

Global Data Center Lithium-ion Batteries Market, Forecast to 2029

Data Centre Advancements Drive Market Penetration

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2022&2023



F R O S T & S U L L I V A N

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Executive Summary

Key Findings

- The Global Data Center Li-ion Batteries market was worth \$667.4 and \$766.9 million in 2022 and 2023. The market is still in its growth stage. The market is expected to grow at a high pace during the forecast period, but growth rates are expected to further decrease after 2024. Frost & Sullivan estimates the CAGR to be 13.8% between 2024 and 2029.
- North America (NA) and Europe accounted for 38.9% and 39.4% of the total market revenue in 2022 and 2023. However, Asia-Pacific (APAC), including China, was the single-largest revenue contributor, accounting for 40.8% and 41.5% in the same year. Rest of the World (ROW) is expected to register the lowest CAGR among all regions at 7.4% during the forecast period.
- Emerging markets are expected to grow at a faster rate than developed markets. China will be the fastest-growing region during the forecast period with 15.5% CAGR, followed by NA and Rest of Asia-Pacific (ROAPAC) with both 15.1% CAGR.
- The Internet Data Center(IDC) segment accounted for a big majority of the total market revenue, with a share of 36.6% and 37.5% in 2022 and 2023. It is expected to be the fastest growing segment, slightly followed by BFSI(EDC). The Telecom(EDC) segment is expected to experience the slowest growing sector, but still with a CAGR of 10.2%.

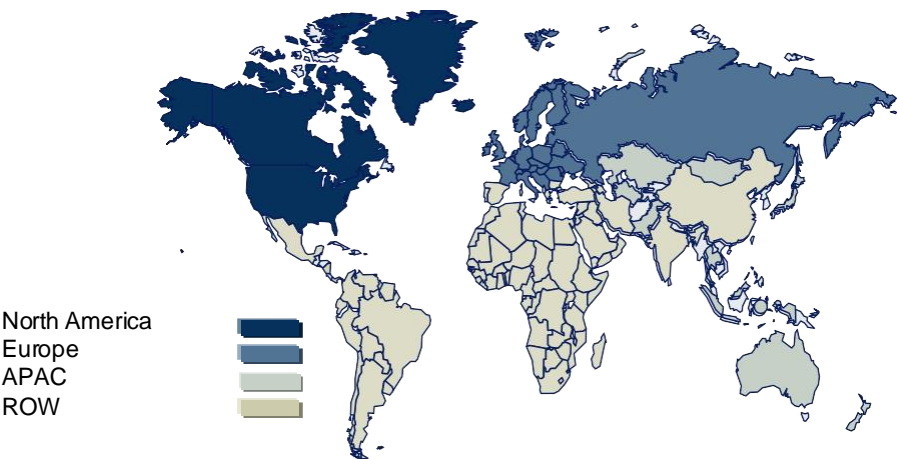
Key: NA — North America; ROAPAC — Rest of Asia-Pacific; ROW — Rest of the World (includes LATAM and the Middle East and Africa) ; BFSI — Banking Financial Services and Insurance. Source: Frost & Sullivan

Market Scope, Definitions, and Segmentation

Market Scope

Scope	
Geographic Coverage	Global
Study Period	2020–2029
Base Year	2023
Forecast Period	2024–2029
Monetary Unit	US Dollars

Segmentation by Region



The Data Center Li-ion Batteries mentioned in this report refer to the AC lithium-ion battery that is paired with UPS, which are specifically designed to provide power storage and backup power for data centers and critical power supply scenarios.

These battery systems are based on lithium-ion technology and are widely used in modern data centers for power security and energy management due to their high energy density, long lifespan, and fast charging capability. When there is a power outage or unstable power grid, it is used in conjunction with an UPS system to provide temporary power support for the data center, ensuring the normal operation of servers and other critical equipment.

Key: NA — North America; ROAPAC — Rest of Asia-Pacific; ROW — Rest of the World (includes LATAM and the Middle East and Africa) . Source: Frost & Sullivan

Market Definition

According to application scenarios, the Data Center Li-ion Batteries Market can usually be divided into two segments: **Data Centers** and **Critical Power Supply**.

