5 DECADES OF UNEARTHING ENERGY

सीएमपीडीआई
मिनी रत्न
cmpdi
Mini Ratna

प्रकृति सँकल्प

ई-पत्रिका (द्वि-वार्षिक)

Inspired by Nature.

For Climate

For Our Future

संस्करण 01
अंक 01

जून
2026

सतत विकास | पर्यावरण संरक्षण | हमारा भविष्य

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MISSION

To provide total consultancy in Coal and mineral exploration, mining, engineering and allied fields as premier consultants in India and a leading one in the international arena.

VISION

To be market leader in an expanding earth resource sector and allied professional activities.

प्रकृति संकल्प

Prakriti Sankalp

Sustainable Mining Responsible Environment Better Future

CMPDI – Innovating for a Greener Tomorrow

बी. साईराम
अध्यक्ष-सह-प्रबंध निदेशक

B. Sairam
Chairman-Cum-Managing Director

(एक महारत्न कंपनी)
5 DECADES OF UNEARTHING ENERGY

कोल इण्डिया लिमिटेड
COAL INDIA LIMITED
(Govt. of India Enterprise)
Premises No. 04 MAR, Plot No. AF-III
Action Area - 1A, New Town, Rajarhat
Kolkata - 700 163
CIN : 123109WB1973GOI028844

(An ISO 9001:2015, ISO 14001 : 2015 & ISO 50001:2011 Certified Company)

WORLD ENVIRONMENT DAY' 2026

MESSAGE

Nature in her benevolence ever provides the mankind all that is required to sustain life on Mother Earth. The kindness of Nature is such, she does not differentiate, discriminate or distance any species. In a universal harmony and equanimity Nature allows all organisms -plants and animals alike- to thrive and sustain life without prejudice. Personified as mother figure, protecting Nature thus is not an optional choice but a moral obligation and responsibility of all of us. While benefitting from Nature we also have to restore and replenish and leave something behind for future generations as well. The famous saying 'We do not inherit the earth from our ancestors. We borrow it from our children' aptly encapsulates the environmental sustainability and philosophy.

It is in this belief and spirit that World Environment Day is observed every year on 5th June serving as the largest international platform, mobilizing millions of people globally to reflect and renew the commitment to the planet that sustains us. The theme for World Environment Day -2026 is "Inspired by Nature. For Climate. For Our Future". India is firmly committed to address climate changes and champions the principle of 'Climate Justice'.

On its part, Coal India Limited embraces friendly environmental measures in the whole gamut of its operations. It includes deployment of eco-friendly technologies, mechanized coal transportation, pursuing renewable energy, and undertaking massive scale of greening the mining areas through plantation measures. The single pointed focus of these initiatives is ecological restoration and bringing back the Nature to pre-mining conditions, to the extent possible.

Nurturing the Nature, controlling the Climate impact and fostering the Future is critical, and every action at every level counts. It is our planet and every one of us have to safeguard it. The Antarctic explorer Robert Swan said, "The greatest threat to our planet is the belief that someone else will save it". We make the world that we live in. And, with this belief let us make our world a better place to live.

Best Wishes,

(B. Sairam)

Ph. : (033) 2324 6611/2324 6622 ■ Email : chairman.cil@coalindia.in ■ Website : www.coalindia.in

MESSAGE

Sri Chaudhari Shivraj Singh
Chairman-Cum-Managing Director
CMPDI

Dear Readers,

It is my privilege to welcome you to the inaugural edition of ***Prakriti Sankalp***, our biannual magazine launched on World Environment Day 2026. As the global community amplifies its call for urgent climate action, this publication reinforces CMPDI's commitment to balancing national energy needs with rigorous environmental stewardship.

CMPDI endeavours to integrate sustainability across the entire mine planning lifecycle—from high-precision Environmental Impact Assessments to scientific overburden management and progressive mine closures to final mine closures. Moving beyond traditional afforestation, CMPDI utilizes advanced remote sensing and GIS mapping to implement and monitor three-tier ecological restoration frameworks. Embracing a circular economy, we maximize waste utilization and repurpose treated mine discharge water for community irrigation and aquaculture, creating sustainable, post-mining livelihoods.

Aligned with *Atmanirbhar Bharat*, our indigenous R&D in exploration technologies and laboratory services establishes CMPDI as a premier sustainable mining knowledge hub. I encourage our engineers and planners to utilize ***Prakriti Sankalp*** as a platform to share the field-driven innovations shaping a cleaner, more resilient energy future for India.

With warm regards and green resolve,

(Chaudhari Shivraj Singh)
Chairman-cum-Managing Director
Central Mine Planning & Design Institute Limited (CMPDI)

MESSAGE

Sri Ajay Kumar
Director (T/P&D)

Dear Readers,

On behalf of CMPDI's Planning & Design division, I warmly welcome you to the inaugural edition of *Prakriti Sankalp* — a magazine born from our collective conviction that today's ideas will shape tomorrow's sustainable development blueprints.

As India accelerates coal production to ensure energy security while advancing its Net Zero ambitions, mine planning must evolve from extraction optimisation to a holistic integration of environmental safeguards across every stage of the project lifecycle. CMPDI is uniquely positioned to lead this transformation.

Being launched on World Environment Day 2026 under the theme “Inspired by Nature. For Climate. For Our Future” this magazine affirms that long-range sustainability planning is not a constraint on development but its most intelligent enabler. This edition brings together insights on integrated environmental frameworks, planning innovations, strategic land-use models and forward-looking regulatory trends. It also serves as an open invitation to planners, policymakers and strategists to join this important conversation.

I encourage every reader to contribute, collaborate and co-author the sustainable development blueprint that India's future calls for.

Ajay Kumar
Director (Technical / P&D)

MESSAGE

Sri Nripendra Nath

Director (T/CRD)

Dear Readers,

I am delighted to introduce the inaugural edition of ***Prakriti Sankalp***, our new biannual magazine debuting on World Environment Day 2026. This year, as global climate commitments demand tangible action, CMPDI is reinforcing its strategy to deliver the mineral intelligence driving India's growth while actively decarbonizing the coal value chain.

As the backbone of India's electricity generation, our sector's production is a sovereign necessity. However, our corporate planning must look beyond the active life of a mine. Through progressive mine closure frameworks, we are transforming heavily used industrial landscapes into self-sustaining ecological and economic assets. Our current strategy focuses on establishing massive biological carbon sinks through targeted plantations drive like " Ek ped Maa ke naam" or "Vriksharopan Abhiyan" that accelerate carbon sequestration.

In tandem with environmental recovery, we are committed to a "Just Transformation" for our mining regions.

Our commitment to self-reliance through indigenous Exploration activities, Environment Laboratories, Drone & GIS based Surveys and clean coal technology ensures that our growth remains economically robust and environmentally resilient.

Prakriti Sankalp stands as a testament to this vision. I invite our professionals to contribute their strategic insights in making low-carbon future for the nation.

With warm regards,

Nripendra Nath
Director (T/CRD)

MESSAGE

Sri Rajeev Kumar Sinha

Director (T/ES), CMPDI

प्रिय पाठकों,

माता भूमिः पुत्रोऽहं पृथिव्याः। (अथर्ववेद, भूमि सूक्त — १२.१.१२)

"यह पृथ्वी हमारी माता है और हम इसके पुत्र हैं। यह श्लोक हमें स्मरण कराता है कि प्रकृति के प्रति हमारा दायित्व पुत्रवत् है — सेवा, संरक्षण और कृतज्ञता का।

"प्रकृति संकल्प" के प्रथम अंक में आपका हार्दिक स्वागत करते हुए मुझे अत्यंत प्रसन्नता एवं गौरव का अनुभव हो रहा है। यह पत्रिका पर्यावरण संरक्षण, सतत् विकास तथा हरित भविष्य के प्रति हमारी सामूहिक प्रतिबद्धता को समर्पित है।सीएमपीडीआई की यह द्विवार्षिक पत्रिका पर्यावरणीय रूप से सतत् विकास के क्षेत्र में विचारों, अनुभवों एवं नवाचारों के आदान प्रदान का एक मंच है। हमें विश्वास है कि यह प्रकाशन समय के साथ विभिन्न औद्योगिक क्षेत्रों के विशेषज्ञों एवं व्यावसायिकों के लिए एक महत्वपूर्ण स्रोत के रूप में स्थापित होगा।

कोयला क्षेत्र में पर्यावरणीय नियोजन एवं प्रबंधन की पर्यावरण सलाहकार के रूप में, सीएमपीडीआई ने पर्यावरणीय प्रभावों के नियंत्रित करने के लिए , खनन क्षेत्रों के पुनर्वास एवं पुनर्स्थापन, प्रदूषण नियंत्रण, पर्यावरणीय निगरानी तथा नीतिगत सहयोग के क्षेत्रों में व्यापक विशेषज्ञता विकसित की है। इस पत्रिका के माध्यम से हमारा उद्देश्य इस ज्ञान एवं अनुभव को साझा करना तथा सतत औद्योगिक विकास पर व्यापक संवाद को प्रोत्साहित करना है।

भारत के आर्थिक विकास एवं ऊर्जा सुरक्षा के लक्ष्यों की प्राप्ति के साथ-साथ उत्तरदायी पर्यावरणीय प्रबंधन की आवश्यकता और भी महत्वपूर्ण हो जाती है। विश्व पर्यावरण दिवस 2026 की थीम **"Inspired by Nature. For Climate. For Our Future,"** के अवसर पर हमें इस मंच को प्रस्तुत करते हुए गर्व का अनुभव हो रहा है, जो ज्ञान विनिमय, नवाचार तथा हरित एवं सतत् भविष्य के लिए सामूहिक प्रयासों को समर्पित है।

शुभकामनाओं सहित,

राजीव कुमार सिन्हा
निदेशक (तकनीकी/इंजीनियरिंग सेवाएँ), सीएमपीडीआई

MESSAGE

Sri Anand Mohan
Director (T/RD&T, BD)

Dear Readers,

Welcome to the inaugural edition of ***Prakriti Sankalp*** — a magazine. I hope it will become a trusted knowledge, common for everyone working at the intersection of technology, innovation and environmental sustainability in coal and energy sector.

CMPDI has long served as the nodal agency for coordinating R&D projects under the Ministry of Coal's S&T programme and the CIL R&D Board, giving us a panoramic view of where research stands and where it must go. Our Clean Energy Department is actively engaged in Coal Bed Methane exploration, working with the Global Methane initiative – recognising that harnessing mine methane is simultaneously a safety imperative, a greenhouse gas mitigation measure and an energy opportunity.

On World Environment Day 2026, the launch of ***Prakriti Sankalp*** reaffirms our commitment to making research visible, accessible and actionable. I earnestly invite researchers, technologists, academics and industry professionals to contribute, collaborate and help to build a living repository of solutions for a sustainable and energy-secure India.

With warm regards,

Anand Mohan
Director (T/RD&T, BD)

MESSAGE

पंकज कुमार, भा.रे.पा.से
मुख्य सतर्कता अधिकारी

Pankaj Kumar, IRTS
Chief Vigilance Officer

सत्यमेव जयते

सीएमपीडीआई
मिनी रत्न
cmpdi
Mini Ratna

सेन्ट्रल माईन प्लानिंग एण्ड डिजाइन इन्स्टीच्यूट लिमिटेड
(कोल इण्डिया लिमिटेड की अनुषंगी कम्पनी / भारत सरकार का एक लोक उपक्रम)
गोण्डवाना प्लेस, कांके रोड, राँची - 834 008, झारखंड (भारत)
Central Mine Planning & Design Institute Limited
(A Subsidiary of Coal India Limited / Govt. of India Public Sector Undertaking)
Gondwana Place, Kanke Road, Ranchi - 834 008, Jharkhand (INDIA)
कॉर्पोरेट आइडेन्टिटी नंबर - L14292JH1975G01001223
Corporate Identity Number

VIGILANCE DEPARTMENT

सन्देश

तस्मिन् लोके समाहितम् — तं लोकं न विनाशयेत्॥ — (अथर्ववेद)

(जिस लोक में समस्त प्राणी निवास करते हैं, उस लोक का विनाश मत करो)

"प्रकृति से प्रेरित, जलवायु के लिए, हमारे भविष्य के लिए" की भावना को आगे बढ़ाते हुए "प्रकृति संकल्प" के प्रथम अंक का प्रकाशन पर्यावरण संरक्षण के प्रति हमारी सामूहिक प्रतिबद्धता का प्रतीक है। इस सार्थक पहल के लिए पर्यावरण विभाग को हार्दिक बधाई।

आज विश्व जलवायु परिवर्तन, जैव-विविधता के ह्रास और प्राकृतिक संसाधनों की कमी जैसी गंभीर चुनौतियों से जूझ रहा है। जलवायु परिवर्तन अब भविष्य की नहीं, वर्तमान की वास्तविकता है। भारतीय ज्ञान-परंपरा का प्रकृति के साथ सह-अस्तित्व का दर्शन हमें यही सिखाता है कि सतत समृद्धि का मार्ग प्रकृति से सामंजस्य में निहित है।

खनन और ऊर्जा क्षेत्र राष्ट्र की प्रगति के आधार हैं, किंतु विकास तभी सार्थक है जब वह पर्यावरणीय उत्तरदायित्व के साथ हो। प्राकृतिक संसाधनों का संरक्षण, प्रदूषण नियंत्रण और जैव-विविधता की सुरक्षा हमारी नैतिक जिम्मेदारी है। स्वच्छ वायु, स्वच्छ जल और संसाधनों का सतत उपयोग ही टिकाऊ विकास की नींव है।

"**पृथिवीं धारयाम्यहम्**" के इस मंत्र को लेकर, इस विश्व पर्यावरण दिवस पर संकल्प लें कि हम अपने छोटे-छोटे प्रयासों से एक स्वच्छ, हरित और सुरक्षित भविष्य के निर्माण में सहभागी बनेंगे।

जय हिन्द!

