Presentation on CNPN

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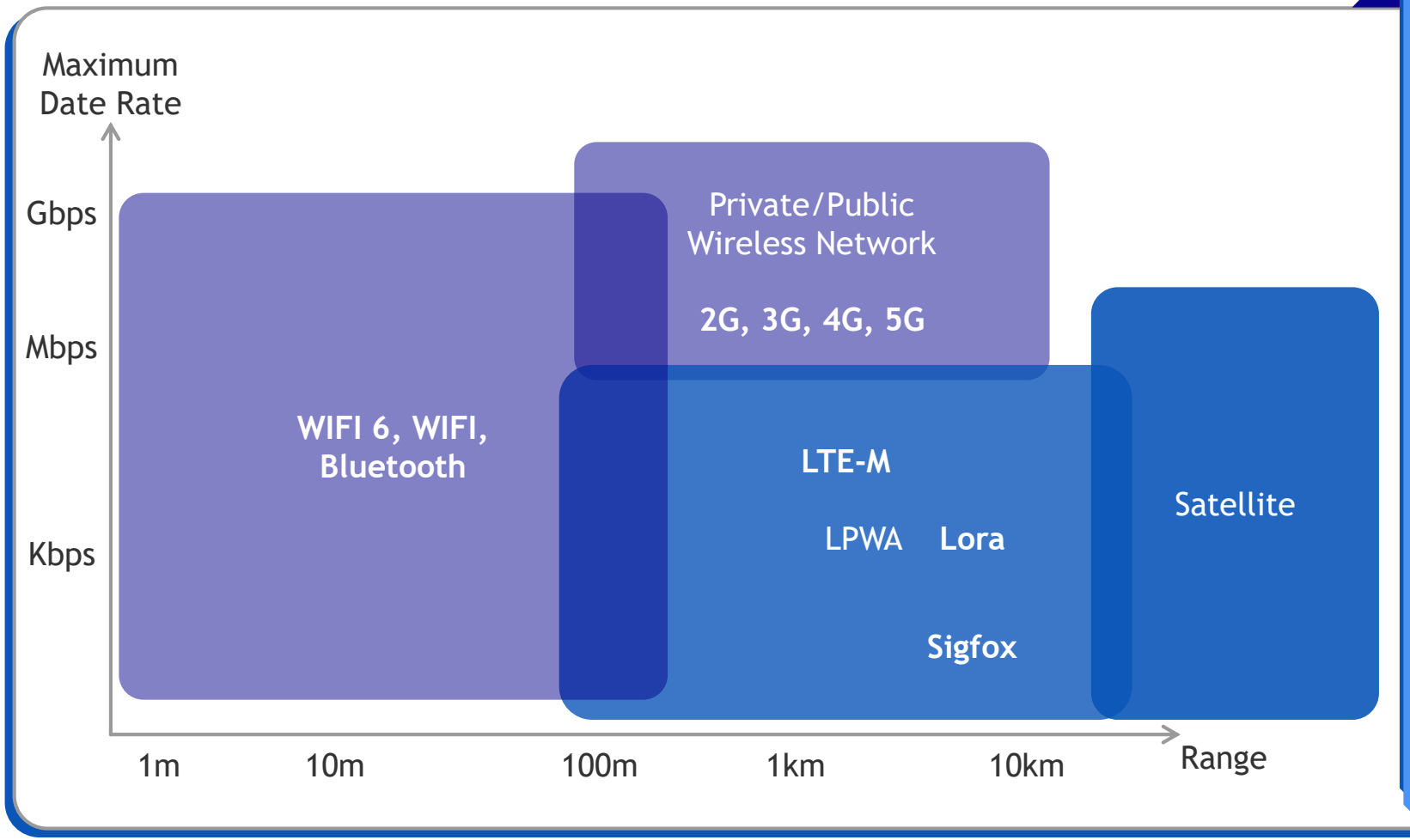
BSNL
Connecting Bharat
Securely • Affordably • Reliably

5G CNPN is a core connectivity solution offered by Telcos today - powering connectivity for Industry 4.0 adoption



