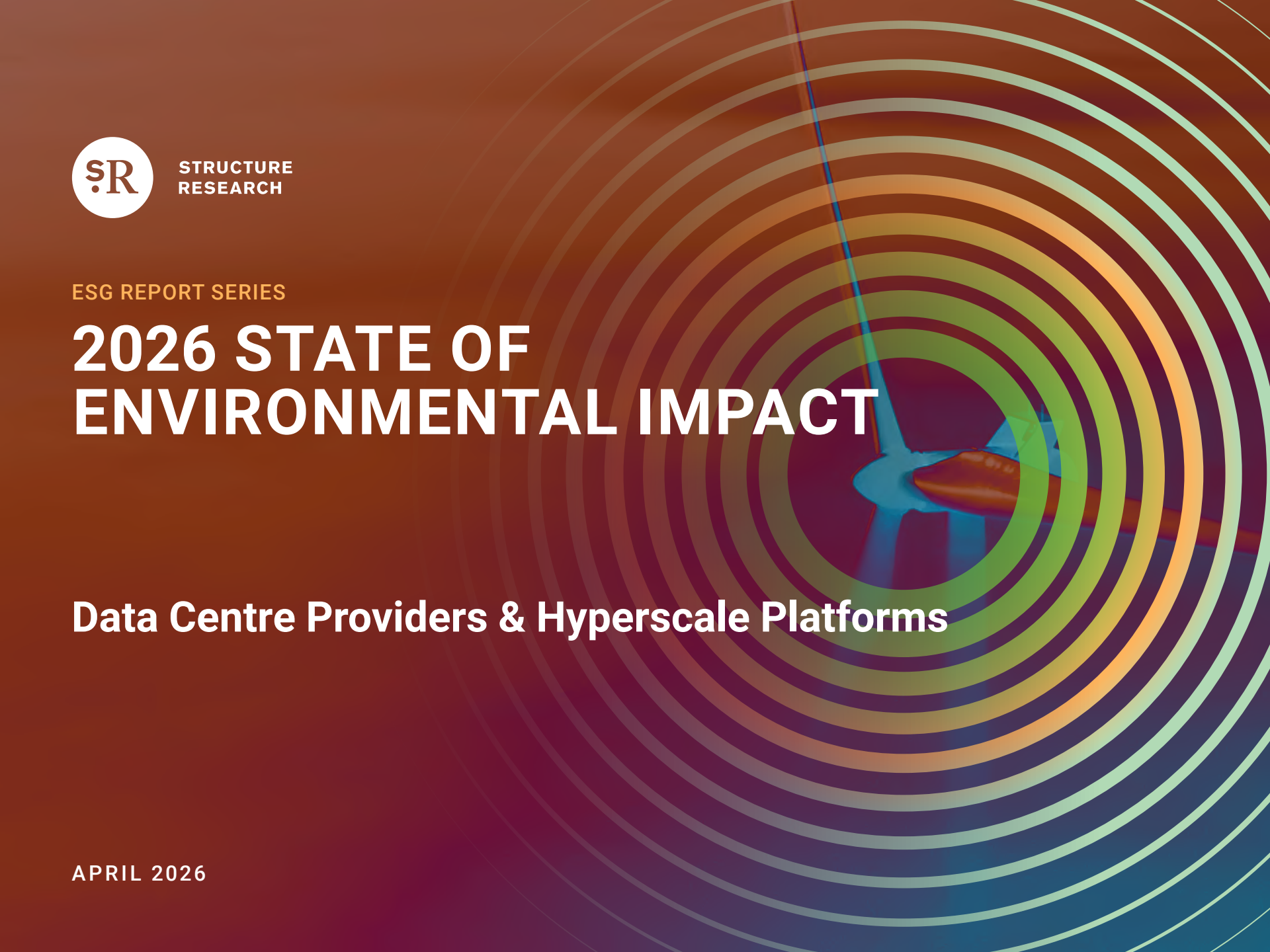
STRUCTURE RESEARCH

ESG REPORT SERIES

2026 STATE OF ENVIRONMENTAL IMPACT

Data Centre Providers & Hyperscale Platforms



APRIL 2026

Executive Summary

The US EIA reported that in 2025, about 29,476 TWh of energy was consumed globally. Of that number about 1.23% is estimated to be attributed to data centres. Globally, data centre companies and hyperscalers have been rapidly expanding their footprint and entering new markets, fueled by the rising demands for AI technologies. This also coincides with larger data centre buildings, increased absolute emissions and higher energy consumption. Higher rack densities for high-performance computing workloads are also driving larger volumes of water withdrawal for cooling. Meeting these demands is of high importance for data centre providers, but with concerns about climate change, energy constraints, and water security, data centres are under scrutiny for their environmental impacts.

Energy availability has become the most important resource in considering new data centre builds. Data centres have been increasingly looking at plots outside of major metros to suburbs and even rural locations in the US. Data centre companies have also been working closely with utility providers to invest in local power generation and infrastructure upgrades. Companies are also going directly to alternative energy sources like natural gas and nuclear to support their new data centres while bringing them to market in a relatively fast timeline. Energy consumption from data centres has seen an increase from 198,746 GWh in 2020 to 362,329 GWh in 2025. Despite the absolute increases in energy consumption, improvements in data centre design and increased rates of carbon-free energy usage has led to reductions in average PUEs between 2020 and 2025. These efficiencies also translate to carbon emissions and water usage, where the absolute volume of emissions and water withdrawal has increased, but the average intensity has actually decreased over the years.

This report is informed by the environmental metrics shared in the ESG and sustainability reports published from various data centre operators and hyperscalers in the industry. We have identified 33 data centre providers and 9 hyperscale cloud companies that have published key environmental metrics for 2024. These 42 companies represent ESG leaders and inform the majority of our data. An additional 5 data centre operators were found to have reported sustainability metrics for prior years but have not published a 2024 report. These five companies were also included to provide a wider understanding of the environmental trends in the industry.

The 2026 State of Environmental Impact report provides insights into the environmental footprint of the data centre industry. This report provides an overview of the environmental impacts of data centres, specifically focused on greenhouse gas emissions, energy consumption, and water usage.

Key Takeaways

1. Total data centre energy consumption made up about 1.23% of the global energy consumption in 2025.
2. Colocation ESG Leaders represent about 51% of the total colocation operational IT capacity.
3. Total data centre emissions grew at a rate of 9.7% between 2020 and 2025. Average emissions per GWh of energy consumption decreased from 328.3 $mtCO_2e$/GWh in 2020 to 229.3 $mtCO_2e$/GWh in 2025.
4. Energy usage by ESG Leaders grew by 20.1% between 2020 and 2025, but renewable energy use has grown considerably faster, at 26.2% over the same period.
5. Average operating PUEs decreased from 1.44 in 2020 to 1.38 in 2025 for data centre providers. For hyperscalers, PUEs remain about the same at 1.21 between 2020 and 2025, with some fluctuations in between.
6. Water consumption by ESG Leaders increased from 55.8 million m^3 in 2020 to 114.9 million m^3 in 2025.

Methodology

Structure Research extracted environmental data from 38 data centre providers and 9 hyperscale platforms with publicly available ESG reports between 2019 and 2024. Key data parameters captured from these ESG reports (if available) include:

- **Greenhouse gas (GHG) emissions (metric ton of CO_2e or $mtCO_2e$)**
  - Scope 1
  - Scope 2 (Market- and Location-Based)
  - Scope 3
- **Total energy usage (in GWh)**
- **Renewable energy usage (in GWh or as a % of total energy usage)**
- **Power Usage Effectiveness (PUE)**
  - Annual operating average
  - Design PUE
- **Total water consumption/withdrawal (in m^3)**
- **Water usage effectiveness (WUE)**
- **Total operational data centre IT capacity (MW)**

In place of unavailable IT capacity data, previous Structure Research datasets were used to fill in the gaps. Values were converted to the appropriate measurement as listed above if required. Since the most recent ESG reports currently published cover the 2024 fiscal year, Structure Research estimated 2025 ESG data based on existing data and market trends.

Not all data centre and hyperscale providers disclose the full range of metrics listed above and thus we used conservative assumptions as well as benchmarking available data to other the ESG Leaders' reported numbers.

Disclaimer: Some companies only produce one enterprise-wide ESG report which does not separate out the company's data centre-specific ESG values. These companies include: Alibaba, Amazon, Google, Microsoft, Oracle, and Tencent. In such cases, Structure Research provided estimates for the company's data centre values using our benchmarking analysis.

Definitions

ESG LEADER
Structure Research defines an ESG Leader as a data centre operator or hyperscale platform which has published a sustainability/ESG report for the 2024 fiscal year with reported metrics on the organisation's carbon emissions, energy usage and/or water consumption.

GREENHOUSE GAS EMISSIONS
Metric ton CO_2 equivalent ($mtCO_2e$): The universal unit of measurement to indicate the global warming potential (GWP) of each greenhouse gas, expressed in terms of the GWP of one unit of carbon dioxide. It is used to evaluate releasing (or avoiding releasing) different greenhouse gases against a common basis.

SCOPE 1 EMISSIONS (SOURCE: EPA)
Direct greenhouse gas emissions from sources that are controlled/owned by the organisation. Examples include fuel combustion for generators, vehicles, boilers.

SCOPE 2 EMISSIONS (SOURCE: EPA)
Indirect greenhouse gas emissions associated with the purchase of electricity, steam, heat, or cooling and are often the result of the organisation's energy use. Scope 2 emissions can be measured by either location-based or market-based:

- **Location-based scope 2 emissions** are emissions based on the energy generation defined by the location of the energy consumption area.
- **Market-based scope 2 emissions** are based on the emissions of the energy generation that the organisation has purchased. Market-based emissions are often lower than location-based emissions if the organisation has purchased carbon-free energy sources.

SCOPE 3 EMISSIONS (SOURCE: EPA)
All indirect emissions that occur in the value chain of the organisation from assets not controlled or owned by the reporting organisation including both upstream and downstream activities.

- Examples include transportation/distribution of products and assets, employee commuting, and end-of-life treatment of sold products.

POWER USAGE EFFECTIVENESS (PUE)
A metric to determine the energy efficiency of a data centre. PUE is calculated by: data centre electricity consumption / IT equipment electricity consumption.

WATER USAGE EFFECTIVENESS (WUE)
A metric to determine the water efficiency of a data centre. WUE is calculated by: data centre water consumption / IT equipment electricity consumption.

RENEWABLE ENERGY
Energy from sources that are inexhaustible. This includes solar, wind, hydro, geothermal, and biofuels.

CARBON-FREE ENERGY
Energy from sources that emits relatively little or no carbon but are still finite resources. This includes nuclear energy and natural gas.

ESG Leaders

DC PROVIDERS

- AirTrunk
- ark
- ark data centres
- Ascenty
- atNorth
- CDC Data Centres
- Chindata
- Cologix
- Colt DCS
- Compass
- Coresite
- Crusoe
- CyrusOne
- DATA4
- Databank
- Digital Edge
- Digital Realty
- EdgeConnex
- Equinix
- Flexential
- GDS
- Global Switch
- Green Mountain
- Iron Mountain
- Keppel DC REIT
- Nebius
- NEXTDC
- NTT DATA
- Princeton Digital Group
- QTS
- Sabey Data Centers
- Scala Data Centers
- Stack Infrastructure
- STT GDC
- SUNeVision (iAdvantage)
- Switch
- Vantage
- VNET

HYPERSCALE PLATFORMS

- Alibaba
- Amazon
- Apple
- Google
- Kingsoft Cloud
- Meta
- Microsoft
- Oracle
- Tencent

Data Centre Providers: 2024 Environmental Data Reporting by Segment

	CARBON EMISSIONS			ENERGY CONSUMPTION			WATER	
Company	Scope 1	Scope 2 (Location or Market)	Scope 3	Total Usage	Renewable Usage	PUE	Total Usage	WUE
AIRTRUNK	✓	✓	✓	✓	✓	✓	✓	✓
ark data centers				✓	✓	✓		✓
Ascenty	✓	✓	✓	✓	✓	✓	✓	✓
atnorth	✓	✓	✓		✓	✓		✓
CDC	✓	✓				✓		✓
cologix	✓	✓	✓	✓	✓	✓		✓
colt Data Centre Services	✓	✓	✓	✓	✓	✓	✓	
COMPASS datacenters	✓	✓	✓					✓
Crusoe	✓	✓	✓	✓	✓			
CyrusOne	✓	✓	✓	✓	✓	✓	✓	✓
Data4	✓	✓	✓		✓	✓		✓

Data Centre Providers: 2024 Environmental Data Reporting by Segment, Cont.

	CARBON EMISSIONS			ENERGY CONSUMPTION			WATER	
Company	Scope 1	Scope 2 (Location or Market)	Scope 3	Total Usage	Renewable Usage	PUE	Total Usage	WUE
DATABANK	✓	✓	✓	✓	✓	✓	✓	✓
Digital Edge DC	✓	✓	✓	✓	✓		✓	
DIGITAL REALTY	✓	✓	✓	✓	✓		✓	
edgeconnex	✓	✓	✓	✓	✓	✓	✓	
EQUINIX	✓	✓	✓	✓	✓	✓	✓	✓
FLEXENTIAL	✓	✓		✓	✓	✓		
DAYONE	✓	✓	✓	✓	✓	✓	✓	✓
GLOBAL SWITCH	✓	✓	✓	✓	✓	✓	✓	✓
Green Mountain	✓	✓	✓		✓	✓	✓	✓
IRON MOUNTAIN DATA CENTERS	✓	✓		✓	✓	✓	✓	✓
Keppel DC REIT	✓	✓	✓	✓	✓		✓	

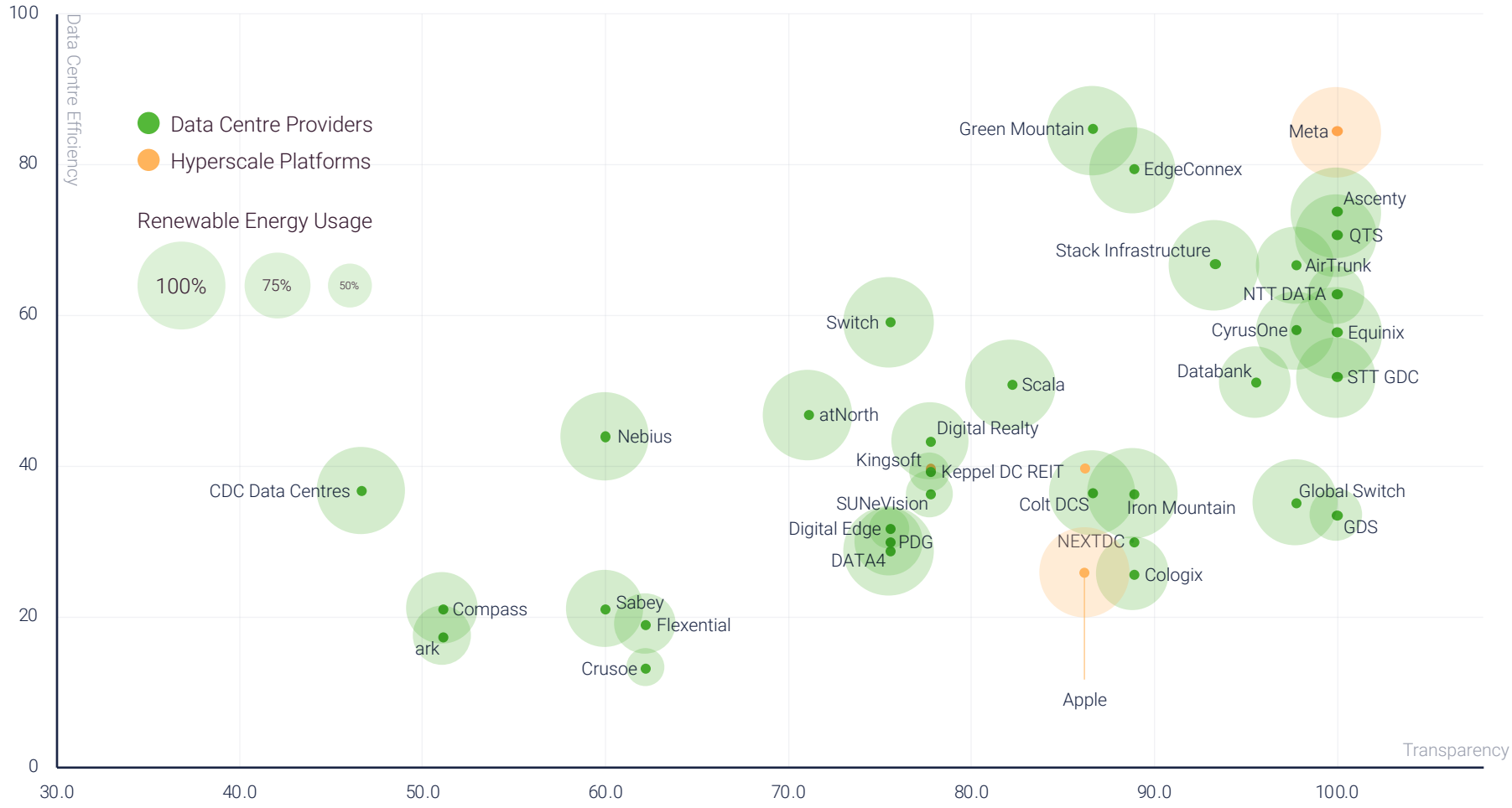
Data Centre Providers: 2024 Environmental Data Reporting by Segment, Cont.

	CARBON EMISSIONS			ENERGY CONSUMPTION			WATER	
Company	Scope 1	Scope 2 (Location or Market)	Scope 3	Total Usage	Renewable Usage	PUE	Total Usage	WUE
NEBIUS	✓	✓		✓	✓	✓		
NEXTDC	✓	✓		✓	✓	✓	✓	✓
NTT DATA	✓	✓	✓	✓	✓	✓	✓	✓
PDG	✓	✓	✓	✓	✓	✓		
QTS	✓	✓	✓	✓	✓	✓	✓	✓
sabey Data Centers	✓	✓	✓	✓	✓			
SCALA DATA CENTERS	✓	✓	✓	✓	✓		✓	✓
STACK INFRASTRUCTURE	✓	✓	✓	✓	✓	✓	✓	✓
STTelemedia Global Data Centres	✓	✓	✓	✓	✓	✓	✓	✓
sunevision	✓	✓		✓	✓		✓	✓
switch	✓	✓		✓	✓		✓	✓

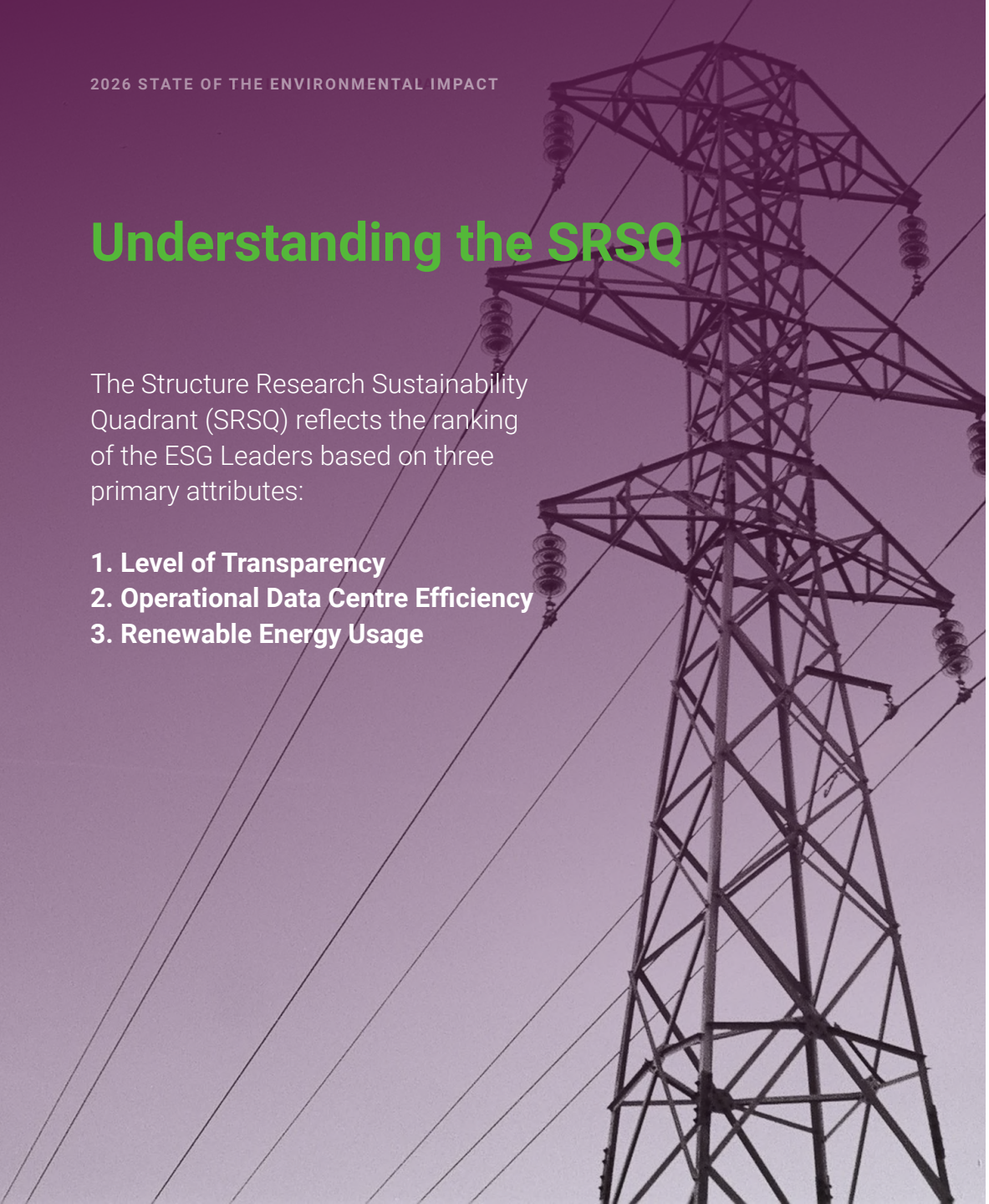
Hyperscale Providers: 2024 Environmental Data Reporting by Segment

	CARBON EMISSIONS			ENERGY CONSUMPTION			WATER	
Company	Scope 1	Scope 2 (Location or Market)	Scope 3	Total Usage	Renewable Usage	PUE	Total Usage	WUE
Alibaba	✓	✓		✓	✓	✓	✓	✓
amazon	✓	✓	✓		✓	✓		✓
	✓	✓	✓	✓	✓		✓	
Google	✓	✓	✓	✓	✓	✓	✓	
Kingsoft Cloud	✓	✓	✓	✓		✓	✓	
Meta	✓	✓	✓	✓	✓	✓	✓	✓
Microsoft	✓	✓	✓	✓	✓	✓	✓	✓
ORACLE	✓	✓	✓	✓	✓		✓	
Tencent	✓	✓	✓	✓	✓	✓	✓	✓

SR SUSTAINABILITY QUADRANT



Alibaba, Amazon, Google, Microsoft, Oracle, Tencent: These hyperscale cloud companies have published an ESG report for 2024 at a consolidated group level. The reports do not publish environmental data for the cloud infrastructure business and were excluded from the Sustainability Quadrant as an accurate score could not be calculated. Scores are normalized from 0-100, see next pages for details.