5/6/26

(पंकज कुमार, भा.रे.पा.से.)
मुख्य सतर्कता अधिकारी

MESSAGE

Rajiva Kumar Singh
Executive Director (Exploration)
Coal India Limited
Office: CMPDI, Kanke Road, Ranchi

Dear Readers,

It is with great pride and a deep sense of purpose that I welcome you to this edition of **Prakriti Sankalp**. In today's world, Environmental, Social, and Governance (ESG) principles are no longer peripheral — they are central to responsible industry, in India and globally. As the apex institution for mine planning and exploration under Coal India Limited, CMPDI is uniquely positioned to lead by example. Our designs and assessments guide subsidiaries across the country, and with that leadership comes an unwavering obligation to uphold the highest standards of environmental stewardship.

I am glad to say that CMPDI integrates environmental sensitivity into its operations from the very first stage of exploration. We recognise that responsible mining begins well before the first shovel breaks the earth. Our teams assess ecological conditions, identify eco-sensitive zones, and ensure that exploration activities leave the smallest possible footprint on land and local communities.

Beyond exploration, CMPDI actively supports subsidiary companies in mine reclamation and ecological restoration. Through ecological greening of overburden dumps, stabilisation of mine spoil slopes, and systematic rehabilitation of disturbed land, our technical expertise contributes to a healthier environment. What was once bare overburden gradually transforms into green landscapes thriving with flora and fauna.

Our commitment to carbon sequestration and ecological rehabilitation — embedded in mine closure plans and plantation programmes — reflects CMPDI's contribution to India's climate goals and the global ESG agenda. **Prakriti Sankalp** is our platform to share this journey with conviction: that energy security and ecological integrity can, with wisdom and will, walk hand in hand.

With regards and green resolve,

Rajiva Kumar Singh
Executive Director (Exploration), Coal India Limited, Ranchi

From the Desk of General Manager (Environment)

V. K. Pandey
General Manager (Environment), CMPDI

Dear Readers,

It gives me immense pleasure to present the inaugural edition of *Prakriti Sankalp* on the occasion of World Environment Day 2026. The theme “Inspired by Nature. For Climate. For Our Future.” reminds us that environmental stewardship is not merely a responsibility but a collective commitment towards securing a sustainable future for generations to come.

As environmental professionals, we stand at a crucial juncture where developmental aspirations must be harmonized with ecological preservation. The challenges of climate change, biodiversity loss, land degradation, and resource depletion demand innovative, science-based, and inclusive solutions. At CMPDI, environmental sustainability forms an integral part of every stage of the mining lifecycle—from environmental planning and impact assessment to mine closure, ecological restoration, and post-mining land use.

Over the years, our efforts have focused on promoting sustainable mining practices through scientific reclamation, afforestation, biodiversity conservation, water resource management, and the application of advanced technologies such as remote sensing, GIS, and environmental monitoring systems. These initiatives not only mitigate environmental impacts but also contribute to climate resilience and community well-being.

This magazine is envisioned as a platform for sharing knowledge, experiences, innovations, and best practices in environmental management. Through the contributions of experts, practitioners, researchers, and young professionals, *Prakriti Sankalp* seeks to foster meaningful dialogue and inspire collective action towards a greener and more sustainable future.

I congratulate all contributors for their dedicated efforts in bringing out this special issue. I also invite readers to actively participate in this journey by sharing their ideas, experiences, and success stories that can help strengthen our commitment to environmental excellence.

Let us draw inspiration from nature and work together to build a climate-resilient, environmentally responsible, and sustainable future.

संपादकीय

विश्व पर्यावरण दिवस हमें यह स्मरण कराता है कि प्रकृति केवल हमारे अस्तित्व का आधार नहीं, बल्कि मानव सभ्यता की निरंतरता और भविष्य की सुरक्षा की सबसे बड़ी शक्ति भी है। इस वर्ष की थीम "प्रकृति से प्रेरित — जलवायु के लिए, हमारे भविष्य के लिए" हमें यह संदेश देती है कि जलवायु परिवर्तन, जैव विविधता ह्रास और प्रदूषण जैसी वैश्विक चुनौतियों का समाधान प्रकृति के साथ सामंजस्य स्थापित किए बिना संभव नहीं है।

आज विश्व अभूतपूर्व पर्यावरणीय संकटों का सामना कर रहा है। बढ़ता वैश्विक तापमान, अनियमित वर्षा, सूखा, बाढ़ तथा चरम मौसमी घटनाएँ स्पष्ट संकेत हैं कि पृथ्वी हमें चेतावनी दे रही है। विकास और पर्यावरण के बीच संतुलन स्थापित करना अब केवल एक विकल्प नहीं, बल्कि मानवता के सुरक्षित भविष्य के लिए अनिवार्य आवश्यकता बन चुका है। यदि हम वर्तमान उत्पादन और उपभोग की प्रवृत्तियों में आवश्यक परिवर्तन नहीं करते, तो आने वाली पीढ़ियों के लिए एक सुरक्षित, समृद्ध और संतुलित पृथ्वी सुनिश्चित करना कठिन होगा।

भारतीय संस्कृति ने सदैव प्रकृति को श्रद्धा, संवेदना और सह-अस्तित्व के भाव से देखा है। वैदिक उद्घोष "माता भूमिः पुत्रोऽहं पृथिव्याः हमें पृथ्वी के प्रति अपने दायित्व का बोध कराता है। आज आवश्यकता है कि हम इस सांस्कृतिक विरासत को आधुनिक विज्ञान, नवाचार और सतत विकास के सिद्धांतों के साथ जोड़ते हुए पर्यावरण संरक्षण को जन-आंदोलन का स्वरूप दें। जल संरक्षण, स्वच्छ ऊर्जा, वृक्षारोपण, जैव विविधता संरक्षण तथा उत्तरदायी उपभोग जैसे प्रयास केवल पर्यावरणीय आवश्यकताएँ नहीं, बल्कि भविष्य की पीढ़ियों के प्रति हमारी नैतिक जिम्मेदारियाँ भी हैं।

भारत ने अक्षय ऊर्जा, वन एवं वन्यजीव संरक्षण, आर्द्रभूमि संरक्षण तथा जनभागीदारी आधारित पहलों के माध्यम से पर्यावरण संरक्षण के क्षेत्र में उल्लेखनीय प्रगति की है। तथापि पर्यावरणीय चुनौतियों की व्यापकता को देखते हुए प्रत्येक नागरिक, संस्था और समुदाय की सक्रिय सहभागिता अत्यंत आवश्यक है। छोटे-छोटे व्यक्तिगत प्रयास भी व्यापक परिवर्तन का आधार बन सकते हैं और सामूहिक संकल्प ही स्थायी समाधान का मार्ग प्रशस्त कर सकता है।

"प्रकृति संकल्प" का यह अंक पर्यावरण संरक्षण, जलवायु कार्रवाई और सतत विकास के प्रति हमारी सामूहिक प्रतिबद्धता का प्रतीक है। हमें विश्वास है कि यह प्रयास पाठकों में प्रकृति के प्रति संवेदनशीलता, उत्तरदायित्व और सकारात्मक परिवर्तन की भावना को और अधिक सुदृढ़ करेगा।

आइए, इस विश्व पर्यावरण दिवस पर हम सब मिलकर प्रकृति के संरक्षण, संसाधनों के विवेकपूर्ण उपयोग और सतत जीवनशैली को अपनाने का संकल्प लें, ताकि आने वाली पीढ़ियों को एक स्वच्छ, हरित, समृद्ध और जलवायु-सुरक्षित पृथ्वी प्रदान की जा सके।

शुभकामनाओं सहित,

मनोज कुमार

डॉ. मनोज कुमार
संपादक

Contents		
1	Water Stewardship and Climate Resilience: Shared Lessons for Urban Utilities and the Coal Sector	*Shilpa Halyal, IIT Delhi*
2	Artificial Intelligence Vs Natural World	Ankita S, FMS, New Delhi
3	World Environment Day 2026: Climate Action, Responsible Mining And Scientific Environmental Governance	*Anand Shekhar , RI-I CMPDI*
4	Too Hot To Ignore: The Reality Of Climate Change	*Manish Yadav, Neeraj Kumar Singh, Krishnadas A.M, Shalinie Kumar, RI-VII, CMPDI*
5	From Coal Mines To Carbon Sinks	*R A Khan, RI-V, CMPDI*
6	Community Development And Livelihood Plan Under Mine Closure Guidelines, 2025	*Dr. Amarjeet Singh, CMPDI HQ*
7	Role Of Geospatial Technology In Environmenta Monitoring In Coal Mining Areas	*Rakesh Ranjan, CMPDI HQ*
8	Nationwide Mine Water Resource Assessment And Utilisation – An Initiative By CMPDI	V.K.Pandey, Punam Singh, D. Bandopadhyay, Abhishek Kumar Singh, CMPDI HQ
9	Nurturing Nature: India's Ecological Vision for Planetary Stewardship	*Vivek Kumar, NIT Tiruchirappalli*
10	By Nature & Sustainable Practices for Our Future	*Vijay Krishna Nagda, RI-VI, , Navin Kumar, RI-II*
11	CMPDI's Contributions To Solar Energy Development in CIL	*Sudarshan Prasad, Atul Kumar, Mukesh Kumar, Rakesh Kumar, Utpal Kumar Sarkar, CMPDI, HQ*
12	From Pits to Forests: Nature-Based Solutions for Ecological Restoration in Mining Areas	*Shyamal Kumar Mahto, IIFM Bhopal*
13	*Inspired by Nature: Building Climate Resilience Through Sustainable Mining Environment Department, CMPDI RI-IV, Nagpur*	V N Dupattawala, *CMPDI RI-IV*
14	Carbon Credits and Circular Economy : Transforming Environmental Responsibility into Economic opportunity	Md M Rabbani, RI IV, CMPDI
15	प्रकृति संकल्प: धरती को बचाने का महाअभियान और हमारा नैतिक दैनिकत्व	*Rajesh ,RI-IV, CMPDI*
16	पर्यावरण पर भूभौतिकी के अनुप्रयोग एवं प्रभाव	*Vivekanand Gupta, CMPDI,HQ*

Contents		
17	From Mining Waste to Green Concrete: The Circular Economy Revolution at Damoda Colliery, BCCL	*Kumar Vaibhav Mgr (Env) & Navin Kumar*
18	Way Forward	*Punam Singh, CMPDI, HQ*
	Environmental Stewardship and Sustainability Initiatives CMPDI Activities 2025–26	
	CMPDI's Growing International Role in Sustainable Mining and Environmental Governance	
	Current Technological Innovations Transforming Environmental Management in Mining	

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Stewardship and Climate Resilience: Shared Lessons for Urban Utilities and the Coal Sector

Shilpa Halyal, Executive Engineer, Bengaluru Water Supply & Sewerage Board (BWSSB)
Government of Karnataka, M.Tech, IIT Delhi

World Environment Day serves as a reminder of our collective responsibility to protect and preserve the natural resources that sustain life on Earth. The theme for World Environment Day 2026, "Inspired by Nature. For Climate. For Our Future," emphasizes the importance of drawing solutions from nature to address the demanding challenges of climate change, environmental degradation and resource scarcity. As the cities continue to expand, the need for sustainable environmental management has become more critical than ever. Water, being one of our most precious natural resources, lies at the heart of environmental sustainability and climate resilience.

The Bangalore Water Supply and Sewerage Board (BWSSB) has been committed in its potential to ensuring sustainable water and wastewater management for the city of Bengaluru. Beyond its primary mandate of providing safe drinking water and effective sewerage services, BWSSB has embraced environmentally responsible practices that contribute to the protection of ecosystems and conservation of natural resources. Through continuous investment in advanced sewage treatment infrastructure, wastewater reuse initiatives and lake rejuvenation programmes, the Board is transforming urban water management into a model of sustainability.

Inspired by nature's own cycles of renewal and regeneration, BWSSB has adopted the principles of a circular water economy. Rainwater harvesting is promoted in homes, apartments and offices. With an installed treatment capacity of 1,348 MLD across 34 Sewage Treatment Plants (STPs) strategically located throughout the city, BWSSB is actively promoting the beneficial reuse of treated wastewater for industrial, construction, landscaping and environmental applications. This approach not only conserves water drawn from the Cauvery River but also supports groundwater recharge and enhances the resilience of the city against droughts and climate-related uncertainties. By viewing wastewater as a resource rather than waste, BWSSB is contributing to a more sustainable and climate-conscious future.

A key aspect of BWSSB's environmental efforts is the rejuvenation and protection of Bengaluru's lakes and water bodies. Treated wastewater from sewage treatment plants is being utilized to rejuvenate lakes, improve ecological health and support biodiversity. These initiatives strengthen natural ecosystems, promote groundwater replenishment and create greener urban environments. Such nature-based solutions demonstrate how environmental conservation and

urban development can co-exist to deliver long-term benefits for both people and the planet.