BSNL ensures optimal solutions tailored for diverse Enterprises

5G CNPN networks form the cornerstone of dedicated connectivity today

5G CNPN Networks are owned by and utilized solely for the needs of an enterprise

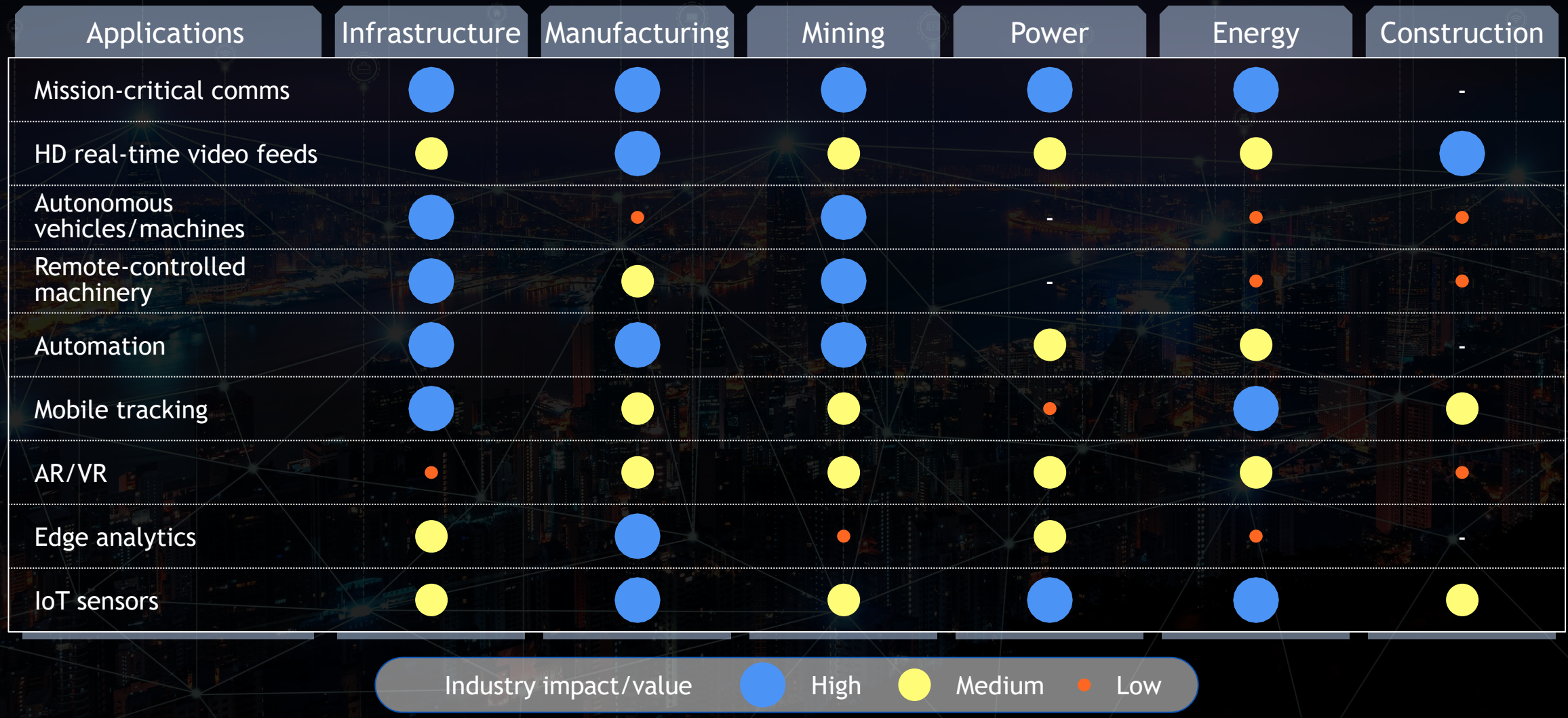
CNPN Networks are Secure Radio Access Networks utilized solely for the benefit of a non-operator entity

The networks are generally **owned by the beneficiary,** and may be operated by themselves or a third party (e.g., MNOs)

CNPN Networks, like public networks, **need to utilize a dedicated 5G spectrum (typically)**

Use cases like real time video feed, mission critical comms and automation emerging as high potential hotspots across key sectors

Illustrative



Key Features of 5G CNPN Solutions

Preliminary; non-exhaustive

Key Features	5G CNPN
Technology	• Efficient use of the radio spectrum • Transmit data to large number of devices simultaneously (MU-MIMO) • Encode more data in the same amount of spectrum (Advanced QAM) • Enable high data rate at a given range resulting in greater network capacity • Effectively share channels to increase network efficiency and lower latency for both uplink and downlink traffic in high demand environments (OFDMA) • Aggregate spectrum channels to increase spectrum (up to 1000 mHz aggregate channel compared to 100mHz of 4G LTE)
Spectrum Access	• New Radio Unlicensed (NR U) utilizes unlicensed spectrum for extra capacity for high-bandwidth applications; currently only have New Radio Licensed
Deployment/ Customer Adoption	• Network slicing allows access to private spectrums on public network • Top equipment vendors already produce 5G-ready devices
Security	• 5G defines full-system, E2E specifications with secure user access & traffic prioritization
Cost	• Traction with network slicing might reduce need for large cell installment to hop onto PN[1]

