

The Analysis of Business Scenarios and Implementation Path of “5G+Source-network-load-storage ”multi-station integration

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Abstract. With the gradual implementation of the country's "new infrastructure" strategy, the market demand for infrastructure in strategic emerging industries such as 5G, data centers and electric vehicle charging has become more intense. The multi-station integration business that carried out by power grid companies can effectively meet market demand, avoid the repeated construction and investment problems of state-owned assets, and reduce the cost of operators, Internet enterprises and other customers of infrastructure construction. Combined with the current market demand and the development trend of emerging industries, this paper puts forward the concept of "5G-source network-load storage"multi-station integration which mainly focusing on digital services and energy services, studies the commercial application scenarios of "5G-source network-load storage"multi-station integration, analyzes its implementation optimization path, and provides a reference for power grid companies to accelerate multi-station integration business.

1 Preface

Under the trend of interweaving energy revolution and digital revolution, China's energy industry, data industry and communication industry will enter the era of intelligent economy. Especially since 2020, the state has focused on promoting the "new infrastructure" strategy, which has provided a booster for the rapid development of emerging industries such as 5G and data centers.

State Grid Corporation actively responded to the "new infrastructure" strategy, focusing on data centers, industrial Internet of Things, energy Internet 5G networks, artificial intelligence and other "new infrastructure" areas, carried out new digital infrastructure construction such as energy data center, power big data application and smart energy integrated service.

Multi-station integration is an important part of the new digital infrastructure construction of State Grid Corporation, through the use of existing substation resources, with the construction of data centers, charging stations, energy storage stations, 5G base stations, Beidou enhancement stations, distributed photovoltaic stations and other content, so as to improve the utilization rate of substation site resources and energy efficiency, while serving the region's 5G industry, big data industry and other emerging business development, to achieve enterprise-enterprise cooperation, mutual benefit and win-win situation^[1].

2 The definition and apply value of “5G+Source-network-load-storage ” multi-station integration

2.1 The definition of “5G+Source-network-load-storage ”multi-station integration

In January 2019, State Grid Corporation proposed to explore a new model for the use of substation resources to build power storage stations and data center stations, that is, the "three-in-one" model of the convergence of substations and energy storage stations and data centers, laying the foundation for the development of multi-station integration business.

In the same year, State Grid Information Industry Communications Group Co., Ltd. launched the "multi-station integration" operation center construction, fully supporting the State Grid Corporation "multi-station integration" special work. The "multi-station integration" pilot with data center as its core is gradually spreading within the scope of state grid company operations.

In the process of promoting the practice of piloting in various places, the connotation and extension of multi-station integration are also constantly updated. Such as Jiangsu Wuxi Red Flag substation project integrated substation, charging station, data center station, 5G base station and Beidou base station ;The all-DC prefabricated data center built in Tonuri, Suzhou, integrated data center and power electronic transformer energy storage system,

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and becomes the core of the new energy "micro-ecosystem" in Tonli demonstration area.

Based on the development trend of Internet, communication and other related market demand and the changing trend of multi-station integration project, it can be seen that the application value of multi-station integration mainly reflects the digital service with 5G as the core, and the energy service including the "source network load storage" two aspects.

Therefore, this paper puts forward the idea of "5G+Source-network-load-storage" multi-station integration. In this scenario, multi-station integration is based on substation basic resources, integration and construction of 5G base station, 5G convergence room, data center, distributed photovoltaic station, energy storage station, electric vehicle charging station and other functions.

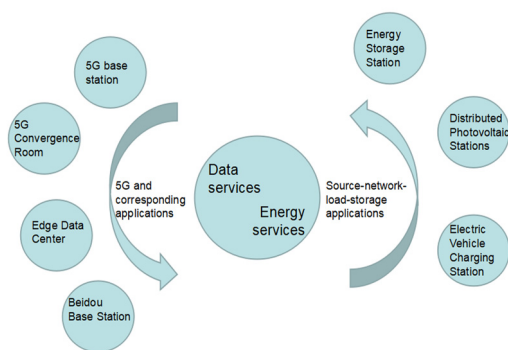


Fig. 1. The definition of "5G+Source-network-load-storage" multi-station integration.

2.2 The apply value of "5G+Source-network-load-storage" multi-station integration

"5G+Source-network-load-storage" multi-station integration set communications services and energy services as the two major directions, focusing on meeting the market demands of following areas:

(1) The 5G network infrastructure market demand.

With the orderly deployment of "new infrastructure" strategy, the process of 5G network construction has been accelerated significantly, and the scale of 5G infrastructure construction has expanded significantly. According to the Ministry of Industry and Information Technology, 5G network construction and application will be carried out in an orderly manner in 2021, 5G coverage

Table 1. The typical business scenario of "5G+Source-network-load-storage" multi-station integration.