The principles of sustainable water management and environmental stewardship adopted by BWSSB also hold significant relevance for India's coal sector. Coal India Limited and CMPDI are increasingly integrating environmental safeguards, mine water management, wastewater reuse, land reclamation, biodiversity conservation and climate-resilient planning into mining operations. Treated mine water can support local communities, agriculture and ecosystem restoration, while scientific mine closure and afforestation programmes contribute to carbon sequestration and ecological recovery. The transition towards resource efficiency, circular economy practices and nature-based solutions demonstrates how urban utilities and the coal sector can work together towards the common goal of sustainable development and environmental protection.

BWSSB is also advancing resource recovery and renewable energy generation through innovative sludge management practices. By harnessing biogas from sewage sludge and promoting energy-efficient wastewater treatment technologies, the Board is reducing greenhouse gas emissions while contributing to the transition towards cleaner and more sustainable energy systems.

People are being involved through the Green Star Challenge. Societies and institutions that save water are recognized and rewarded. Awareness is created about rainwater harvesting and water conservation. Citizens are encouraged to join hands in protecting Bengaluru’s water. These initiatives align closely with national and global efforts to mitigate climate change and build environmentally resilient communities.

On this World Environment Day, let us reaffirm our commitment to protecting the environment through responsible water use, conservation and sustainable practices. Environmental stewardship is not solely the responsibility of institutions but also the active participation of every citizen. Together, inspired by nature and guided by a shared vision for climate action, we can create a healthier, greener and more sustainable future for generations to come.

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ARTIFICIAL INTELLIGENCE VS NATURAL WORLD

How the Gen-AI push is destroying our environment

Ankita S, FMS, New Delhi

In 1970, a psychological experiment on children was conducted at Stanford University, where these young test subjects were left alone with a marshmallow for 15 minutes. The child had the option to immediately eat one marshmallow, or wait and get rewarded with another marshmallow after 15 minutes. These children were continuously studied for the next decade, and it was found that those who could wait for the better reward, performed better academically and were healthier, as compared to those children who preferred instant gratification. Humanity is currently at a crossroads, where we are collectively mesmerized by the sweet prospects of AI chatbots right in front of us and we cannot wait to fully capitalize on it. We do not seem to realise that we are going to lose the much bigger future reward of a healthy planet and a functioning human civilization.

Climate change and global warming have become an extensively studied subject, and it is no doubt that the current model of development, based on fossil fuel consumption and unsustainable manufacturing processes, is driving the planet towards an ecological disaster. Thrown into this mix is artificial intelligence, which has become ever present on our phones and computers, pervading our personal and professional lives. I cannot watch a short video of four cats jumping over each other without YouTube recommending I use AI to picturise myself in the scene. LLMs can talk to you, read books for you, write projects for you, solve homework, draw, code, create presentations, even replace close personal relationships with artificial silicon-based personalities you can tell your deepest darkest secrets to. The supply of this commodity by big tech corporations has been plentiful, and the demand for it by the masses near unquenchable. What was a $600 million industry in 2016 has burgeoned into a $390 billion industry in a decade.

The backbone of this is the massive growth of data centers and computing hardware manufacturing. The functioning of Large Language Models (LLMs) is made possible only by large clusters of Graphics Processing Units (GPUs). These GPUs consume 2-4 times more electricity than conventional data centers. A Google search consumes about 0.3Wh of electricity, equivalent to a small LED lightbulb left on for a few minutes. According to some estimates, a query on ChatGPT 4.0 consumes 10 times that, about 3Wh. The daily energy consumption of ChatGPT may be 40 million kWh. That is equal to the average daily consumption of 10 million Indians. The global electricity consumption by all the data centers was 415 TWh in 2024, about 1.5% of total consumption. It is estimated to approach 1050 TWh by 2030. An often-cited statistic is that if this sector were a country, it would become the fifth largest electricity consumer in the world. All of this

is merely for query processing, and it does not even take into account the training process LLMs.

As a corollary to this, we must talk about the greenhouse gas emissions. The Greenhouse Gas Protocol categorizes the emissions into three scopes: first is the direct emissions, which include the diesel backup generators for data centers; second is indirect operations emissions, counting the emissions from the generation of electricity purchased and consumed by the tech company; third is the indirect emissions from the broader supply chain – manufacturing semiconductor chips, mining ores of cobalt, silicon, lithium etc., physically constructing the infrastructure. Companies who are building hyper scale data centres have all committed to Net Zero goals, but in fact they have reported significant increase in their emissions due to generative AI. Google's carbon emissions have soared by 51% since 2019, and Microsoft's have grown by 29% since 2020. Independent researchers have estimated that the training for GPT 3.0 emitted more than 500 metric tons of carbon dioxide, which is around 610 one-way direct flights from New York to Paris. A platitude given by AI optimists is the switch to renewables for electricity generation, but this adoption has been slow to arrive and is outpaced by the power demand of data centres. And in any case, there seems to be few alternatives for Scope 3 emissions, as mining and manufacturing continue to be extremely polluting endeavours.

The data centres are hungry for electricity but they are also thirsty for water, required for cooling. A 100 MW data centre can use up to 2 million gallons every day. By 2027, global data centre operations are projected to consume roughly 5 trillion litres of water annually. These cooling systems also continuously release warm air into the atmosphere, creating a warm micro-climate. This exacerbates the conditions in urban areas which have become heat islands and are already facing water stresses. The world also generated 62 million tonnes of e-waste in 2024, estimated to rise to 82 million by 2030. Generative AI could add about 5 million tonnes more to this figure.

It is no wonder then that the opening of new data centres has encountered protests in the USA. A Gallup poll found that 71% of Americans don't want a data centre being built where they live. In comparison, only 53% oppose construction of a nearby nuclear power plant. The opponents of local data centre construction cited excessive water and energy use as their main concern, and also expressed fear over rising electricity costs. North Virginia has about 35% of all known hyper scale data centres, and recently a plan for a 2100-acre data centre had to be scrapped due to opposition by the local Virginians. Hundreds of citizens in Salt Lake City have taken to the streets to strongly oppose a proposed 40,000-acre mega data centre. Citizens in UK organise their efforts under the banner of #StopDirtyDataCentres.

Therefore, the push for building data centres in India needs to be seen in this alarming context. As opposition grows among citizens and the government tightens regulations in the developed

countries, big tech corporations turn to India to build their data centres. Exploitation of lax environmental laws in developing countries is an old game that has been played by many industries like chemical and shipbreaking, to name a few. AI data centres are the newest entrants, and the $15 billion facility planned in Andhra Pradesh is no reason to rejoice. The Human Rights Forum has raised alarms over rushed environmental clearances. The project documentation has failed to explicitly state the source or volume of water needed for cooling. This is a critical omission given that Visakhapatnam holds incredibly low domestic groundwater availability. This is nothing but a new form of colonialism where resources are extracted from India, to build compute power by companies headquartered in other nations, who will reap profits.

A dilemma that now faces us is this: we have already accepted the rationale of harming the environment to fulfil developmental needs – India is indeed ramping up its coal production to meet its growing power demands, at a time when the Indian household consumes less than the global average. So can we also accept this harm to the environment in order to feed the AI industry? The offering of this industry as it currently stands is mostly speculative. Gen-AI *can* make wonderful discoveries, Gen-AI *can* cure cancer. But what it *is* doing the most right now is convincing us that we need it for doing things that we were doing perfectly well by ourselves 4 years ago. We don't need it to write 100-word emails for us. A simple google search for litti chokha recipe will suffice. A human managing a task can take business decisions far more effectively and accurately than a chatbot. The all-pervasive push for its use everywhere is unnecessary, and honestly not worth the cost we will pay to scale up infrastructure that can satisfy this demand. And isn't it funny that the global business leaders who keep warning people to use Gen-AI lest we are rendered obsolete, these are the same people who gain the most by wider adoption of their technologies. They are not visionaries, they are just salesmen.

The announcement of each LLM model more powerful than the previous one is met with enthusiasm and also dread. However, the fear related to AI has always been about it gaining sentience and achieving singularity, a problem widely confronted by books and movies on science fiction. But the threat posed by it is more mundane, and it is already a reality, because the effects of climate change are already reality, not fiction. If we become slaves to convenience, if we gulp down this marshmallow now, there will be no more marshmallows in the future, because there will be no more planet in the future.

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World Environment Day 2026: Climate Action, Responsible Mining and Scientific Environmental Governance

Anand SHekhar, GM(E&M)/(Env), RI-I

World Environment Day reminds us that environmental responsibility must be integrated into every stage of development—from planning and operation to monitoring, restoration and mine closure. The 2026 theme of climate action is especially significant for the coal sector, where energy security must be balanced with environmental stewardship, scientific planning and social responsibility.

Environmental management in mining today extends beyond pollution control to include climate resilience, biodiversity conservation, water stewardship, renewable energy, circular economy practices, responsible mine closure and technology-driven monitoring. In this context, CMPDIL RI-I, Asansol, plays a vital role as the in-house consultant of Eastern Coalfields Limited (ECL), supporting environmentally responsible and compliance-oriented mining.

ECL, incorporated in 1975, operates in West Bengal and Jharkhand. During FY 2024–25, ECL operated 79 mines comprising 47 underground, 22 opencast and 10 mixed mines across 13 areas, with coal reserves of approximately 57.218 billion tonnes. During the year, ECL produced 52.035 million tonnes of coal, achieving 96.36% of its target and registering 9.409% growth over the previous year. Overburden removal reached 187.167 million cubic meters, highlighting the need for strong environmental management systems. ECL's Corporate Environment Policy aligns with Coal India Limited's vision of sustainable development through pollution prevention, resource conservation, ecosystem restoration, responsible waste management and climate-change response. The policy promotes the "10 Rs" approach—Reduce, Recycle, Reuse, Redesign, Repurpose, Refurbish, Repair, Recover, Redeploy and Refuse.

Afforestation and land reclamation remain important priorities. During FY 2024–25, ECL carried out plantation over 78.03 hectares with about 1.27 lakh saplings and planted or distributed 35,620 saplings under Vriksharopan Abhiyan 2024. Green belts were strengthened along transportation corridors and coal-handling facilities. ECL has also engaged CSIR-CIMFR to scientifically evaluate plantation success through field studies, drone surveys and data analysis. Air-quality management has been strengthened through the installation of nine additional Continuous Ambient Air Quality Monitoring Stations, enabling real-time monitoring across all ECL areas and integration with CPCB and SPCB networks. Dust-control measures such as fog cannons, sprinklers, water tankers and road-sweeping machines have been expanded to reduce emissions from mining and transportation activities.

Water stewardship is another key focus area. Groundwater abstraction permissions were obtained for 72 mines in West Bengal, while studies by IIT-BHU and IIT-ISM are assessing mine-water availability, quality and utilisation potential. The objective is to develop mine-wise water-management plans and promote the productive use of surplus mine

water for domestic, agricultural and industrial purposes. ECL further strengthened its environmental governance through certification under ISO 9001:2015, ISO 14001:2015 and ISO 45001:2018. Mine closure has also become a structured environmental obligation. During FY 2024–25, 91 Mine Closure Plans required revision under the revised Ministry of Coal guidelines. Forty-eight proposals amounting to Rs. 99.43 crore were submitted after third-party audit, while Rs. 57.82 crore was reimbursed and Rs. 76.13 crore deposited in escrow funds. Climate action is gaining momentum across ECL operations. Coal India Limited has assigned ECL a target of installing 525 MW of solar capacity to support its Net Zero vision. Solar capacity increased to 2.756 MW during FY 2024–25, generating 12.55 lakh kWh of electricity and saving Rs. 63.79 lakh. Energy-efficiency measures involving fans, air conditioners, lighting systems and motors are expected to save nearly 1.1 million units of electricity annually.

As ECL's technical partner, CMPDIL RI-I provides expertise in mine planning, environment, hydrogeology, geomatics and mine closure. CMPDIL's Environment Division undertakes EIA/EMP preparation, environmental monitoring, pollution-control planning and baseline environmental studies. The organisation has completed over 400 EIA/EMP studies, securing environmental clearances for more than 350 projects.During FY 2024–25, CMPDIL prepared 48 environmental reports and conducted monitoring for 303 projects and establishments of Coal India Limited, including 16 in ECL. It analysed 1,60,689 air samples, 26,042 noise samples and 23,716 water samples, generating environmental-service revenue of Rs. 359.69 crore. Its NABL-accredited laboratories and QCI accreditation ensure reliable environmental support and compliance monitoring.

CMPDIL also plays a critical role in hydrogeological assessment and land reclamation monitoring. During FY 2024–25, it prepared 90 groundwater modelling reports and 88 comprehensive hydrogeological reports. Satellite-based reclamation monitoring of 114 projects and vegetation-cover mapping of six coalfields were completed. Drone and UAV technologies are increasingly being used for topographical surveys, mine-fire mapping, settlement studies and plantation monitoring.

On World Environment Day 2026, the shared commitment of ECL and CMPDIL RI-I is clear: strengthen compliance, promote data-driven decision-making, conserve land and water resources, implement practical climate-action measures and maintain a technically rigorous approach to sustainable mining.

Environmental protection and energy security are not competing goals. They must be integrated through science, planning, governance and institutional discipline. As India continues to rely on coal, the sector's future credibility will depend on its environmental performance. Through responsible mining, scientific environmental governance and climate-conscious development, ECL and CMPDILRI-I remain committed to building a cleaner, safer and more resilient future.