Understanding the SRSQ

The Structure Research Sustainability Quadrant (SRSQ) reflects the ranking of the ESG Leaders based on three primary attributes:

1. Level of Transparency
2. Operational Data Centre Efficiency
3. Renewable Energy Usage

1. TRANSPARENCY

While we applaud all of our ESG Leaders for being trailblazers at producing the first wave of ESG reports, it is also striking the amount of variance in terms of reported data within the ESG Leader group. Some have disclosed more environmental parameters compared to others. The goal of placing Transparency as a pillar of the SRSQ is to incentivize and encourage the current group of ESG Leaders as well as providers that are in the process of producing their ESG reports to prioritize transparency over only reporting data that reflects positively on a company's operating metrics.

Transparency scoring: Providers are scored on the below categories of reported environmental data. One point was awarded for each category reported in 2024 and 0.25 points were awarded based on the number of ESG reports published between 2020 and 2024. The points were summed and scaled to 100 to calculate the final Transparency Score.

Understanding the SRSQ, Cont.

2. OPERATIONAL DATA CENTRE EFFICIENCY

This category measures data centre operating efficiency across three main segments:

Annual Average Operating Power Usage Effectiveness (PUE)

- PUE = Total Energy Usage / Total Energy Used by the IT Equipment
- The PUE is a metric used to measure the actual energy efficiency of a data centre that incorporates a time series element to arrive at the annual operating average. This is different and a more accurate measure of data centre efficiency compared to the "Design PUE" metrics which only reflect the theoretical optimal PUE of the facility when running at full load
- A PUE of 1.0 would be ideal, as it would indicate that all of the energy used by the data centre is being used to power the IT equipment. However, in reality, most data centres have a PUE of 1.2 to 1.8, due to losses in the data center infrastructure, such as cooling systems, power distribution systems, and lighting.
- The lower the provider's PUE, the higher their score will be for this category

Carbon Intensity (CI) = (Scope 1 + Scope 2 Emissions) / Total Energy Usage

- The CI metric reflects the amount of carbon emissions generated relative to the total energy usage of the provider. The lower the provider's CI, the higher their score will be for this category.

Water Intensity (WI) = Total Water Usage / Total Energy Usage

- The WI metric reflects the amount of water used within the provider's data centre footprint relative to the total energy used within the data centre. The lower the provider's WI, the higher their score will be for this category

Scoring: Providers are given a normalized score between 0-100 for each category (PUE, CI, WI). The normalized score is calculated using the standard normalisation formula for each category, with modifications to scale the scores within 0-100. The formulas also account for lower values of PUE, CI, and WI being scored higher, since lower PUE, CI, and WI represents more efficiency. Scores are calculated based on reported data. For CI, a provider that reported only one of either scope 1 or scope 2 was given a CI score, with the missing data point estimated. When reported Total Energy Usage was unavailable, an estimate was calculated for scoring. Providers that did not report data for any of these categories received a score of 0 in that category. The final category scores were then added together and further normalized such that the final Data Centre Efficiency score falls within a range of 0-100. Note that the efficiency scoring does not factor in regional differences that can cause variations in data centre sustainability metrics. See page 51 for further details.

Understanding the SRSQ, Cont.

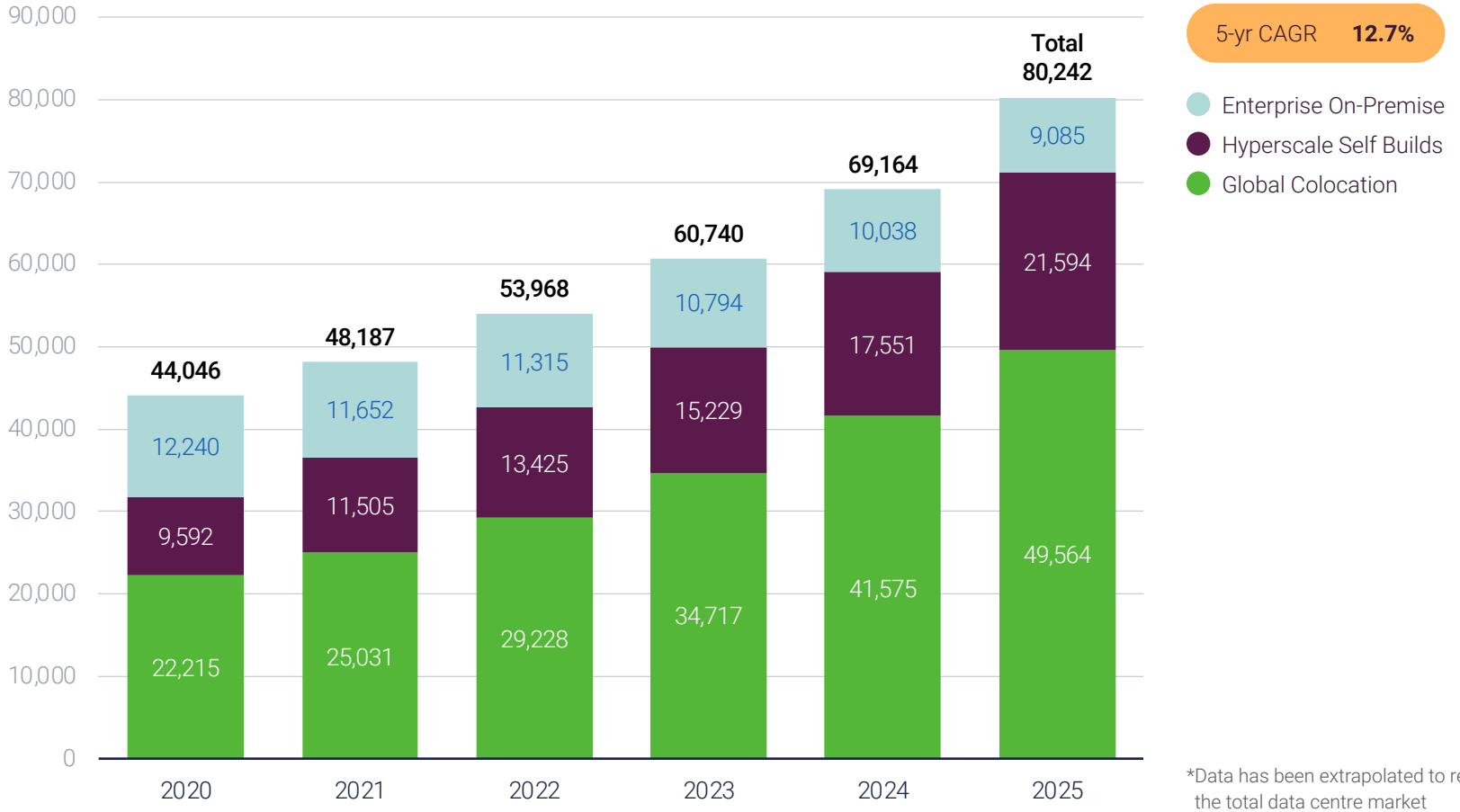
3. RENEWABLE ENERGY

This category measures the percentage of renewable energy used relative to the total energy usage of a provider's data centre footprint. The higher the % of renewable energy used, the higher the provider's score will be. The renewable energy % score is reflected in the size of the bubble surrounding each provider's company name in the SRSQ chart.

4. OUTLIERS

We give credit to companies who have published an ESG report for their entire enterprise, although the company may not report data breaking out data centre specific metrics. The reported data points in the enterprise-level ESG reports are reflected in the Reporting by Segment charts on pages 6–9. Structure Research uses the information provided in these reports towards the estimation of global sustainability metrics (e.g. total data centre emissions), however, an accurate efficiency score cannot be calculated for these companies' data centre/cloud business. These companies were left out of the SRSQ for this report. This includes: Alibaba, Amazon, Google, Microsoft, Oracle, and Tencent. The SRSQ also excludes the data centre providers that did not publish an updated 2024 ESG report or relevant data points, but has previously reported. The data points from these companies' ESG reports for the 2023 fiscal year and earlier helped inform industry-wide sustainability metrics in this report, but were excluded from the SRSQ. These companies include ark data centres, Chindata, Coresite, Vantage, and VNET.

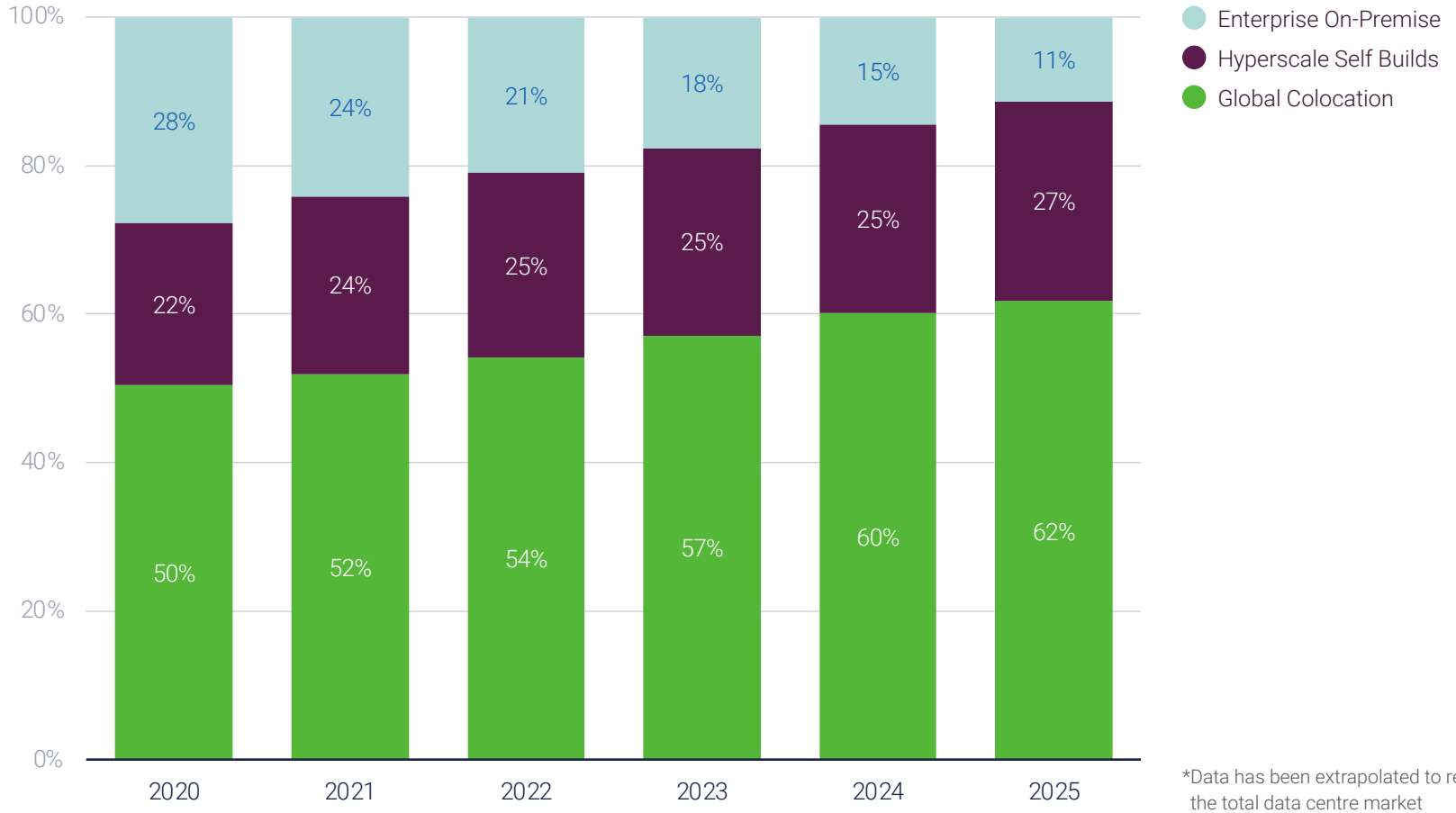
Total Data Centre Market: Operational IT Capacity (MW)