The Data Center segment can be further divided into **IDC** (including Cloud services, Colocation) and **EDC**, which refers to the data center built and used for digitalization of various industries (especially in highly digitized industries such as **Telecom, Government and BFSI**)

Especially, **the Telecom** segment includes IDC type data centers (Colocation), EDC type self use data centers, and communication station equipment power supply for Critical Power Supply type (such as antenna, BBU, microwave and other access equipment power supply for communication base stations). The Telecom in this report only refers to its EDC type self use data centers.

Segmentation by End-user Vertical:

- **Internet Data Center(IDC)** comprises cloud services, colocation, internet services and Web hosting, etc
- **Enterprise Data Center(EDC)** comprises the data centers used for digitalization of various industries, which are self built and self used data centers. It mainly includes:
 - **Telecom** includes all core telecommunications applications for telecom manufacturers' self built and self used data centers.
 - **Government** comprises EDC for government facilities, institutions, utilities, and other government sectors.
 - **BFSI** mainly comprises EDC for banking, financial services, and insurance industries, and so on.
- **Critical Power Supply** comprises applications for critical infrastructure in non data center scenarios, such as the power supply of precision manufactured lithography machines, medical surgical equipment, airport runway lights/gates/subway screen doors and other terminal equipment.

Source: Frost & Sullivan

Drivers—Data Center Li-ion Batteries Market

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Overall Market Drivers

Data Center Li-ion Batteries Market: Key Market Drivers, Global, 2024–2029

Drivers	1-2 Years	3-4 Years	5-6 Years
Technological Advantages – Li-ion batteries with obvious technical advantages , are increasing the penetration rate of applications in data centers	H	H	M
Market Needs - Increasing demand for overall data centers and various scenarios drive the development of data center li-ion batteries market	H	H	M
Policy Supports - Various governments and companies have enacted favorable policies and capital supports and regional energy plans , to support the development of data center li-ion batteries market	H	H	M

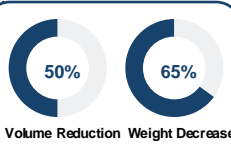

Impact Ratings: H = High, M = Medium, L = Low

Source: Frost & Sullivan

Driver 1: Technical Advantages of Li-ion Batteries

Lead-acid Battery vs Li-ion Batteries

Compared with the traditional mainstream materials (lead-acid batteries), lithium-ion batteries have more **technical advantages in size, weight, life, safety, cost** and etc..

	Lead-acid Battery	Lithium-ion Battery	→ Technical Advantages
Volume & Weight	Big & Heavy	Small & Light	 <p>Volume Reduction 50% Weight Decrease 65%</p>
Energy density(Wh/kg)	30—50	75—250	
Operating Temperature (°C)	-5—40	-30—60	
Low-temperature Tolerance (°C)	Need low-temperature electrolyte to thaw	Charge > 0°C, discharge > -10°C	<p>Higher operating temperature Wider tolerance to low and high temperatures</p>
High-temperature Tolerance (°C)	The best use temperature is 15°C-30°C	The best use temperature is 10°C-45°C	
Environmental Friendliness	Some toxic substances	Non-toxic substances	
Safety	Relatively mature technology and excellent safety	Technology in progress, good safety	<p>Eco-friendly</p>
Cycle Life (Times)	150-400	2,000-10,000	
Theoretical Life	Short	Long	
Cost	Low	Initial cost is high but TCO is lower, expected to be further reduced as tech matures	<p>2-3 times lifetime extension 4 times stock life</p>  <p>40% TCO Savings</p> <p>1.5-2 Times CAPEX 40% TCO Savings</p>

Outstanding Comprehensive Performance of Li-ion Batteries

Charging performance	Unable to charge quickly with high current	Achieve high current fast charging
Discharge performance	Unable to discharge high current, causing irreversible damage to the battery	Perform high rate and ultra-high rate discharge without affecting battery performance and lifespan
Self discharge rate	Capacity 10%	Can be ignored
Vibration/overcharge/high current test	Prone to leakage, expansion, and rupture	No leakage, no expansion, and no rupture phenomenon
Wear and Tear	Large capacity loss	Small loss capacity
Memory effect	Exist	No

The maturity and progress of lithium-ion battery technology support its application in data centers:

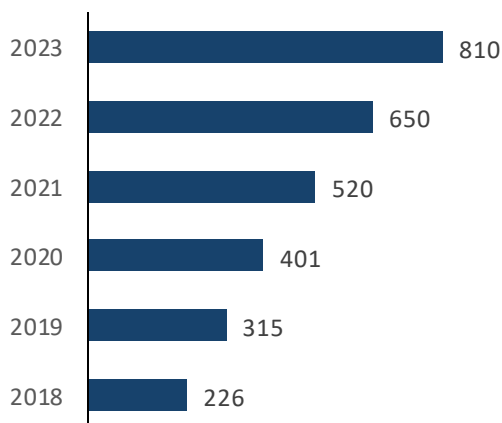
- **Performance improvement:** Lithium ion batteries have high energy density, long lifespan, fast response time, and low maintenance requirements, making them an ideal choice for backup power in data centers.
- **Space and cost efficiency:** Lithium ion batteries have a small footprint and low load-bearing requirements, which helps reduce space and cost pressures in data centers.
- **Flexible design:** Supports modular design, easy to expand and deploy, suitable for application scenarios in modular data centers and edge data centers
- **Environmental characteristics:** The environmental characteristics of lithium-ion batteries, including longer service life, less waste generation, and higher recyclability, meet the demand for green energy in data centers.

Source: Frost & Sullivan

Driver 2: Overall and Segmented Market Needs

Overall - The data center market needs, and scale are growing.

Number of Data Center Rackmount Servers in China (in ten thousand racks)



From the perspective of the number of rackmount servers, the size of data centers continues to grow steadily, with the size of large data centers growing rapidly.

The value of data center is highlighting

- Most foreign countries are guiding the development of data center, and the scale of data center market is expanding, with active investment and mergers and acquisitions.
- With the growth of new infrastructure and Digital China in the 14th Five-Year Plan, the data center market has entered a new phase with a steady increase in scale.

Increasing size of China's data center

- For the number of data center rackmount servers in China reaches 8.1million racks in 2023, with a compound average growth rate of nearly 30% in the past five years, showing the size of China's data center is increasing rapidly. The rapid expansion of data centers has driven the widespread adoption of lithium-ion batteries, especially in large rack mounted server scenarios where they are used more frequently.

Segmented - With the demand and trend of lithium batteries replacement, lithium battery data centers will further develop.

Energy storage systems in data centers in various countries are upgrading to li-ion, since trend of replacing lead-acid with lithium batteries is more obvious.