Too Hot to Ignore: The Reality of Climate Change

The Earth is sending signals. The only question left is what we send back

Manish Yadav, Manger(Env), Neeraj Kumar Singh, Manger(Env), Krishnadas A.M, Dy. Manager(Env), Shalinie Kumar, Dy Manager(Env), Environment Department, CMPDI RI-VII, Bhubaneswar

1. Background

Once a year, on 5 June, the planet gets a day of its own. World Environment Day is the UN's biggest stage for environmental action UNEP (United Nation Environmental Programme) has run it since 1973, and these days more than 150 countries take part. For 2026 the spotlight shifts to Baku, where Azerbaijan hosts the global event, and the focus narrows to the one emergency that now overshadows all the others: climate change. UNEP puts it plainly. The Earth is already talking through rising seas, bigger wildfires, retreating glaciers, and heat that simply won't let up and the campaign throws the question straight back at us: what are we going to do about it? # Now For Climate.

2. A planet running a fever

Begin with the numbers, because statistics are difficult to ignore. Year 2025 landed as one of the three hottest years ever measured, roughly 1.44°C above the 1850–1900 baseline. It trailed 2024 the hottest single year on record, about 1.55°C above pre-industrial levels. But the individual years aren't even the frightening part. The eleven years from 2015 to 2025 are now the eleven warmest in 176 years of records, and 2023–2025 was the first three-year stretch to average a full 1.5°C above pre-industrial, the exact line governments swore to stay under in Paris (Fig-1).

And it isn't easing off. The World Meteorological Organization (WMO) puts the odds of at least one year between 2025 and 2029 topping 1.5°C at 86%, with a 70% chance the whole five-year average does too. UNEP's Emissions Gap Report 2025 bluntly titled *Off Target* runs the math and still finds us headed for 2.3–2.5°C this century under current pledges, and as much as 2.8°C if we just keep doing what we're doing. That's not a margin the climate can absorb quietly.

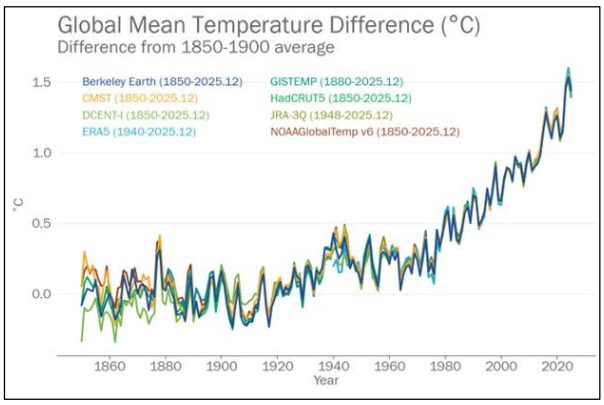

Figure 1: Annual global mean temperature anomalies from 1850 to 2025 (Source: https://wmo.int/news/media-centre/wmo-confirms-2025-was-one-of-warmest-years-record)

2.1. When heat becomes a killer

Numbers on a chart are easy to skim past. The bodies are harder. The 2025 *Lancet Countdown on Health and Climate Change* 128 experts, 71 institutions, built with the WHO found 12 of its 20 health-threat indicators sitting at record highs. Heat-related deaths are up 63% since the 1990s, now averaging around 546,000 a year across 2012–2021. Do the arithmetic and that works out to roughly one death every minute (Fig-2).

None of this is just bad luck with the weather. From 2020 to 2024, about 84% of the heat wave days people lived through each year simply wouldn't have happened without human-driven warming and the pain isn't shared evenly. China alone logged more than 20,100 heat-related premature deaths in 2024 roughly 1.7 times its historical baseline[11] while India lost 247 billion potential working hours to heat in a single year, with farm and construction workers carrying the heaviest load.

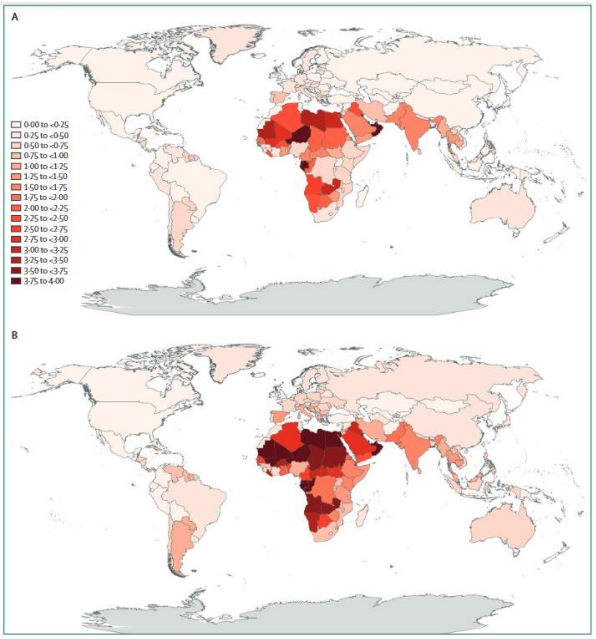

Figure 2: Average percentage of total deaths that were heat-related in 1990–99 (A) and 2012–21 (B); (Source: *Lancet Countdown. "2025 Report" – key findings on heat and health*.)

2.2. The economic burn

Heat wrecks more than health; it quietly bleeds money. In 2024 it cost the world a record 640 billion potential labour hours nearly double the 1990s average adding up to productivity losses of around US$1.09 trillion, close to 1% of global GDP. Heat deaths among older adults accounted for an estimated US$261 billion of that on their own. Here's the part that stings: governments handed fossil fuels roughly US$956 billion in subsidies in 2023 more than triple the climate finance promised to vulnerable countries, and in fifteen nations, more than they spend on health altogether.

3. Sending a signal back

So is it all doom? Not quite. The same science ringing the alarm also hands us a way out. UNEP keeps hammering one point every fraction of a degree we avoid means fewer deaths, lower bills, and a smaller chance of tripping an irreversible tipping point. The Lancet Countdown backs it up: cleaning up coal emission alone already prevented an estimated 160,000 premature deaths a year between 2010 and 2022, even as renewables hit a record 12% of global electricity and created some 16 million jobs.

That's really the whole point of World Environment Day 2026. The way UNEP frames it, change isn't a question of *if* anymore it's a question of how fast we steer it. Start a conversation. Fund a solution. Shift a policy. Tell a story. Every move is a signal, and signals move other people. The planet has already sent one we can't pretend not to hear. The heat is still ours to handle but only if we answer.

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From Coal Mines to Carbon Sinks

-R A Khan, GM(M) HOD(Env), RI-5

Can the Next Coal Mine Become a Carbon Credit Project?

An Environment Professional's Perspective

A few years ago, the idea that an exhausted mine could generate value through forests, carbon storage, solar power, fisheries and ecosystem services would have seemed unrealistic. Mining professionals traditionally viewed mines through the lens of reserves, production targets and equipment productivity. Yet today, reclaimed overburden dumps covered with vegetation and mine voids transformed into reservoirs prompt a new question: are we overlooking the next generation of environmental assets?

As CMPDI professionals, we routinely prepare mine plans, environmental studies, hydrogeological investigations, mine closure plans and sustainability reports. Perhaps it is time to view mined landscapes differently—not as disturbed land or exhausted assets, but as future carbon sinks.

Looking Beyond Coal

Coal will continue to support India's energy needs for decades. However, the future of mining will increasingly be judged not only by the coal extracted, but by what remains after mining. Can a mine leave behind a forest, a reservoir, a renewable energy park, sustainable livelihoods and measurable climate benefits? Increasingly, the answer appears to be yes.

The Hidden Asset in Mine Closure

Every year, CMPDI prepares and reviews numerous Mine Closure Plans focusing on land stabilization, plantation, water management, safety and socio-economic transition. Yet these same activities can also create climate assets.

Consider a reclaimed mine of 1,000 hectares. Even at a conservative sequestration rate of 6 tonnes of CO_2 per hectare annually, such an area could absorb nearly 6,000 tonnes of carbon dioxide every year. Over time, what was once viewed as a post-mining liability begins functioning as an environmental asset. Plantation becomes more than a statutory requirement—it becomes a long-term climate investment.

The View from the Field

Across SECL and other coalfields, reclaimed mine lands have already demonstrated this transformation. Barren overburden dumps have evolved into green landscapes, mine voids into water bodies, and reclaimed areas into habitats supporting biodiversity. Local communities increasingly utilize post-mining reservoirs for irrigation and fisheries.

At Bishrampur and similar projects, future land-use discussions already include pisciculture, eco-tourism, recreation facilities, solar power generation and community development. The challenge is no longer how to close a mine, but how to create value after mining.

Coal India's Hidden Resource

Coal India possesses one of the largest land banks among Indian industrial organizations. Thousands of hectares of reclaimed land, stabilized dumps, abandoned mine areas and mine-water reservoirs

already exist within the system.In the coming decades, these lands may become as strategically important as coal reserves themselves—not for extraction, but for carbon sequestration, renewable energy generation and ecological restoration.

Solar Power: The Second Life of Mine Land

Many reclaimed mining areas may not be suitable for agriculture, but they can support solar power projects. A 20 MW solar plant typically requires about 80–100 acres of land, making reclaimed mine land an attractive option for renewable energy development.

Coal India has already embarked on an ambitious renewable energy programme. The vision is compelling: a mine that once supplied coal to a thermal power station may one day supply solar power to the grid. The mine continues producing energy even after mining ceases; only the form of energy changes.

Carbon Credits: From Concept to Opportunity

Carbon credits are no longer limited to multinational corporations. Governments, industries and investors are actively exploring carbon markets. If scientifically managed reclamation activities can demonstrate measurable carbon removal, they may create opportunities for carbon-credit generation. This emerging field will require carbon-stock estimation, plantation monitoring, satellite-based verification and technical documentation. These are areas where CMPDI already possesses significant expertise.

A New Role for CMPDI

For decades, CMPDI has been the technical backbone of Coal India in geology, exploration, mine planning, environment, hydrogeology and remote sensing. A new frontier is now emerging, carbon management. Future environmental studies may evaluate carbon sequestration potential, climate vulnerability and carbon-credit feasibility alongside traditional assessments. Mine closure planning may increasingly include measurable climate outcomes.

Preparing for the Future

The environmental professional of tomorrow will require expertise in carbon accounting, ESG reporting, remote sensing analytics, drone-based monitoring, AI applications, renewable energy planning and climate-risk assessment. Much of this capability already exists within CMPDI and can be strengthened through integration and innovation.

The Mine of 2047

Imagine visiting a reclaimed coal mine in 2047. The pit has become a lake, the dump a forest and the reclaimed land a solar park. Local communities operate fisheries, biodiversity has returned and carbon credits are being generated.

A signboard reads:

"This landscape once produced coal for the nation. Today, it produces clean energy, water, biodiversity and climate benefits."

Perhaps that is what the future of mining looks like. And perhaps CMPDI is uniquely positioned to help build it.

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Community Development and Livelihood Plan under Mine Closure Guidelines, 2025

Dr. Amarjeet Singh, Senior Manager (Env) CMPDI (HQ)

The Ministry of Coal, Government of India, through the Guidelines for Preparation of Mining Plan and Mine Closure Plan for Coal and Lignite Blocks, 2025, has emphasized a people-centric and sustainable approach to mine closure. The guidelines recognize that mine closure is not merely a technical and environmental activity but also a socio-economic transition process affecting project-affected persons (PAPs), local communities, and mine-dependent livelihoods.

Accordingly, a dedicated **Community Development and Livelihood Plan (CDLP)** is an important component of the Mine Closure Plan. The objective is to facilitate a just transition by creating sustainable livelihood opportunities, strengthening local capacities, improving community assets, and ensuring socioeconomic resilience in mining-affected areas during and after mine closure. The plan aims to reduce dependence on mining-related employment and promote alternative income-generating activities for affected families.

Indicative activities under the Community Development and Livelihood Plan include:

Sl.	Head as per MPG-2025 Guideline
1	Skill Development & Trainings (Alt. Livelihood)
2	Plantation / Afforestation (Fruit, Medicinal, Local Species)
3	Agriculture & Allied Activities
4	Eco-Tourism Development
5	Flora & Fauna / Wildlife Conservation / Eco-Parks
6	Water Resource Management / Fish Ponds / Recreation

As per the Mine Closure Guidelines, at least 25% of the five-yearly escrow amount earmarked for mine closure activities must be allocated to community development and livelihood-related initiatives. These activities are to be implemented in consultation with local stakeholders and should complement, rather than duplicate, statutory obligations under CSR, R&R, DMF, or other government schemes.

Sl.	Head as per MPG-2025 Guideline
7	Clean Energy Projects (Solar etc.)
8	Art & Culture
9	Women Empowerment
10	Welfare of Aged & Disabled (Medical Camps etc.)
11	Sustainable Living & Socio-Economic Improvement
12	Sanitation
13	Any other

The Community Development and Livelihood Plan is to be prepared based on a baseline socio-economic assessment, stakeholder consultations, and identification of local needs and opportunities.

Accordingly, a total of 296 CDLP reports of different subsidiaries of CIL have been prepared by different Regional Institutes of CMPDI, and the same have been approved by the subsidiary boards.