*Data has been extrapolated to represent the total data centre market

Total Data Centre Market: Operational IT Capacity

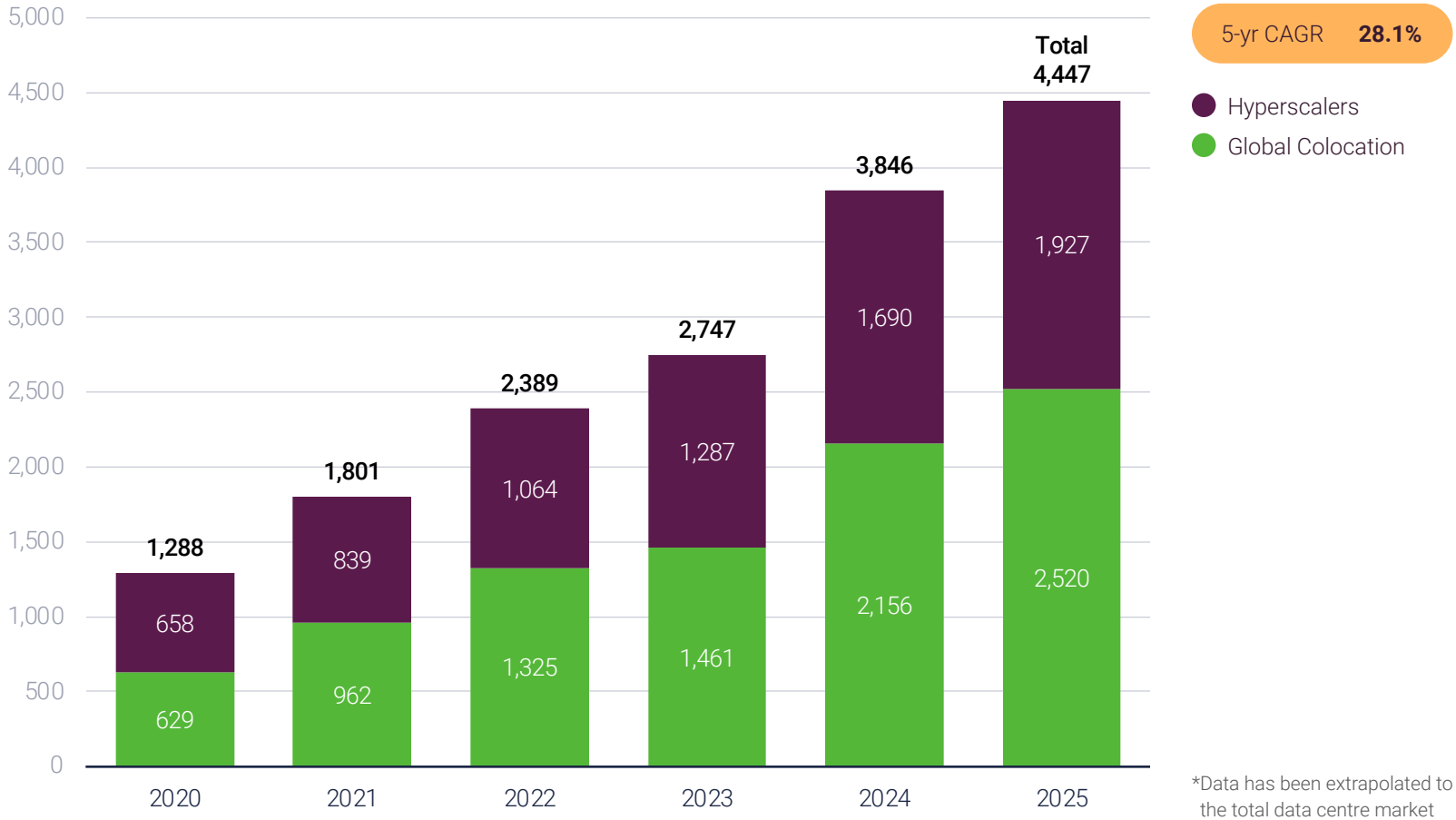
SEGMENT % SHARE



*Data has been extrapolated to represent the total data centre market

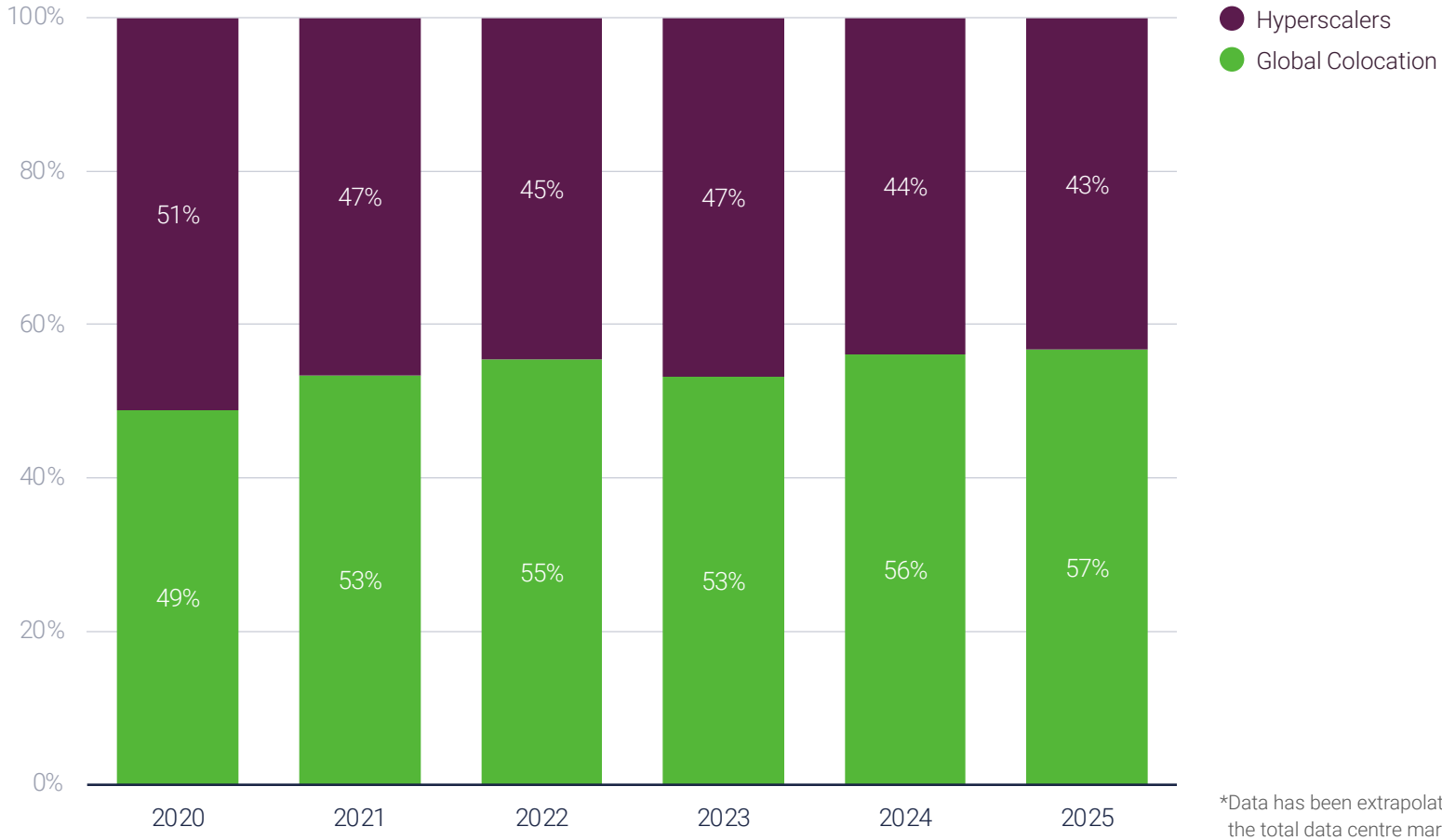
Scope 1 Emissions

In thousands $mtCO_2e$



*Data has been extrapolated to represent the total data centre market

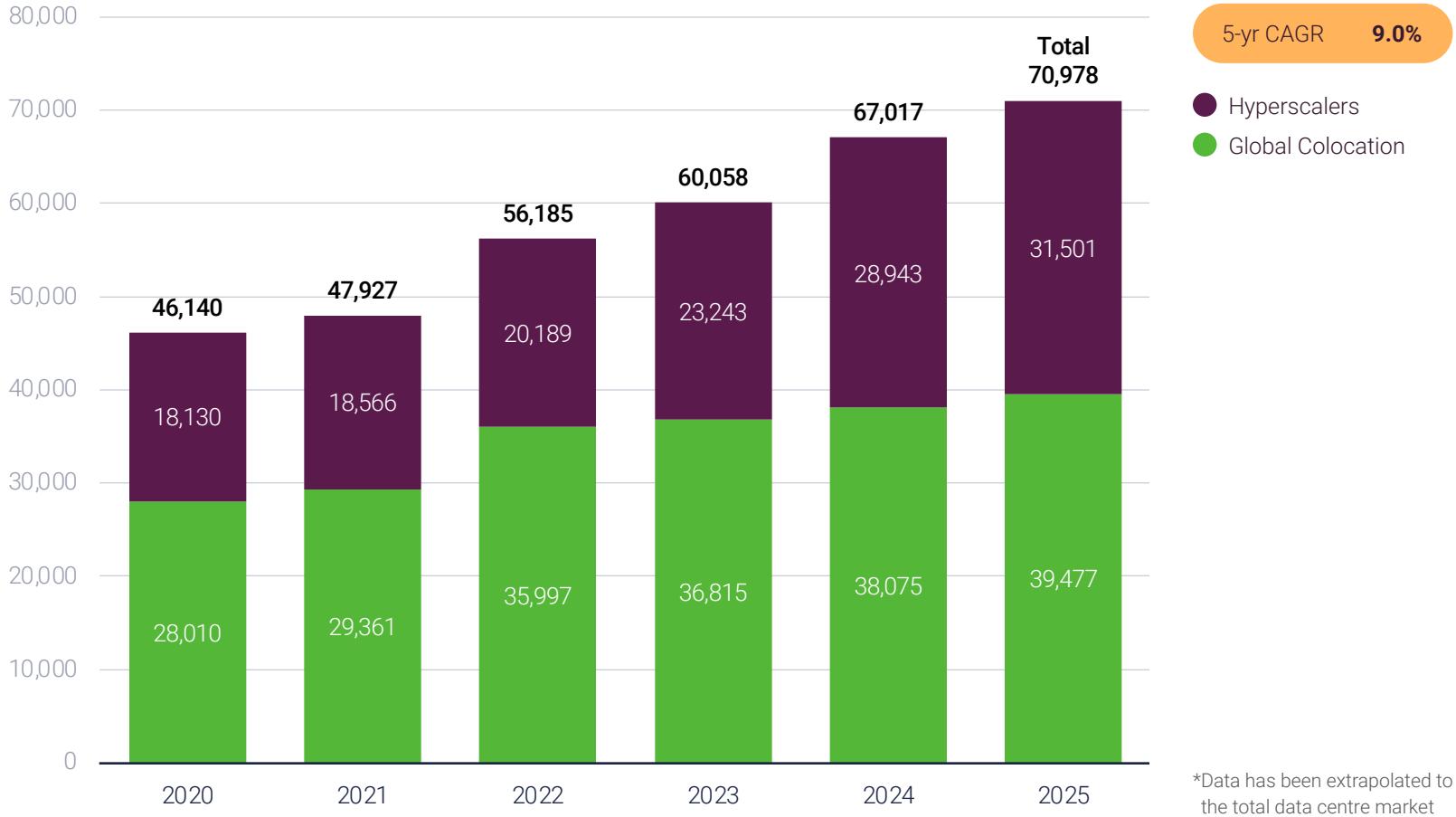
Scope 1 Emissions (%)



*Data has been extrapolated to represent the total data centre market

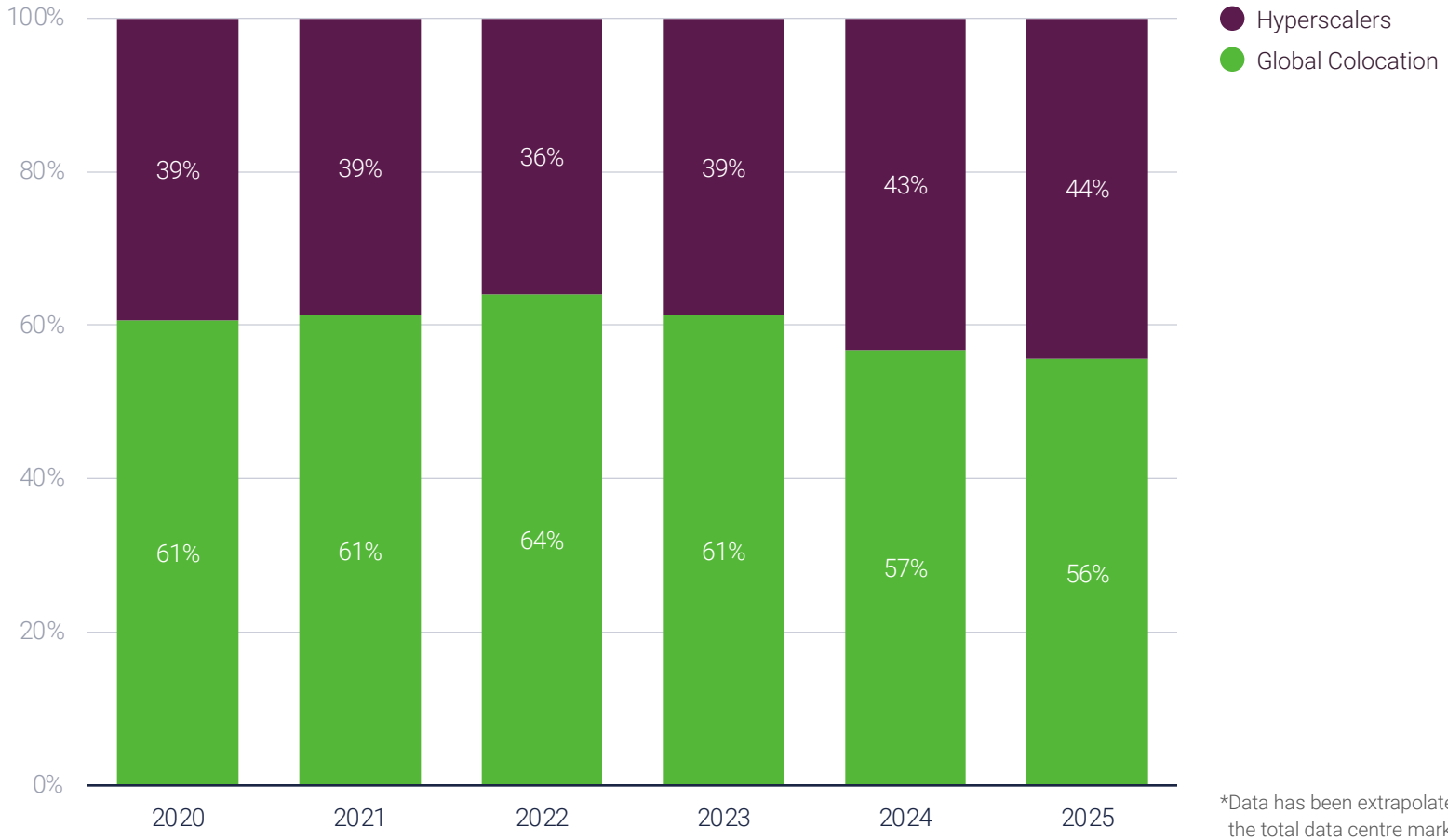
Scope 2 (Location-Based) Emissions

In thousands $mtCO_2e$



*Data has been extrapolated to represent the total data centre market

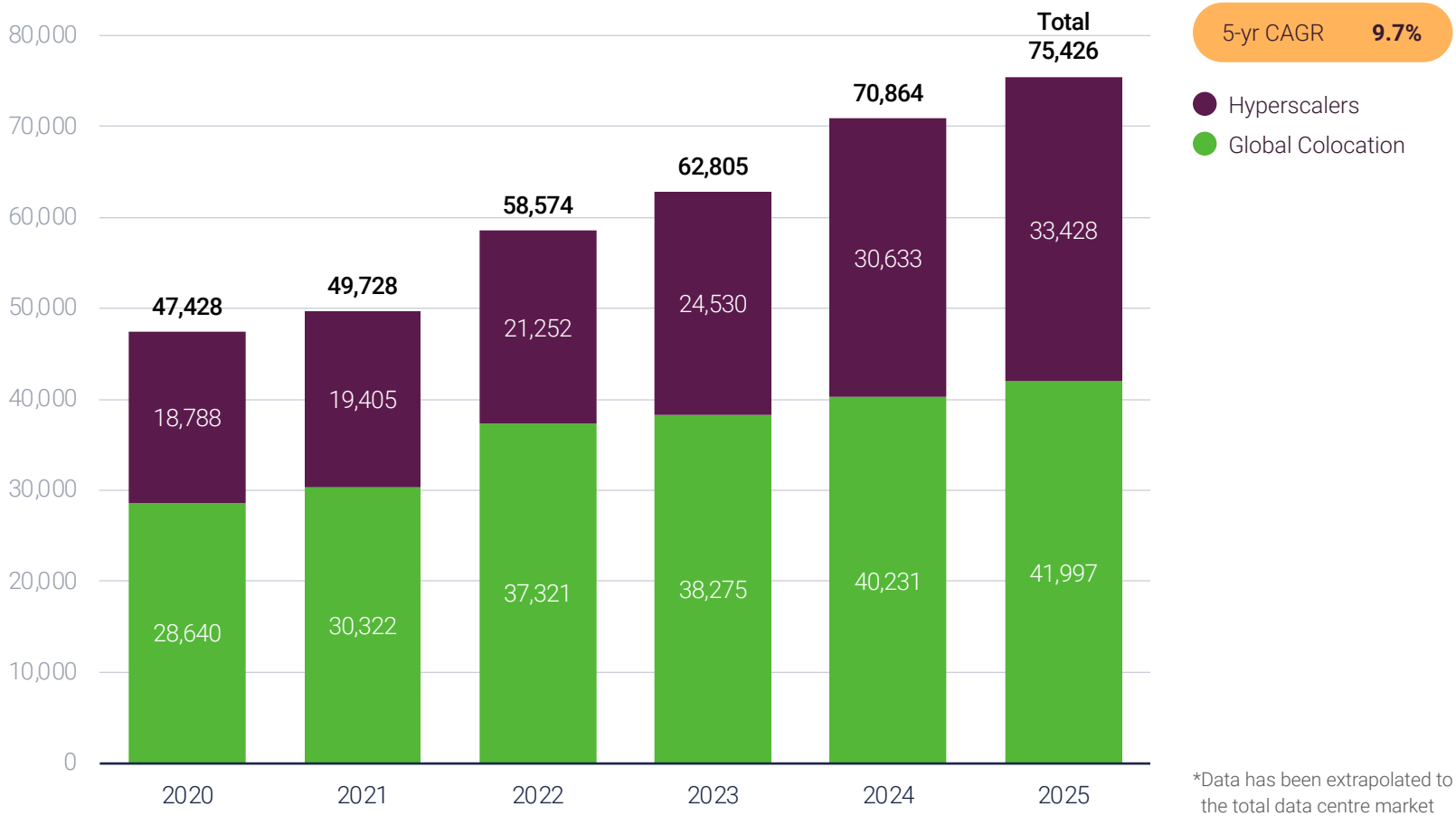
Scope 2 (Location-Based) Emissions (%)



*Data has been extrapolated to represent the total data centre market

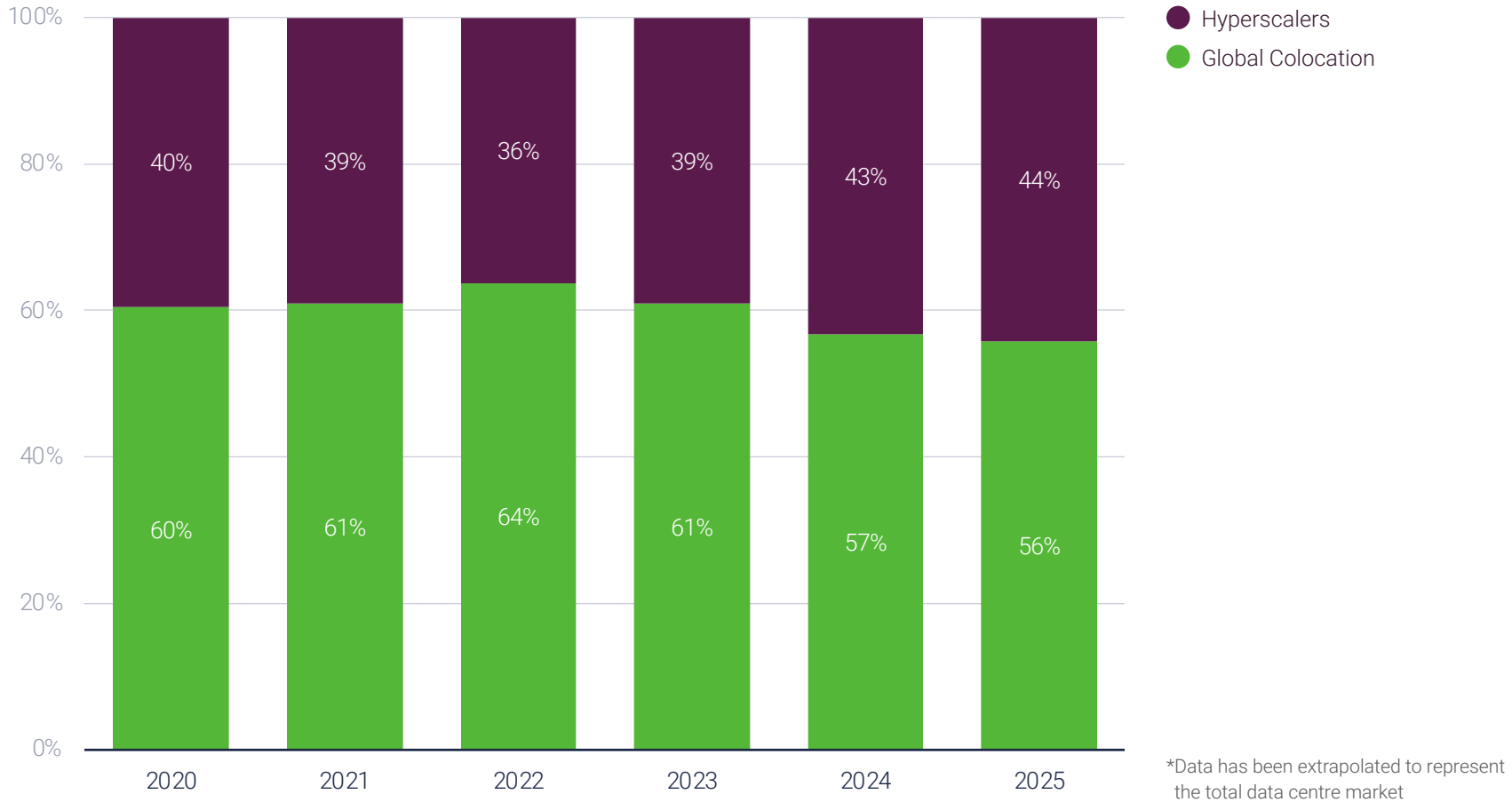
Total Scope 1 + Scope 2 (Location-Based) Emissions

In thousands $mtCO_2e$



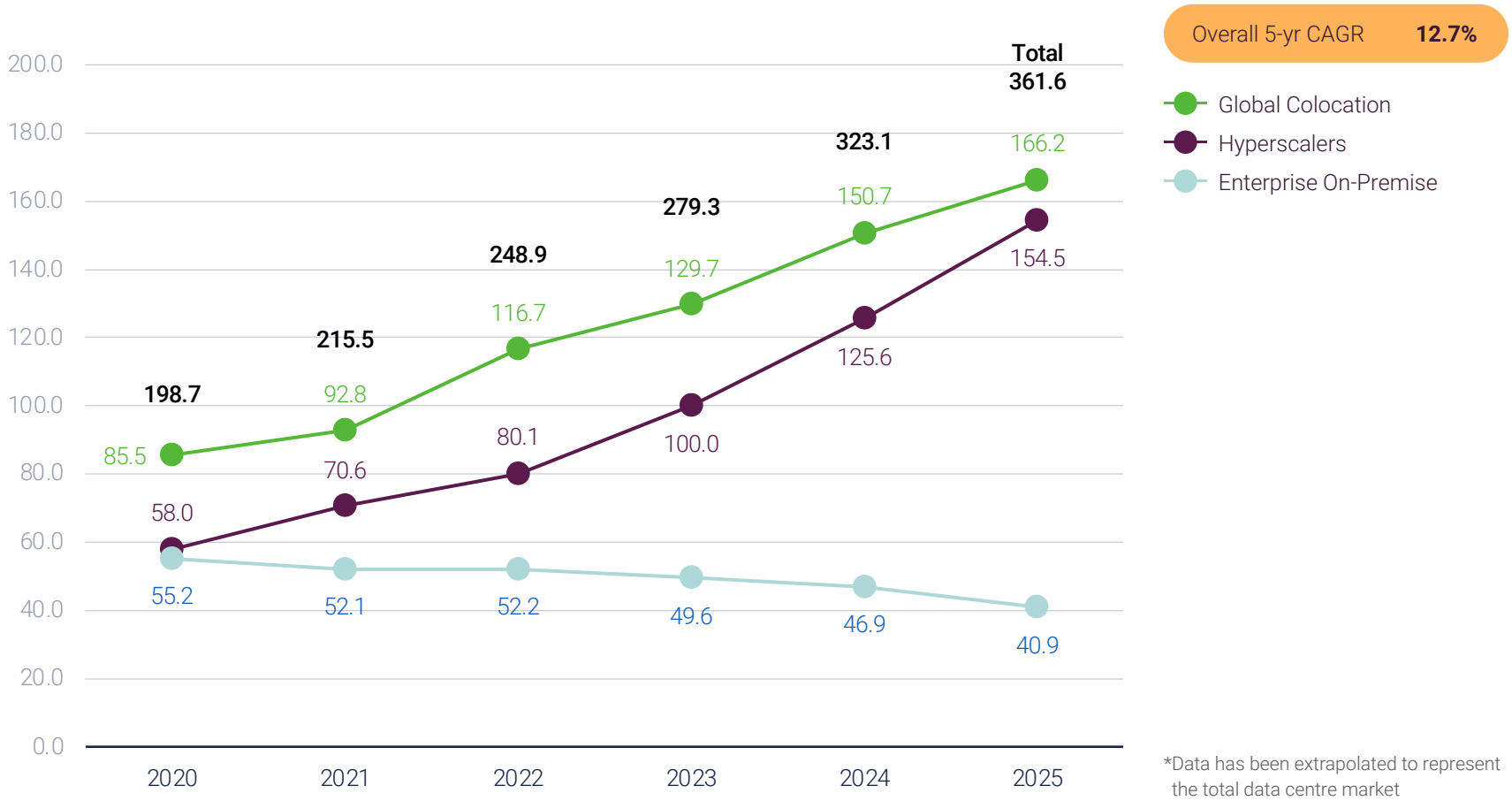
*Data has been extrapolated to represent the total data centre market

Total Scope 1 + Scope 2 (Location-Based) Emissions (%)



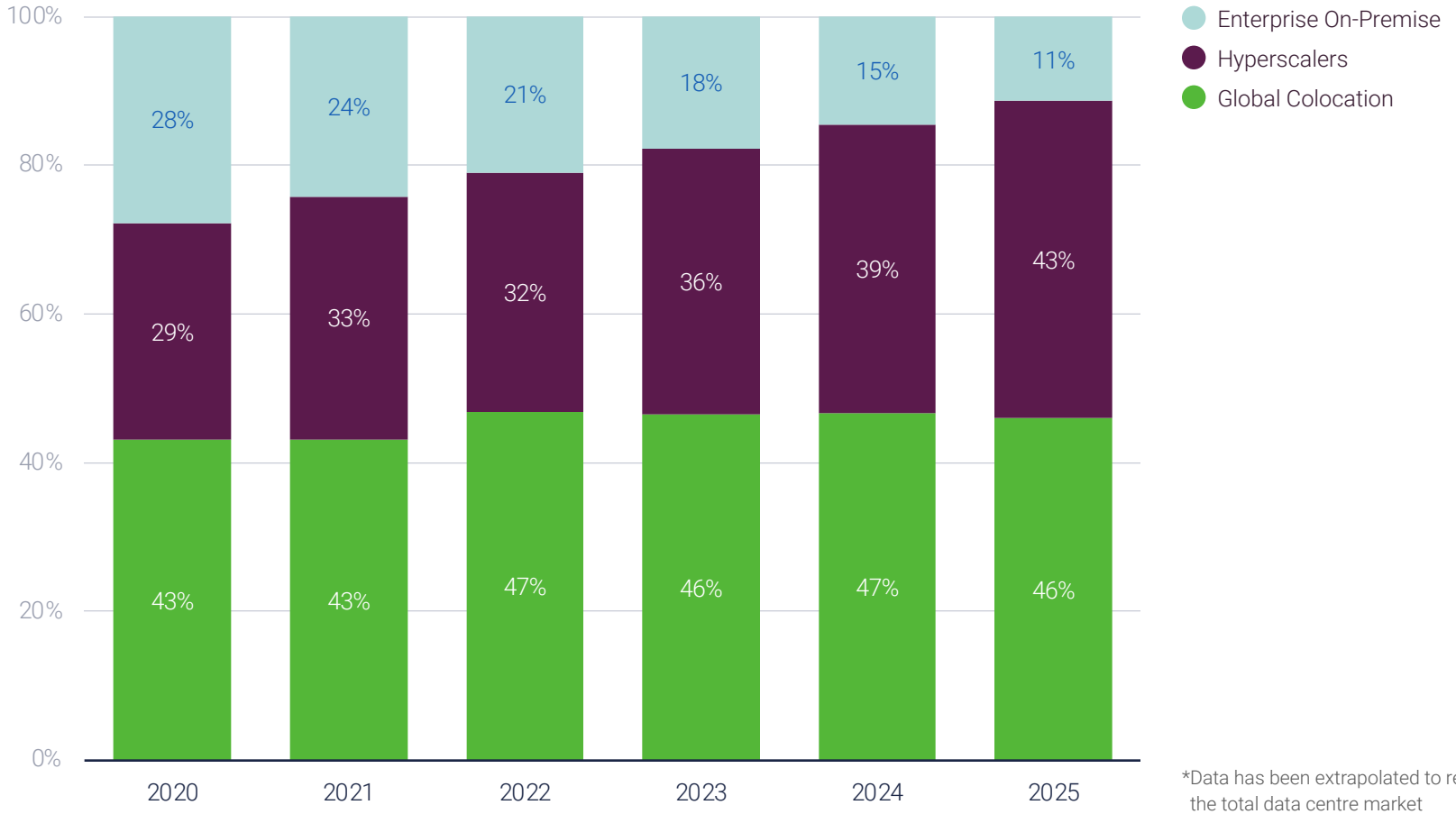
*Data has been extrapolated to represent the total data centre market