1. Private networks

Source: Market interviews, BCG analysis

Primary application areas and use cases for 5G CNPN networks

Preliminary; non-exhaustive

Industry / Use Case	Transportation	Manufacturing and Logistics	Energy and Raw Material	Government & Public Safety	Healthcare
Mission-critical comms	• High-speed wireless in/outdoor connectivity for communications across stations, lines and depots	• MEC supports automated guided vehicles (AGVs) to replace the production line[1] • Video access to the engine overhaul shop floor, enabling remote engine parts inspection	• Remote control of pit- vipers and bulldozers • High-resolution AR/VR in mining to increase precision during ground excavations	• Reliable, secure data & voice communications to first responders • Real-time train-to-ground video surveillance from the train cab to control center	• Provide doctors and nurses with resilient communications across campus
Real-time video feeds	• Live video for traffic monitoring, accident management across highways and urban intersections	• Real-time monitoring of assembly lines to detect defects or ensure process compliance	• High-resolution video surveillance of mining operations for safety and precision in excavation	• Real-time video for crowd management, disaster response, and surveillance in critical areas	• Remote medical consultations with HD clarity for real-time diagnostics
Multi-purpose and scalable IoT networks	• Tracking, analyzing & managing connected devices such as tugboats, air pollution detectors, cameras & port sensors		• Advanced metering infra. (AMI): gas system sensors & controls, monitoring & control of customer-owned distributed energy inverters	• Connected drones. In the future, automated drones for traffic and road monitoring purposes	

1. MEC = Multi-Access Edge Computing; Source: BCG analysis

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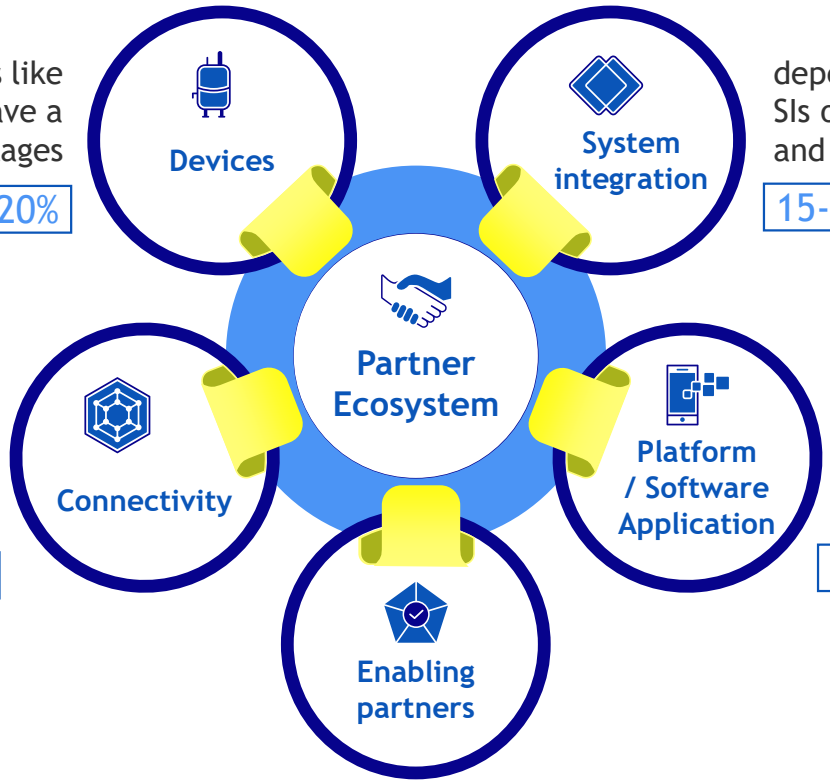
Value chain of delivering 5G CNPN network involves a strong ecosystem



hardware providers for devices like routers or IoT endpoints typically have a smaller share due to scale advantages

10-20%

depending on complexity; SIs often lead on integration and implementation efforts