In line with the Mine Closure Guidelines, 2025, CMPDI undertook the preparation of Community Development and Livelihood Plan (CDLP) reports for the subsidiaries of Coal India Limited (CIL). The exercise aimed to ensure sustainable socio-economic development of communities affected by mine closure. Different Regional Institutes of CMPDI carried out detailed field surveys and stakeholder consultations for the preparation of these plans. The CDLPs identified community needs, livelihood opportunities, and infrastructure requirements in the project-affected areas. Special emphasis was placed on skill development, income generation, and enhancement of local employment opportunities. The plans also incorporated measures for strengthening education, healthcare, and basic civic amenities in the mining regions. A total of **296 CDLP reports** were prepared covering various mining projects across different CIL subsidiaries. The reports were formulated in accordance with the provisions and objectives of the Mine Closure Guidelines, 2025.The preparation of these reports reflects CMPDI's commitment to sustainable mine closure and community welfare. All 296 CDLP reports were subsequently approved by the respective subsidiary Boards, facilitating their implementation in a structured and time-bound manner. Subsidiary wise no of reports are as under:

Name of Subsidiary	Regional Institute	No of Reports prepared and approved
ECL	RI-I, Asansol	57
BCCL	RI-II, Dhanbad	45
CCL	RI-III , Ranchi	44
WCL	RI-IV, Nagpur	46
SECL	RI-V , Bilaspur	72
NCL	RI-VI, Singrauli	9
MCL	RI-VII, Bhubaneshwar	20
NEC	HQ, Ranchi	3
	Total	296

Regular monitoring and evaluation mechanisms should be established to assess outcomes and ensure long-term sustainability of interventions. Through this approach, mine closure will become an opportunity for ecological restoration, economic diversification, and inclusive development, leaving behind a positive and sustainable legacy for the affected communities.

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ROLE OF GEOSPATIAL TECHNOLOGY IN ENVIRONMENTAL MONITORING IN COAL MINING AREAS

Rakesh Ranjan, Advisor (Geomatics), CMPDI (HQ), Ranchi

Abstract

Geospatial technologies which including Remote Sensing, GIS, GPS, Digital Photogrammetry, LIDAR, UAVs, Terrestrial Laser Scanners etc. are transforming how coal mining operations monitor and manage environmental impacts. These tools enable high-coverage, repeatable, and cost-effective monitoring of land use, vegetation, water resources, reclamation progress, slope stability, and reservoir sedimentation, helping mining companies meet regulatory requirements and advance sustainable mining practices.

Geospatial Technology has a very important role in coal mining industry, as coal mining has become much more environmentally sensitive business. "Environmental monitoring using geospatial tools such as satellite/ aerial data provides a level of coverage that is much higher than that offered by any other mapping technology."

Introduction

Coal mining is inherently site-specific and often causes significant disturbance to land, air, and water. Accurate, spatially referenced information is essential across all mining phases viz pre-mining, syn-mining, and post-mining - to assess impacts, plan mitigation, and demonstrate regulatory compliance. Geospatial technology supplies the spatial database and analytical capability needed to quantify change, prioritize interventions, and communicate environmental performance to stakeholders.

Core Geospatial Tools and Their Roles

- **Satellite Remote Sensing**
  Multi-spectral and multi-temporal imagery for land use/cover mapping, vegetation health assessment, and large-area change detection.
- **Geographic Information Systems (GIS)**
  Integration, analysis, modeling, and map production for environmental planning and reporting.
- **Global Positioning System (GPS)**
  Accurate ground control for mapping, monitoring transects, and validating remote observations.
- **Digital Photogrammetry and Terrestrial Laser Scanning**
  Volumetric calculations for overburden dumps and stockpiles; high-resolution topographic models.
- **LIDAR and UAVs**
  Fine-scale terrain models, canopy structure, and targeted surveys for reclamation and slope monitoring.
- **Interferometric SAR and Slope Stability RADAR**
  Deformation monitoring for early warning of slope movement.

Application Areas in Coal Mining Environmental Management

Vegetation Cover Mapping

Regular, three-year satellite-based vegetation mapping at scales such as 1:50,000 supports natural resource planning and impact assessment of mining on Vegetation Cover in the major coalfields under CIL. Time-series analysis reveals loss, recovery, and

fragmentation patterns that guide reclamation and biodiversity measures.

Environmental Management Planning

Geospatial outputs form the backbone of Environmental Management Plans (EMP): Core and Buffer zone land use/cover maps, assimilative capacity assessments, and spatially explicit mitigation plans. Buffer zones (typically a 10 km radius) are monitored periodically to detect off-site impacts.

Land Reclamation Monitoring

Annual satellite surveillance of reclamation progress across multiple opencast mines enables objective assessment of restoration success and prioritization of remedial actions.

Watershed and Groundwater Management

Hydro-geomorphic mapping and watershed delineation using Remote Sensing data and DEMs identify recharge zones, guide water conservation measures, and support hydrological modeling for sustainable water use.

Reservoir Sedimentation Assessment

Remote sensing provides rapid, repeatable reservoir capacity and siltation assessments that inform sediment budgeting and catchment management around industrial clusters and thermal power stations.

Slope Stability and Disaster Management

Regular interferometric measurements and radar-based slope monitoring detect subtle deformations, enabling early warning and targeted stabilization works to reduce disaster risk.

Volumetric and Inventory Management

Digital photogrammetry, TLS point clouds, and UAV surveys deliver accurate overburden and coal stockpile volumes, improving logistics, planning, and environmental accounting.

Case Example and Institutional Practice

CMPDI's long-term use of satellite-based environmental monitoring demonstrates institutional value: a multi-decadal geo-environmental database enables retrospective change analysis and supports mine planning, reclamation monitoring, and reservoir studies. The organization is also expanding UAV deployment to enhance accuracy and responsiveness in environmental monitoring.

Conclusion and Outlook

Geospatial technology is indispensable for modern, environmentally responsible coal mining. By delivering repeatable, scalable, and spatially explicit information, these tools enable better planning, faster response to environmental risks, and measurable reclamation outcomes. Emerging capabilities - higher-resolution satellites, routine UAV operations, LIDAR, and automated change detection workflows - will further reduce environmental footprints and help mining companies align operations with sustainable development goals.

Looking Forward

Adoption of an integrated geospatial monitoring system that combines satellite time-series, UAV/TLS surveys, deformation monitoring, and a maintained geo-environmental database to convert spatial data into actionable environmental management.

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Nationwide Mine Water Resource Assessment and Utilisation – An Initiative by CMPDI

V.K.Pandey, Punam Singh, D. Bandopadhyay, Abhishek Kumar Singh, CMPDI(HQ)

In a landmark initiative aimed at promoting sustainable water resource management in mining regions, CMPDI undertook a comprehensive and pioneering assessment of mine water resources across all active and abandoned mine voids of Coal India Limited (CIL). The study was one of the most extensive exercises of its kind in the Indian coal sector, covering mine water reservoirs spread across multiple coalfields and geographical regions of the country.

The assessment involved detailed hydrogeological investigations, evaluation of groundwater and surface water interactions, estimation of water accumulation and recharge potential, water quality characterization, and analysis of seasonal variations in water availability. Advanced scientific methodologies and field-based studies were employed to assess the storage capacity of mine voids, quantify available water resources, and determine their suitability for various beneficial uses. The study also examined existing mine water management practices and identified opportunities for optimizing the utilisation of this valuable resource.

A key focus of the initiative was to explore sustainable and socially beneficial utilisation pathways for mine water. Comprehensive techno-economic analyses were undertaken to evaluate the feasibility of supplying treated mine water for domestic consumption, irrigation, industrial use, groundwater recharge, pisciculture, eco-tourism, and other livelihood-supporting activities. The assessment further considered treatment requirements, infrastructure needs, environmental safeguards, and long-term operational sustainability of proposed schemes.

The findings of the study were consolidated into a landmark report that provided a strategic roadmap for transforming mine water from a mine management challenge into a valuable resource for regional development. The report received wide appreciation and commendation from the Ministry of Coal for its scientific rigor, innovative approach, and practical recommendations for enhancing water security in coal-bearing regions.

Based on detailed technical evaluations and prioritization criteria, the report identified **22 high-potential pilot project sites across six states** for implementation of mine water treatment and utilisation schemes. These pilot projects are expected to demonstrate the viability of large-scale mine water utilisation for community welfare, agricultural development, industrial applications, and environmental sustainability. The initiative has laid the foundation for a nationwide programme on mine water management and serves as a significant contribution towards sustainable mining, resource conservation, and socio-economic development in coalfield areas.

Through this pioneering effort, CMPDI has reaffirmed its role as a leading technical and environmental consultancy organization, supporting Coal India Limited and the Ministry of Coal in advancing

innovative solutions for responsible mining and sustainable development.

Table: 22 high-potential pilot project sites across six states

Sl. No.	Subsidiary Name	Project Name	Area Name	Abandoned / Active	State
1	CCL	Saunda D OC	Barka Sayal	Abandoned	Jharkhand
2		Bhurkunda Colliery	Barka Sayal	Abandoned	Jharkhand
3		Giddi C OC	Argada	Abandoned	Jharkhand
4		Giddi A OC	Argada	Abandoned	Jharkhand
5		Ray Bachra UG	Piparwar	Abandoned	Jharkhand
6	SECL	Jamuna OC	J&K	Abandoned	Madhya Pradesh
7		West Chirimiri OC	Chirimiri	Abandoned	Chattisgarh
8		Bishrampur OC (Quarry 3, 4 & 5)	Bishrampur	Abandoned	Chattisgarh
9		Piparia UG	Johila	Active	Madhya Pradesh
10		Sharda OC	Sohagpur	Abandoned	Madhya Pradesh
11	ECL	Purushottampur OC	Bankola	Abandoned	West Bengal
12		Sangramgarh OC	Salanpur	Abandoned	West Bengal
13		Madhaipur UG	Pandaveswar	Active	West Bengal
14	BCCL	Sudamdih Shaft	Bhowra	Abandoned	Jharkhand
15		Murulidih 20/21 Colliery	WJ	Abandoned	Jharkhand
16		Lohapatty Colliery	WJ	Abandoned	Jharkhand
17	MCL	Balaram OC (Gandhisagar Void)	Hingula	Abandoned	Odisha
18		Handidhua UG	Talcher	Abandoned	Odisha
19		Deulbeda UG	Talcher	Abandoned	Odisha
20		Orient 1,2 UG	Orient	Active	Odisha
21	WCL	Patansaongi UG	Nagpur	Active	Maharashtra
22		Ghorawari OC	Kanhan	Abandoned	Madhya Pradesh

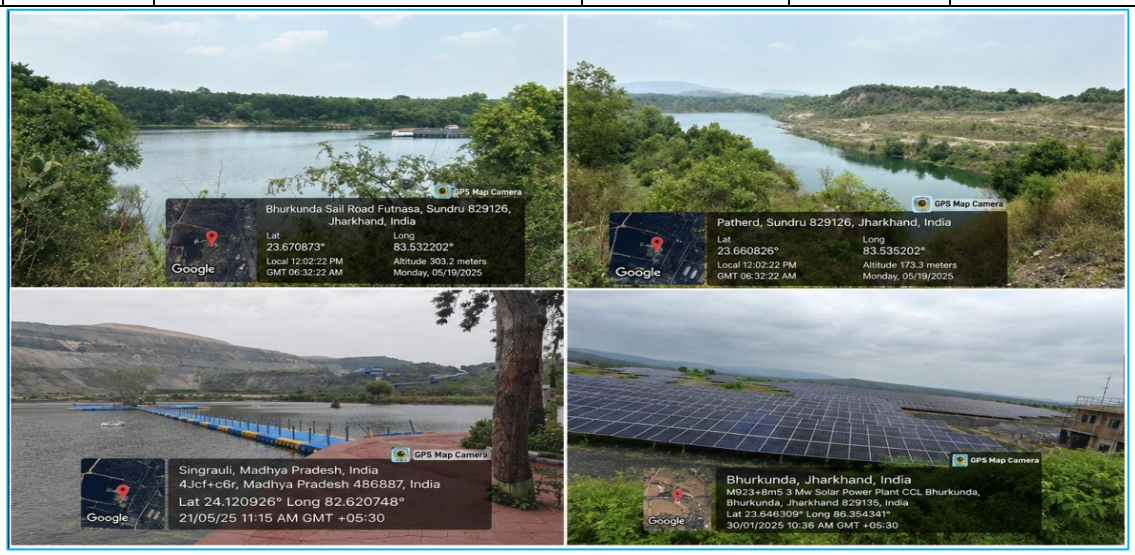

Fig.- Potential Sites for Mine Water Treatment and Utilisation Projects

The proposed projects envisage the sustainable treatment and productive use of mine water for a variety of applications, including agricultural irrigation, drinking water supply, industrial consumption, groundwater recharge, and packaged/bottled drinking water production. By transforming a mining by-product into a valuable water resource, these initiatives aim to enhance water security in mining-affected regions, particularly in water-stressed and rural areas.

Beyond addressing local water needs, the initiative contributes significantly to environmental sustainability and climate resilience by promoting circular water management practices, reducing pressure on conventional freshwater sources, and facilitating the beneficial reuse of mine water. The programme directly supports India's commitments towards achieving several United Nations Sustainable Development Goals (SDGs), particularly SDG 6 (Clean Water and Sanitation), SDG 13 (Climate Action), and SDG 12 (Responsible Consumption and Production).

The Nationwide Mine Water Utilisation Drive stands as a flagship example of how scientific innovation and sustainable mining practices can be integrated to generate long-term environmental, social, and economic benefits for communities and stakeholders.

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Nurturing Nature: India's Ecological Vision for Planetary Stewardship

—Vivek Kumar, NIT Tiruchirappalli

"पृथ्वी संतरणात् संतु नः पुन्या पुन्येन वातः ।पुन्येन अध्युष्ट पुन्या पृथ्वी पुन्येन संतु नः ॥"

The ancient sages of India did not merely write poetry when they called the Earth a mother. This Shloka calls us to protect earth, water, and air — for our well-being and that of all future generations. They encoded a living truth — that we are not separate from nature, we are nature. Nurturing the nature is the present quest for survival for both humanity and Mother Earth.

The Planetary Crisis: Earth is Sending Signals — Is the World Ready to Listen?