Total Energy Consumption (TWh)



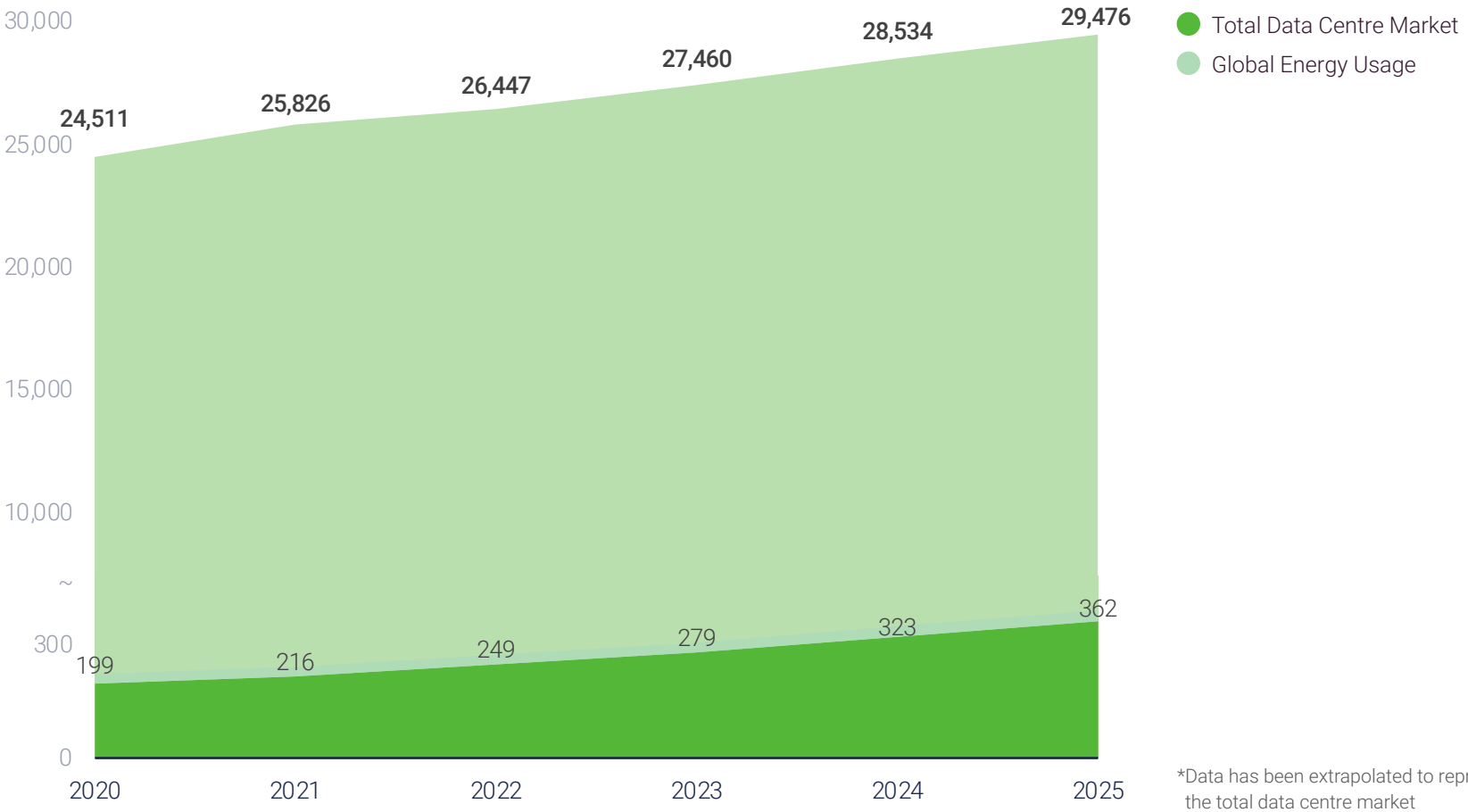
*Data has been extrapolated to represent the total data centre market

Total Energy Consumption (%)



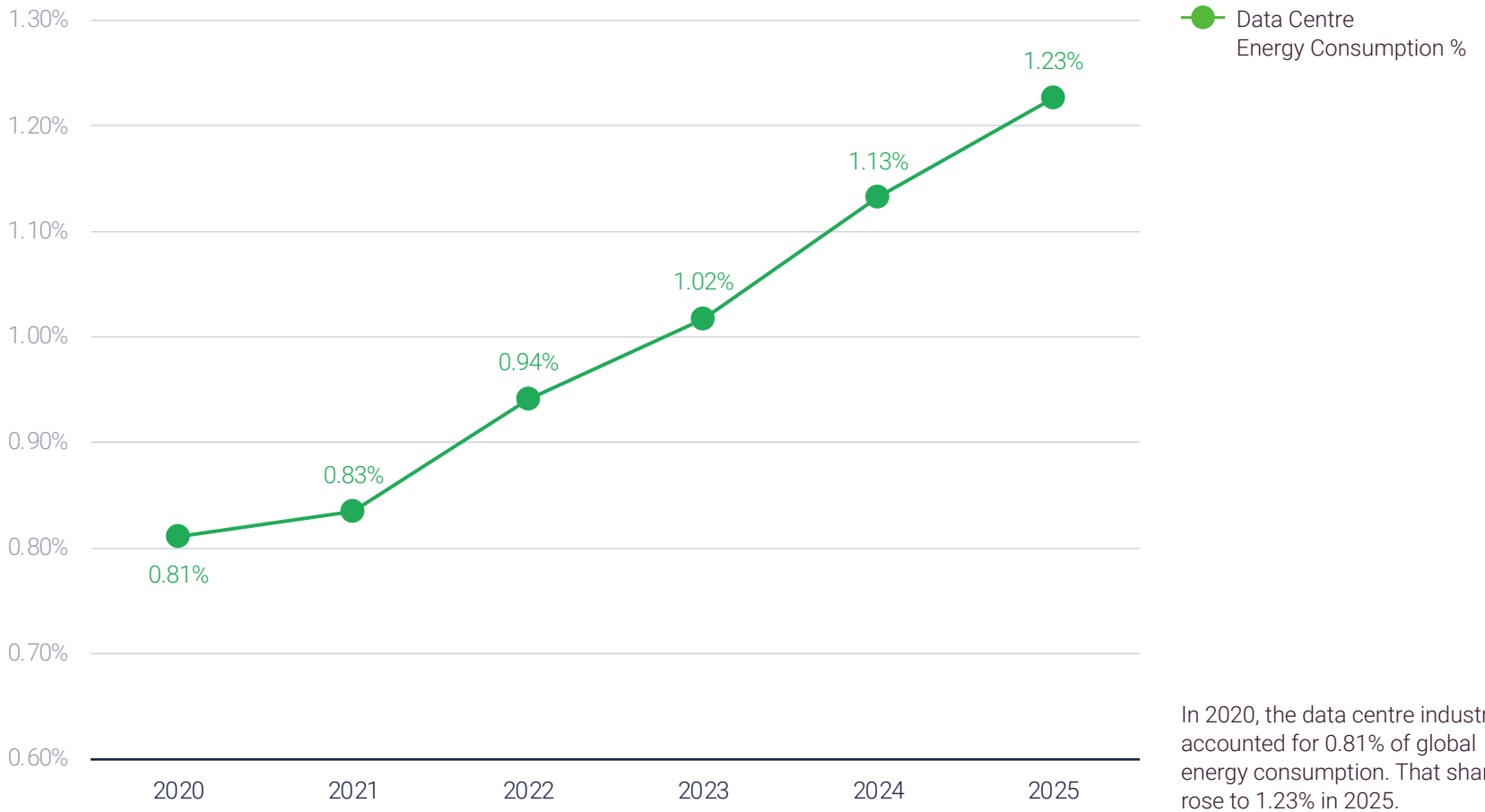
*Data has been extrapolated to represent the total data centre market

Total Data Centre Market vs. Global Energy Usage (TWh)



*Data has been extrapolated to represent the total data centre market

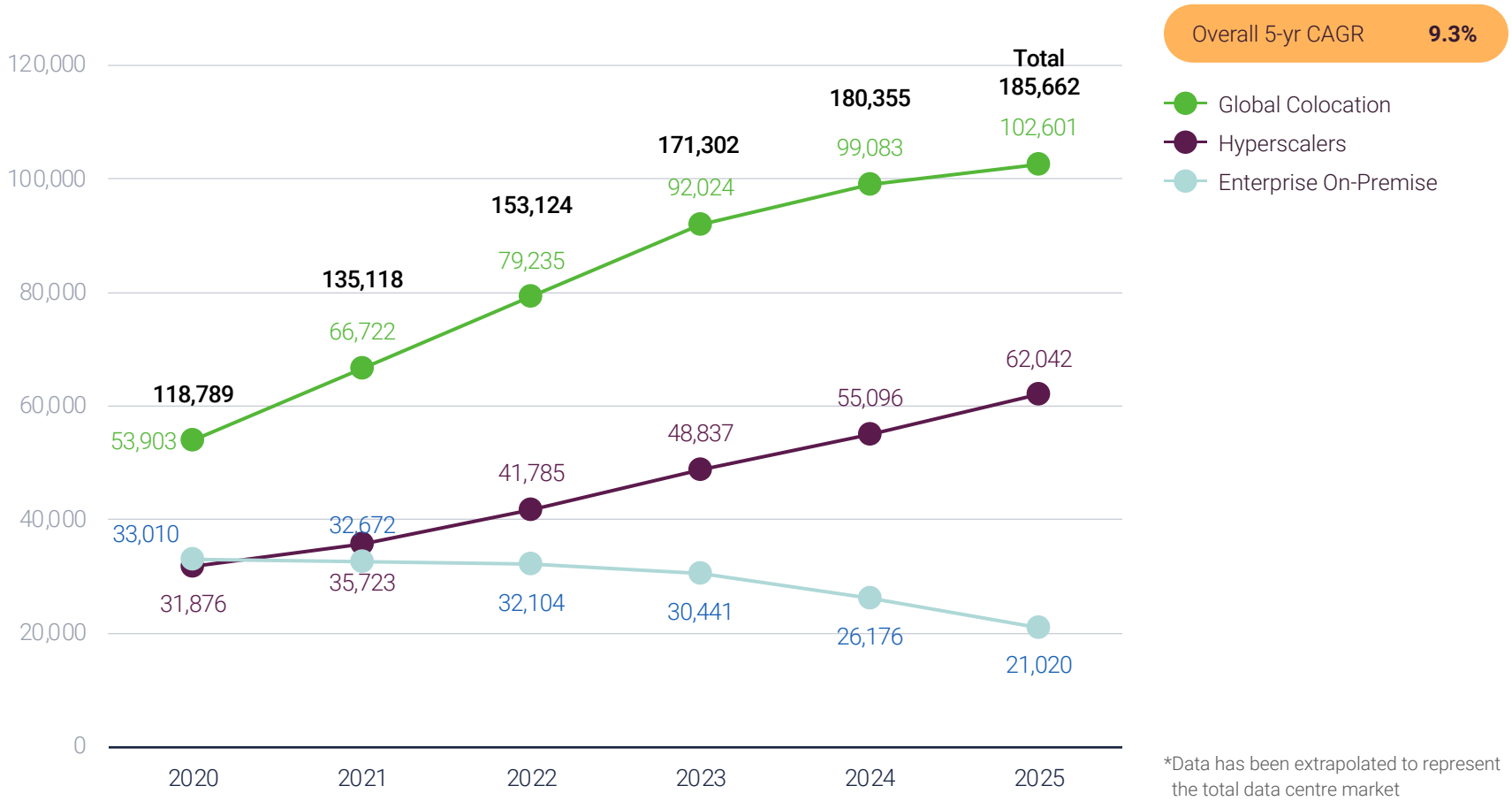
Data Centre vs. Global Energy Consumption (%)



In 2020, the data centre industry accounted for 0.81% of global energy consumption. That share rose to 1.23% in 2025.

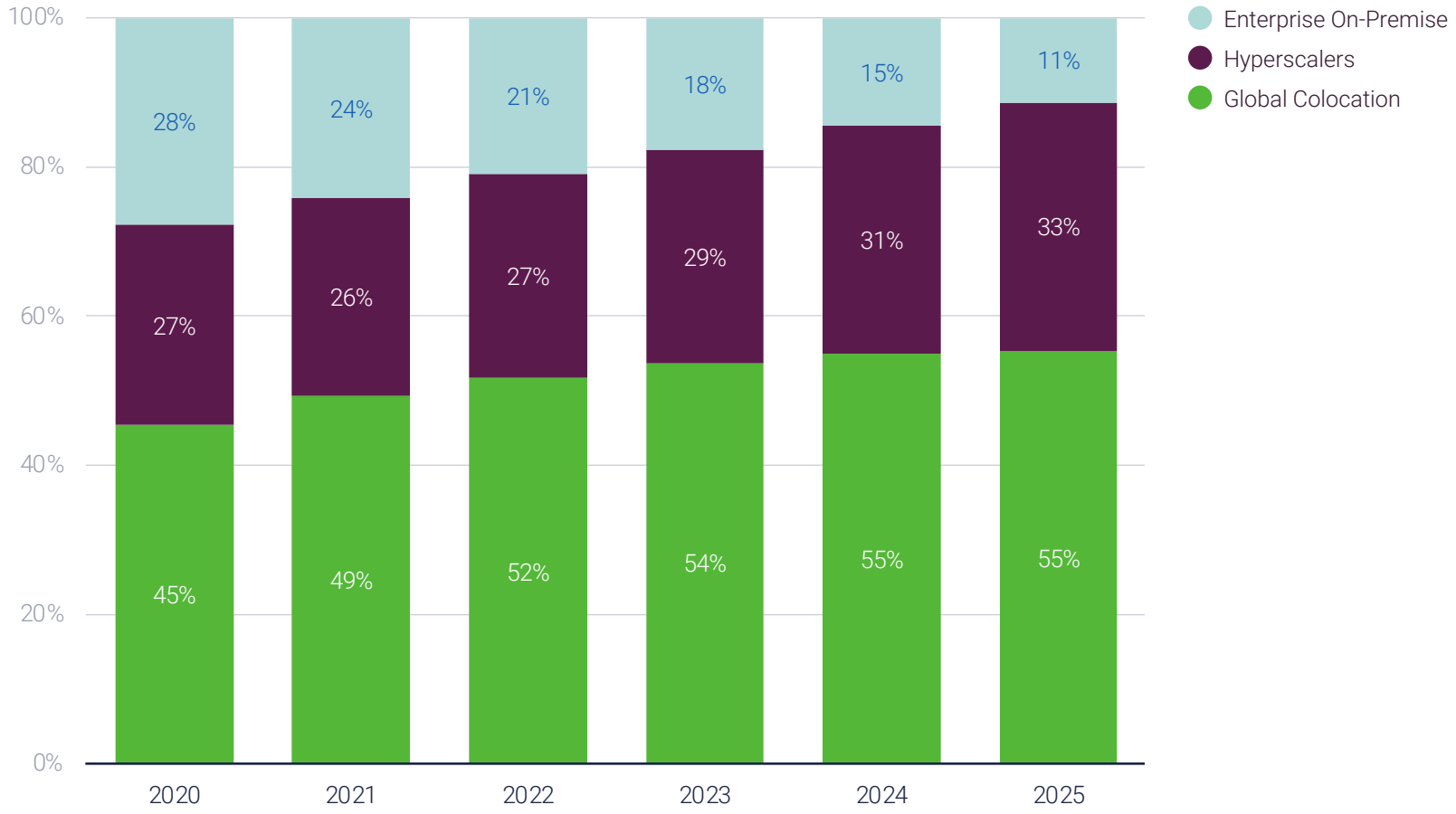
Total Water Consumption

In thousands m³



*Data has been extrapolated to represent the total data centre market

Total Water Consumption (%)



Global Market Insights

OPERATIONAL IT CAPACITY

- Total operational IT capacity in the data centre industry reached an estimated 80,242 MW in 2025, up from 69,164 MW in 2024 and 44,046 MW in 2020, growing at a 5-yr CAGR of 12.7%.
- Global colocation makes up about 49,564 MW of the total IT capacity in 2025, or about 62%. This is up from 22,215 MW in 2020, or 50% of the total market share and growing at a CAGR of 17.4%.
- Hyperscale self-build capacity has reached 21,594 MW of operational IT capacity in 2025, up from 9,592 MW in 2020 and growing at a 5-yr CAGR of 17.6%.
- Hyperscale self-builds make up about 27% of the total operational capacity in 2025, up from 22% in 2020.
- Enterprise on-premises capacity decreased from 12,240 MW in 2020 to 9,085 MW in 2025, decreasing at a 5-yr CAGR of about -5.8%.
- The decline in on-premise capacity reflects the pattern of enterprises shifting workloads to off-premise services like colocation for largely economic, cost-saving reasons.
- This rise in IT capacity also frames the growth of carbon emissions, energy and water usage. More and more IT workloads need to be deployed and data centre operators and hyperscalers aim to capture those workloads and demands.
- Resources needed to support future demands will only increase, reflecting a wider need to balance capacity growth and sustainability measures.

TOTAL CARBON EMISSIONS

- Scope 1 carbon emissions from total data centres increased from 1.288 million $mtCO_2e$ in 2020 to 4.447 million $mtCO_2e$ in 2025, growing at a 5-yr CAGR of 28.1%.
- Scope 1 emissions from colocation providers in 2025 is an estimated 2.520 million $mtCO_2e$, compared to 629 thousand in 2020.
- Scope 1 emissions from hyperscalers in 2025 is an estimated 1.927 million $mtCO_2e$, compared to 658 thousand in 2020.
- Global colocation providers are estimated to account for approximately 57% of the total scope 1 emissions in 2025.
- Total scope 2 emissions for the data centre market increased from 46.140 million $mtCO_2e$ in 2020 to 70.978 million $mtCO_2e$ in 2025 at a 5-yr CAGR of 9.0%.
- Global colocation providers account for approximately 56% of the total scope 2 emissions.
- The total amount of carbon emissions (scope 1 + scope 2) has increased on a yearly basis, increasing at a 5-yr CAGR of 9.7%.
- About 56% of the total emissions are from colocation providers in 2025.
- Hyperscalers have grown their emissions more slowly than data centre providers despite similar capacity growth rates. This can be attributed to the amount of renewable energy procurements that hyperscalers invest in to offset their carbon emissions.
- Colocation providers are also heavily procuring carbon offsets and implementing more efficient data centre designs, but these strategies are more varied based on the provider and the regions they operate in.

Global Market Insights, Cont.

