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# Tech-Driven Transformation: Smart Industrial Parks on Reclaimed Wastelands with Sustainable Protection Strategies

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**Abstract:-**

In the face of rapid urbanization and dwindling availability of industrial land, transforming underutilized wastelands into productive, future-ready hubs represents a sustainable and innovative solution. This project proposes the development of a **Smart Industrial Park** on degraded or abandoned land, aiming to blend environmental rehabilitation with cutting-edge technology and economic revitalization. By integrating green energy solutions, IoT infrastructure, smart logistics, and modular construction, the Smart Industrial Park envisions an ecosystem that fosters innovation, supports startups and established enterprises, and promotes circular economy practices. The initiative not only reclaims land that would otherwise remain economically and ecologically barren, but also catalyzes job creation, infrastructure development, and technological advancement. This abstract outlines the vision, key components, sustainability strategies, and projected impacts of this transformative approach to land use and industrial planning.

**Key words:-** Smart Industrial Park, Wasteland Reclamation, Sustainable Development, Green Infrastructure, Smart Technology, Renewable Energy.

## 1. Introduction:-

In an era where sustainable development and technological innovation are crucial to economic growth, the transformation of barren, underutilized land into smart industrial ecosystems offers a compelling solution. Wastelands—often seen as liabilities—hold immense potential to be repurposed into thriving tech hubs that can drive industrial progress while addressing environmental and urban challenges.

This paper explores the concept of building a Smart Industrial Park on reclaimed wasteland, merging ecological restoration with the power of Industry 4.0 technologies. Such a park is designed to be more than just a collection of factories; it is a digitally connected, energy-efficient, and environmentally friendly zone that fosters innovation, supports high-tech manufacturing, and encourages sustainable practices.

By integrating smart infrastructure—such as IoT-based monitoring systems, renewable energy sources, automated logistics, and digital twin simulations—this initiative aims to redefine industrial development. The transformation not only revives neglected land but also contributes to regional economic upliftment, reduces urban congestion, and minimizes the carbon footprint of traditional industrial setups.

This introduction sets the stage for understanding how strategic planning, technological integration, and environmental consciousness can convert neglected landscapes into future-ready industrial powerhouses.

### 1.1 Industrial development in Madhya Pradesh

Madhya Pradesh has emerged as a key hub for industrial growth in India, leveraging its central location, abundant natural resources, and established infrastructure. The state's industrial sector encompasses a diverse range of industries, including automobile manufacturing, textiles, pharmaceuticals, cement, food processing, and renewable energy. Over the past decade, Madhya Pradesh has attracted significant domestic and international investments, aided by a business-friendly environment that encourages ease of doing business, reduces administrative barriers, and incentivizes industrial growth. Historically, the state has been strong in agriculture-based industries, particularly in producing soybean, wheat, and pulses, which form

the backbone of its food processing sector. This industrial base has seen significant growth, with major corporations like Tata Motors, Bridgestone, Grasim Industries, and Lupin Pharmaceuticals establishing manufacturing units, drawn by large tracts of land, lower operational costs, and supportive governance. Infrastructure projects such as the Delhi- Mumbai Industrial Corridor (DMIC) and Atal Progress way have enhanced connectivity and logistics, positioning Madhya Pradesh strategically for industries linked to major urban centres like Delhi, Mumbai, Bhopal, and Indore. The state presents abundant opportunities for investors due to its skilled workforce and raw material availability, particularly in sectors like automobile manufacturing and renewable energy, where the growing emphasis on sustainable industrial practices offers additional potential.

However, challenges remain in balancing rapid industrialization with environmental sustainability and addressing infrastructural gaps in certain regions. The state government actively promotes industrial growth through various initiatives, including "Ease of Doing Business" reforms, "Make in Madhya Pradesh," and investment promotion policies that streamline processes, providing incentives like tax exemptions and subsidies. Public-private partnerships (PPP) and the development of smart cities are critical in stimulating economic growth and modernizing infrastructure, with a focus on developing industrial corridors that facilitate economic activity and connectivity.

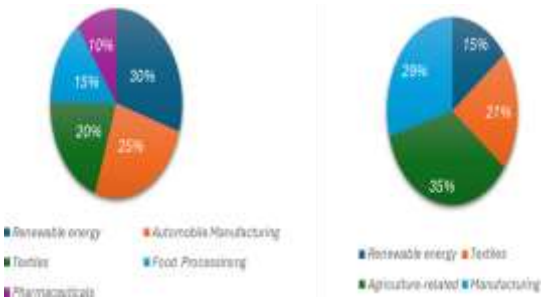



Figure breakdown of industries & Employment Distribution

## 1.2 Project Brief

The Chain Pura Industrial Development Project in Guna, Madhya Pradesh, is a transformative initiative set to establish the region as a thriving industrial hub. Covering 334.58 acres, this project strategically leverages Guna's advantageous geographic location, ensuring it becomes a centre for diverse industrial activities. Site features predominantly flat to gently undulating terrain, ideal for industrial construction and infrastructure development. The land is classified as non-agricultural, facilitating its transformation into an industrial hub. Surrounding land use is primarily agricultural, with crops like soybean and wheat thriving in the fertile alluvial soil, which supports local farming communities. The strategic land use and topography present a unique opportunity for the Chain Pura project to enhance regional industrial capabilities.