World Environment Day in Baku warns that the planet neither argues nor negotiates — it sends signals through rising seas, wildfires, heatwaves, and melting glaciers. As Wendell Berry said, the Earth is what we all have in common, yet we are pushing it past its limits.

- 40% land degraded; 10M ha forest lost yearly; 1M+ species facing extinction.
- 1.5°C limit being crossed; floods and droughts now strike every nation.

WMO confirms 2015–2025 as the hottest eleven years ever recorded with Earth's energy imbalance at a 65-year high and oceans absorbing nearly 18 times humanity's total annual energy use. If this trajectory continues unchecked, by 2050 droughts could affect 75% of the global population, one-third of glaciers may vanish forever and Paris Agreement commitments face serious risk of remaining unfulfilled. Protecting nature is not an act of sentiment; it is an act of survival. Are we using our resources sustainably? Definitely not.

- Earth is likely to remain extremely hot over the next five years; at least one year may cross the 1.5°C danger threshold.
- Nature underpins nearly half the world's economy — thermal destabilisation is not just ecological, it is an economic catastrophe in the making.
- Without binding global action, the Triple Planetary Crisis will accelerate beyond any nation's capacity to respond unilaterally.
- India's Bhumi Sukta — humanity's first environmental manifesto — recognised healthy soil as both a food source and carbon store, centuries before modern climate science.

Where Tigers Roam and Wetlands Thrive: India's Conservation Story

India and the world must simultaneously strengthen biodiversity conservation, climate resilience, and sustainable growth. From national policy commitments to ground-level action, India's conservation strategy spans protected landscapes, endangered species recovery, coastal ecosystems, and citizen-driven green cover — forming one of the world's most comprehensive ecological action frameworks.

- Policy & Biodiversity: NBSAP at COP16 targets reversing biodiversity loss by 2030; whole-of-government and whole-of-society approach essential for ecosystem, species, and coastal restoration.

- Wildlife & Green Cover: PAs expanded 745→1,134; Tiger Reserves 46→58 with 36 corridors; Projects Cheetah, Snow Leopard & Dolphin driving species recovery; 262.4 crore saplings planted under "Ek Ped Maa Ke Naam" by Dec 2025.
- Wetlands & Coasts: MISHTI restored 4,536 ha of mangroves; 22,560 ha identified for future plantation; 98 RAMSAR Sites safeguarding wetlands for biodiversity, water security, and climate resilience.

From Policy to Participation: Mobilizing Collective Action for a Sustainable Future

India's environmental ambition is firmly anchored in measurable sustainable development progress. EPR and the Carbon Credit Trading Scheme are driving circular economy practices and low-carbon industrial growth. India's low-carbon transition demands more than intent — it requires every institution, every citizen, and every rupee of investment aligned toward a single direction.

- SDG Performance: India scored 71 in SDG India Index 2023–24; strong SDG 7 progress reflects growing access to affordable and clean energy nationwide.
- Renewable Rankings: 3rd in Solar, 4th in Wind, 4th in total RE capacity globally per IRENA 2025 — cementing India's clean energy leadership.
- ISA & Green Hydrogen: Mobilising 120+ nations under solar cooperation
- PM Surya Ghar & GOBARdhan: Delivering rooftop solar to 1 crore households and converting organic waste into biogas
- LiFE Movement: Championing pro-planet behaviour across 1 billion+ citizens — making sustainable consumption a daily habit, not a government directive.

From Planetary Crisis to Planetary Stewardship: A Vision for 2050 —The Urgent Mitigation Need for Humankind

Coordinated action from every institution, government, industry, and citizen is the only credible pathway to sustainable and equitable development. Compliance mandates are not formalities — they are the pillars upon which Vision 2050 of living in harmony with nature must be built.

Institutional & Citizen Action: Every sector must work under a calibrated framework — biodiversity, climate resilience, and sustainable growth are shared, non-negotiable responsibilities.

Multi-Layered Strategy: Renewable energy, carbon markets, expanded PAs, species recovery, wetland conservation, and citizen participation deliver development at macro and micro levels.

द्यौः शान्तिरन्तरिक्षं शान्तिः पृथिवी शान्तिरापः शान्तिरोषधयः शान्तिः।
वनस्पतयः शान्तिर्विश्वेदेवाः शान्तिर्ब्रह्म शान्तिः सर्वं शान्तिः॥

-यजुर्वेद

"May there be peace in the heavens, peace in the atmosphere, peace on the Earth, peace in the waters, peace in the herbs and plants, peace in the trees and forests, peace among all divine forces, peace in the Supreme consciousness — may there be peace everywhere, in everything."

Environmental Solutions inspired by Nature & Sustainable Practices for Our Future

Vijay Krishna Nagda, Sr Mgr(Env), Ri-VI, CMPDI

Environmental Solutions: Inspired by Nature

World Environment Day 2026 highlights the need for industrial system reform and climate action. As India advances towards economic growth and energy security, the energy sector—particularly coal mining and thermal power generation—must balance development with environmental protection. Increasingly, coal and power companies are demonstrating that industrial growth and ecological conservation can progress together through nature-inspired solutionsIndia's coal industry remains the backbone of the nation's energy infrastructure, supporting power generation, steel manufacturing and industrial growth. In the evolving geopolitical scenario in West Asia and Europe, domestic coal assumes even greater significance for ensuring India's energy security. However, coal mining also presents environmental challenges including air pollution, water pollution and ecological degradation.

As the saying goes, "Nature is the best doctor." The same principle applies to environmental challenges arising from industrial activities. Some examples are discussed below:

A. Treatment of Acidic Mine Discharge through *Typha latifolia*

Acidic Mine Discharge (AMD) occurs when sulphide-bearing rocks exposed during mining react with air and water, producing acidic effluents that adversely affect surrounding ecosystems. Some WCL mines have experienced this phenomenon and sought a cost-effective treatment solution from CMPDI.CMPDI proposed a three-tier system comprising lime dosing, limestone-bed filtration and bioremediation through constructed wetlands. *Typha latifolia* (cattail) contains sulphate-reducing bacteria in its root zone, which help improve pH. Its root network also acts as a natural filter for sediments and sludge generated during treatment. This approach demonstrates how nature-based systems can provide sustainable and long-term treatment of mine-water pollution.

B. Combating Air Pollutants through Liquid Trees at NCL

Northern Coalfields Limited (NCL) has installed a Liquid Tree system at its headquarters in Singrauli, a Severely Polluted Area (SPA). Unlike conventional plantations requiring large land areas, Liquid Trees use microalgae cultures that absorb carbon dioxide and release oxygen efficiently.

The technology functions as an urban carbon sink and complements traditional greening initiatives. By integrating biological carbon-capture systems, NCL is supporting climate action while enhancing environmental awareness and demonstrating innovative approaches to pollution mitigation.

C. Biological Control of Invasive Aquatic Weeds at Sarni TPS

Sarni Thermal Power Station (MPPGCL), located in Betul district of Madhya Pradesh, meets its water requirement from the Satpura Reservoir on the Tawa River.

Over time, the reservoir experienced extensive growth of the invasive aquatic weed *Salvinia molesta* ("Chinese Jhalar"), which covered large portions of the water body. Mechanical removal proved costly, time-consuming and ineffective as the weed rapidly regenerated, causing eutrophication and affecting both Sarni TPS and local communities.

To address the problem, biological-control insects were introduced to naturally suppress the weed. The approach provided an environmentally sustainable, cost-effective and long-term solution for restoring reservoir health and protecting an important water resource.

Nature as a Solution

These examples demonstrate that environmental challenges associated with industrial activities can often be addressed through nature-based solutions. By integrating ecological processes with scientific management, industries can achieve pollution control, ecosystem restoration and climate resilience in a sustainable and cost-effective manner. Inspired by nature and guided by science, such approaches offer a practical pathway towards responsible development and environmental sustainability.

A comparative scenario is illustrated below:

Figure 1 Satpura Reservoir before being affected by Salvinia molesta (May 2016)

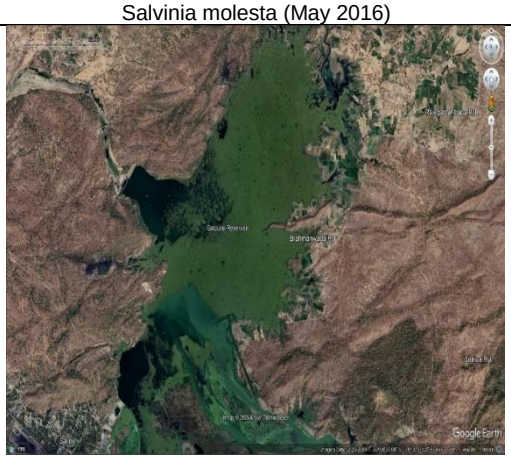

Figure 2 Satpura Reservoir completely affected by Salvinia molesta (Feb 2019)

Directorate of Weed Research (DWR), Jabalpur was approached for providing a better solution for the above problem. DWR has suggested a nature-based approach of treatment through weevil Cyrtobagous salviniae, an insect which takes Salvinia Molesta as food. This led to cleaning of Satpura Reservoir. The weevil Cyrtobagous salviniae was mass reared at DWR Jabalpur and strategically released across infested zones along with periodic monitoring every 30–45 days.

Figure 3 Satpura Reservoir after introduction of weevil (Nov 2022)

Figure 4 Satpura Reservoir after bio-remediation through weevil (May 2024)

A Supplementary release to maintain population pressure through Community involvement (fishermen, STPS staff) in distribution and monitoring was also done. This resulted in Complete clearing of ~1100 ha of reservoir area, recovery of fisheries, water intake, and reservoir ecology. This nature inspired solution did not involve herbicides, making it safe for drinking water and aquatic life. More information on this amazing project can be found at https://dwr.org.in.These instances show how industries have employed nature inspired solutions for not only reducing environmental effects but also actively recovering ecosystems and producing favourable environmental results. The industry is adopting sustainable development as an operational goal through carbon sequestration technologies, phytoremediation, bio-based water treatment, and wetland restoration.

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Applications of NISAR in the Coal Mining Industry: Opportunities for Sustainable Mining and Environmental Monitoring

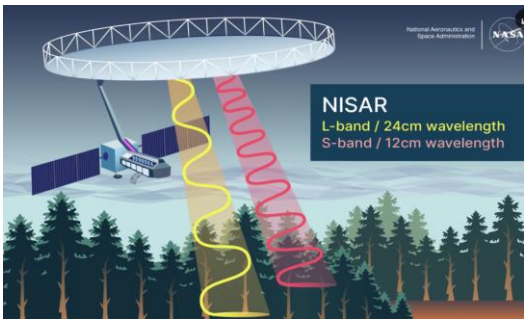
Sandeep Sharma, Lakshmi Deep G, Amul Patwal, Environment Department, CMPDI, RI-III

The coal mining industry is entering a new technological era. Traditionally dependent on field inspections, manual surveys, and localized monitoring systems, mining is increasingly embracing advanced digital technologies to improve productivity, safety, and environmental performance. Among the most promising recent innovations is the NASA–ISRO Synthetic Aperture Radar (NISAR) mission—a breakthrough Earth observation satellite expected to redefine how mining landscapes are monitored and managed.

As coal mining operations become deeper, larger, and environmentally sensitive, the demand for continuous, accurate, and predictive monitoring systems has grown significantly. NISAR represents a major leap in this direction by offering advanced radar-based observation capabilities that can monitor the Earth's surface with exceptional precision, regardless of weather conditions or time of day.

For the coal mining industry, NISAR offers a glimpse into the future of smart, technology-driven, and sustainable mining. NISAR is a joint mission of NASA and ISRO, designed to provide high-resolution measurements of Earth surface changes using advanced Synthetic Aperture Radar (SAR) technology. Unlike conventional optical satellites that require sunlight and clear skies, radar-based systems actively transmit microwave signals and record reflected responses from the Earth's surface.

This technological advancement allows NISAR to operate during day and night. Under cloud cover, haze, dust, and smoke. During adverse weather conditions such as monsoon seasons. For mining regions, where dust pollution, seasonal cloud cover, and harsh weather frequently limit visibility, this capability represents a significant advantage.



NISAR's uniqueness lies in its dual-frequency radar system, combining L-band radar developed by NASA and S-band radar developed by ISRO

This combination enables highly detailed imaging and improved sensitivity to land surface changes. Most importantly, *NISAR can detect ground movement with centimeter- to millimeter-level precision*, making it one of the most advanced monitoring tools available for mining applications.

Mission Overview

The NASA-ISRO Synthetic Aperture Radar (NISAR) is the first joint satellite mission of ISRO and NASA. It was launched aboard GSLV-F16 on 30 July 2025 from SDSC SHAR, Sriharikota, into a 743 km sun-synchronous orbit with an inclination of 98.4°. The satellite's global coverage pattern provides extensive

observation of the Indian subcontinent through overlapping acquisition swaths.

Orbital Characteristics and Coverage Frequency

NISAR operates in a near-polar, sun-synchronous orbit, revisiting the same location every 12 days with an effective observation frequency of six days during its planned five-year mission. This repeat-pass capability enables interferometric analysis of subtle ground deformation. Dense swath coverage over India ensures frequent observations across major physiographic regions, including the Himalayas, Western Ghats and Indo-Gangetic Plain.

Sensor Capabilities

NISAR carries two Synthetic Aperture Radar systems—NASA's L-band (L-SAR) and ISRO's S-band (S-SAR)—making it the first satellite with dual radar frequencies. Both sensors penetrate clouds and vegetation, while the L-band offers deeper canopy penetration. The dual-frequency system enables vegetation characterization and detection of ground movement with centimetre- to millimetre-scale precision.