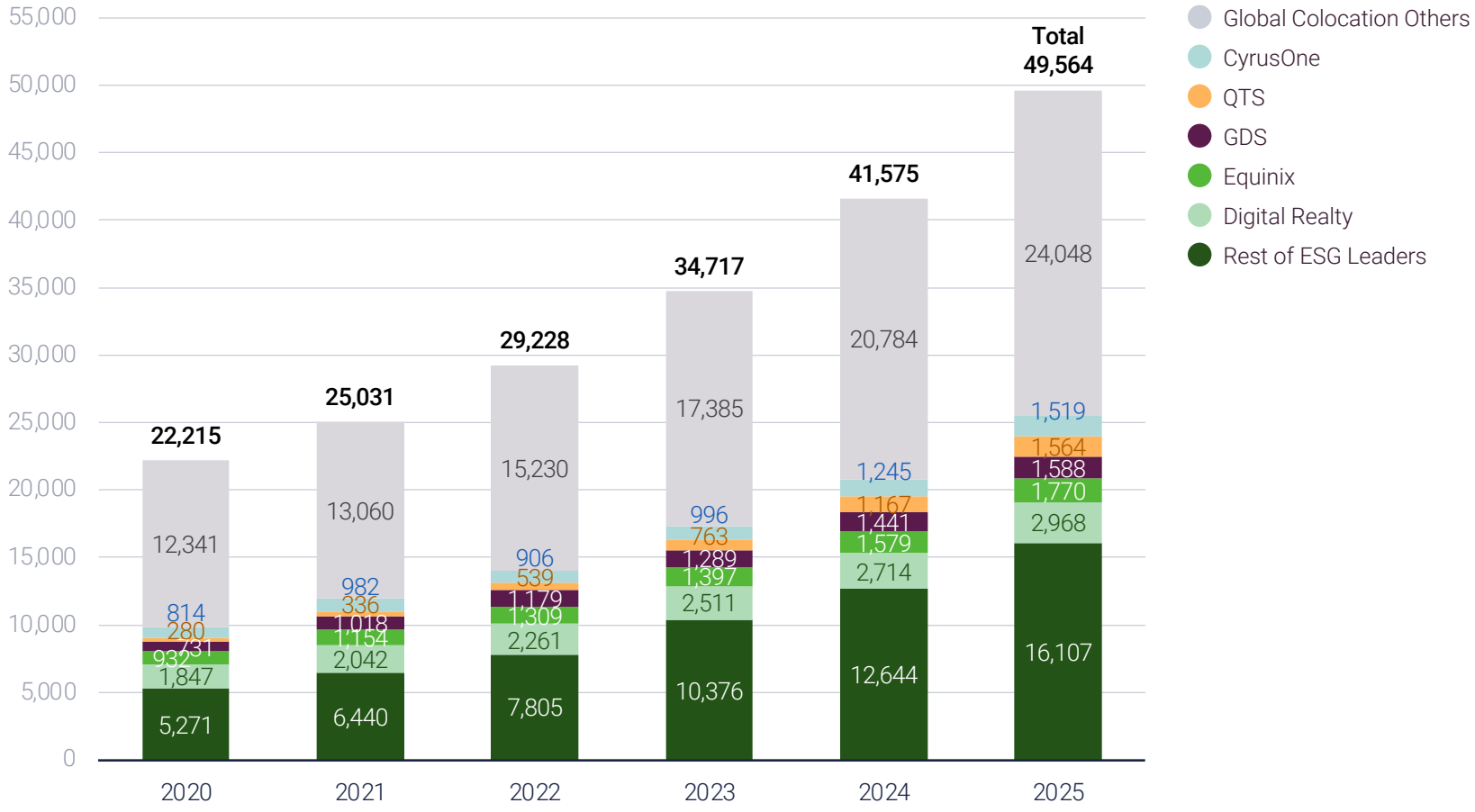
TOTAL ENERGY CONSUMPTION

- Total data centre energy consumption increased from about 198.7 TWh in 2020 to 361.6 TWh in 2025, growing at a 5-yr CAGR of 12.7%.
- Colocation providers increased from about 85.5 TWh in 2020 to 166.2 TWh in 2025 at a 5-yr CAGR of 14.2%.
- Hyperscalers increased from 58.0 TWh in 2020 to 154.5 TWh in 2025 at a 5-yr CAGR of 21.6%.
- Enterprise on-premise energy consumption has declined as enterprises opt for off-premise solutions. On-premise energy consumption decreased from 55.2 TWh in 2020 to 40.9 TWh in 2025.
- Notably, in terms of the estimated total global energy consumption as reported by the US Energy Information Administration (EIA), the data centre industry uses about 1.23% of the total energy consumption in 2025, up from 0.81% in 2020.
- The data centre share is expected to continue to expand as more data centres come online in 2026 and the future to support the considerable increase in AI workloads.

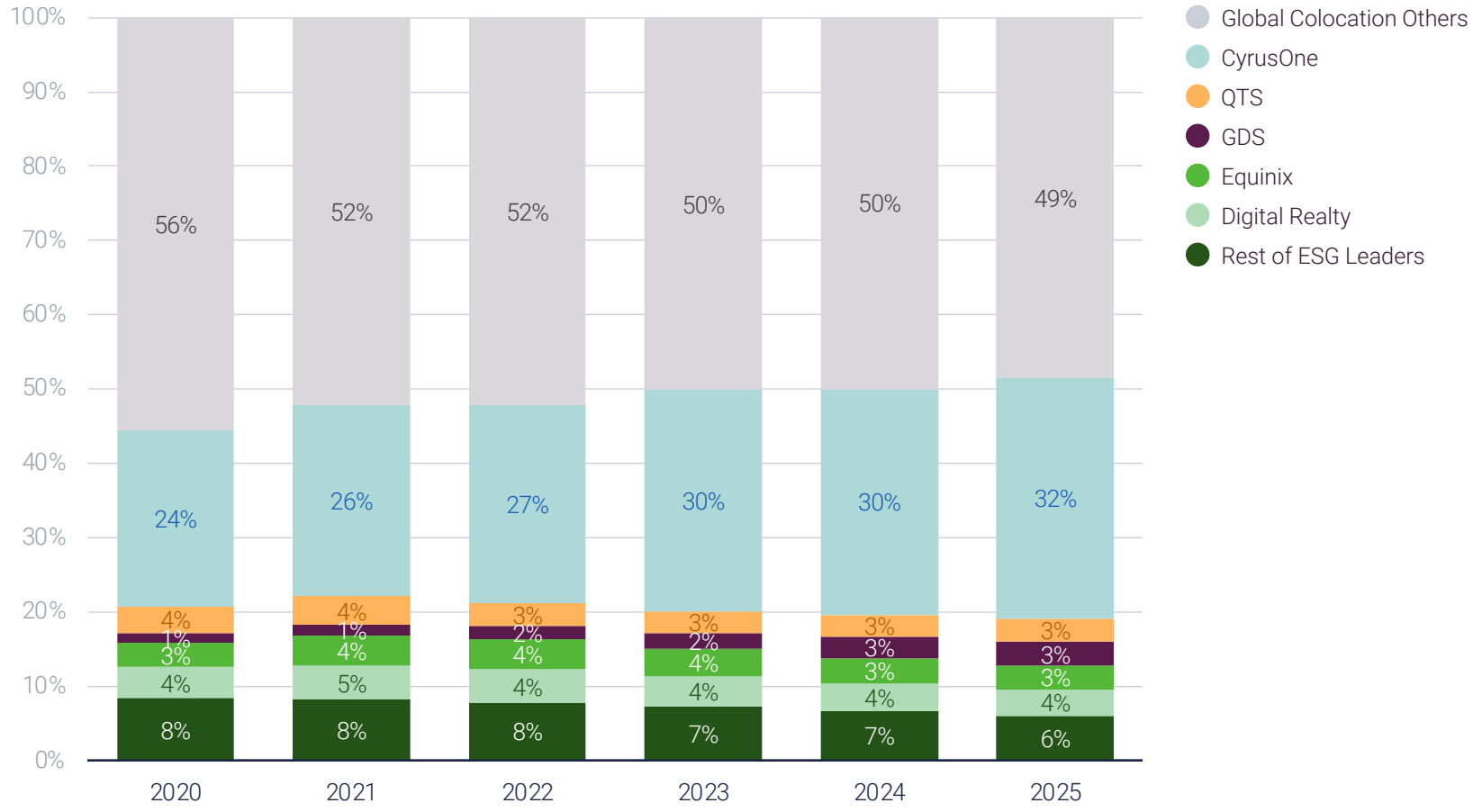
TOTAL WATER CONSUMPTION

- Total water consumption from data centres has increased from 118.8 million m^3 in 2020 to 185.7 million m^3 in 2025 at a 5-yr CAGR of 9.3%.
- Global colocation increased its water consumption from 53.9 million to 102.6 million m^3 between 2020 and 2025.
- Hyperscalers have increased their water consumption from 31.9 million to 62.0 million m^3 in the same period.
- Rack densities have increased since 2020, and customers are increasingly demanding higher densities. In the past five years, double-digit rack densities have become more common and new data centre designs have been advertising densities of 50+kW/rack to even 100+kW/rack densities.
- Higher rack densities are currently only possible with liquid cooling technology, resulting in larger volumes of water withdrawal.
- Closed-loop systems have started to become the standard for liquid-cooled data centres. Using a closed-loop system, the facility can circulate the same volume of water without having to draw more, leading to efficiencies in water consumption.

Total Operational IT Capacity (MW)



ESG Leaders (Data Centre Providers) by % Share of Global Capacity



Total Operational IT Capacity

The previous charts show the global colocation IT capacity with representation for the ESG Leaders included in this report. The 5 largest entities by operational IT capacity are split out. Between 2020 and 2025, the total proportion of IT capacity taken up by the ESG Leaders increased from 44% in 2020 to 51% in 2025.

The rest of the report focuses on the ESG Leaders (38 data centre providers and 9 hyperscalers) and the data reported in their published ESG/sustainability reports.

49,564 MW

Total global operational colocation capacity in 2025

51%

The proportion of colocation capacity represented by ESG Leaders in 2025

5 largest entities by IT capacity

DIGITAL REALTY

EQUINIX

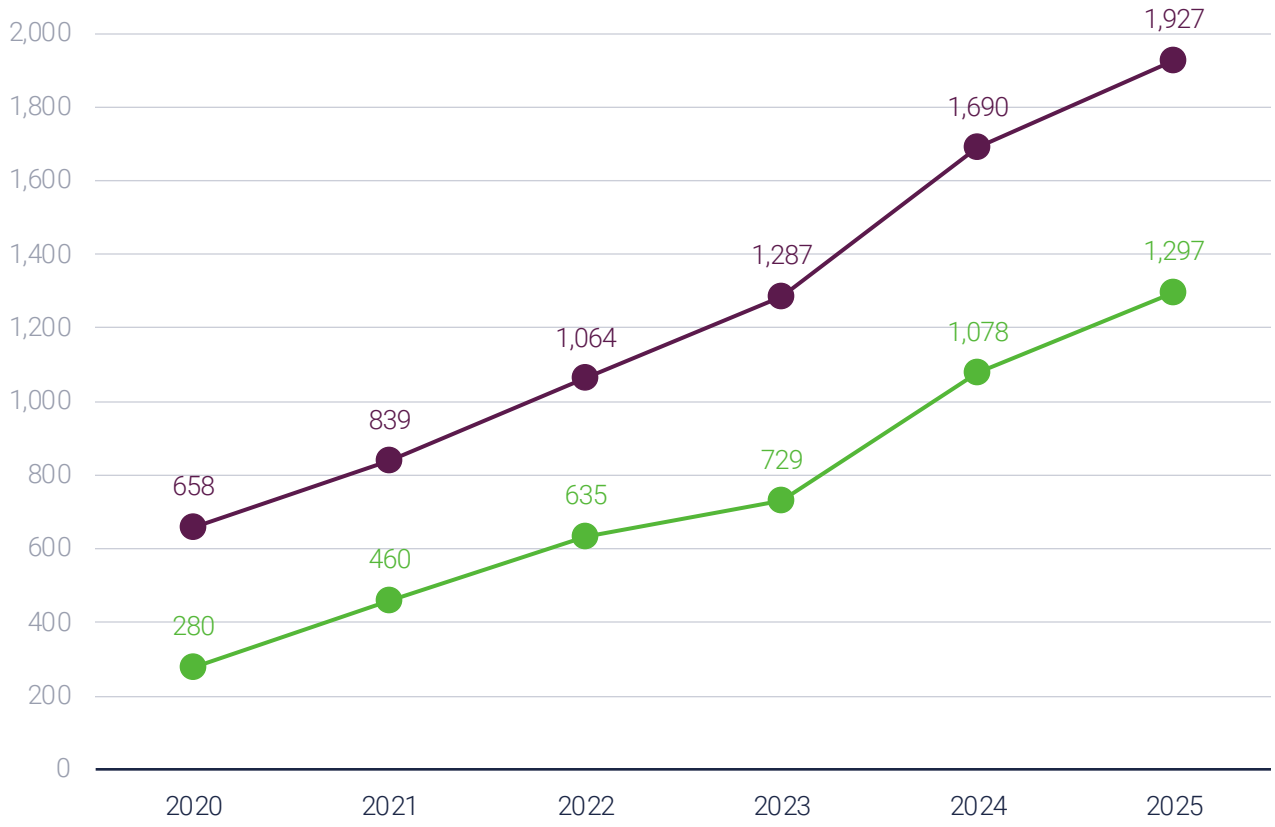
GDS万国数据

QTS

CyrusOne

Scope 1 Emissions: Hyperscale Platforms vs. Data Centre Providers

In thousands $mtCO_2e$



Hyperscale 5-yr CAGR **24.0%**

DC Provider 5-yr CAGR **35.9%**

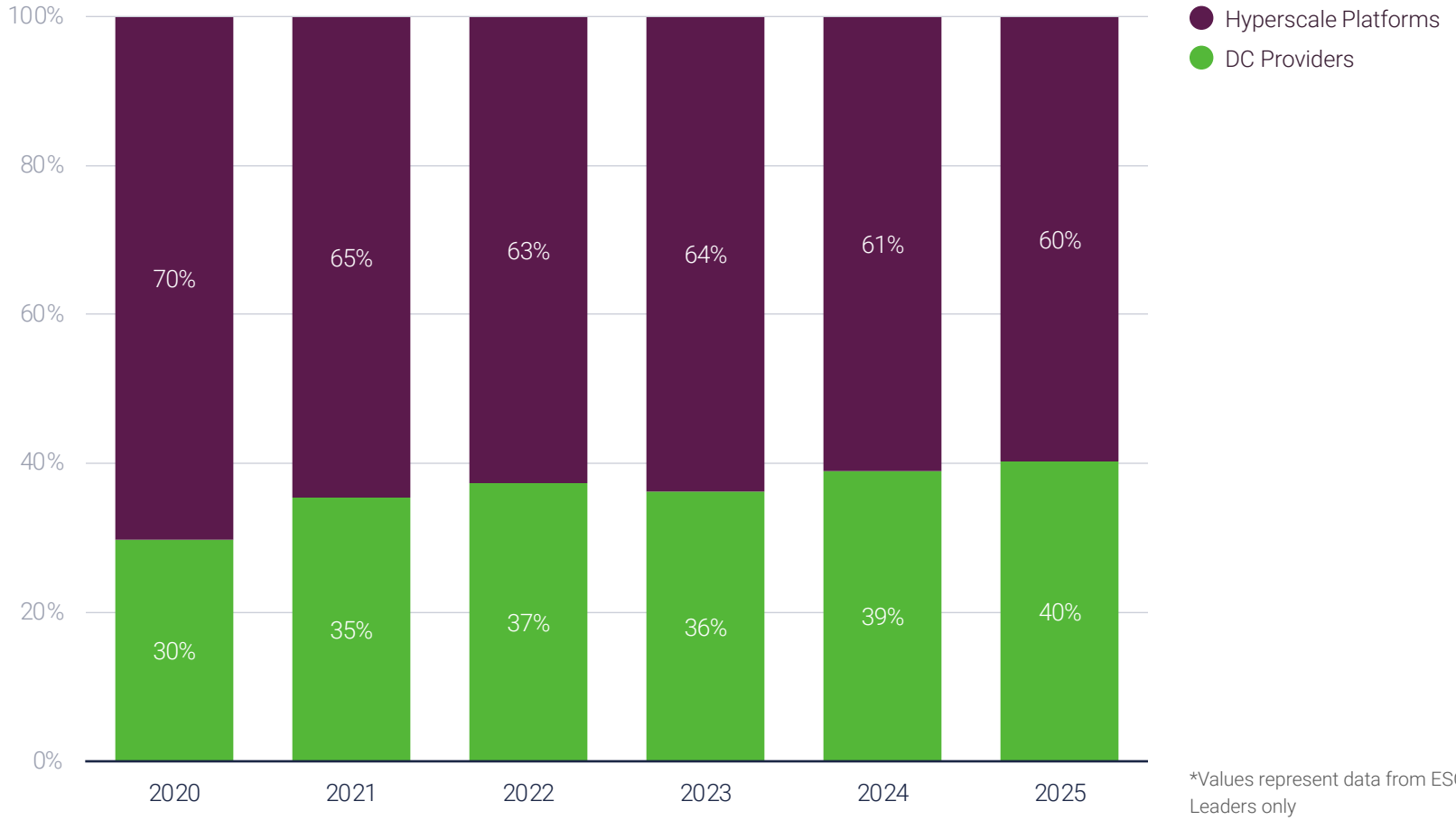
Overall 5-yr CAGR **28.0%**

Hyperscale Platforms

DC Providers

*Values represent data from ESG Leaders only

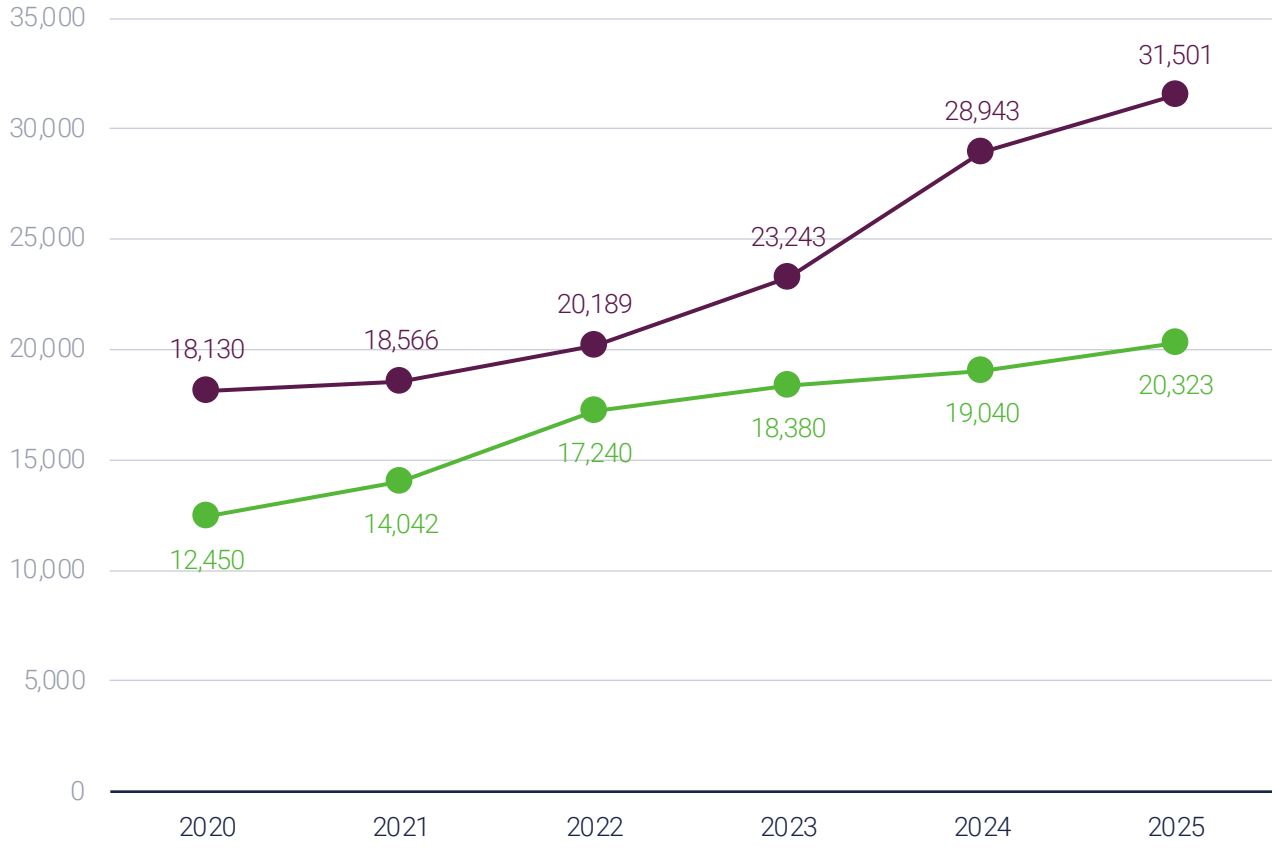
Scope 1 Emissions (%): Hyperscale Platforms vs. Data Centre Providers



*Values represent data from ESG Leaders only

Scope 2 (Location-Based) Emissions: Hyperscale Platforms vs. Data Centre Providers