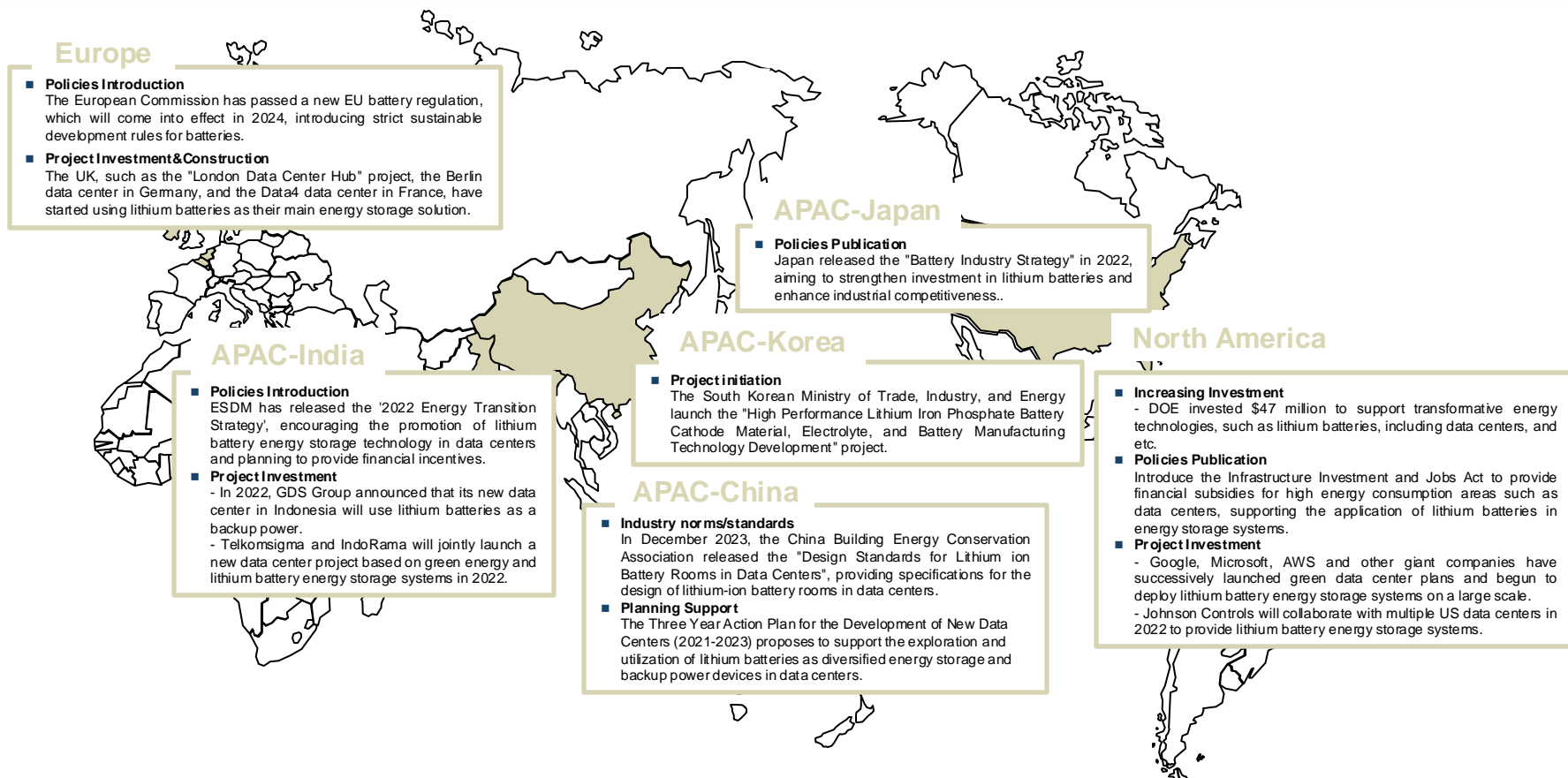
- As foreign countries propose the use of new energy storage applications, which in turn will use li-ion batteries, in order to promote energy saving and efficiency in data centers and help achieve the goal of carbon peaking and carbon neutrality.
- According to the target set by various countries, such as China's NDRC and MIIT announced the proportion of data centers reaching the benchmark level will exceed 30% by 2025. And based on the excellent environmental performance of lithium batteries, proportion of lithium batteries replacing lead-acid in data center will increase.

HPC and Edge computing scenarios are in great demand

- High density computing requires more power, while edge computing requires flexible distributed power solutions. The high energy density and modular characteristics of lithium-ion batteries can meet the diverse needs of these scenarios.

Source: National Development and Reform Commission (NDRC), Ministry of Industry and Information Technology (MIIT), Frost & Sullivan

Driver 3: Favorable Policies & Capital Supports in Countries



During 2022-2024, various countries have introduced policies and financial support related to the application of lithium batteries in data centers, aiming to promote the construction of the utilization system of lithium batteries in data centers and guide the standardized and integrated development of the industry.

Source: Frost & Sullivan

Forecasts and Trends —Data Center Li-ion Batteries Market

Forecast Assumptions

Forecasts are based on the factors listed below:

- Impact of global gross domestic product (GDP) growth
- Macroeconomic trends, such as resource availability, government regulations, and political stability
- Mega Trend analysis and impact assessment
- Technology evolution and its impact
- Impact of market drivers and restraints during the forecast period
- Data center expansion/new build trends
- Data center investment trends
- Data center application trends
- End-user vertical trends