Data Availability

NISAR data is archived by the Alaska Satellite Facility (ASF) DAAC and is freely accessible. More than 100,000 Level-1 to Level-3 L-band products were released in February 2026. In line with NASA's open-data policy, all L-band and S-band products are publicly available. Indian users can also access data through ISRO's Bhoonidhi portal.

Moving from Reactive to Predictive Mining

Mining monitoring has traditionally relied on identifying problems after visible signs such as cracks, slope failures or subsidence appear. NISAR introduces a predictive approach through Interferometric Synthetic Aperture Radar (InSAR), enabling detection of subtle land deformation before it develops into operational or safety concerns. This capability has the potential to transform mining risk management.

Revolutionizing Subsidence Monitoring

Land subsidence remains a major concern in coal mining, threatening settlements, transportation networks and industrial infrastructure. Conventional monitoring methods are often costly and spatially limited. NISAR enables continuous regional-scale monitoring through repeated observations, allowing detection of deformation hotspots and generation of continuously updated deformation maps. This capability is particularly valuable in legacy coalfields such as Jharia and Raniganj. Other facilities include Smarter Mine Slope and Overburden Monitoring, Supporting Intelligent Environmental Monitoring, Land Use Change Detection, Ground Movement Prediction, Vegetation Recovery Assessment, Water Resource Monitoring and Strengthening Mine Fire and Hazard Monitoring, Coal seam fires continue to threaten several mining regions by destabilizing land.

The Road Ahead

Over its five-year mission, NISAR will provide valuable data for climate science, seismic and volcanic studies, forest mapping and resource management. Its all-weather, day-and-night imaging capability, centimetre-scale precision and open-data policy make it a powerful tool for

scientific, developmental and disaster-management applications. The mission will support diverse national priorities, including Himalayan glaciology, monsoon agriculture, coastal resilience, urban infrastructure monitoring and natural-resource management.

As the mining industry moves toward automation, digital intelligence and sustainability, NISAR arrives at a critical time. Although effective utilization will require technical expertise and geospatial infrastructure, its benefits for safety, environmental monitoring and operational planning are substantial. More than a satellite mission, NISAR represents the future of data-driven mining, where decisions are guided by precise and continuous observations rather than delayed field assessments. For the coal industry, the message is clear: the future of mining may well be monitored from space.

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CMPDI'S CONTRIBUTIONS TO SOLAR ENERGY DEVELOPMENT IN CIL

Sudarshan Prasad, HoD (E&M), Atul Kumar, GM(E&M/Solar),
Mukesh Kumar, (E&M), Rakesh Kumar, SM (E&M), Utpal Kumar Sarkar, SM (E&M)
Electrical & Mechanical Division, CMPDI, Ranchi

1. OVERVIEW

As the nodal consultancy organization of Coal India Limited (CIL), Central Mine Planning and Design Institute Limited has been playing a pivotal role in advancing solar energy development across CIL subsidiaries. CMPDI provides comprehensive consultancy services covering identification of suitable sites, feasibility studies, preparation of detailed project reports (DPRs), techno-economic assessments, tendering support, and project monitoring for grid-connected and ground-mounted solar photovoltaic (PV) projects. By leveraging available land resources, including reclaimed mine lands and other non-operational areas, the scope of services covers DPR preparation, NIT/tender preparation, technical scrutiny, third-party inspections, site supervision, and commissioning support. CMPDI has facilitated the deployment of renewable energy infrastructure that contributes to CIL's clean energy targets and sustainability commitments. Through its technical expertise and project management support, CMPDI is helping transform the coal sector's energy landscape by promoting the integration of renewable energy, reducing carbon emissions, and supporting India's transition towards a greener and more sustainable future.

CMPDI is providing Project Management Consultancy (PMC) services for solar power projects across Coal India Limited (CIL) and its subsidiaries. As on 01.06.2026, CMPDI is engaged in **37 solar projects** with a combined capacity of **637.57 MW** spanning all CIL subsidiaries.

2. OVERALL STATUS OF SOLAR PROJECTS (CIL Subsidiaries)

The subsidiary-wise stage-wise status of solar projects under CMPDI's PMC scope is given at table 1.

Table 1: STATUS OF SOLAR PROJECTS (CIL Subsidiaries)

Sub.	Total Proj. (Nos.)	Total Cap. (MW)	PFR/DPR		NIT Submitted		Under Tendering		Agmt. Pending		Under Installation		Commissioned	
Sub.	Nos.	MW	Nos.	MW	Nos.	MW	Nos.	MW	Nos.	MW	Nos.	MW	Nos.	MW
BCCL	3	54.68	1	25	1	4.68	1	25	0	0	0	0	0	0
CCL	9	142.05	2	108	0	0	1	1.5	0	0	3	22.53	3	10.02
ECL	3	27.5	2	22.5	0	0	0	0	0	0	1	5	0	0
MCL	6	147	5	137	0	0	0	0	0	0	1	10	0	0
NCL	3	8.5	1	6	0	0	0	0	0	0	2	2.5	0	0
SECL	5	126.6	3	120.1	0	0	0	0	0	0	2	6.5	0	0
WCL	7	131	4	33	0	0	0	0	0	0	3	98	0	0
IICM	1	0.24	0	0	0	0	1	0.24	0	0	0	0	0	0
Total	**37**	**637.57**	**18**	**451.6**	**1**	**4.68**	**3**	**26.74**	**0**	**0**	**12**	**144.53**	**3**	**10.02**

Note: *Agmt. Pending = Agreement yet to be signed. Cumulative capacities are in MW.*

3. KEY HIGHLIGHTS

Pipeline: 18 projects (451.6 MW) are at DPR/PFR stage — the largest share of CMPDI's solar portfolio, with MCL (137 MW) and CCL (108 MW) leading.

Under Installation: 12 projects (144.53 MW) are currently under installation, with WCL having the highest capacity under installation (98 MW across 3 projects).

Commissioned: 3 projects (10.02 MW) have been commissioned to date, all in CCL.

Grid Synchronization: The 5 MW Solar Plant at Balakudra OB dump (CCL, Barkasayal Area) was successfully synchronized with the grid on 5th February 2026 — a significant milestone for CMPDI.

4. Recent achievements (E&M Division — Since November 2025)

Key deliverables completed / in progress by CMPDI's under PMC services since November 2025:

Sl	Work Description	Subsidiary	Capacity	Status / Remarks
1	Charging of 5 MW Solar Power Plant at OB dump, Balakudra, Barkasayal Area	CCL	5 MW	Successfully charged and synchronized with grid on 5th Feb 2026.
2	Preparation of Tender Document for 5 MW RTS at Belgaria Township	BCCL	5 MW	Tender document submitted to BCCL for approval.
3	Preparation of Tender Document for 25 MW Ground-Mounted Solar Plant at Dugdha	BCCL	25 MW	Tender document submitted to BCCL for approval.
4	DPR / Tender document and floating of tender for 1.5 MW RTS at various CCL areas	CCL	1.5 MW	Tender under scrutiny.
5	Preparation of DPR for 6 MW Solar Plant with Battery Storage at Sarni	WCL	6 MW + BESS	DPR submitted to WCL for approval.
6	DPR preparation for 20 MW Floating Solar Plant at Chiluwa Taal, Gorakhpur	CIL (HQ)	20 MW	DPR under preparation at CMPDI.
7	Estimation and Tariff derivation for 125 MW / 500 MWh Standalone BESS, Chhattisgarh	CIL (HQ)	125 MW / 500 MWh BESS	Estimate and Tariff submitted to CIL (HQ).

5. SOLAR / BESS PROJECTS OUTSIDE CIL SUBSIDIARIES

CMPDI is also providing DPR preparation and PMC services for projects outside CIL subsidiaries:

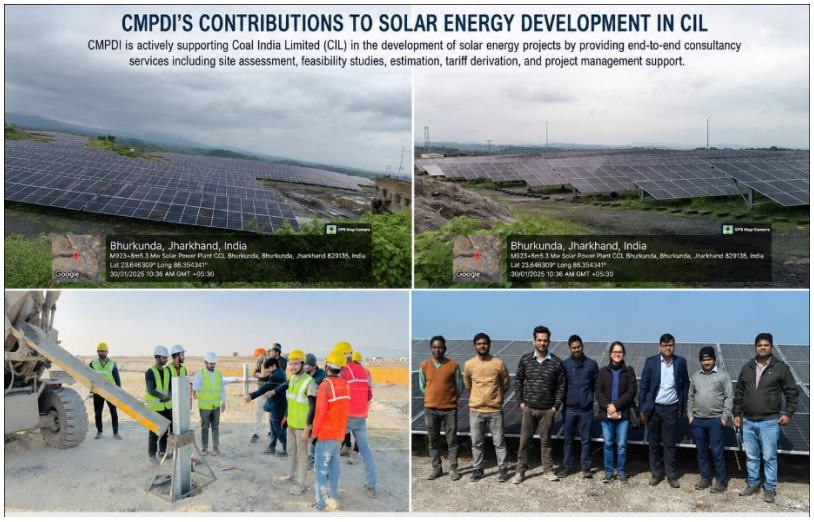
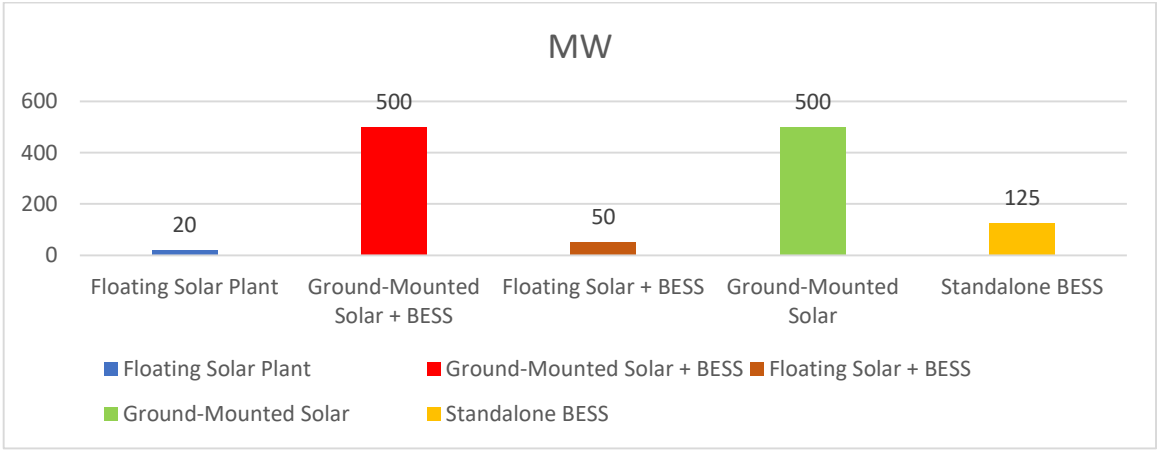


Fig 1- Site photographs

- **20 MW Floating Solar Plant, Chiluwa Taal, Gorakhpur (UP):** STU-connected plant with 40% DC overloading. Tender floated by CIL (HQ) on 19.12.2025. DPR under preparation; PMC services within CMPDI scope. End-user: UP Discom.
- **500 MW Ground-Mounted Solar + BESS, Jalaun (UP):** CIL proposes 500 MW with 10% BESS at Jalaun. CMPDI has submitted offer for PMC services. Awaiting confirmation from CIL; site visit to follow.
- **50 MW Floating Solar + BESS, Rihand Dam (UP) — expandable to 100 MW:** Under planning stage.
- **500 MW Ground-Mounted Solar, Betiah (Bihar):** Site visit completed by CMPDI team. Awaiting confirmation on land availability for the project.
- **125 MW / 500 MWh Standalone BESS, Chhattisgarh:** Estimation and tariff derivation for participation in Requests for Selection (RfS) submitted to CIL (HQ).



Coal and Community: Livelihood, Demography, Culture, and Power in the Shadow of Magadh and Amrapali Mines- A Case Study from Central Coalfields Limited (CCL), Jharkhand

Premchand Guria, CMPDI, RI-III

Introduction

The Magadh and Amrapali Open Cast Projects (OCPs), sprawling across the North Karanpura coalfield in Jharkhand, represent two of the most productive assets of Central Coalfields Limited (CCL). Together, these mines contribute approximately 50% of CCL's total coal production, making them indispensable pillars of India's energy infrastructure. Yet beneath the tonnage figures and production records extends beyond economics into demography, culture, and political power.

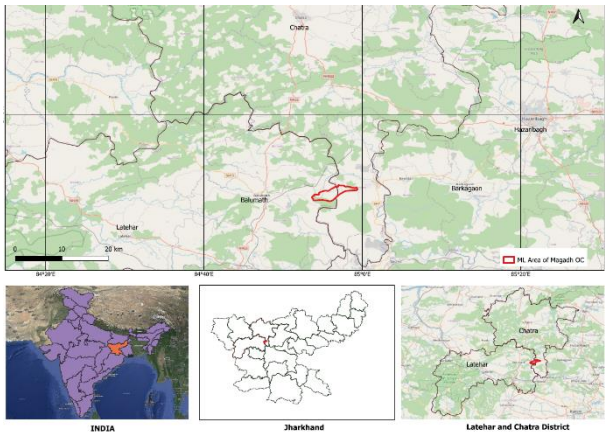


Figure 1 Magadh OC- Located in Chatra and Latehar District of Jharkhand

The Pre-Mining Mosaic: A Homogeneous Cultural Landscape

Before mining, the Magadh and Amrapali region was characterized by an agrarian and forest-based economy. Communities, including Oraon, Munda and other backward groups, depended on farming, livestock rearing and collection of minor forest produce. Land served not only as an economic asset but also as a source of identity, social status and intergenerational security. Social and political life revolved around kinship networks, traditional tribal institutions, village elders and common property resources. Despite limited infrastructure and connectivity, communities remained culturally cohesive and closely connected to the landscape.