Guna's central positioning in Madhya Pradesh significantly enhances its connectivity to key transport networks, making it a prime location for logistics and distribution. The Guna Railway Station, part of the Western Railway network, provides essential rail connectivity, linking the city to major urban centres such as Indore, Bhopal, and Gwalior. This efficient rail network is vital for industries that rely on the timely transportation of raw materials and finished products. Additionally, Guna is approximately 115 km from Gwalior Airport, which offers domestic flights and serves as a gateway to larger airports in Indore. The Devi Ahilya Bai Holkar Airport in Indore is also about 113 km away, further enhancing air connectivity. Road infrastructure is equally impressive, with National Highways 3 (NH 3) and 46 (NH 46) providing seamless access to major cities. NH 3 connects Guna to Indore and extends towards Mumbai, while NH 46 links Guna to Bhopal. This extensive road network facilitates the efficient movement of goods, solidifying Guna's role as a logistics hub. Surrounding industries contribute significantly to Guna's economic landscape. The region hosts a diverse range of sectors, including textiles, agriculture, and food Processing.

## 1.3 Objectives

The goal is to transform Guna into a thriving industrial hub where innovation, sustainability, and economic growth come together. The industrial park will attract global investments, create jobs, and improve the quality of life for the local community. By fostering technological advancements and sustainable practices, we aim to position Guna as a leader in manufacturing, logistics, and technology while ensuring inclusive growth and environmental responsibility

### 1.4 Project Appreciation

In the context of the Madhya Pradesh Multiproduct Industrial Development at Guna, Project Appreciation is the comprehensive assessment and recognition of the project's intricate elements. This includes understanding its aims, scope, objectives, potential risks, benefits, and feasibility. Project Appreciation entails an evaluation of the project's potential to drive economic growth, create jobs, and promote investment in the region. It involves assessing how well the project aligns with the development goals and objectives for Guna, ultimately determining whether it is a valuable and viable undertaking. This appreciation process empowers stakeholders to make informed decisions, set clear project directions, and pave the way for effective project planning and execution.

### 1.5 Project Site

The Chainpura site, located in Guna district, Madhya Pradesh, holds strategic advantages for industrial development due to its favourable geography, infrastructure, and access to resources. The site's flat terrain provides a solid foundation for the creation of a well-planned industrial zone, facilitating ease of construction and development. Additionally, Guna's central location within Madhya Pradesh positions it as a natural distribution hub, offering seamless connectivity to both regional and national markets. The proximity to major roadways and the expanding Madhya Pradesh Industrial Corridor further enhances its accessibility, allowing for efficient transportation of raw materials and finished goods. The surrounding agricultural landscape is another key advantage, with fertile land supporting the cultivation of crops such as wheat, rice, and oilseeds. This makes Chainpura an ideal location for agro- based industries, including food processing, biofuels, and other manufacturing activities that can leverage locally sourced raw materials. Moreover, the presence of agricultural industries in the region encourages the establishment of supply chains that can be directly integrated into the industrial ecosystem, creating synergies between farming and manufacturing sectors.

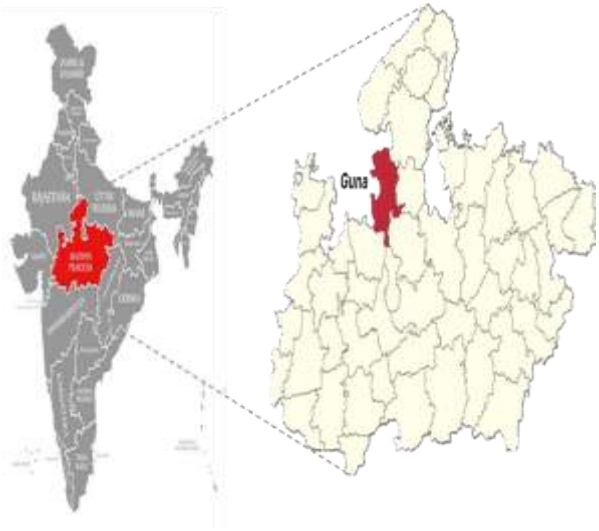



Figure: Location of Guna district

Additionally, Guna is approximately 115 km from Gwalior Airport, which offers domestic flights and serves as a gateway to larger airports in Indore. The Devi Ahilya Bai Holkar Airport in Indore is also about 113 km away, further enhancing air connectivity. Road infrastructure is equally impressive, with National Highways 3 (NH 3) and 46 (NH 46) providing seamless access to major cities. NH 3 connects Guna to Indore and extends towards Mumbai, while NH 46 links Guna to Bhopal. This extensive road network facilitates the efficient movement of goods, solidifying Guna's role as a logistics hub.

Surrounding industries contribute significantly to Guna's economic landscape. The region hosts a diverse range of sectors, including textiles, agriculture, and food processing. Guna is a notable producer of soybean and wheat, with local firms such as Guna Agro Products transforming these raw materials into market-ready products.