15-25%

spectrum operators includes spectrum licensing, network maintenance, and end-user services

20-30%[1]

these include software and analytics platforms managing 5G functionalities and use cases

15-25%

for supporting services like security layers, cloud, edge computing

10-20%

Revenue Share

Note: Based on early estimates derived from the BSNL Capnet project. As private 5G deployments are in their nascent stages, these numbers may evolve depending on actual implementation and scale of use cases. E.g., AR/VR use cases will have high cost for devices, whereas IoT use cases may have higher cost for software.
1. Owning spectrum is the hardest-to-replace value in the chain, provides leverage in negotiating revenue shares.
Source: GSMA Intelligence, Expert discussions, BCG Analysis

Global Telcos have shown a partnership-driven solution for markets and targeted solutioning has been critical to success

End-to-end value chain	End Client	Partnership	Targeted Solution
Connectivity	Brussels Airport	Citymesh + Nokia	**Airport in Brussels** • IoT • Automated vehicles • Mobile safety systems
System integration	Philips 66 Refinery	AT&T + Accenture	**Refinery in US** • Address existing coverage gaps • Support upcoming use cases based on IoT and low latency applications
Platform / Software Application	Enel Power	H3G (now WindTre) + Athonet	**Power Plant in Italy** • Critical communications • Predictive diagnostics • Personnel safety via body-worn sensors
Devices	Ford	Vodafone + Ericsson	**Manufacturing Engineering facility** • Enhanced manufacturing efficiency • Improve security and reliability • Increase productivity

Source: GSMA Intelligence, BCG Analysis

BSNL's has pioneered the 5G CNPN space | India's first 5G CNPN in coal mining

1

Partner Contributions

- **Client:** Coal India Limited (CIL), Amlohri Project of Northern Coalfields Ltd (NCL)
- **C-DAC & CMPDI:** Technical expertise and innovation in mining solutions.
- **BSNL:** Pioneering India's indigenous telecom stack and ensuring project success with Made-in-India equipment.

2

5G Use Cases envisaged

- Voice & video call over 5G CNPN
- 5G Camera based surveillance
- IoT Sensors for Environmental Monitoring
- 5G Drone based Monitoring & Mine Mapping
- Virtual Reality Model of Amlohri Coal Mine
- Digital Twin of Load Haul Dump Operation
- 5G C-V2X based Collision Avoidance System
- Traffic Control for Haul Road Crossings

3

Benefits

- Ensures **connectivity** in vast, remote, and underground areas.
- Adapts to operational growth with **flexible and scalable** wireless infrastructure.
- Provides a robust, **secure network** for real-time operations and data protection.
- Boosts **efficiency** and safety with autonomous equipment and advanced monitoring.

4

Alignment with National Vision

- Promotes **self-reliance** through indigenous telecom technology (*Atmanirbhar Bharat*).
- **Boosts productivity** and operational safety for mining.
- Supports the vision of a **Digital India** and addresses India's **energy needs** with efficient mining operations.

Note: Centre for Development of Advanced Computing (C-DAC), Central Mine Planning & Design Institute (CMPDI), 5G Captive Non-public Network for Integrated Voice, Video & Data Communication in Opencast Coal Mines (5G-CapNet), awarded by Coal India Limited (CIL)

BSNL CNPN at Mahakumbh 2025 |
Demonstrates its strength in 5G CNPN connectivity

BSNL's success in powering Mahakumbh 2025 showcases its unmatched ability to handle large-scale events, setting the stage for future collaborations in 5G CNPN networks.