In thousands $mtCO_2e$



Hyperscale 5-yr CAGR **11.7%**

DC Provider 5-yr CAGR **10.3%**

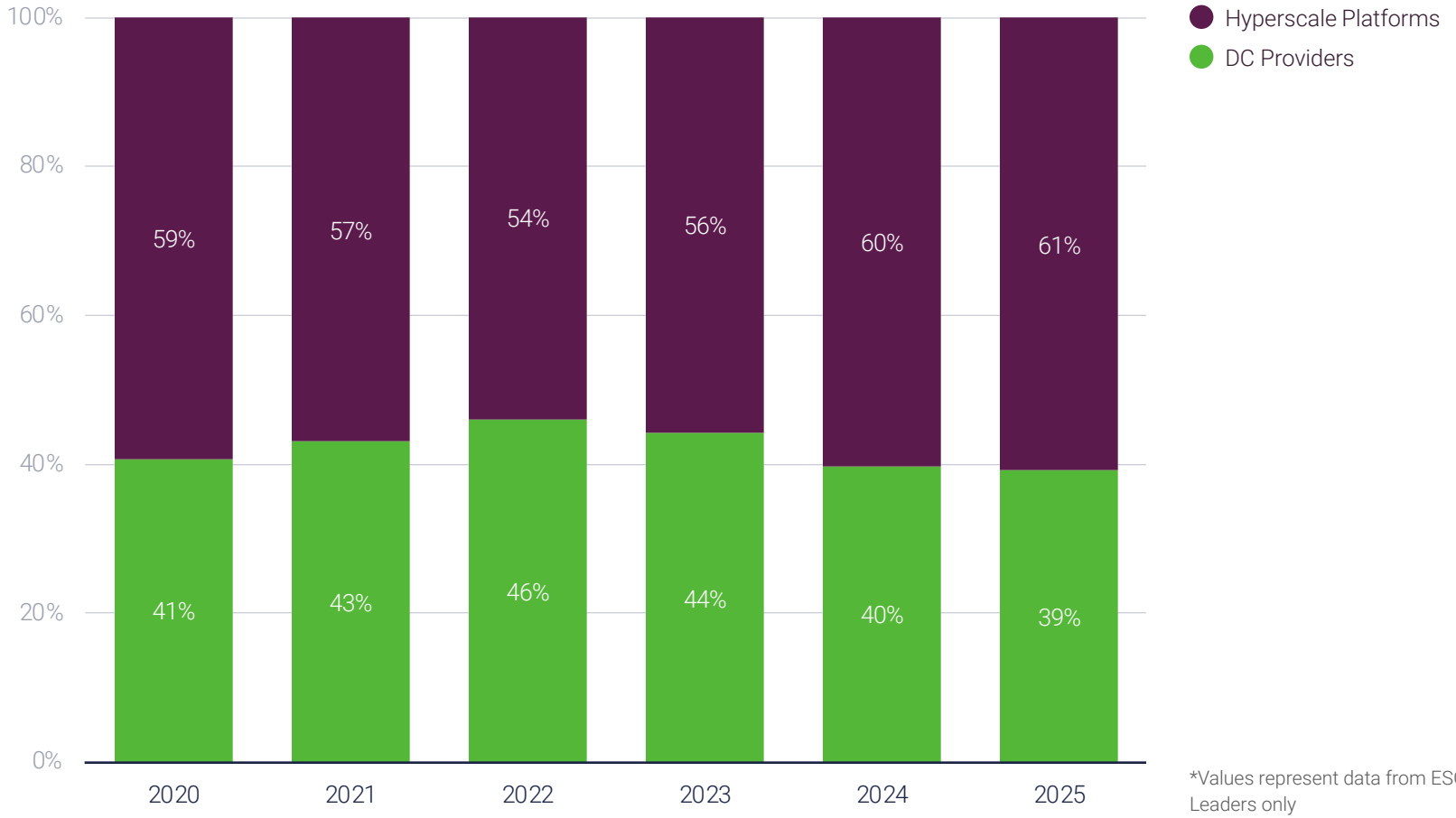
Overall 5-yr CAGR **11.1%**

Hyperscale Platforms

DC Providers

*Values represent data from ESG Leaders only

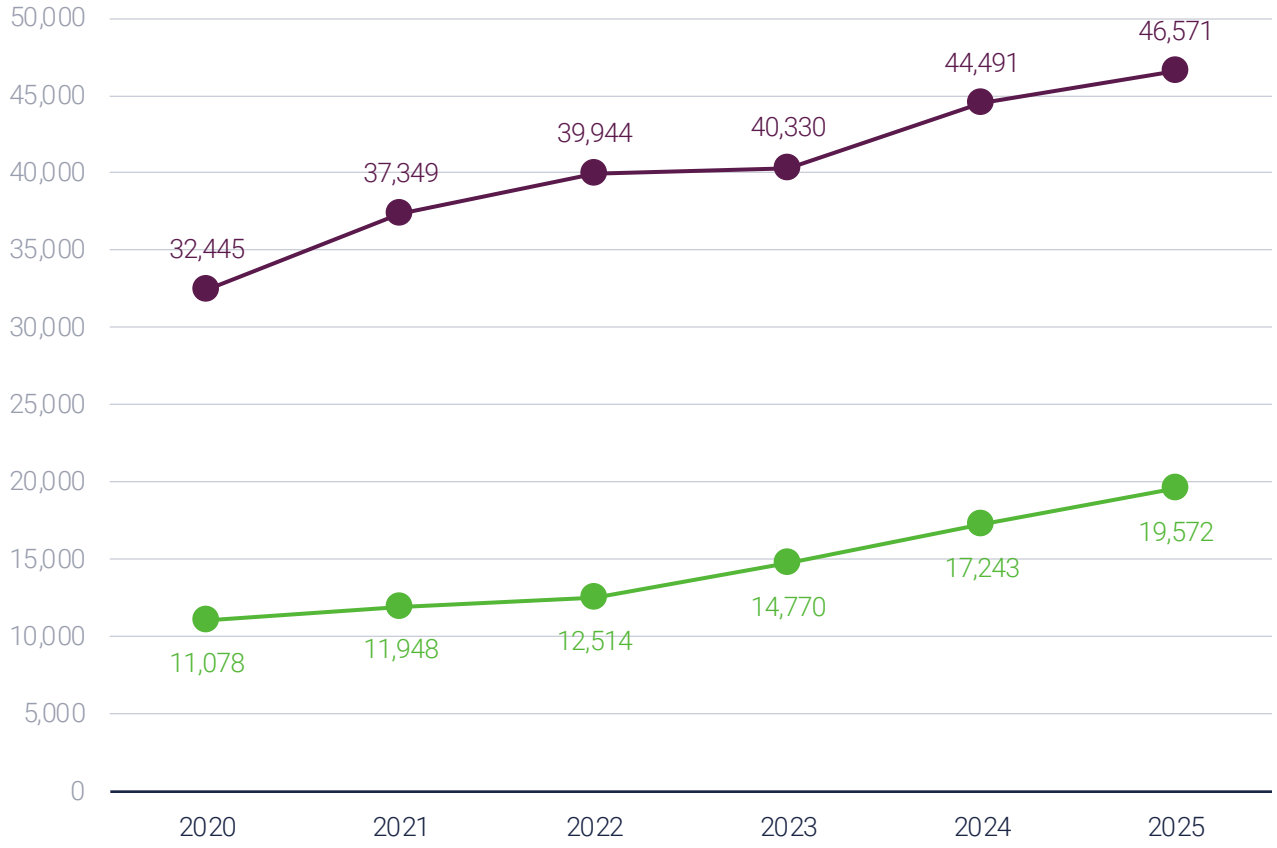
Scope 2 (Location-based) Emissions (%): Hyperscale Platforms vs. Data Centre Providers



*Values represent data from ESG Leaders only

Scope 3 Emissions: Hyperscale Platforms vs. Data Centre Providers

In thousands $mtCO_2e$



Hyperscale 5-yr CAGR **7.5%**

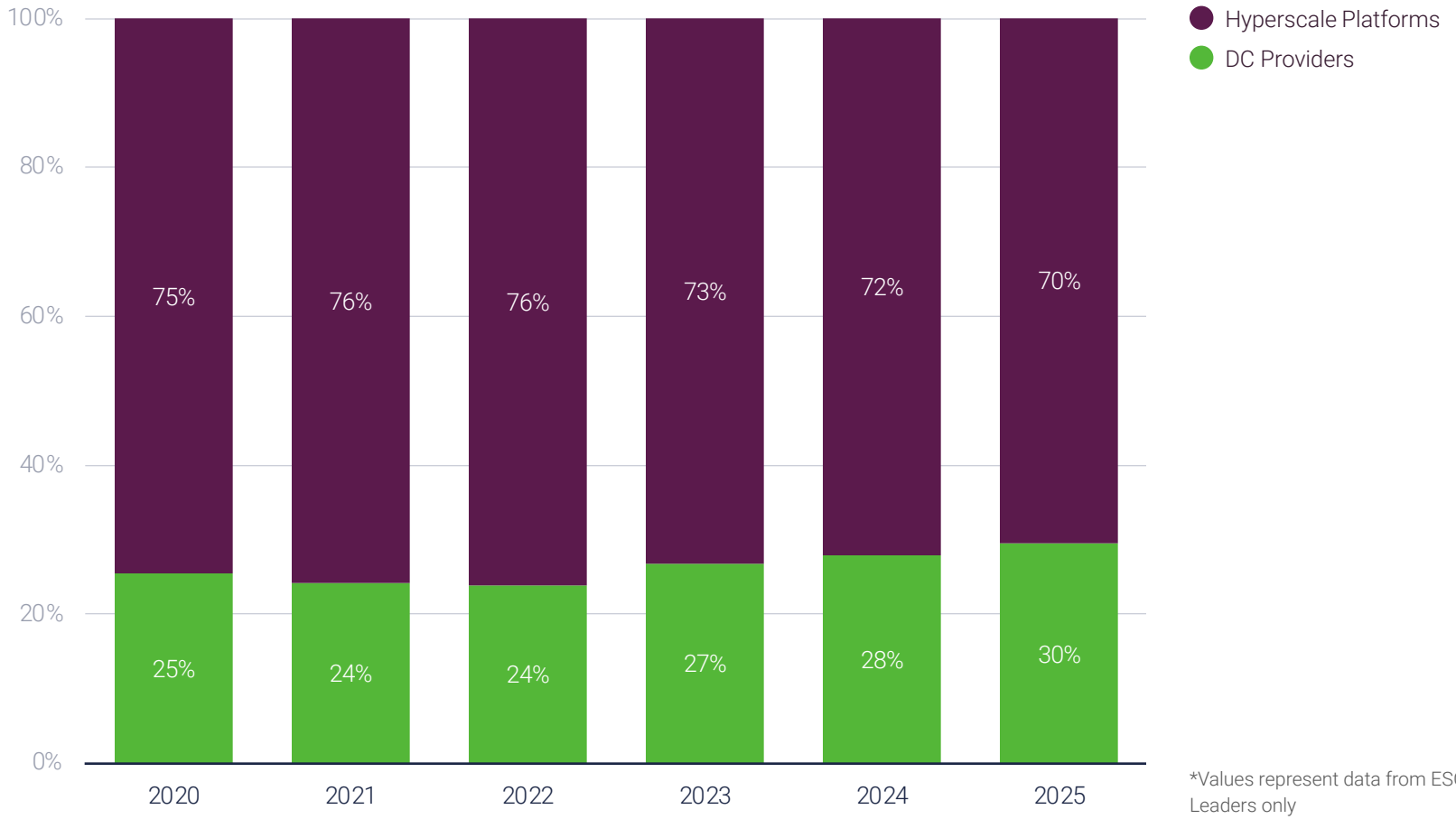
DC Provider 5-yr CAGR **12.1%**

Overall 5-yr CAGR **8.7%**

- Hyperscale Platforms
- DC Providers

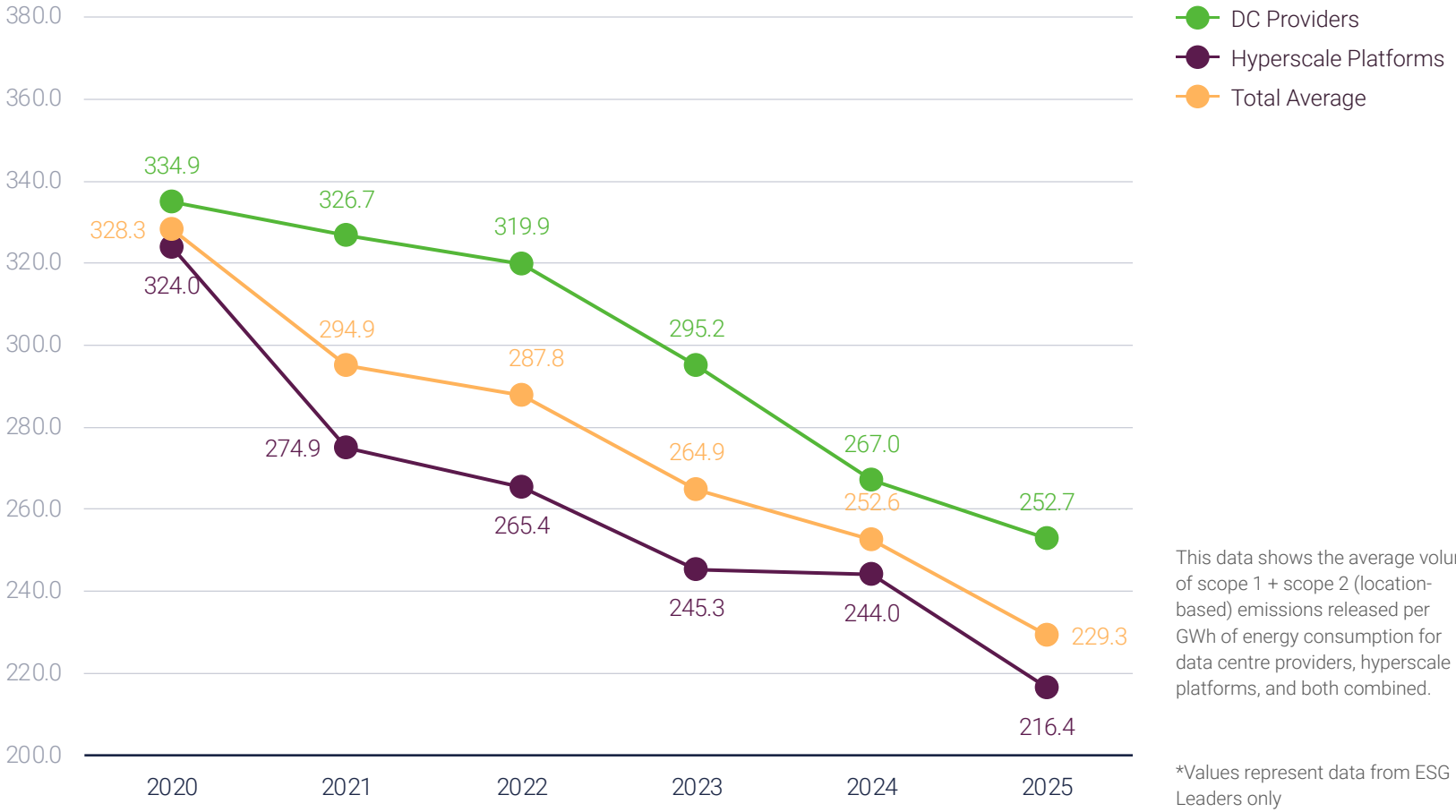
*Values represent data from ESG Leaders only

Scope 3 Emissions (%): Hyperscale Platforms vs. Data Centre Providers



*Values represent data from ESG Leaders only

Average Emissions per GWh of Energy Usage ($mtCO_2e/GWh$)



This data shows the average volume of scope 1 + scope 2 (location-based) emissions released per GWh of energy consumption for data centre providers, hyperscale platforms, and both combined.

*Values represent data from ESG Leaders only

Carbon Emissions Hyperscale vs. Global Colocation Insights

CO_2 EMISSIONS

The ESG Leaders show an overall increase in the volume of scope 1 CO_2 emissions, increasing from 937,963 $mtCO_2e$ in 2020 to about 3.2 million $mtCO_2e$ in 2025, showing a 5-yr CAGR of 28%.

- Scope 1 emissions for data centre providers increased from 279,747 $mtCO_2e$ in 2020 to about 1.3 million $mtCO_2e$ in 2025 at a 5-yr CAGR of 35.9%.
- Hyperscaler emissions increased from 658,216 $mtCO_2e$ in 2020 to about 1.9 million $mtCO_2e$ in 2025 at a 5-yr CAGR of 24.0%.

Location-based scope 2 emissions have also increased, with total scope 2 emissions increasing from 30.6 million $mtCO_2e$ in 2020 to 51.8 million $mtCO_2e$ in 2025 at a 5-yr CAGR of 11.1%.

- Scope 2 emissions for data centre providers increased from about 12.4 million $mtCO_2e$ in 2020 to 20.3 million $mtCO_2e$ in 2025, at a 5-yr CAGR of 10.3%.
- Hyperscaler emissions have increased from 18.1 million $mtCO_2e$ in 2020 to 31.5 million $mtCO_2e$ in 2025 at a 5-yr CAGR of 11.7%.

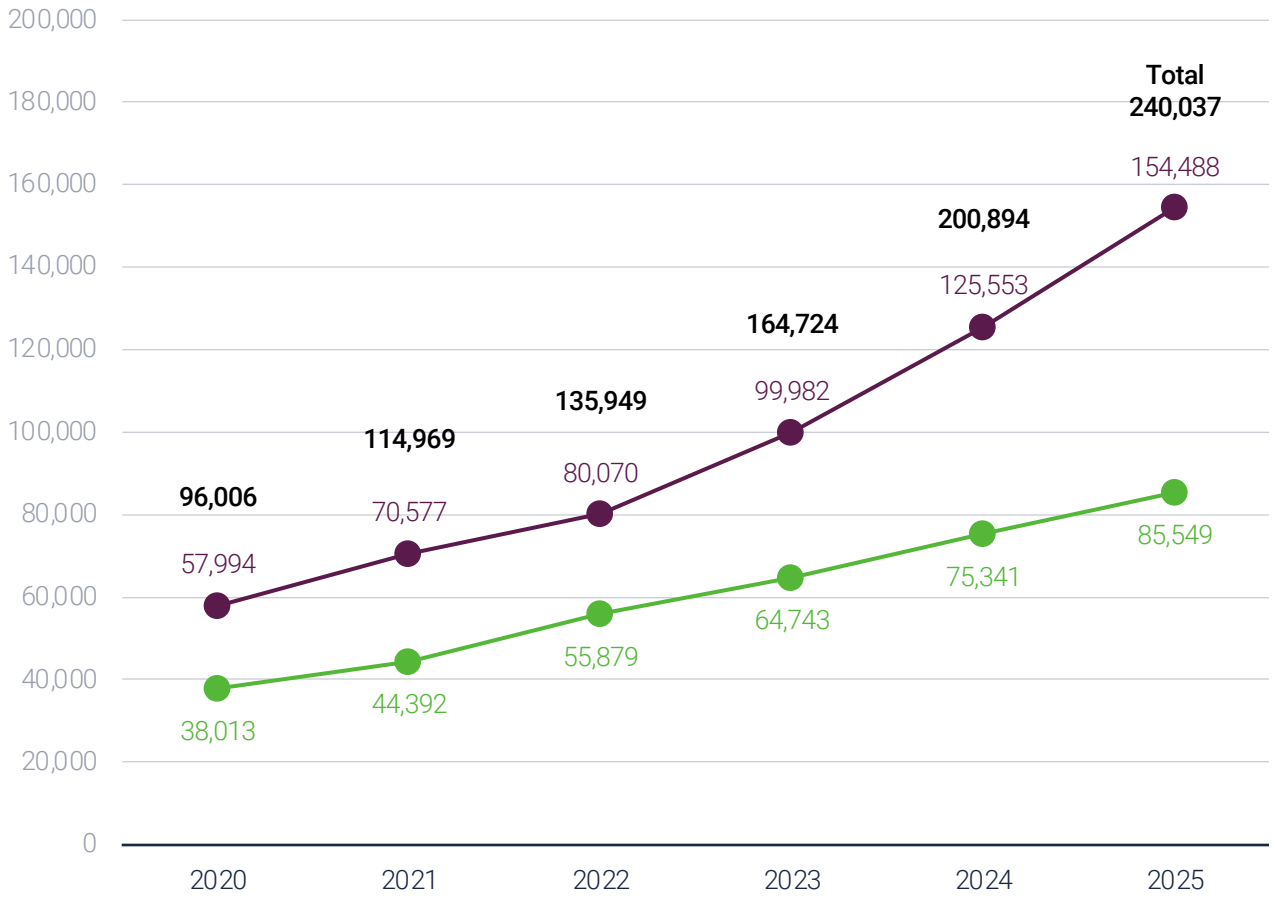
Although total carbon emissions from data centres have increased, the average emissions per GWh of energy consumption have generally decreased over time, falling from 328.3 $mtCO_2e$/GWh in 2020 to 229.3 $mtCO_2e$/GWh in 2025.

- Average emissions per GWh for data centre providers decreased from 334.9 $mtCO_2e$/GWh in 2020 to 252.7 $mtCO_2e$/GWh in 2025.
- Average emissions per GWh for hyperscalers decreased from 324.0 $mtCO_2e$/GWh in 2020 to 216.4 $mtCO_2e$/GWh in 2025.
- The use of both carbon-free energy sources and renewable energy sources for the operation of data centres have decreased the average emissions footprint per GWh of energy usage.
- New, large-scale facilities can implement energy and carbon efficiencies into their designs to improve the overall carbon footprint of the facility.

Scope 3 trends and estimates were included in this report for the first time as scope 3 emissions become increasingly highlighted as an area of concern. More companies are now reporting metrics for scope 3 emissions, but the breadth of scope 3 categories reported is varied in the industry.

- Of the 42 companies that have reported for 2024, 33 shared data points on scope 3 emissions.
- For data centres, the majority of scope 3 emissions are attributable to purchased goods, capital goods, and downstream leased assets. These emissions are more difficult to quantify than categories like business and employee travel since there are many partners involved that may not be able to provide these values and needs more effort and resources to track.
- Notably, ESG reports for 2024 had more detailed metrics on more scope 3 categories than previous years including emissions from purchased goods. This trend will likely continue as scope 3 reporting becomes more refined.