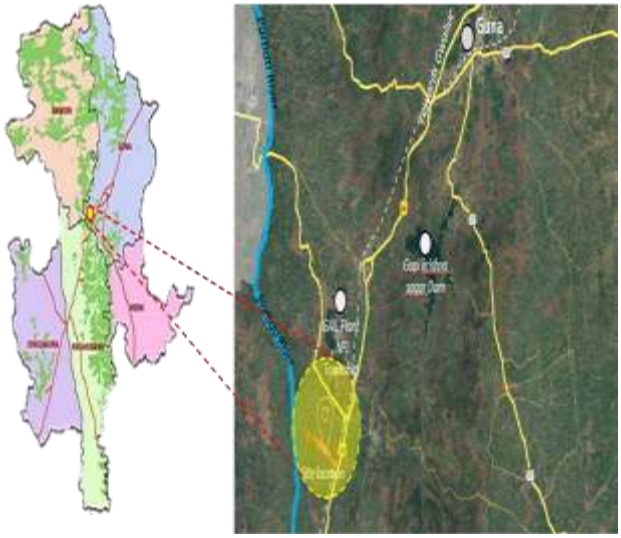


Figure: Site Location in Guna District

## 2. Masterplan Area:-

### 2.1 Industrial Plots:-

The meticulous planning and allocation of industrial plots within the project exemplify a thoughtful approach towards accommodating a diverse range of manufacturing enterprises. The distribution into small, medium, and large plots showcases a nuanced understanding of the varying needs and capacities of industrial ventures. With total 140 nos of industrial plots, under which some are proposed to be developed as logistics park development, some for medium size processing industrial and small plots for MSME units of different sectors filler industries of finish goods industries. This strategic division not only fosters a dynamic mix of enterprises but also reflects a keen foresight into the potential growth and expansion of businesses over time. The detailed size range in acres for each plot category further adds a layer of adaptability, allowing businesses of different scales to seamlessly integrate into the industrial framework. Overall, this approach underscores a commendable commitment to creating a versatile and accommodating environment for a thriving industrial ecosystem.

### 2.2 Amenities:-

Nestled within the heart of the proposed industrial area lies comprehensive infrastructure that caters to the diverse needs of its occupants. An Industry Union Office stands as a focal point, fostering camaraderie and providing a platform for collective action among industry workers. Departmental offices of the Central and State Government i.e MPIDC, dedicated to industrial development, offer streamlined services and guidance to businesses. A strategically positioned electrical substation ensures a reliable and uninterrupted supply of power to fuel the industrial growth engine. A open plot for future development of Police Station/Chowki maintains law and order, safeguarding the well-being of workers and residents alike. A dedicated water treatment plant & Pump station ensures a steady supply of clean and potable water, essential for both industrial and domestic purposes. A joint pollution control plant stands as a testament to the commitment to environmental sustainability, effectively treating industrial waste to minimize environmental impact. A readily accessible fire brigade provides prompt and efficient emergency response, ensuring the safety of the industrial community. Public drinking water facilities and well-maintained public toilets cater to the basic needs of workers and visitors, promoting hygiene and convenience. The infrastructure further extends to support public welfare schemes of the government, ensuring the well-being of the industrial community. Additionally, the Department of (Micro, Small and Medium) Enterprises actively explores and incorporates innovative initiatives that enhance the overall infrastructure and foster a thriving industrial ecosystem.

Open area - Open areas are strategically located throughout the proposed industrial area, providing ample space for various purposes for an area of 25.5 ha. These open areas serve as valuable buffers between industrial zones, contributing to a well-planned and visually appealing industrial landscape. They also offer opportunities for landscaping, recreational activities, and the creation of green spaces that enhance the overall environment of the industrial area. Furthermore, these open areas can be utilized for stormwater management and the preservation of natural habitats, promoting sustainable practices within the industrial development

### 2.3 Parking Area:-

The allocation of 2.9 ha for parking facilities, representing 0.9% of the project's total area, signifies a keen acknowledgment of the paramount

need for an efficient vehicular infrastructure on-site. This dedicated parking space accommodates a wide range of vehicles, encompassing trucks, cars, and bikes, illustrating the project's comprehensive approach to accessibility. It serves as a concrete manifestation of the project's steadfast dedication to ensuring smooth access for employees, visitors, and the diverse array of businesses operating within the industrial complex. The deliberate provision of substantial parking, strategically situated around the periphery of the industrial area, reflects the project's proactive stance in averting potential traffic congestion while enhancing the site's functionality and overall operational efficiency.

**2.4 Commercial:-**

The allocation of 12 ha for commercial spaces, constituting 2% of the project's total area, embodies a deliberate effort to cultivate a diverse ecosystem of supplementary services and businesses within the industrial precinct. These commercial spaces are envisioned to encompass a range of amenities, including essential services, retail outlets, or additional ventures supporting the complex's functionality. This strategic allocation reflects a forward-thinking approach aimed at enriching the environment and enhancing convenience and accessibility for businesses and stakeholders. It signifies the project's proactive intent to foster a dynamic environment beyond core industrial activities, creating a well-rounded and self-sustaining ecosystem that caters to varied needs within the industrial complex.

**2.5 Landscape Planning**

**2.5.1 Green zone**

Within the industrial park, the designated green zone stands as a testament to a conscious effort towards environmental sustainability and aesthetics. This particular area is deliberately designed to promote ecological balance and biodiversity amidst industrial operations. It serves as a sanctuary for native flora and fauna, contributing significantly to the park's overall environmental health. Moreover, the green zone acts as a visual oasis, offering a calming contrast to the industrial landscape while providing employees and visitors with a tranquil space for relaxation and rejuvenation. Its presence not only underscores the commitment to sustainable development but also highlights the integration of nature within an industrial setting, fostering a holistic and eco-friendly environment.

**2.5.2 Median:**

The inclusion of a median landscape within the industrial park showcases a meticulous approach to enhancing the aesthetic appeal and functionality of the site. Stretching across the heart of the industrial area, this landscape serves as a central feature, offering a striking visual element that seamlessly blends beauty and functionality. Beyond its ornamental role, the median landscape acts as a natural divider, effectively delineating different sections of the industrial park. It serves as a green corridor, providing a pleasing view for commuters while promoting a sense of spatial organization within the industrial complex. Moreover, the careful selection and nurturing of plant species in this landscape contribute to air purification, temperature regulation, and overall environmental improvement, adding immense value to the industrial park's surroundings.