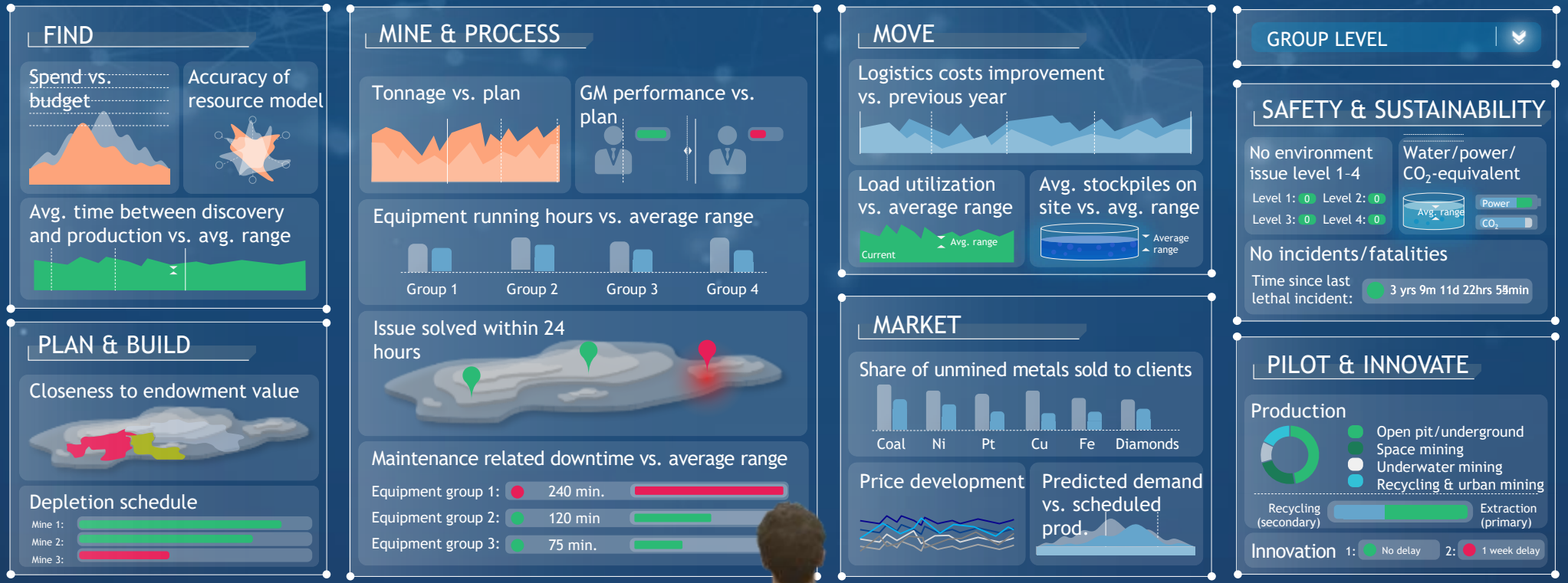
Image Source: BSNL Website

First 5G CNPN for refinery sector in partnership with NRL; a landmark MoU towards the a viable Industry 4.0 use-case

BSNL 5G spectrum in all commercial constructs

- Campus Network based 5G services
- eNode/ gNode B as a service
- Spectrum as an offering

BSNL's vision for 'Mine of the Future'



India's “Factory of Future” vision enabled by BSNL Network

Real-time data flow enabled by 5G

Faster, informed and proactive decision making, focused on right issues

Automated operations

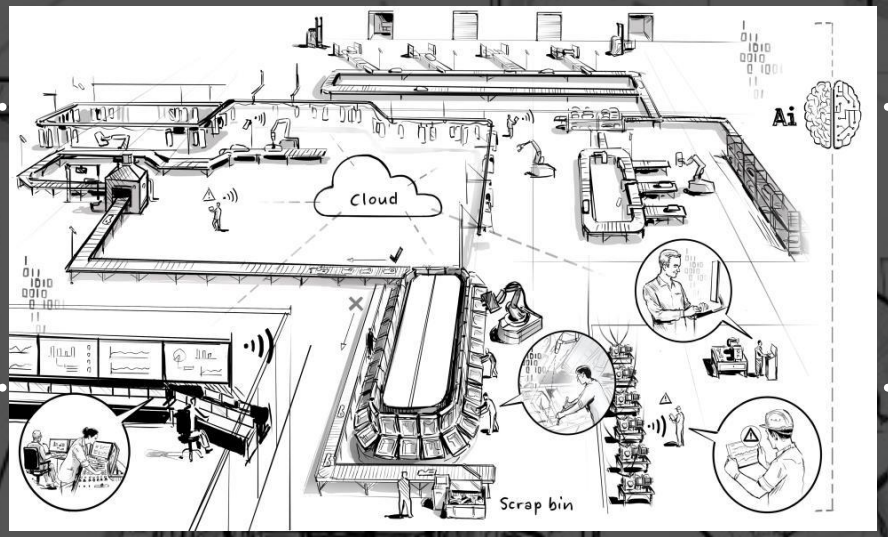
Unlock productivity with limited dependency on manual labor

Near 100% asset utilization

Automated end-to-end production optimization

24 x 7 uninterrupted operations

Real-time asset health monitoring and predictive maintenance alerts



No fatalities/safety incidents

100% PPE compliance ensured AI cameras

Connected faciities

IoT/Camera/Drone enabled data collection for all equipment/ machines/labors/processes & production output