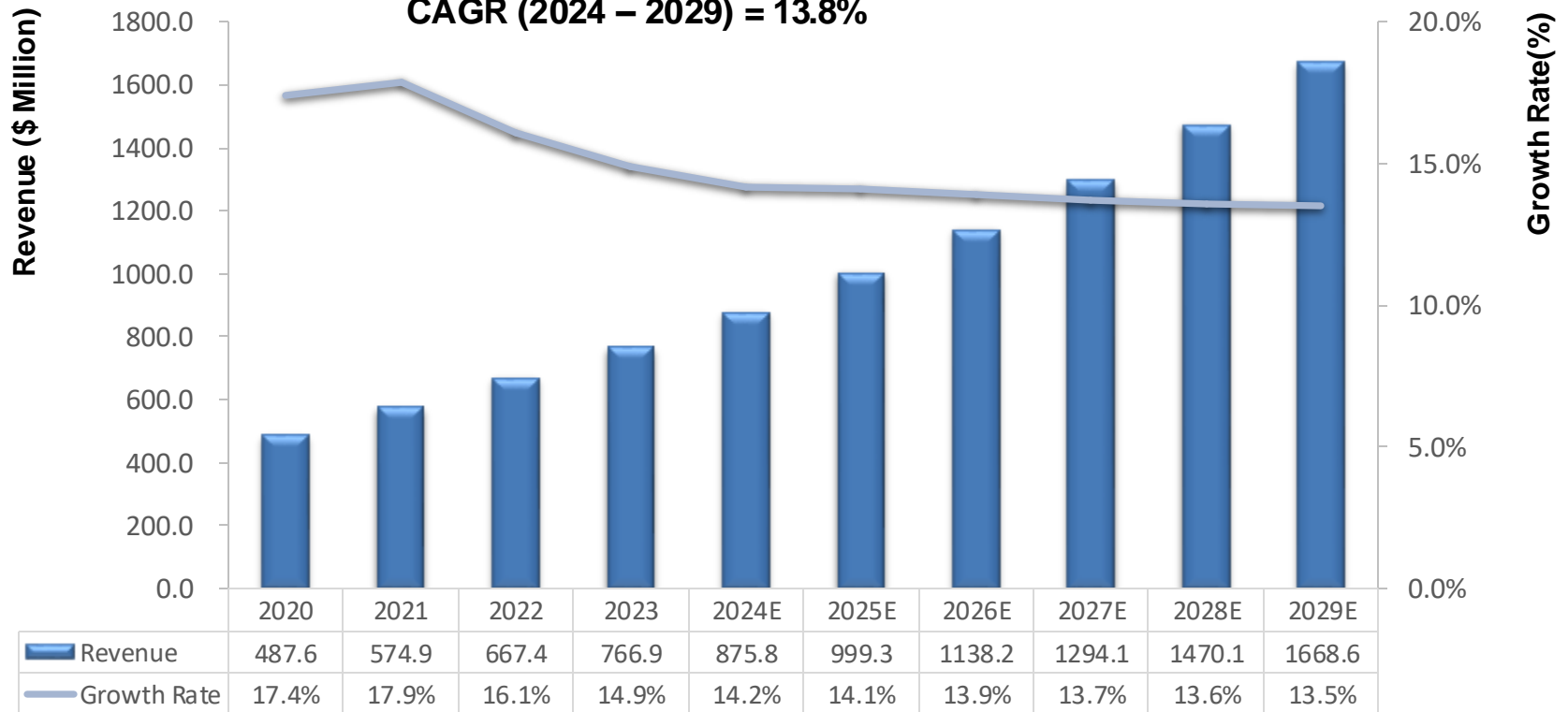
Source: Frost & Sullivan

Total Data Center Li-ion Batteries Market — Revenue Forecast

Key Takeaway: The Data Center Li-ion Batteries market is expected to achieve high-speed growth in the future, with a CAGR of 13.8% during the forecast period.

Total Data Center Li-ion Batteries Market: Revenue Forecast, Global, 2020 – 2029E

CAGR (2024 – 2029) = 13.8%



Note: All figures are rounded. The base year is 2023. Source: Frost & Sullivan

Revenue Forecast Discussion

- The Global Data Center Li-ion Batteries market is still in its growth stage, registering a market size of \$667.4 and \$766.9 million in 2022 and 2023, with a lot of potential for penetration in the future.
- In 2022 and 2023, the growth rate of the Data Center Li-ion Batteries market reach 16.1% and 14.9%, still maintaining stable growth. However, it is expected that the growth rate will gradually decline in the future, and by 2029, the growth rate of the Data Center Lithium-ion batteries market is expected to come down to 13.5%, clocking a CAGR of 13.8% from 2024 to 2029.
- From an End-user vertical segment perspective, Internet Data Center(IDC) clearly dominate the market, accounting for 36.6% and 37.5% of the revenue in 2022&2023 and are expected to drive market revenue during the forecast period. Meanwhile, BFSI(EDC) also contributes to the growth of Data Center Li-ion Batteries market with the CAGR of 12.4% between 2024 and 2029.