**2.6 Proposed Approach Road:**

A proposed approach road is being developed to connect the site to NH-46. This approach will be crossing Railway lien and existing NH for up & Down lane easy entry and exit to respective lanes. This will not hamper railway or national highway for industrial park for industrial park traffic.

**2.6.1 Entry / Exit:**

The primary entry and exit point to the site is via an proposed approach bridge to cross over railway line and connect on National Highway 46 (NH-46) to the proposed site.

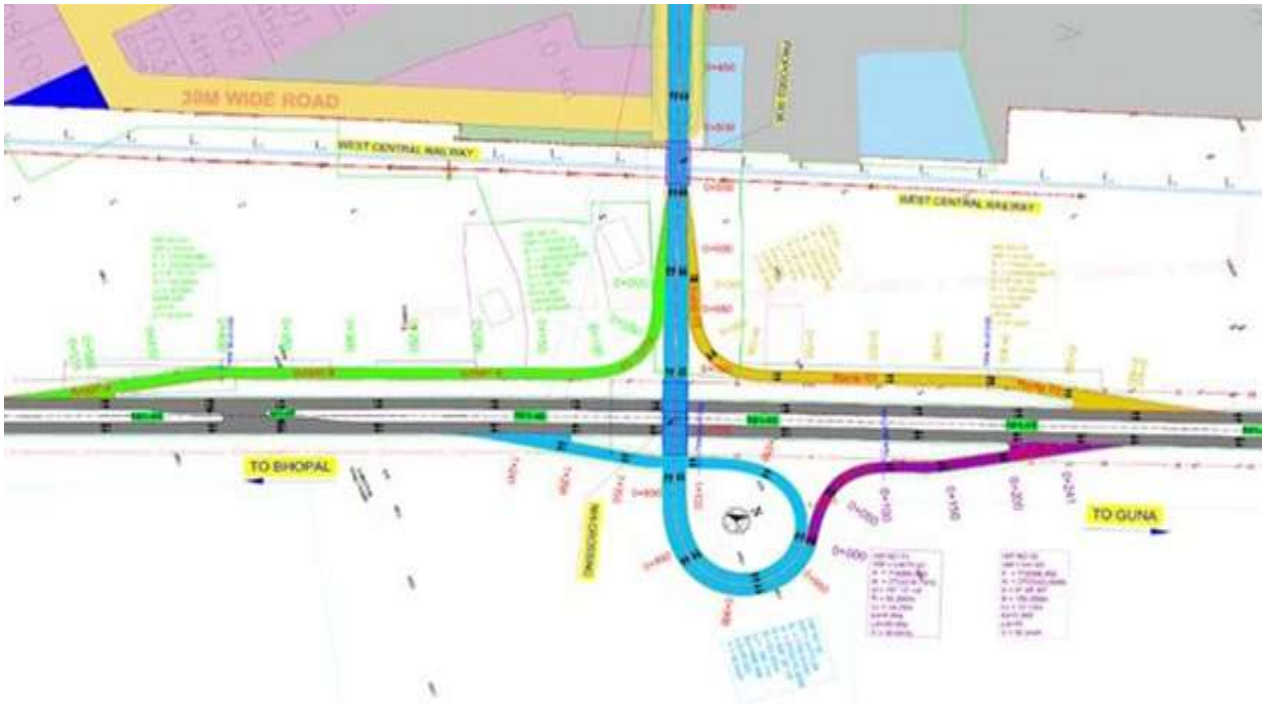



Image- Approach trumpet Design

## 3. Analysis of industrial Scope

### 3.1 Guna Industrial Market:

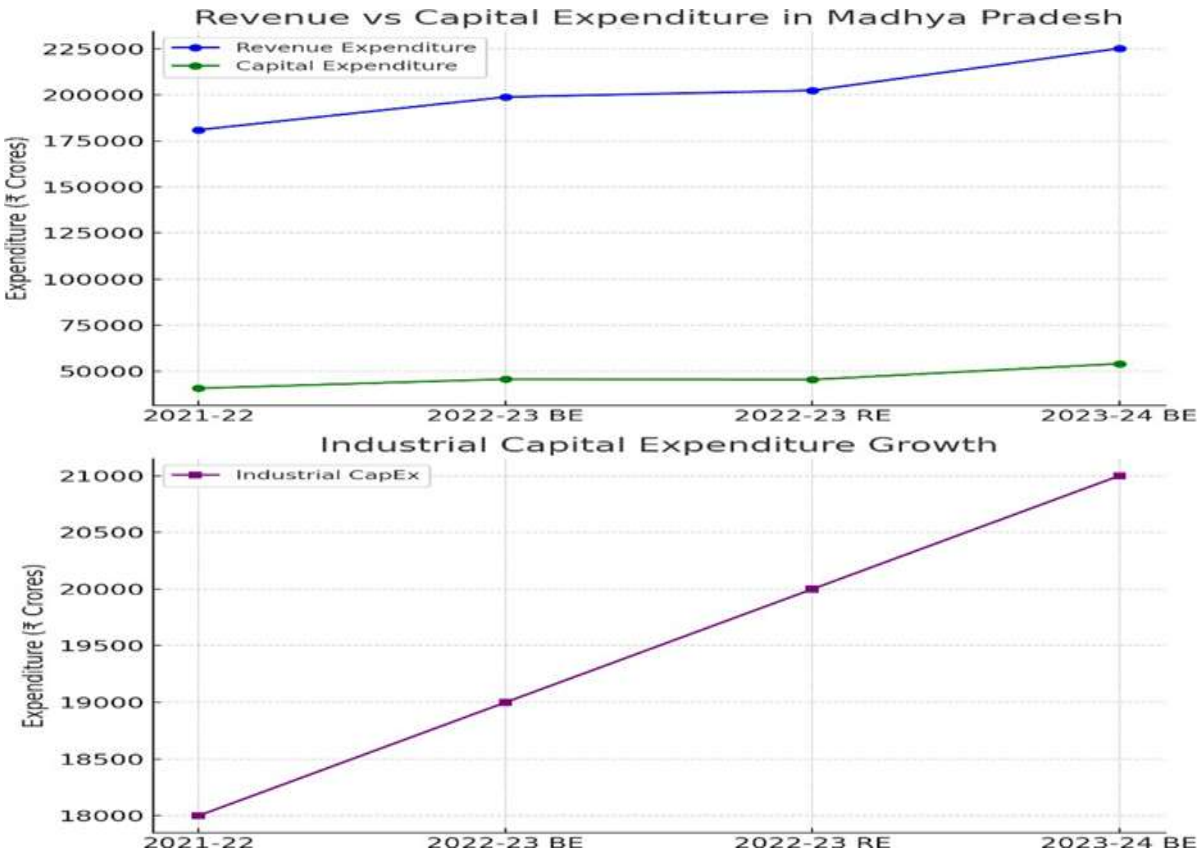
Guna is located in northwestern Madhya Pradesh, positioned on the route connecting the state to Rajasthan, Uttar Pradesh, and Maharashtra, providing logistical advantages for industries. Guna has good rail and road connectivity, with access to national highways and nearby railway lines, aiding supply chain management and distribution. It's an agrarian district with fertile soil and abundant production of crops such as wheat, soybean, and pulses. This makes it suitable for agro-processing industries like grain milling, oil extraction, and food packaging. The agro processing industry has potential due to raw material availability and growing demand for processed food. The state has emerged as a hub for manufacturing, with raw materials and finished goods moving seamlessly between major Indian cities. And It's a growing industrial hub in central India, distinguished by its diversity in industrial sectors, economic growth, and resource rich geography. The state's industrial sector encompasses a diverse range of industries, including automobile manufacturing, textiles, pharmaceuticals, cement, food processing, and renewable energy. This project, along with a new propellant production facility in nearby Shivpuri, is projected to create around 3,500 direct and indirect jobs in the region, bolstering the local economy and contributing to Madhya Pradesh's expanding industrial landscape. The economic strategy for Guna emphasizes both traditional manufacturing and strategic sectors like defence and sustainable energy. The region is set to benefit from a broad range of development initiatives, including improvements in healthcare.