Digital first mindset

Among employees & labors

Connect & collaborate

Via 5G AR/VR within /across plants, HQ and external vendors/customers

BSNL believes great opportunities existing in mining and at airports (I of II)

Enterprise	Production Capacity (MTPA)			Locations
	773.7			322 mines. West Bengal, Jharkhand, Odisha, Chhattisgarh, Madhya Pradesh, Maharashtra, Uttar Pradesh, Assam
NMDC	45+			Chhattisgarh, Karnataka, Madhya Pradesh
SAIL	32.4			Jharkhand, Odisha, Madhya Pradesh
	30.6			Tamil Nadu, Rajasthan
GMDC	12.5			Gujarat
नालको NALCO	Bauxite 6.8	Alumina 2.1	Aluminium 0.5	Odisha
HINDUSTAN COPPER LIMITED	3.4			Rajasthan, Madhya Pradesh, Jharkhand, Maharashtra
MOIL	1.3			11 mines. Maharashtra, Madhya Pradesh.
IREL	0.01			Kerala, Tamil Nadu, Odisha, Andhra Pradesh
	NA			Jharkhand, Andhra Pradesh

Potential of 5G in the mining sector

- Suitable for **deployment in hard-to-reach places** (including underground and offshore)
- Mining industry is roughly **30-40% less digitally mature** than comparable industries, such as automotive or chemicals
- Enables **modern technologies** like IoT and AI, driving mining efficiency, cost savings, and high ROI

Source: BCG's Digital Acceleration Index, Coal India Production, NMDC Annual Report, NALCO Production Data, HCL Corporate Presentation, MOIL Production Data, IREL Production Data, GMDC Annual Report, SAIL Production Data, NLCIL Annual Report; FY 2023-24

BSNL believes great opportunities existing in mining and at airports (II of II)
(Cont'd)

International Airport

71 lac monthly passengers

- Netaji Subhas Chandra Bose International Airport, Kolkata
- Chennai International Airport, Chennai
- Dabolim Airport, Goa
- Biju Patnaik International Airport, Bhubaneswar
- Sheikh ul-Alam International Airport, Srinagar
- Lal Bahadur Shastri International Airport, Varanasi
- Sri Guru Ram Dass Jee International Airport, Amritsar
- Calicut International Airport, Kozhikode
- Coimbatore International Airport, Coimbatore
- Tiruchirappalli International Airport, Tiruchirappalli

Domestic Airport

19 lac monthly pax

- Swami Vivekananda Airport, Raipur
- Birsa Munda Airport, Ranchi
- Jolly Grant Airport, Dehradun
- Jammu Airport, Jammu
- Maharana Pratap Airport, Udaipur
- Raja Bhoj Airport, Bhopal
- Kushok Bakula Rimpochee Airport, Leh
- Jodhpur Airport, Jodhpur
- Dibrugarh Airport, Dibrugarh
- Gorakhpur Airport, Gorakhpur

Potential of 5G in the aviation sector

Give airport operators **full visibility and control** over their wireless infrastructure – from planning and deployment to operations and upgrades

Smart airport use cases:
- asset management via smart devices installed on airport trolleys
- air-quality monitoring
- real-time facial recognition for enhanced security
- improved public Wi-Fi

Utilise connected devices to **improve security and efficiency** throughout operations

1. Total Passengers for Oct'24

Source: Airports Authority of India

Key risk observed as BSNL implements 5G CNPN offerings

Operational Risk

Execution complexity: 5G CNPN demands seamless coordination across diverse components and stakeholders, increasing execution complexity.

Greenfield Focus: Adoption will largely target new deployments, as organizations may not transition from existing 4G/LTE or Wi-Fi networks.

Network capabilities

QoS (Quality of Service): 5G CNPN must consistently deliver ultra-reliable low latency, high throughput, and network isolation to meet enterprise-grade demands.

Ecosystem Maturity: Limited availability of enterprise-specific solutions and compatible devices could delay adoption and undermine early deployments.

Financial Risk

High Capex: Greenfield projects require significant investment for infrastructure deployment.

Revenue Model Pressure: Partnership models hold risks with respect to revenue share and potential for each partner

BSNL is at the juncture of expanding its strong presence in 5G CNPN solutions

Our Commitment

- Willingness to deliver value through pilots
- Investment in the best CNPN solutions
- Help fast-track in policy decisions
- Willingness to partner and boost the ecosystem


Thank You
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