Source: Frost & Sullivan

Revenue Forecast by Region Discussion

North America

- NA accounted for 24.2% and 24.4% of the global market in 2022 and 2023. It is also expected to register a relatively higher share globally at 26.1% in 2029.
- Demand for applications such as Edge computing, AI, Internet of Things (IoT), Big Data analytics, and social media has seen steady increase in the region. This trend is expected to continue during the forecast period, ultimately driving the demand for data center Li-ion batteries.

Europe

- The European Data Center Li-ion Batteries market accounted for a share of 14.8% and 15.0% in 2022 and 2023, at a growth rate of 10.3% and 16.6%. This share is expected to stabilize at 15.1% by the end of the forecast period. The Data Center Li-ion Batteries market in Europe have shown a short-term rise in recent years, influenced by the continued use of lithium batteries in other industries and deepening the transition to green energy.

ROW

- ROW accounted for 20.2% and 19.1% of the global market in 2022 and 2023. Due to the relatively lagging energy supply and infrastructure construction, the demand for efficient and reliable energy storage solutions in this region is not as urgent as in developed regions, and the compound annual growth rate is relatively low compared to North America and the Asia Pacific region. The main growth in this region is expected to be driven by the Middle East, especially Dubai and the United Arab Emirates (UAE), and LATAM.

Source: Frost & Sullivan

Revenue Forecast by Region Discussion

China

- China is the single-biggest country in the world for Data Center Li-ion Batteries revenue. It accounted for 27.9%&28.5% of the global revenue and 68.4%&68.7% of the entire APAC region in 2022%2023. It is also expected to be the fastest growing region, and its revenue share is expected to increase from 28.5% in 2023 to 31.6% in 2029, registering a CAGR of 15.5% during this period.
- As one of the earliest regions to validate and implement lithium batteries, relying on the advantages of the global supply chain and the support of national policies, as well as the huge demand for new energy in the domestic, the Chinese Data Center Li-ion Batteries market is experiencing rapid growth.

ROAPAC

- Rest of APAC is expected to be the lowest market worldwide, with the share of 12.9% and 13.0% in 2022 and 2023. Its revenue is expected to increase from \$99.5 million in 2023 to \$233.1 million in 2029, at a CAGR of 15.1% during this period.
- As the dominant market for Data Center Li-ion Batteries, the Asia Pacific region is driven not only by the Chinese market, but also by the rapid expansion of data centers in Japan, South Korea, India, and Southeast Asian countries, which has brought significant growth to the market.

Source: Frost & Sullivan

Revenue Forecast by End-user Vertical Segment

Discussion 2022&2023

- The lead-acid batteries traditionally used in data centre UPS face high energy consumption, take up more space, increase costs, operate in a demanding environment, are prone to environmental pollution and require a lot of maintenance. Compared to these traditional batteries, Lithium-ion batteries are able to offer more advantages in terms of capacity, energy consumption and environmental requirements. So with the passage of time and the development of lithium battery technology in the past 2 to 3 years, its application in other end user vertical fields has gained considerable appeal and become an important choice for various industry scenarios.

Internet Data Center (IDC) Segment

- Internet Data Center end users have increasingly high demands for data center energy efficiency and sustainability and are more inclined towards Li-ion battery solutions, ultimately driving market growth. IT accounts for 36.6%&37.5% of the total market revenue in 2022&2023 and are also expected to be the fastest-growing segment during the forecast period, growing at 16.6% CAGR from 2024 to 2029.

Telecom (EDC) Segment

- The Telecom vertical is expected to register the CAGR between 2024 and 2029, growing at a relatively slow rate of 10.2%. The main reason is that the telecom industry has become saturated, with limited incremental demand from major operators and a slowdown in data center infrastructure construction.