### 3.2 Revenue Generation from Industrial Outcome:-

Madhya Pradesh is an agrarian state. Primary sector's contribution to the state's Gross Value Added (GVA) increased from 33.85% in 2011-12 to 46.98% in 2020-21. At current prices, the Gross State Domestic Product (GSDP) of Madhya Pradesh is estimated at Rs. 1,387,117 crore (US$ 169.36 billion) in 2023-24, registering an annual growth of 10% over FY21. Between 2015-16 and 2023-24, The GSDP increased at a CAGR (in Rs.) of 12.49%. Net State Domestic Product (NSDP) of Madhya Pradesh was about Rs. 8.27 trillion (US$

113.94 billion) in 2020-21. Between 2015-16 and 2020-21, state's NSDP grew at a CAGR of around 11.22%. MP's Gross State Domestic Product (GSDP) reached approximately $166.3 billion for 2023-24, with a strong annual growth rate of around 12.5% over recent years. This growth is supported by agriculture, services, and manufacturing, with agriculture holding the largest share of the GSDP at 47%, followed by services (34%) and manufacturing (19%).

Exports have been a major revenue source, reaching about $7.88 billion in FY24, with significant contributions from cotton yarn and pharmaceutical products, which respectively generated $982.5 million and 23.35% of the state's total exports. Foreign Direct Investment (FDI) has also supported the state's industrial expansion, with a cumulative FDI inflow of $553.49 million between 2019 and 2024.




### 3.3 Economic growth:-

Guna District in Madhya Pradesh has shown substantial economic growth, driven by infrastructure developments and significant investments in various sectors. This includes a major industrial boost from the Adani Group, which is investing around ₹3,500 crore in the district to establish a 2 million tonnes per annum (MTPA) cement grinding unit. This development aims to create approximately 3,500 direct and indirect jobs, showcasing Guna as a potential hub for industrial growth in the region. This project, part of Madhya Pradesh's broader industrial expansion, aligns with the state's push to attract large-scale industrial investments and bolster employment. Additionally, Madhya Pradesh has witnessed initiatives like the setup of district-level industrial facilitation centres, including one in Guna, to streamline industry establishment and support business activities. The state's strategic location and expanding transportation links also contribute positively to its attractiveness for industries looking to expand in Central India. With ongoing infrastructure improvements and industry-friendly policies, Guna is well-positioned for continued economic growth, with strong indicators of a promising future for industrial activity in the region.