Integrate Content	Function Output	Resource Requirements	development pain points
5G base station and convergence room	5G communication service	Construction site; Transformation and Distribution resources department; Reduce electricity expenditure	The power consumption of 5G base station is 2-3 times that of 4G base station, and the construction density of base station is 1 times higher than that of 4G base station, so it is difficult to select the site of urban center for land acquisition
Edge data center	Data storage, calculation and transmission	Construction site; Transformation and Distribution resources department; Reduce electricity expenditure	Electricity expenditure accounts for 60% - 70% of the total operation and maintenance cost, which requires high power supply reliability and site safety and stability

will be accelerated in major cities, co-construction and sharing will be promoted, and more than 600,000 new 5G base stations will be built. The 5G operators will face high investment costs, central urban site acquisition difficulties operational maintenance difficulties and other difficulties of large-scale 5G infrastructure construction. Multi-station integration project uses the resources of urban center substation to carry out 5G base station and machine room construction, effectively reduces the investment cost of operators, solves the problem of operator site acquisition, avoids repeated investment and repeated construction, and is conducive to accelerating the construction of 5G network.

(2) The market demand for edge computing nodes.

The explosive growth of data traffic and network bandwidth brought about by the 5G era makes it necessary for data processing to be matched by edge compute nodes with wide distribution, high density, proximity to the user side and data source to solve the problem of long centralized processing delays and high aggregation of traffic. Relying on edge computing nodes built by multi-station converged data center, we can meet the high density deployment requirements of 5G and industrial IoT computing nodes and support the needs of IoT applications.

(3) The charging station pile market demand.

In recent years, China's electric vehicle industry has developed rapidly, and it is predicted that the number of new energy vehicles in China will reach 7.77 million in 2021. China's charging station pile development is relatively lagging behind, as of February 2020, the China Charging Alliance member vehicle enterprises sampling 1047525 vehicle piles with information, the ratio of unsatisfied vehicle charging needs was up to 31.85 percent, seriously affecting the user experience. The construction of electric vehicle charging station pile by multi-station integration can effectively reduce the investment and operating cost of building stations in urban center business circles, office areas and residential areas, further reduce the ratio of electric vehicle piles, and alleviate the user's "mileage anxiety", which is of positive significance for promoting the development of electric vehicle industry.

3 Analysis of the integration business scenario of "5G+Source-network-load-storage" multi-station integration

Energy storage station	Four quadrant power capability, Power time shift	Construction site; Power transformation and distribution Resources department;	The cost is high; The business application scenarios are not rich; The profit model is not mature
Distributed photovoltaic	Clean energy in place	Construction site	The output power has randomness and fluctuation, so it can not be used as a stable power supply
Electric vehicle charging station	Charging service	Construction site; transformation and distribution resources department; Reduce electricity expenditure	The structural supply of charging infrastructure in densely populated areas is insufficient

Figures 1 shows the typical business scenario of "5G+Source-network-load-storage" multi-station integration.

3.1 5G base station and convergence room

The main target customers of multi station convergence 5G base station and convergence room service are communication operators with 5G network infrastructure construction needs. According to statistics, China Mobile has built the world's largest 5G SA network in 2020, opening more than 385000 5G base stations. China Telecom and China Unicom have opened more than 320000 5G sites, covering more than 300 cities in China, and built the world's largest co-construction and sharing 5G network. It is reported that the three 5G operators will continue to invest in the construction of 5G base stations in 2021 to expand their coverage.

The main construction content of multi-station integration of 5G base station and convergence room is to carry out 5G base station construction and attachment, 5G convergence room construction and sharing services by using the resources of substation open space, room, roof, tower and so on.

Multi-station integration of 5G base station and convergence room business mainly realizes space rental income by providing indoor room, outdoor space, roof and other site resources of substation, and realizes modern operation and maintenance income by providing 5G equipment operation and maintenance later.

3.2 Edge data center

The edge computing center is widely deployed in the densely populated downtown business district, office district, residential district and substation of large-scale park to realize the interconnection of stations, mutual perception, mutual cooperation, and form a decentralized fog computing grid, which can meet the requirements of high-density deployment of 5G and industrial Internet of things computing nodes, and support the intensive bandwidth of consumer Internet, industrial Internet and other fields' real-time scene requirements. In the field of consumer Internet, edge computing can support the smooth application of high-definition video, cloud games, live video, CDN, smart logistics, new retail and other businesses. Facing the field of industrial Internet, it can support smart security, industrial Internet of things, smart medical, 5Gmcc, smart integrated energy services and other applications^[2].