Source: Frost & Sullivan

Revenue Forecast by End-user Vertical Segment

Discussion 2022&2023

Government (EDC) Segment

- The government segment still accounts for a small portion of the total market and is expected to register the CAGR of 11.7% during the forecast period, which is slightly behind Telecom segment. Especially under the promotion of smart cities and digital governments, a large number of government related data center construction and energy management projects have been launched one after another.

BFSI (EDC) Segment

- The BFSI segment is expected to have a steady growth in the future, reaching a compound growth rate of 12.4% between 2024 and 2029. As the BFSI scenario attaches great importance to data security and business continuity, especially in the context of high availability requirements for financial transactions and customer service. The high-density storage capacity, fast response capability, and support for modular design of lithium-ion batteries have become an ideal choice for its data centers.

Critical Power Segment

- The Critical Power Supply scenario is an important segment of the application of data center Li-ion batteries, which will show a high growth trend in the future, reaching a CAGR of 12.4% between 2024-2029. Mainly due to the increasing demand for high energy efficiency, high load capacity, and high reliability in medical surgical equipment, laboratory precision instruments, production automation equipment, etc., the development of lithium-ion batteries meets this demand.

Source: Frost & Sullivan

Growth Opportunities and Companies to Action

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Growth Opportunity—The Demand for Cost Reduction and Efficiency in Growing Data Centres

Applicable
Regions

Global

Vision Transformation

Mega Trends' Impact

Disruptive Applications

Business Models

Offerings

New Capabilities

Value-add Services

Vertical Markets

Geographic Expansion

Partnerships

Investment/M&A

Context and Opportunity



- The rapid development of technologies such as cloud computing, big data, AI, and IoT has driven the continuous expansion of global data centers, and more and more enterprises are choosing to migrate their business to cloud platforms.
- At the same time, most data centers are currently facing challenges of space constraints and operating costs. Traditionally, lead-acid batteries in data centers have problems such as high energy consumption, low energy density, and environmental unfriendliness.
- These will drive the development of Li-ion batteries from the demand side.

Call to Action



- Compared to lead-acid batteries, Li-ion batteries provide the same power in less than a third of the footprint.
- Li-ion batteries support customers to increase the size of their existing IT system deployments while reducing cooling requirements and the space available for UPS power supplies to save investment costs and operational costs.
- Li-ion batteries have a longer average operating life, effectively reducing the cost and maintenance burden of battery replacement.

Source: Frost & Sullivan

Growth Opportunity—Upgrading and Innovation in Li-ion Battery Technology

Applicable
Regions

Global

Vision Transformation

Mega Trends' Impact

Disruptive Applications

Business Models

Offerings

New Capabilities

Value-add Services

Vertical Markets

Geographic Expansion

Partnerships

Investment/M&A

Context and Opportunity



- Security: Under over-temperature and over-voltage conditions, the exothermic side reactions occur in Li-ion battery cells, followed by positive heat feedback, resulting in thermal runaway, high temperatures, and large amounts of combustible gases, followed by combustion.
- Design: Li-ion batteries have modular characteristics and high energy density, which enables them to support flexible deployment and expansion.