**4. Site Development:-**

The project is going to be developed in an area of 285.5 hectares. The site topography is undulating in nature and having a rocky terrain. To utilize the land area in effective way, acquisition of private land is proposed over 337.6 hectares.

**4.1 Road Network:-**

Road infrastructure plays a pivotal role in the proposed project, enhancing mobility for people, goods, and services. All plots within the industrial area have access to the main road. Additionally, internal roads connect to the primary road network. The choice of asphalted roads aligns with industry standards and the guidelines set forth by the Indian Roads Congress (IRC). Asphalt road surfaces, composed of mineral aggregates bound by asphalt, offer several advantages, including cost-effectiveness, noise pollution reduction, enhanced safety and comfort, durability, and recyclability. Utilizing asphalt materials in road construction and maintenance is not only cost-effective but also aligns with sustainable road material choices. The layout of the road network is designed to ensure that mass transport services can be accessed from any part of the industrial area, promoting convenient connectivity. All road construction adheres to the standards outlined in the IRC MORTH manual. Total road network is approx..12 Kmtr having 45 mtr, 30 mtr, 24 mtr, ROW

**4.2 Water Supply:-**

Water is required for the day-to-day consumption and industrial demand at the project site. For the current stage; water will be taken by tapping Existing Rising Main (From Narmada River to Jetapur WTP). The existing rising main will be tapped near Jetapur WTP & from there it is proposed to lay a new Rising Main till proposed WTP at project site (Lalbag & Baswi). In the next Ultimate) stage; it is proposed to lay a separate Rising Main from the source itself (Intake Well at Narmada River). Raw water coming from tapping point near Jetapur WTP will be treated at Lalbag WTP & stored in Clear Water sump before transmitting it to Clear Water ESR (Elevated Service Reservoir) located in the same plot as that of WTP. This water will then be supplied to Industrial & other plots at the project site. Water supply distribution network from the ESR to different land use parcels at project site has been designed as per CPHEEO Manual using Bentley OpenFlows WaterGEMS software (Version 23.00.00.16).

**4.3 Design standard:-**

Standards and Specifications which are used for the Design and laying potable water supply distribution network for all areas of project site are given in this section. Design of potable water supply system is based on Central Public Health and Environmental Engineering Organization (CPHEEO) Manual on Water Supply and Treatment. The pressures to be made available at different locations from its supply point to the consumption end, at nodes and velocities shall be considered as per CPHEEO guideline. Minimum pressure at nodes shall be considered as 7 m for all areas. The water supply distribution network has been designed in such a way that the maximum velocity is 1.8 m/s.

**4.4 Codes & Standards:-**

The complete Water Supply work has been carried out through the usage of necessary codes and standards

**4.5 Sewerage System:-**

This section describes the assumptions and the design basis for the planning and design of various components involved in sewerage system at the proposed project site of Lalbag & Baswi. The design calculations for the sewerage network system would be based on the discharge collected from different land use parcels at the project site.

Wastewater generated from each of the land use parcel is based on the population that will be there in the area under consideration. Sewerage Network for the project site has been designed as per Manuals using Bentleys OpenFlows SewerGEMS software (Version 10.04.00.158).

The population in the present case is the working population of Industries, Warehouses, Commercial areas & daily visitors.

### 4.6 Electrification:-

The proposed Industrial Area in Chainpura is set to receive its electricity supply from two nearby power sites, each operating at a voltage level of 132 kilovolts (KV). This electricity will be distributed to the industrial area through feeder pillars, which act as intermediate points for power distribution, helping to manage and direct the flow of electricity. The electricity will then be further regulated and stepped down in voltage to proposed substations. These substations play a vital role in the power distribution process, as they transform the high-voltage electricity from the 132KV sources into a lower and safer voltage level for use within the industrial area. The availability of two substations adds redundancy and reliability to the electrical supply system, ensuring a consistent and stable power source for the businesses and operations within Chainpura Industrial Area.

### 4.7 Illumination System:-

LED Lighting system is proposed to be provided road lighting, substation indoor & outdoor areas. Minimum LUX levels of illumination which are recommended as per IUT-Institute of Urban Transport and Indian Standard SP: 30 – 2011 and as per IS 3646 / IS 1944 will be adopted. Illumination system shall comprise AC Normal Lighting, AC Emergency Lighting, DC Emergency Lighting and Portable Fixtures etc. Light fitting proposed at various Areas A well-designed, energy-efficient street lighting system should permit users to travel at night with good visibility, in safety and comfort, while reducing energy use and costs and enhancing the appearance of the neighborhood. The design shall be based mainly on (IS 1944-1981)

### 4.8 Protection Philosophy:-

Micro-processor based /numerical protective relays along with adequately rated and quick acting circuit breakers will be adopted for quick isolation of faults. The numerical relays shall be 61850 compatible. Relays will be properly graded for discriminative and selective tripping.
The selection of the protective scheme will be based mainly on reliability, sensitivity, selectivity and technical merits. All main protections will be of fast acting type in order to isolate the faulty system from the healthy system in the shortest possible time, to minimize damage to the equipment and ensure continuity of power supply, if possible. Numerical type of relay for protection of Switchyard, HT switchgear, LT switchgear and motors will be provided.