Edge data center can provide the following services

and generate revenue for customers in data center, Internet, Internet of things and other fields:

IDC services. Provide parking space, cabinet, micro module or container, lease cabinet and network resources, and charge rental fee.

Cloud services. Provide IAAs cloud products such as computing, storage and network, PAAS layer cloud products such as database, big data platform and micro service platform, SaaS layer products such as security and Bi software, and charge service fees^[3].

Cloud edge collaborative integration solution. According to the needs of industry customers, integrate the resource advantages of IDC, centralized cloud platform and edge nodes, supplemented by the platform architecture design and algorithm capabilities of vertical industry demand scenarios, create an integrated solution and charge service fees^[4].

3.3 "Photovoltaic-Charging-Storage"micro-grid

The distributed photovoltaic power station, electric vehicle charging station and energy storage station in the energy storage station can form the self circulating microgrid in the station^[5]. Among them, the distributed photovoltaic power station provides green power for electric vehicle charging station, and the remaining power is connected to the energy storage station for energy storage. During the peak period of power grid, the energy storage station can supply power for the charging pile, and at the same time, it can be integrated into the power grid to supply power for its power users. In this way, the "optical charging and storage" system is integrated to build a two-way flow of power flow and energy flow, forming a self circulation micro-grid system with self use and surplus. As a virtual power plant, the micro-grid of "optical charging and storage" can be included in the dispatching scope, participate in peak load reduction and valley filling, reduce the load transfer rate and reduce the investment of power grid capacity increase^[6]. Based on the platform of smart Internet of vehicles, the electric vehicle charging station can become the information and energy interaction carrier among the power grid, charging station and electric vehicle users. The peak valley price incentive mechanism can be used to guide users to charge off peak and reduce the power cost.

4 The Optimization path analysis of “5G+Source-network-load-storage” multi-station integration

4.1 Strive for government support

“5G+Source-network-load-storage” multi-station integration is a new business mainly facing the national strategic emerging industry market. At present, it is still in the initial pilot stage, and has not formed a perfect business model and mature business system. It needs the government's policy support and the cooperation of relevant enterprises to help the business smoothly through the cultivation period. Therefore, it is suggested that the power grid enterprises should adopt the strategic policy of “government guidance, enterprise operation”, closely combine the characteristic needs of the local government in 5G, digitization, clean energy consumption, smart city operation, smart government affairs and other aspects as well as the development planning of key industries in the city, carry out multi-station integration business planning and integration product design, and actively strive for capital and technology guidance from the government Guidance and policy preference.

4.2 Unified business operator

“5G+Source-network-load-storage” multi-station integration involves rich integration content, wide market-oriented, and large scale of participants. There are multi professional and multi-agent intersections in project planning, design, construction, operation and maintenance. The scope of responsibilities and work interface are not easy to sort out and clear, which will have a certain impact on power grid companies after large-scale development. Therefore, the power grid company should consider building a unified business operation entity covering the headquarters, provincial and local levels within the scope of business, coordinating the cooperation of various specialties of the company internally, and all kinds of partners and customers externally, so as to further improve the operation efficiency of the business.

4.3 Develop phased marketing strategy

When formulating the market strategy, the power grid enterprises should take the principle of core business priority first, and formulate the market strategy by stages. Taking 5G infrastructure construction and data center as the breakthrough point of business, the power grid enterprises should open up market demand and form a preliminary scale. At the same time, the power grid enterprises should speed up the breakthrough and application of key technologies of “source-network-load-storage” micro system in the station, improve the quality and efficiency of energy consumption in the station, and enhance the economy of multi-station integration. Orderly promote the evolution of service products from base station co construction, computer room sharing and other basic businesses to cloud services and enterprise

customized services, enhance the reuse value of power basic resources and data resources of power grid enterprises, break through the “low-end blockade” of product value chain, and create greater profit space.

5 Conclusion

“5G+Source-network-load-storage” multi-station integration is a kind of integrated service form which can efficiently enhance the comprehensive utilization value of power grid stock assets, help to meet the rapid development needs of 5G industry, Internet industry and other emerging pillar industries, help to promote the digital transformation of energy, and help to cultivate new growth poles and growth points of power grid enterprises.

The core intents of “5G+Source-network-load-storage” multi-station integration include 5G base station and convergence room, edge data center, “Photovoltaic-Charging-Storage” micro-grid, and other extended functions. Therefore, its business model also has a wealth of changes and objective development space. It is suggested that the optimization path analysis of “5G+Source-network-load-storage” multi-station integration for the current situation include striving for government support, Unifying business operator and developing phased marketing strategy.

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