Total Energy Usage (GWh): Hyperscalers vs. Data Centre Providers



Hyperscale 5-yr CAGR **21.6%**

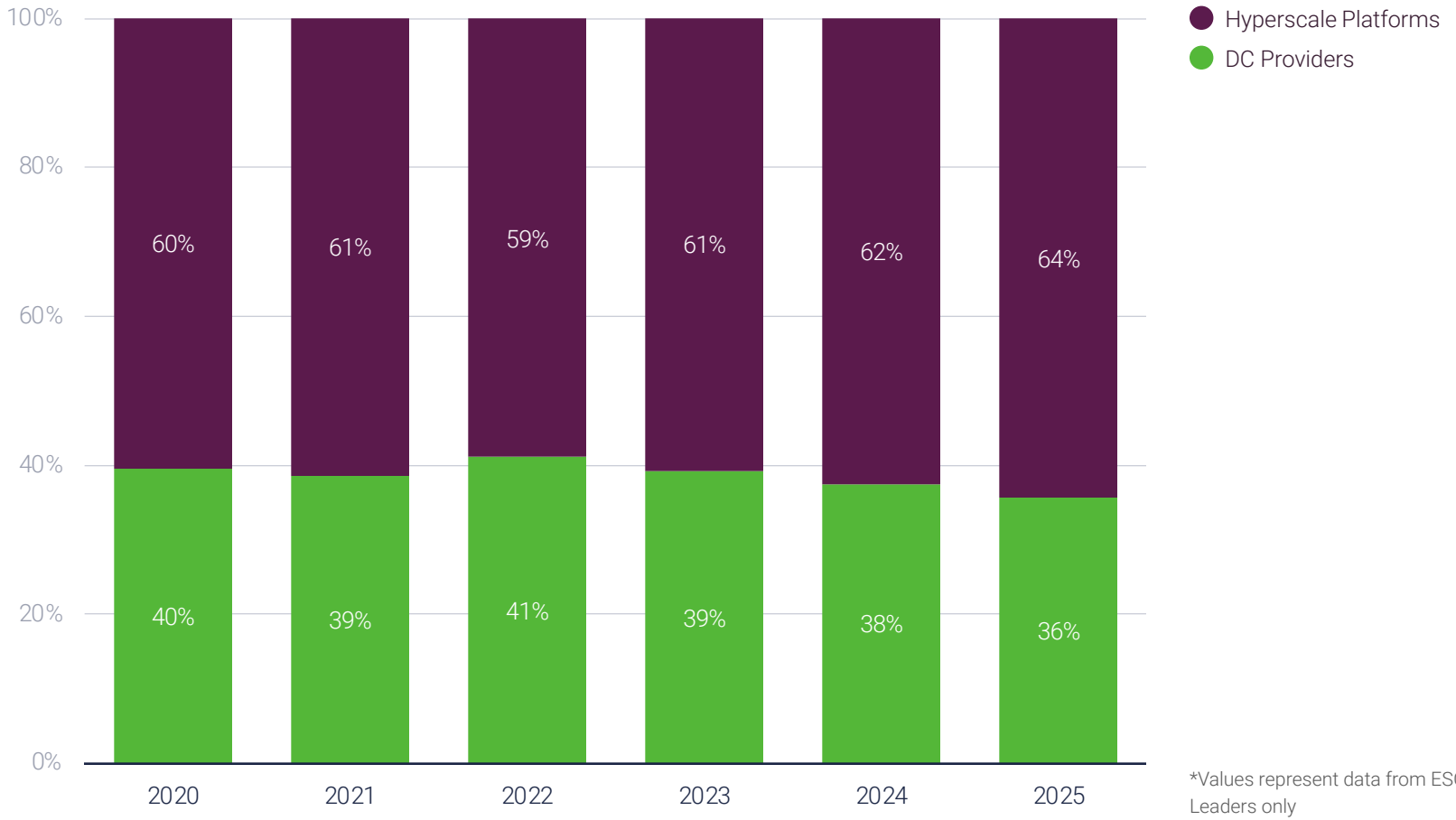
DC Provider 5-yr CAGR **17.6%**

Overall 5-yr CAGR **20.1%**

- Hyperscalers
- DC Providers

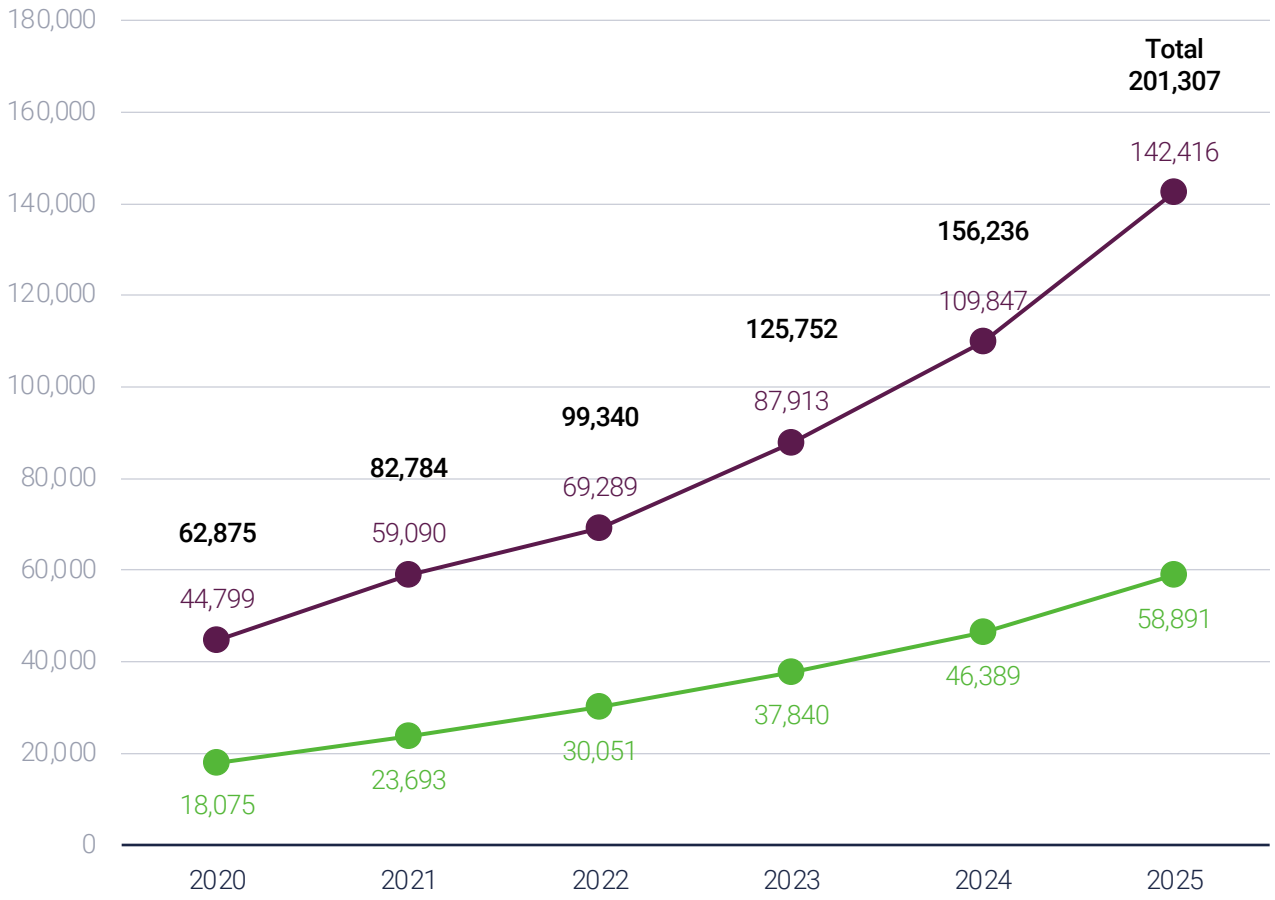
*Values represent data from ESG Leaders only

Total Energy Usage (%): Hyperscale Platforms vs. Data Centre Providers



*Values represent data from ESG Leaders only

Total Renewable Energy Usage (GWh): Hyperscalers vs. Data Centre Providers



Hyperscale 5-yr CAGR **26.0%**

DC Provider 5-yr CAGR **26.6%**

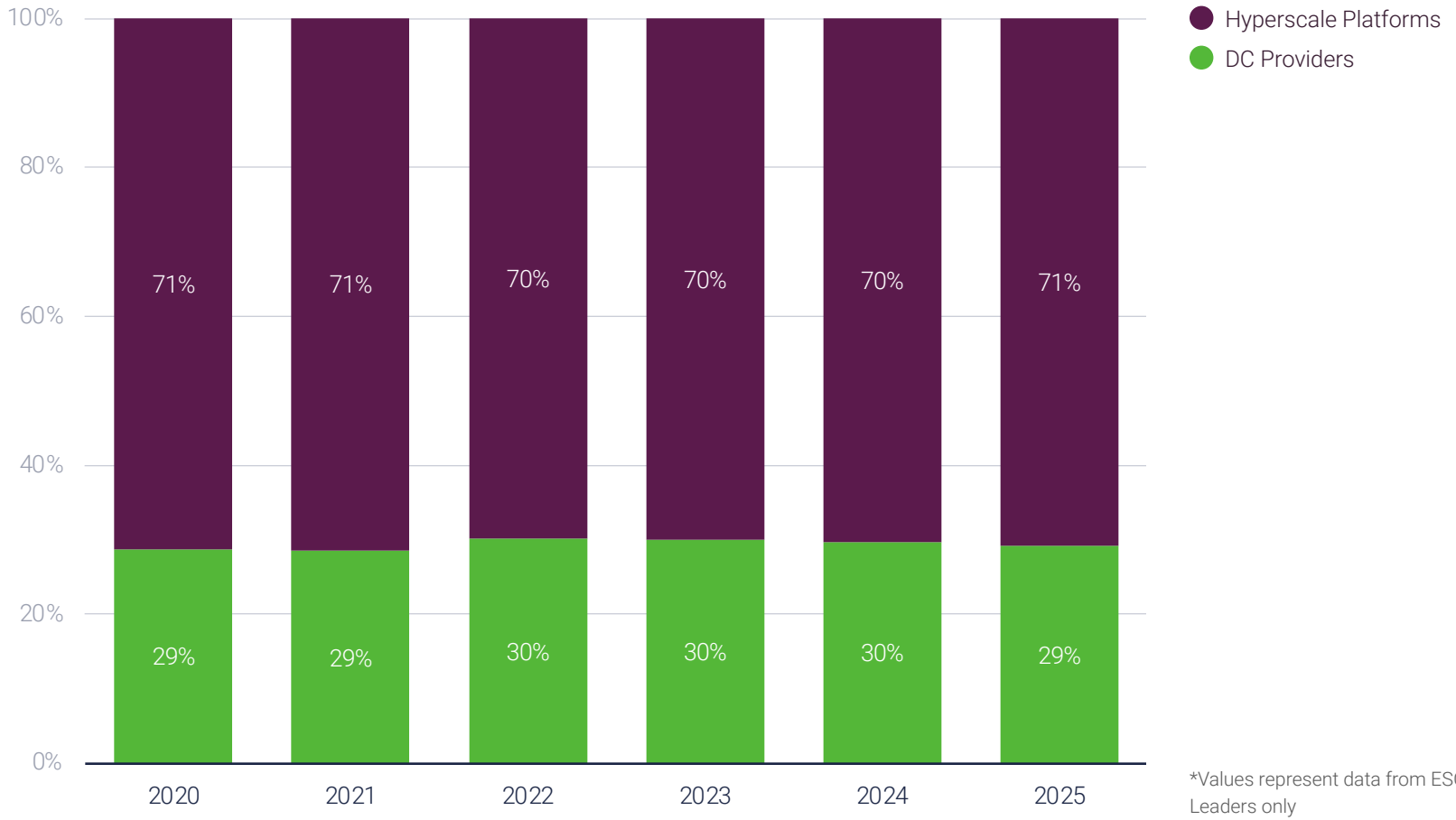
Overall 5-yr CAGR **26.2%**

Hyperscalers

DC Providers

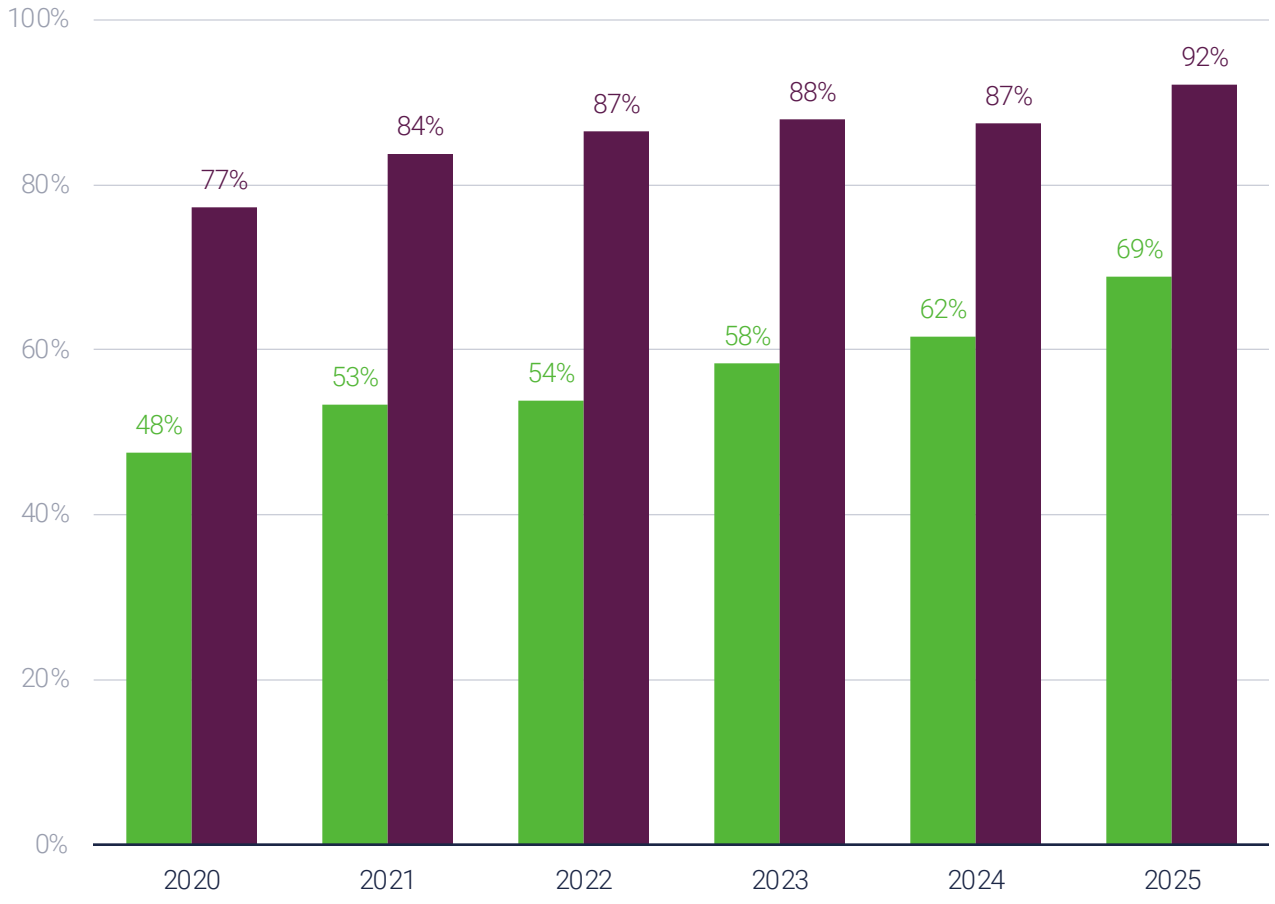
*Values represent data from ESG Leaders only

Total Energy Usage (%): Hyperscale Platforms vs. Data Centre Providers



*Values represent data from ESG Leaders only

Renewable Energy Usage: % by Total Energy Usage



This graph shows the percentage of total energy use that is provided by renewable sources for both data centre providers and hyperscale platforms separately. Overall, hyperscalers are driving renewable energy consumption in the market.

*Values represent data from ESG Leaders only

Energy Consumption Insights

ENERGY CONSUMPTION

Energy consumption from ESG Leaders has increased as these companies grow in efforts to meet capacity demands. More companies are looking to capture and support high-density workloads, leading to rapid increases in energy consumption as these high-density workloads and facilities come online.

- Total energy consumption from ESG Leaders came up to 240,037 GWh in 2025, up from 96,006 GWh in 2020, growing at a CAGR of 20.1%.
- Data centre providers increased their total energy usage from 38,013 GWh in 2020 to 85,549 GWh in 2025, growing at a 5-yr CAGR of 17.6%.
- Hyperscalers have also significantly increased energy consumption, from about 57,994 GWh in 2020 to 154,488 GWh in 2025 at a 5-yr CAGR of 21.6%.
- Hyperscalers make up 64% of the total data centre energy consumption in 2025.

CARBON-FREE ENERGY CONSUMPTION

With the increase in workload densities and energy consumption to support it, data centre providers and hyperscalers have been investing heavily in various energy sources and PPAs to secure enough power to support their workloads and customers. More established tier 1 markets and even many tier 2 markets have reported concerns about power constraints, leading new builds to look at more remote areas with ample access to power generation where possible. In the US, natural gas and nuclear energy sites are being built with the intent to support large-scale data centres, and PPAs are being signed for not only renewable energy but also nuclear sources.

- Total carbon-free energy usage from ESG Leaders increased from 62,875 GWh in 2020 to 201,307 GWh in 2025.
- Data centre providers have increased their carbon-free energy usage from about 18,075 GWh in 2020 to 58,891 GWh in 2025, growing at a 5-yr CAGR of 26.6%.
- Hyperscalers have increased their carbon-free energy usage from 44,799 GWh in 2020 to 142,416 GWh in 2025, growing at a 5-yr CAGR of 26.0%.

Energy Consumption Insights, Cont.

In 2025, data centre providers accounted for approximately 29% of the total carbon-free energy usage.

- Of the total energy consumption from the data centre providers, approximately 69% of the energy usage was from carbon-free energy, up from 48% in 2020.

In 2025, hyperscalers accounted for approximately 71% of the total carbon-free energy usage.

- Of the total energy consumption from hyperscalers, approximately 92% of the energy usage was from carbon-free energy, up from about 77% in 2020.

Energy has become a major theme in 2025, from bottlenecks in producing and securing the large swaths of power needed to operate data centres, to local communities pushing back new builds with energy resources as a major point of contention. These constraints have pushed data centre providers and hyperscalers to look for alternative sources of energy beyond the grid. Companies have been partnering with natural gas and nuclear providers to co-locate data centres directly with energy sources.

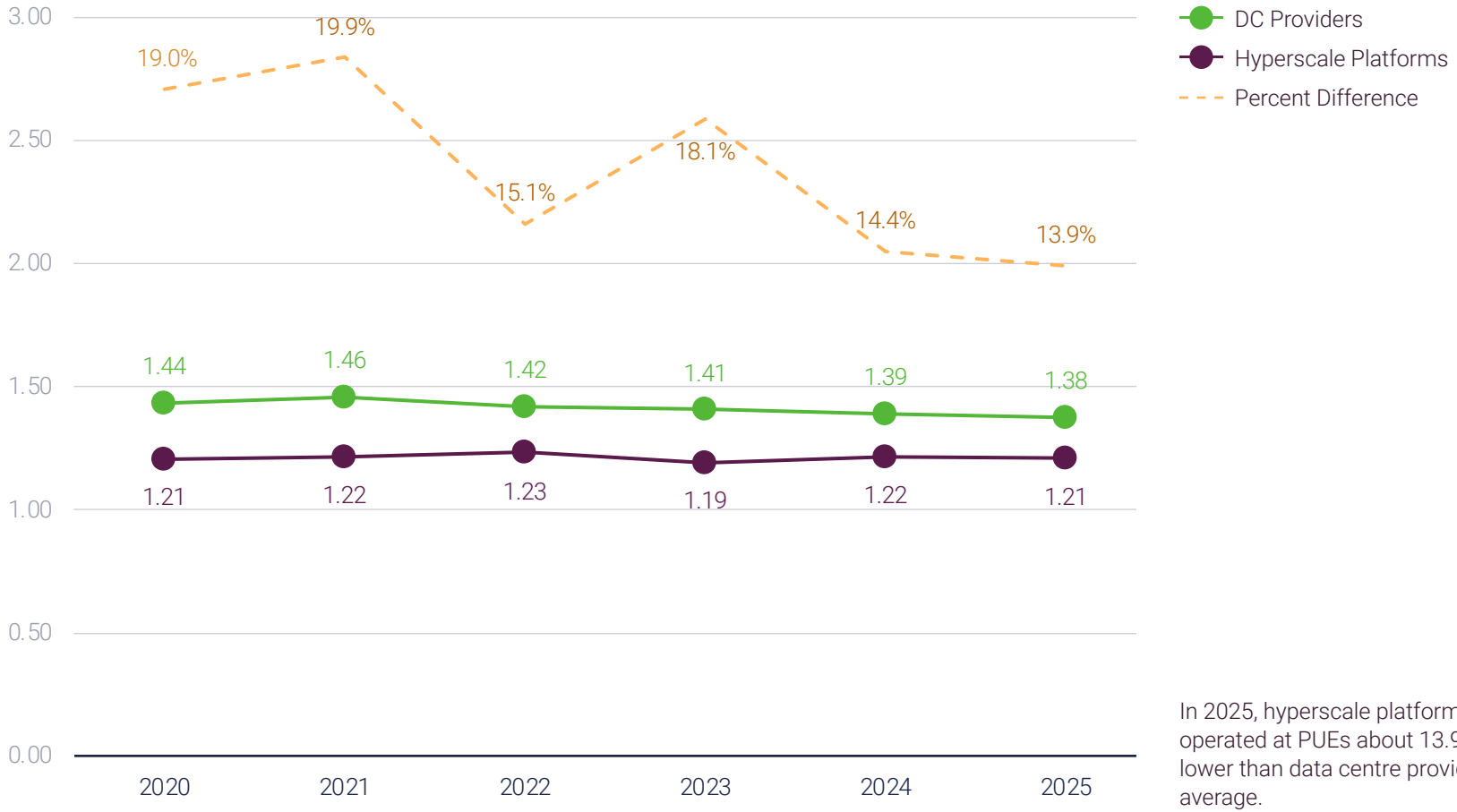
Many nuclear deals have been signed by ESG Leaders, which can contribute to their carbon-free energy reporting in the future as these projects become operational. The Talen Energy nuclear site and the adjoining Cumulus Data Centre was acquired by Amazon in 2024. A future QTS project will also be supported by nuclear power from Talen Energy. Meanwhile, Microsoft is reopening the Three Mile Island nuclear generating station to secure energy from that site for its data centres. Google is partnering with Elementl Power for a nuclear site development. Many companies have been working with nuclear energy provider Oklo for power procurements including Meta, Equinix, and Switch.

Energy and gas companies are also eyeing data centre demand and have shared plans to build gas plants to support data centre campuses. ExxonMobil and Chevron are looking to build new gas power plants to supply 1+GW of gas-powered energy to data centres in the US and are looking for data centre customers to offtake the capacity. So there is another angle of gas providers working with data centres to build out new carbon-free energy sources.

Data centre providers, especially the ESG leaders, still prioritize using grid energy sources for the reliability of the systems. The energy mix of the grid system also influences the proportion of carbon-free energy that a company uses. Companies with the resources, like hyperscalers, are working with the local grid systems to build out and improve the infrastructure needed to support their data centres. This can also include connecting new renewable energy sources like solar power into the grid, improving the sustainability of the energy mix in the grid.

A caveat worth noting from the ESG reporting is that the renewable/carbon-free energy figures reported by companies almost always relies on a combination of PPAs, RECs, and green tariff programs alongside direct generation. Purchasing PPAs and RECs can allow companies to report a better energy footprint but that may not actually reflect the amount of carbon-free/renewable energy that the company uses directly.