Call to Action

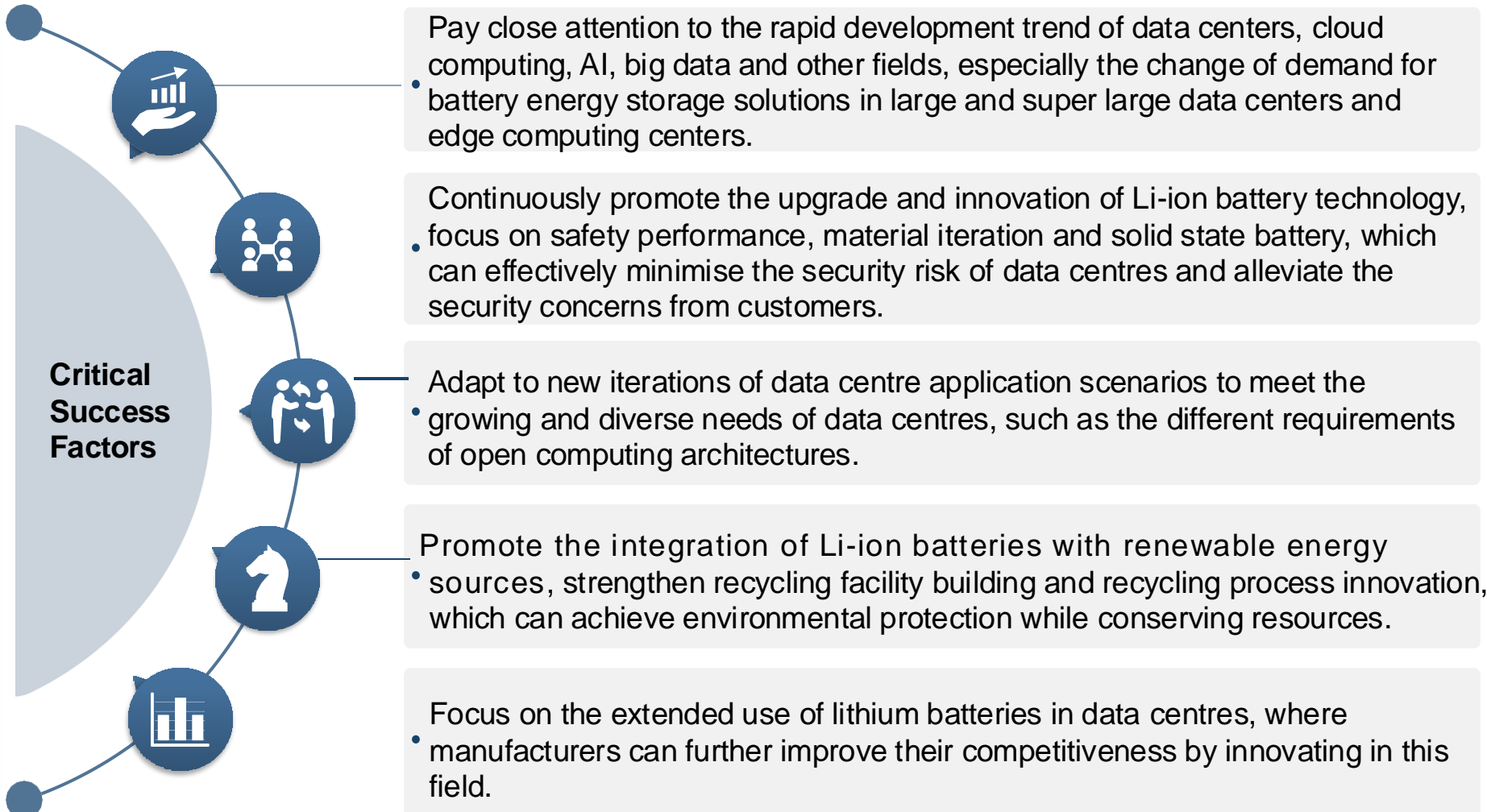


- Chemical changes and packaging improvements, as well as improvements and maturity in materials and production processes, and development of Solid State Batteries make Li-ion batteries more stable and reliable.
- Utilize BMS system for management, monitoring, and testing to prevent overcharging or overheating of Li-ion batteries.
- The development of miniaturized and distributed lithium battery energy storage system will meet the needs of scenarios such as edge computing nodes and 5G base stations.

Source: Frost & Sullivan

Strategic Imperatives for Success and Growth

Critical Success Factors



Pay close attention to the rapid development trend of data centers, cloud computing, AI, big data and other fields, especially the change of demand for battery energy storage solutions in large and super large data centers and edge computing centers.

Continuously promote the upgrade and innovation of Li-ion battery technology, focus on safety performance, material iteration and solid state battery, which can effectively minimise the security risk of data centres and alleviate the security concerns from customers.

Adapt to new iterations of data centre application scenarios to meet the growing and diverse needs of data centres, such as the different requirements of open computing architectures.

Promote the integration of Li-ion batteries with renewable energy sources, strengthen recycling facility building and recycling process innovation, which can achieve environmental protection while conserving resources.

Focus on the extended use of lithium batteries in data centres, where manufacturers can further improve their competitiveness by innovating in this field.

Source: Frost & Sullivan