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Case Study

NTPC Vindhyachal (Power & Construction)

Wireless Power, Driving Efficiency

Powering Connectivity at One of the Largest Thermal Power Plant

Background

NTPC Vindhyachal is a major coal-fired thermal power plant operated by NTPC Limited, India's largest power generating company. It is located in the Singrauli district of Madhya Pradesh. Established in the late 1980s, NTPC Vindhyachal is one of the largest power plants in India and plays a crucial role in meeting the country's electricity demands. The plant has a total installed capacity of 4,760 MW, making it one of the highest-capacity coal-fired power plants in India.

The plant consists of 13 separate units, each with a capacity ranging from 210 MW to 500 MW. The first unit of the plant was commissioned in 1988, and the last unit became operational in 2012. NTPC Vindhyachal is equipped with advanced technology and emission control systems to reduce its environmental impact. It employs electrostatic precipitators and flue gas desulfurization (FGD) systems to control particulate matter and sulfur dioxide emissions, respectively. Additionally, the plant has implemented several energy-efficiency measures, such as air-cooled condensers and regenerative air preheaters, to optimize its performance.

The power generated at NTPC Vindhyachal is supplied to various states, including Madhya Pradesh, Uttar Pradesh, Delhi, Haryana, Rajasthan, and Maharashtra, through the national grid. The plant plays a vital role in meeting the energy demands of these states and contributes significantly to the overall electricity generation in the country. NTPC Vindhyachal is also known for its efforts in promoting sustainable development and community welfare.

The plant has undertaken various initiatives in the areas of education, healthcare, and skill development for the local communities surrounding the plant. It has also implemented measures for environmental conservation, such as afforestation and water management programs.

NTPC Limited received 9th PSU IT Award under organization category on 16.02.2023 at New Delhi. This award has been given to NTPC under Digital PSU Category for its Digital Transformation Strategy to be a Digital Enterprise.[1]

NTPC operates from 70 locations in India, one location in Sri Lanka and two locations in Bangladesh. In India, it has eight regional headquarters.[2]

As our fourth deployment for NTPC across India, we're pleased with the success of our Wi-Fi solution at Vindhyachal. It has made a significant impact, enhancing connectivity and efficiency throughout the plant. Our dedication to providing reliable networking solutions remains unwavering, and we're proud to continue supporting NTPC's operations nationwide.

Bhuvnesh Sachdeva
(Senior Vice President, Communication)

Overview

The NTPC Vindhyachal power plant is a vast and intricate facility that demands efficient communication and data transfer for seamless operations. In the digital era, wireless connectivity has emerged as an indispensable technology, offering numerous advantages over traditional wired networks. Wireless networks enable plant personnel, including engineers, technicians, and supervisors, to access critical data and communicate seamlessly while on the move, enhancing operational efficiency.

With wireless connectivity, plant operators can remotely monitor and control various systems and processes from centralized control rooms or off-site locations, improving operational intelligence and agility. Moreover, wireless networking is strengthening physical security and safety capabilities through deployments like wireless video surveillance and access control systems, underscoring its vital role in ensuring sustainable performance.
As thermal power plants strive to optimize processes, accelerate digitalization, and drive new levels of operational excellence, robust wireless networking is emerging as a foundational technology enabler. By eliminating the constraints of wired infrastructure, wireless empowers plants to leverage the potential of low-cost, low-power IIoT sensors for comprehensive process monitoring, asset management, and resource planning. Furthermore, wireless connectivity facilitates rapid transmission of high-definition schematics, data, and operational information to mobile devices and heads-up displays, enhancing situational awareness and decision-making.

The deployment of HFCL's Wi-Fi network at NTPC Vindhyachal provides reliable high-speed, high-capacity, and low-latency connectivity across the plant, supporting mission-critical applications. It offers secure connectivity for enterprise-wide asset management, process optimization, and data integration, improving communications, safety, and security across the facilities.