### 5. Protection Strategies:

Following typical protection shall be provided, however based on detailed working at next stage the protection schemes shall be finalized and provided:-

- Pilot Wire Differential Protection (87P)
- Distance Protection (21)
- IDMT Overcurrent & Earth fault current (51 & 51N)
- Under voltage & No Voltage Protection (27)
- Over voltage Protection (59)
- Distance to fault locator (DFL)
- Auto Recloser (79) (Three phase & Single Phase)
- Fault Disturbance Recorder (FDR)
- Transformer Differential Protection (87T) covering incoming cable

### 5.1 SCADA Provision for Sub-stations

SCADA (Supervisory Control and Data Acquisition system) shall perform the following functions:

- 24 Hrs. Monitoring and control of all electrical networks from centralized control system.
- Within a minute, fault isolation and restoration for HT network and monitoring of LT Network in the system.
- Pre-warning of the fault in the system by monitoring of different parameters and preventive action.
- Energy auditing of the system so as to reduce the losses in the system.
- Reduce accidents of the electrical network by interlock in the system.

Considering these factors SCADA system with Centralized control and monitoring is proposed. Thus, in case of any fault in the sub-transmission circuit, it shall be possible to isolate the faulty portion and restore back the main supply from the control room. The maintenance staff can

subsequently be deputed to locate the fault and carryout the repairs.

Under 'SCADA' system Remote Terminal Units (RTU's) would be installed at each of the RMU/ CSS's. The operator at the control room will be able to open and close the breakers, through the computerized control system. A small mimic shall also be installed indicating the status of the network. This would considerably help maintenance personnel during system isolation to plan the whole arrangement at a glance.

**5.2 Renewable Energy - Solar Power:-**

**5.2.1 Solar Roof Top PV Power Systems:-**

There is a large potential available for generating solar power using unutilized space on rooftops and wastelands around buildings. Small quantities of power generated by each individual household, industrial building, commercial buildings or any other type of building can be used to partly fulfill the requirement of the building occupants and surplus, if any, can be fed into the grid. The distribution companies will allow power to feed into the grid and extending net metering facility to the consumers. In grid interactive rooftop or small SPV systems, the DC power generated from SPV panel is converted to AC power using power conditioning unit and is fed to the grid. The generated power during the day time can be utilized fully by powering captive loads and excess power can be fed to the grid as long as grid is available. In case, where Solar Power is not sufficient due to cloud cover or during the night hours, the captive loads are served by drawing power from the grid.

**5.3 Solid Waste Management:-**

With the planned landuses such as residential areas, industrial areas, commercial spaces, public amenities, green and open spaces and a total design population of about more than 7.9 lakh people (comprising of residents, employees and other floating population- direct and indirect), large quantities of solid wastes of different characteristics are likely to be generated from CBIC Krishnapatnam Node. The solid waste likely to be generated will include domestic waste (general and hazardous waste), street sweeping waste, green waste from landscaped areas, industrial waste (hazardous and non-hazardous), biomedical waste, electronic waste (E) and Construction and Demolition (C&D) waste.