Average Annual Operating PUE: Hyperscale Platforms vs. Data Centre Providers



In 2025, hyperscale platforms operated at PUEs about 13.9% lower than data centre providers on average.

PUE Insights

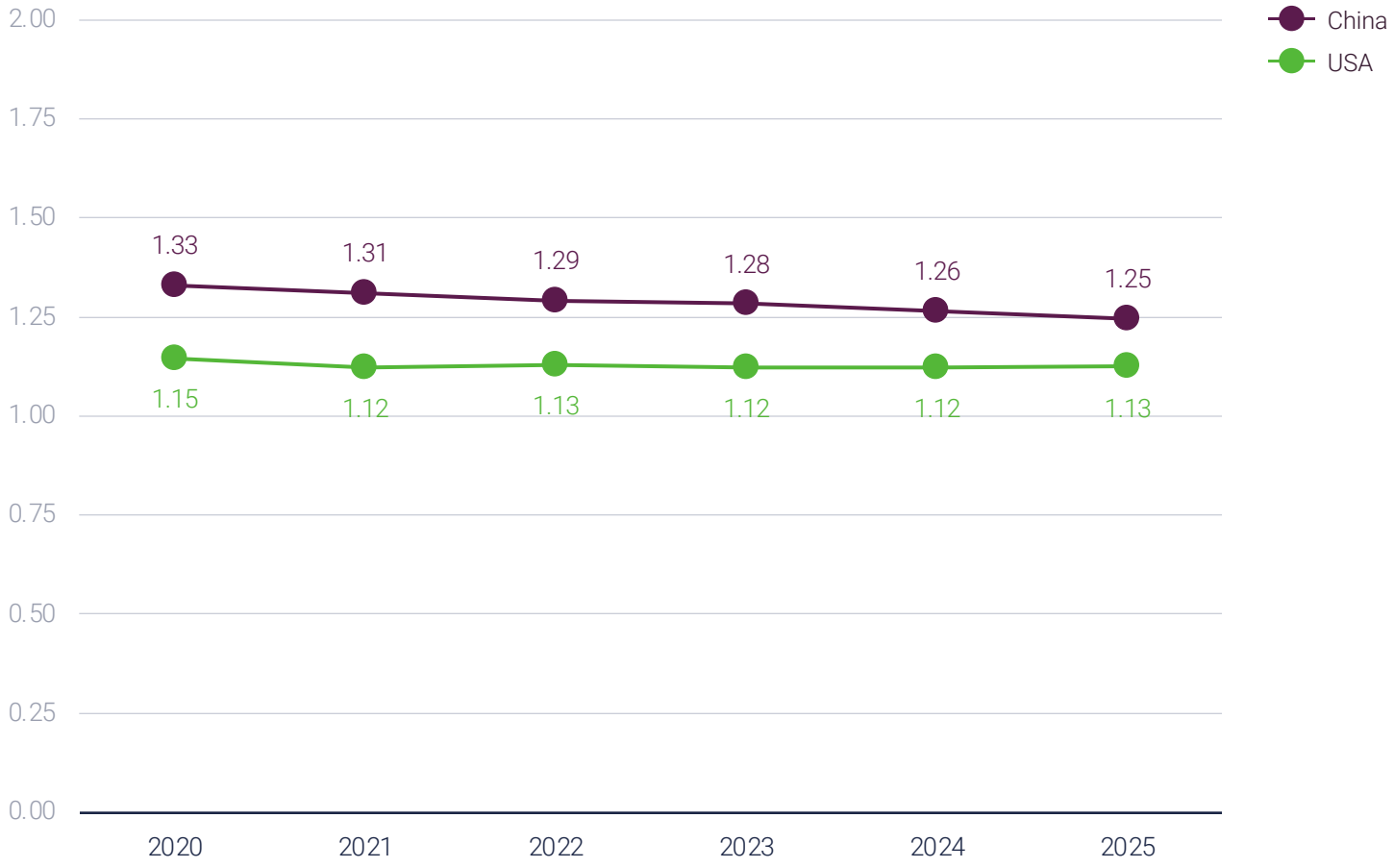
PUE INSIGHTS

PUE, which is a widely used metric to determine data centre energy efficiency, calculates the total data centre energy consumption over the IT equipment energy consumption. The closer the PUE is to 1, the more efficient the data centre is as more of the energy is going directly to the IT equipment.

Average PUE for data centre providers decreased from 1.44 in 2020 to 1.38 in 2025. This can be attributed to better technology efficiency and designs. For hyperscalers, who have historically mostly run PUE-efficient facilities, the average PUE has stayed steady at 1.21 between 2020 and 2025.

- New data centre facilities are designed to be as efficient as possible given currently available technologies. Providers with older, legacy facilities may face challenges retrofitting them to be more efficient.
- With the trend towards large-scale facilities and campuses, large facilities also tend to have more efficient PUEs since the energy supply can better maximize the amount of IT equipment that it supports.
- Facilities that have deployed high-density liquid-cooled halls at scale can deliver better PUE for the same IT load.
- Hyperscalers can build out their facilities from the ground up, giving them greater flexibility to implement high levels of efficiencies and sustainability specifications at a large scale.
- Hyperscalers also have more flexibility in trying new designs and technologies, unlike colocation providers that usually support multi-tenant environments.
- Regional differences also heavily impact PUE values. Data centres operating in warmer climates use more energy to cool their equipment than facilities in cooler climates that can make use of free cooling systems during the cooler months.
- In certain markets, notably in Europe, new regulations mandate PUE levels for new data centre builds as well as legacy facilities. Germany has gone a step further than EU requirements with its Energy Efficiency Act, which came into effect at the end of 2023. Any new data centre that goes into operation from July 2026 must have an operating PUE of 1.2. All existing data centres must operate at a PUE of 1.5 by July 2027 and 1.3 by July 2030.

Average Annual Operating PUE: US vs. Chinese Hyperscalers



Regional Insights and USA vs. Chinese Hyperscalers

REGIONAL DIFFERENCES

One of the key factors for variations in data centre efficiency and sustainability scores for the SRSQ is based on regional differences. Most of the ESG Leaders operate in multiple regions across different countries and continents, however, some mainly operate in one region or continent.

Companies with a large presence in North America and Europe have better efficiency scores due to a multitude of factors.

- North America and Europe have better availability of renewable energy sources used in the local grids compared to other continents. The energy mix of the grid may not be as controllable for a data centre provider.

- Regulations regarding using renewable energy and carbon-free energy sources can also impact a company's access to those sources depending on the region. For instance, nuclear power would not be an option in countries like Ireland or Australia without regulatory changes and large investments to build out new plants.

While regional differences play a major factor in data centre efficiency and influence the company-wide reported data points for sustainability measures, it is difficult to parse out those differences and identify regional metrics for the ESG Providers. Most ESG reporting only offers a scope of the entire company's global operations, and more efficient data centres operating in more efficient markets can help offset worse performing facilities. Some companies do split some regional data points out to varying degrees. Some companies split continental data metrics (e.g. Equinix, STACK Infrastructure) while some break out market/city-level data (e.g. Meta, Apple). The lack of regional data points along with the variation of any shared regional data points makes it difficult for us to accurately provide any regional metrics. We want to encourage future reporting to include metrics on data centres at the facility or regional level to not only provide a better understanding of sustainability differences in global markets, but also to foster transparency and standardization in ESG reporting.

Regional Insights and USA vs. Chinese Hyperscalers, Cont.

US VS. CHINESE HYPERSCALERS

A point of regional comparison that we can make to get some insights into regional differences in sustainability is comparing US and Chinese hyperscalers. Hyperscalers have the resources to design and implement more efficient self-built data centres. US hyperscalers have a large proportion of their footprint in the US while Chinese hyperscalers operate mainly in China.

- US hyperscalers include: Amazon, Apple, Google, Microsoft, Meta and Oracle.
- Chinese hyperscalers include: Alibaba, Kingsoft Cloud and Tencent.

US hyperscalers operate more efficient PUEs than their Chinese counterparts. US hyperscalers have had low PUEs between 1.15 to 1.13 from 2020 to 2025. Chinese hyperscalers have started to push for better PUEs and decreased average PUEs from 1.33 in 2020 to 1.25 in 2025.

- US and China have both been heavily investing in energy generation including renewable and fossil-fuel alternatives.
- Both US and Chinese hyperscalers invest heavily into PPAs for renewable energy. They are responsible for investments in major clean energy projects, especially when they build new projects out in rural areas.
- The narrowing gap between US and Chinese hyperscale PUEs will likely continue to decrease. Not only is China working to reduce its reliance on coal which will benefit Chinese hyperscalers, but US hyperscalers are getting close to the limit of what current technologies can allow in terms of PUE efficiency.
- This means that US hyperscalers will have more difficulties getting from PUEs of 1.13 to 1.10 compared to Chinese hyperscalers that have more room to improve efficiency.

Regional Insights and USA vs. Chinese Hyperscalers, Cont.

China still ranks first for coal consumption, making up just over 50% of global coal use. For Chinese hyperscalers, the grid mix impacts the efficiency and sustainability of their operations.

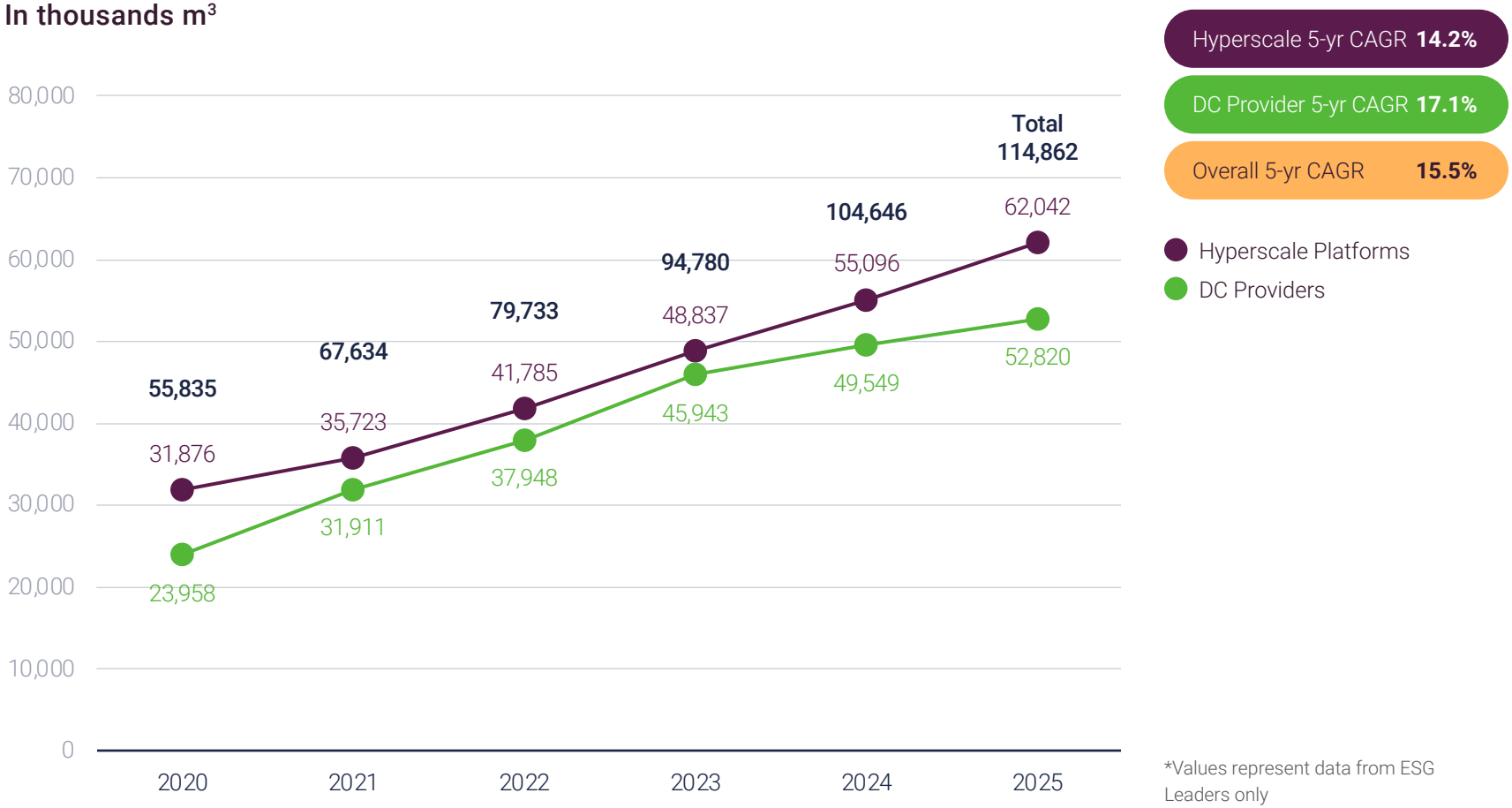
- 58% of China's energy consumption in 2025 came from fossil fuels, down from 62% in 2024, according to Ember.
- Reports from the Centre for Research on Energy and Clean Air have shown that in 2025, China's coal generation fell by 1.6% compared to 2024.
- China is also the largest supplier and producer of renewable energy. About 84% of China's electricity demand growth was met by solar and wind sources in 2024.
- China implemented the 2024 Green Development Action Plan for Data Centres, setting a target to bring national data centre PUEs to below 1.5 by 2025.
- The Ministry of Industry and Information Technology also suggested that large facilities in cooler regions should hit PUE levels of 1.3 or lower.
- Chinese hyperscalers have deployed new facilities in the Northern China provinces like Inner Mongolia, Gansu, and Ningxia. These facilities benefit from operating in cooler climates with substantially cooler ambient temperatures and higher renewable energy availability.
- It is worth noting that Alibaba Cloud uses a greater proportion of clean energy compared to its parent company (62% for the cloud segment compared to 41% for the group), suggesting that hyperscalers in China operate more sustainably than other industries in the country.

In the US, natural gas and nuclear have increasingly been a focus as energy constraints bottleneck new builds and markets. Building out and using natural gas and nuclear that data centres can tap into can bring projects online faster while waiting for the grid and transmission systems to catch up to support data centre demands.

- Dominion Energy plans to expand its Possum Point Power Station in Northern Virginia to support the power demands for the data centres in the market.
- As mentioned earlier, gas and oil companies like ExxonMobil and Chevron have expressed interest in building and operating natural gas plants specifically to support GW-sized data centres in the US.
- US hyperscalers are directly in talks with energy providers to invest in gas and nuclear energy projects to support their builds.

Total Water Usage: Hyperscale Platforms vs. Data Centre Providers

In thousands m³



Hyperscale 5-yr CAGR **14.2%**

DC Provider 5-yr CAGR **17.1%**

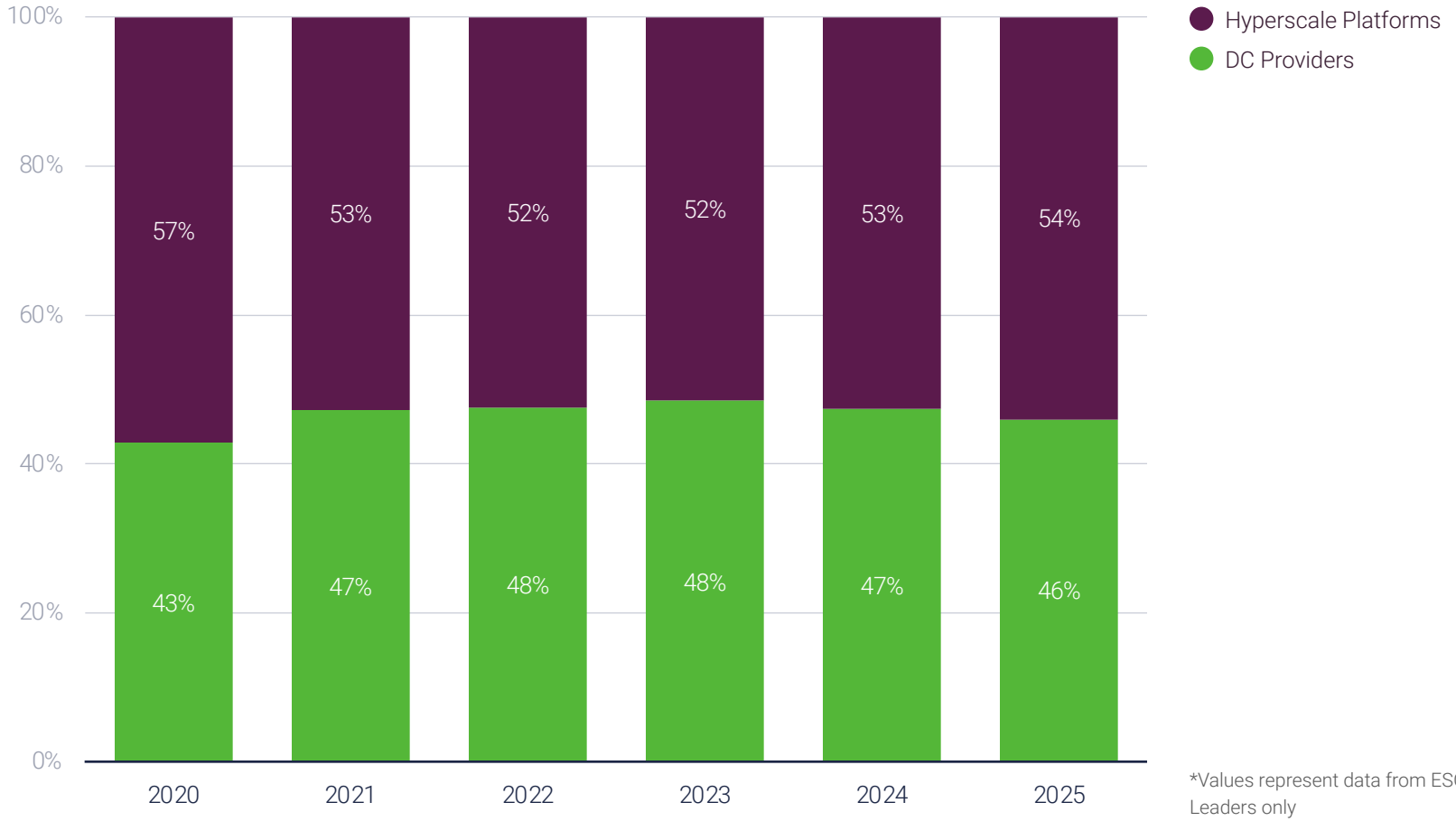
Overall 5-yr CAGR **15.5%**

Hyperscale Platforms

DC Providers

*Values represent data from ESG Leaders only

Water Usage: Hyperscale Platforms vs. Data Centre Providers



*Values represent data from ESG Leaders only

Water Consumption Insights

Total water consumption by ESG Leaders increased from 55.8 million m^3 in 2020 to 114.9 million m^3 in 2025, growing at a 5-yr CAGR of 15.5%.

- Data centre providers increased water consumption from about 24.0 million m^3 in 2020 to 52.8 million m^3 in 2025, growing at a 5-yr CAGR of 17.1%.
- Hyperscalers have also increased water consumption, from 31.9 million m^3 in 2020 to 62.0 million m^3 in 2025, a 5-yr CAGR of 14.2%.
- Hyperscalers accounted for 54% of the total water consumption in 2025.

Data centre racks have been reaching higher and higher densities to support growing AI demands.

- Liquid-cooling is currently the most reliable way to get higher densities of 50kW/rack and higher. For AI workloads that require high densities, liquid-cooling is a necessity for those data centres.
- As more demands are requested for higher density support, new data centres are being built with liquid-cooling in mind.
- Previously, large data centres could get away with using conventional air cooling without problems for common rack densities under 20kW. And for a long time, average densities for enterprise workloads rarely exceeded 20kW.
- With densities of 20kW or higher, some air cooling solutions may not be enough and hybrid or liquid cooling systems have to be considered for the facility.
- Data centre providers have also been retrofitting old facilities to support higher capacities, although retrofitting liquid-cooling systems is expensive so data centre providers opt to build out new facilities that implement liquid-cooling in the initial design.

Water Consumption Insights, Cont.

Similar to energy, water consumption by data centres has become a key point for local backlash against new data centres. The industry has been directly addressing the issue of water usage.

- Water is used in different technologies for cooling data centre equipment and chips.
  - Direct-to-chip liquid cooling with closed-loop water circuits, which materially reduces evaporative water loss relative to conventional evaporative cooling.
  - Air-side economization with rear-door heat exchangers, which eliminates water draw entirely outside of periods of extreme heat.
  - Adiabatic cooling systems that pre-cools air before it passes over heat-rejection coils. These systems only use water during high ambient temperatures.

- Data centres can also draw from non-potable water sources and seawater, so drinking water sources are not at risk.

- Water-cooling technologies operate relatively efficiently in terms of water draw. Closed-loop systems can cycle the same volume of water through the electronics, meaning it only needs to draw water once.

- Many large-scale data centres have plans to design new facilities around closed loop water cooling systems.
  - Microsoft shared a zero-water evaporation closed-loop design, for its Phoenix and Mount Pleasant sites.
  - Google has disclosed that approximately one-third of its new builds in 2025 used dry or hybrid cooling designs by default.
  - Meta's LLM training clusters use closed-loop water systems.
  - Equinix has described closed-loop designs in its Frankfurt, Amsterdam and Paris halls.
  - Vantage has identified closed-loop retrofits as a condition of tenancy for several high-density customers.

- Heat recovery projects can also play a key role in reducing the amount of cooling needed for data centres.
  - Heat from data centres can be used to heat nearby buildings, farms, or greenhouses.
  - Heat recovery projects would be more difficult and less efficient if the data centres are built in rural areas far from other facilities, which many new builds especially in the US are.

None of these developments will eliminate data centre water consumption, but they are contributing to gains in water usage efficiency. Microsoft, for instance, reported a 20% reduction in freshwater use per MW against its 2020 baseline.

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