The country's power consumption grew by over 16% to 151.66 billion units in August 2023 compared to that of the same month last year.[3]

NTPC Group's total installed capacity touches 75,418 MW.[4]

Challenge

NTPC Vindhyachal faced significant challenges with their existing wireless network infrastructure. Despite having a wireless network, consistent and reliable connectivity across the plant premises remained elusive. The existing range was inadequate, restricting wireless coverage to certain areas of the plant premises. Furthermore, the end of life equipment could not meet the increasing demand for higher throughput, necessitating an infrastructure upgrade to support the power plant's operational requirements.

Solution

To address the connectivity issues and provide seamless wireless coverage across the vast plant premises, HFCL implemented a robust Wi-Fi solution consisting of 90 Wi-Fi 5 indoor Access Points (APs), and 50 Wi-Fi 5 outdoor Access Points. A detailed survey of the entire premises was done by the team to figure out the hotspot areas to install the Access Points. These APs were strategically placed to eliminate dead zones and provide reliable connectivity in every corner of the facility. The deployed access network offered significantly higher data rates, increased capacity, and improved performance, even in the high-density environment of the plant with numerous concurrent users.

The 4x4 Wi-Fi 5 indoor APs offered simultaneous data transmission to multiple devices, maximizing data throughput and improved network efficiency. It ensured optimal performance even in high-density areas with numerous concurrent users. Additionally, the indoor APs offered enhanced uplink and downlink performance, delivering faster data speeds for seamless access to bandwidth-intensive applications and resources. Complementing the indoor APs, the 2x2 Wi-Fi 5 outdoor APs delivered an aggregate throughput of 1.27 Gbps and supported up to 256 QAM modulation.

With their IP67-rated enclosure and high-performance antennas, these outdoor APs ensured comprehensive coverage without any dead zones, even in challenging weather conditions. The deployed network catered to both guest and employee access, with authentication integrated with NTPC Vindhyachal's existing AAA (Authentication, Authorization, and Accounting) infrastructure running on their firewall. This streamlined the authentication process and ensured secure and controlled access to the wireless network. Additionally, we deployed an on premise controller, which acted as the central management platform for the entire network infrastructure. It enabled centralized configuration, monitoring, and troubleshooting of all deployed APs, simplifying network administration and ensuring optimal performance.

The on-premise controller also supported Wireless Intrusion Prevention System (WIPS) and Wireless Intrusion Detection System (WIDS) features, providing an additional layer of security by detecting and mitigating potential wireless threats. Furthermore, it offered frequency scanning capabilities, allowing for proactive identification and resolution of interference issues, and generated comprehensive Key Performance Indicator (KPI) reports, enabling data-driven network optimization and performance monitoring.

Indoor Wi-Fi

Wi-Fi 5 Access Points

Outdoor Wi-Fi

Wi-Fi 5 Access Points

Result

01 Achieved seamless and reliable wireless connectivity across the vast plant premises, eliminating dead zones.

02 Increased network capacity, and improved overall performance, even in high-density environments with numerous concurrent users.

03 Indoor APs delivered simultaneous data transmission to multiple devices, maximizing data throughput and network efficiency.

04 Outdoor APs, with their IP67-rated enclosure and high-performance antennas, ensured comprehensive coverage even in challenging weather conditions.

05 Implemented secure and controlled access to the wireless network through integration with existing firewall infrastructure.

Conclusion

The implementation of HFCL's Wi-Fi solution at NTPC Vindhyachal has effectively addressed connectivity challenges, providing seamless coverage across the plant premises. With strategically deployed indoor and outdoor Access Points, dead zones have been eliminated, and network capacity has increased, even in high-density areas. The integration with existing infrastructure ensures secure access, while centralized management simplifies administration. Overall, this upgrade has significantly improved operational efficiency and user experience, emphasizing the importance of robust wireless networking in industrial settings.

References

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4. https://ntpc.co.in/installed-capacity

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