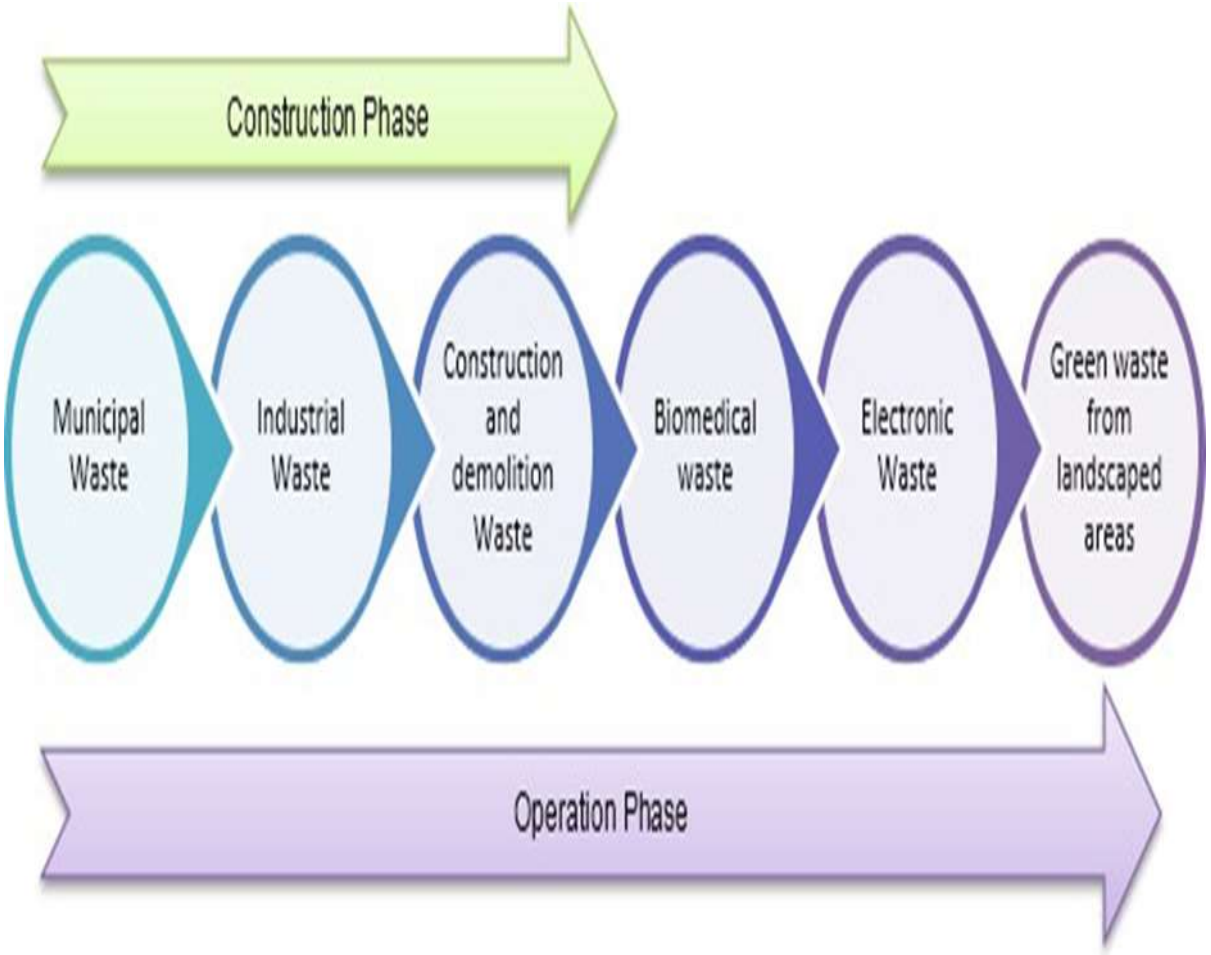



Image: - Waste Generating Components in Construction and Operation Phase

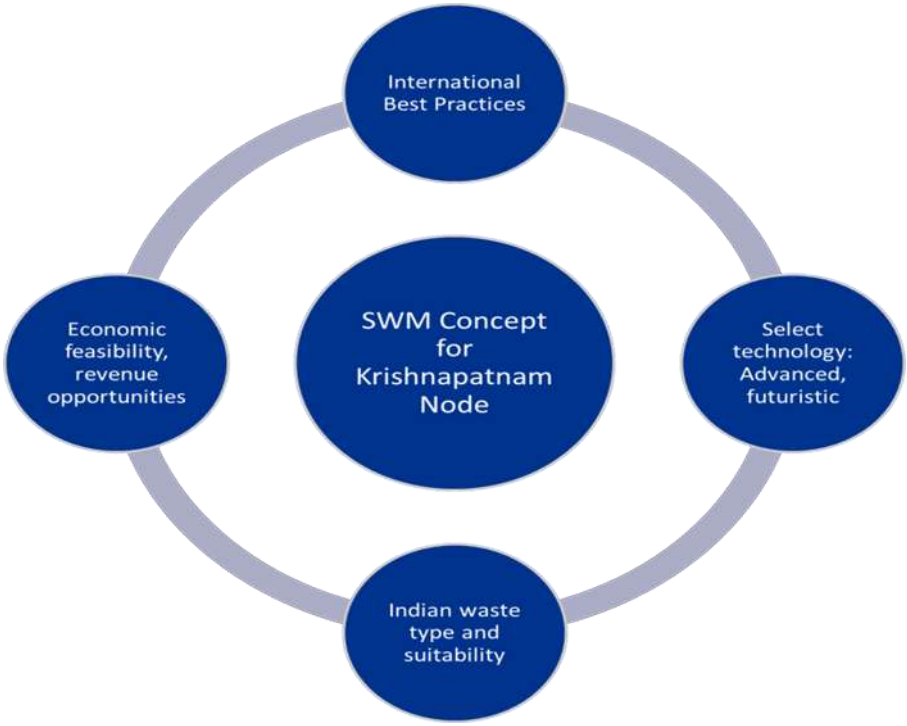


Image: - SWM Concept

Effective management of such huge quantities of waste is paramount to avoid any issues related to public health and environment protection. A comprehensive Solid Waste Management Plan is being formulated to provide state-of-the-art, cost-effective, sustainable solutions to the problems related to solid waste. The Plan is developed keeping in consideration, the international best practices in the field of solid waste management, suited to Indian conditions and complying with the statutory requirements, in consultation with CBIC, which is likely to be generated. The Plan will recommend solutions for waste collection and transportation, storage, segregation, treatment and disposal, which are advanced, futuristic and techno-economically feasible (Above Image of SWM Concept). Concepts of 3 R's- reduce, recycle and reuse form an integral part of the development principles. The waste processing/ treatment technologies to be adopted for the CBIC Krishnapatnam Node will meet international and national standards. Community engagement and disclosure will be a part of the decision–making while selecting various options for waste management at the time of implementation.

## 6. Conclusion:-

The transformation of wasteland into a smart industrial park represents a forward-thinking approach to sustainable development, economic revitalization, and land optimization. By repurposing underutilized or degraded land, this initiative not only mitigates environmental degradation but also unlocks new economic potential through industrial growth and technological integration. The incorporation of smart technologies—ranging from IoT-based infrastructure to energy-efficient systems. This conversion serves as a model for future development, demonstrating how innovation, strategic planning, and eco-conscious practices can turn dormant spaces into vibrant industrial ecosystems. Ultimately, such projects not only boost regional economies but also contribute to broader goals of smart urbanization and inclusive industrial progress.

Innovation from the Ground Up" is more than just a concept—it's a transformative pathway that reimagines neglected wastelands as engines of economic growth and sustainability. By leveraging cutting-edge technologies, data-driven infrastructure, and eco-smart planning, the development of smart industrial parks on previously unusable land demonstrates how innovation can drive inclusive and responsible industrialization.

This ground-up approach not only maximizes land utility but also addresses critical challenges such as urban sprawl, environmental degradation, and infrastructure gaps. As smart industrial parks evolve, they stand as powerful examples of how visionary planning, technological integration, and sustainable practices can converge to turn barren spaces into thriving hubs of innovation, employment, and environmental stewardship.

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