Other factors include :

- The Mining Transformation and the Outsiders' Influx
- Demographic Upheaval: From Homogeneity to Heterogeneity
- Cultural Erosion and the Changing Social Fabric
- Power Shift in Local Politics
- Livelihood Metamorphosis.

The Burden: Negatives of Mining Expansion

The costs of this transformation are substantial and multidimensional:

Land and displacement remain foundational wounds. Environmental degradation has eroded the remaining livelihood base. Coal dust affects air quality across a wide radius, mine runoff alters local hydrology, and noise pollution disrupts daily life. Agricultural yields on lands adjacent to mine boundaries have suffered, closing off a potential

fullback occupation. Health impacts are increasingly visible, with rising incidences of respiratory ailments, water-borne diseases linked to altered drainage, and stress-related conditions. Socially, the influx of outsiders has created a sense of marginalization among original residents, who often feel reduced to bystanders in their own homeland. Tensions over jobs, housing, and public resources occasionally flare into conflict. The weakening of traditional institutions has left many vulnerable—particularly women and the elderly—without the informal safety nets that once protected them.

The Gains: Positives for Local Communities

Providing Medical Help under CSR activities in Ojha Tola

Despite these profound challenges, the mining presence has generated tangible benefits that cannot be ignored:

1. Employment and Income Generation
2. Infrastructure and Connectivity
3. Resettlement and Rehabilitation (R&R)
4. CSR and Social Welfare
5. District Mineral Foundation (DMF) Funds
6. Skill Development and Alternative Livelihoods
7. Market Access and Commercialization
8. Financial Inclusion and Institutional Exposure

Conclusion

The story of Magadh and Amrapali is not a simple tale of destruction or development, but of irreversible transition. The agrarian-forest communities that once lived here have become part of an industrial ecosystem centered on coal extraction. For some, this shift has meant wages, roads, and new opportunities; for others, it has meant landlessness, insecure labor, cultural dislocation, and political marginalization. As these mines continue to feed India's energy hunger, the measure of their success must ultimately include the human development indices of the villages that surround them. Sustainable mining, in the truest sense, is measured not only in million tonnes of coal produced, but in the dignity, stability, and self-determination of the communities living in its shadow.

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From Pits to Forests: Nature-Based Solutions for Ecological Restoration in Mining Areas

Shyamal Kumar Mahto, IIFM, Bhopal

The mining sector has long played a pivotal role in supporting industrial growth, energy security, and infrastructure development in India. Organisations such as Coal India Limited and its consultancy arm Central Mine Planning and Design Institute Limited have significantly contributed to the nation's economic progress through scientific mining and resource management. However, alongside economic benefits, mining activities also create substantial ecological disturbances, including land degradation, biodiversity loss, soil erosion, dust pollution, and altered hydrological systems. The 2026 World Environment Day theme, *"Inspired by Nature. For Climate. For Our Future."*, emphasises the urgent need to integrate nature-based solutions into industrial and developmental planning. In this context, ecological restoration of mining landscapes has emerged as a critical pathway for achieving climate resilience and sustainable development.

Mining Landscapes and Ecological Challenges

Opencast mining operations often transform natural landscapes into fragmented terrains with exposed overburden dumps, depleted vegetation cover, and reduced soil fertility. These disturbances directly impact local ecosystems and the communities dependent upon them.

In mineral-rich regions such as Jharkhand, where mining and forests coexist closely, environmental restoration is not merely a regulatory obligation but a socio-ecological necessity. Restoring mined land helps improve air quality, stabilise soil, conserve water, and create habitats for flora and fauna.

Modern environmental management practices now recognise that reclamation should move beyond cosmetic plantation activities toward scientifically designed ecosystem restoration.

Nature-Based Solutions: The Future of Mine Reclamation

Nature-based solutions are strategies that use natural ecological processes to address environmental and climate-related challenges. In mining areas, these approaches combine ecological science, forestry techniques, and climate adaptation measures to restore degraded land sustainably. One of the most promising approaches is the development of native forest ecosystems over reclaimed mine dumps.

Miyawaki Afforestation Mining Site

The Miyawaki method, developed by Japanese botanist Akira Miyawaki, has gained significant attention for rapid ecological restoration. This technique involves planting diverse indigenous

species at high density to create self-sustaining forests within a relatively short period.

In reclaimed mining zones, Miyawaki plantations offer several advantages include Rapid canopy development, Enhanced carbon sequestration, Improved soil stabilisation, Higher biodiversity recovery, Better dust and noise attenuation, Microclimate improvement.The dense vegetation structure accelerates ecological succession and creates resilient green patches even in degraded mining landscapes.

Importance of Indigenous Plant Species

Scientific studies indicate that indigenous species perform better than exotic species in reclaimed mine soils due to their adaptability to local climatic and edaphic conditions. For the Jharkhand mining belt, suitable native species include:

These species support local biodiversity, improve soil organic matter, and provide ecological as well as socio-economic benefits to nearby communities.

Carbon Sequestration Potential in Reclaimed Mining Areas

Climate change mitigation is now a major component of environmental governance. Reclaimed mining landscapes possess substantial potential for atmospheric carbon capture through afforestation and ecological restoration.

Scientific estimation of carbon sequestration generally involves:Tree girth and height measurement, Above-ground biomass calculation, Below-ground biomass estimation, Carbon conversion coefficients, Soil organic carbon analysis

Studies conducted in reclaimed mine plantations have demonstrated that older plantation sites generally exhibit higher biomass accumulation and greater carbon storage capacity. By transforming degraded overburden dumps into vegetated carbon sinks, mining organisations can contribute meaningfully toward India's climate commitments and net-zero ambitions.

Building Climate-Resilient Green Buffer Zones

Another significant nature-based strategy involves developing dense green buffer zones around mining clusters. These ecological barriers function as natural shields against environmental pollution.

Strategically planned forest corridors can help to :Reduce dust dispersion, Absorb atmospheric pollutants, Minimise noise pollution, Enhance groundwater recharge, Support wildlife movement, Improve landscape aesthetics.

For drought-prone and degraded mining regions, climate-resilient species selection becomes crucial. Mixed plantations with multi-layer vegetation

structures improve ecosystem stability under changing climatic conditions.

Role of Technology and Scientific Monitoring

Modern mine reclamation increasingly integrates environmental analytics and geospatial technologies. Remote sensing, GIS mapping, biodiversity indexing, and multivariate statistical analysis are now widely used for assessing restoration performance. Ecological indicators include Shannon Diversity Index, Simpson Diversity Index, Species Density, Biomass Productivity et. Which provide valuable insights into ecosystem recovery trends.

Community Participation and Sustainable Development

Successful ecological restoration requires active participation from local communities, academic institutions, forest departments, and mining agencies. Community-based plantation drives, awareness campaigns, and livelihood-linked agroforestry initiatives can create shared environmental responsibility while generating socio-economic opportunities.

Institutions such as the Indian Institute of Forest Management contribute significantly by integrating forestry science, climate policy, and sustainable development principles into practical environmental management frameworks.

Conclusion

The transition from degraded pits to thriving forest ecosystems represents more than environmental recovery—it symbolises a new model of sustainable industrial development.

As the world observes World Environment Day 2026 under the theme *"Inspired by Nature. For Climate. For Our Future."*, the mining sector has an opportunity to redefine its environmental legacy through scientifically planned ecological restoration and climate-responsive land management.

Nature-based solutions in mining areas demonstrate that economic growth and environmental stewardship can coexist when guided by science, sustainability, and long-term ecological vision.

Through collaborative efforts involving research institutions, policymakers, and organisations like CMPDI, reclaimed mining landscapes can evolve into resilient ecosystems that support biodiversity, climate mitigation, and community well-being for generations to come.

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Inspired by Nature: Building Climate Resilience Through Sustainable Mining Environment Department, CMPDI RI-IV, Nagpur.

V N Dupattawala, ***Regional Director, CMPDI RI-IV.***

*"*Climate change is no longer something we talk about in the future – it is already affecting our environment, livelihoods, industries and day-to-day life. The theme of the 2026 World Environment Day is 'Inspired by Nature. For Climate. "Nature's Solutions for Our Future.", reminds us that some of the best solutions to these difficulties are present in nature itself.

monitoring, mine closure planning, ecological restoration and sustainability orientated consultancy services.

restoration and sustainability orientated consultancy services.

Mining is a key contributor to India's energy needs and economic growth. But at the same time we realise the need to mine responsibly.. Nature imparts tremendous lessons about resiliency.

Forests regulate the temperature, wetlands provide water security and healthy ecosystems absorb carbon. Modern mining operations are now learning from these natural systems by using green belts, afforestation, rainwater collecting, mine water utilisation and progressive land reclamation to assist restore the ecological balance in mines.

At CMPDI RI-IV, we are actively facilitating this shift through:Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) studies Scientific data production and baseline environmental monitoring.

Quality analysis of air, water, noise and soil by NABL authorized labs. Third party audits of Progressive and Final Mine Closure Plans and Planning for Mine Closure. Monitoring of environmental compliance and support for statutory clearances Research on sustainable water management and mining water use. Capacity building and environmental awareness activities.In recent years, a notable milestone has been the upgrade of our environmental laboratory facilities. The scope of NABL accreditation of CMPDI RI-IV Environmental Laboratory has been enlarged considerably via continuous improvement in quality standards with the adoption of modern analytical methodologies. This allows us to provide more reliable, accurate and complete environmental assessments to assist improved and more informed decision-making. "Technology alone doesn't build climate resilience in mining regions. It has to be a communal endeavor – by legislators, industry, scientists, environmental experts and local communities. We need innovation, we need good environmental governance, and we need to take responsibility for future generations to move towards cleaner mining techniques.

On the occasion of World Environment Day 2026, CMPDI RI-IV reiterates its commitment towards ecologically responsible mining and sustainable development. Every study, every sample, every reclamation project we sponsor is part of a greater whole: a future where development and environment thrive side by side.

The lesson is clear: nature is not simply a resource, it's a collaborator in building climate resilience. By learning from and cooperating with nature, we can design a mining sector that delivers economic prosperity and environmental security.

"The future of sustainable mining is not about what we take out of the earth, but how responsibly we protect and restore it."

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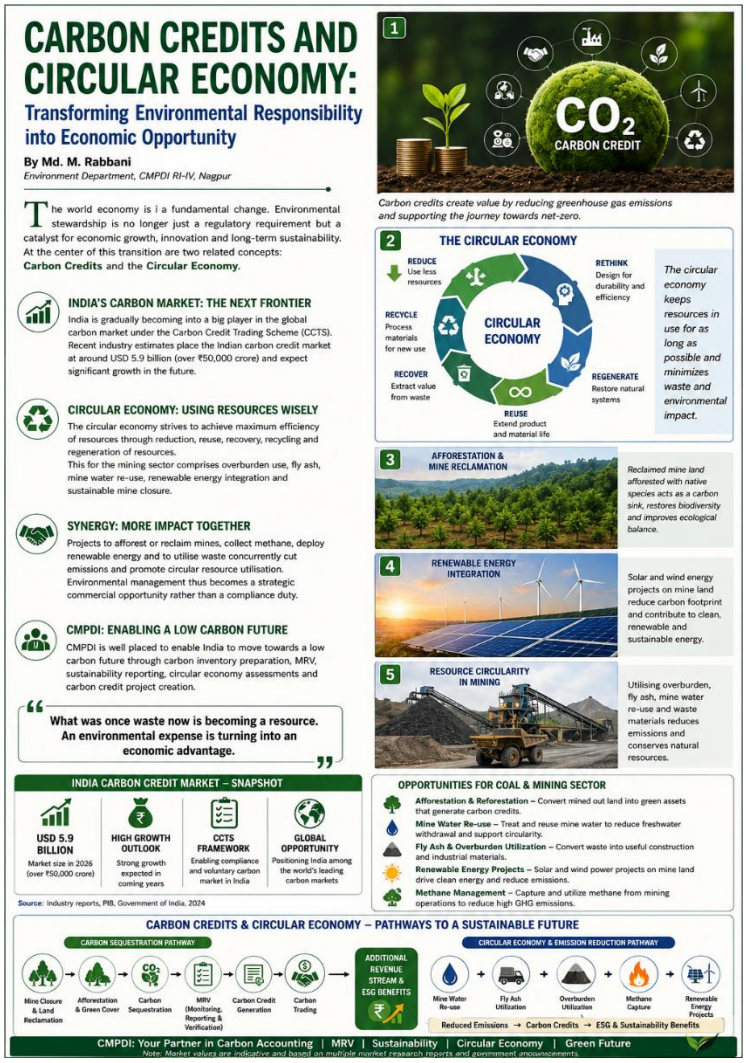
Carbon Credits and Circular Economy: Transforming Environmental Responsibility into Economic opportunity

Md M Rabbani, Env Dept, RI IV, CMPDI

The world economy is in a fundamental change. Environmental stewardship is no longer just a regulatory requirement but a catalyst for economic growth, innovation and long-term sustainability. At the center of this



transition are two related concepts: Carbon Credits and the Circular Economy.

India is gradually becoming into a big player in the global carbon market under the Carbon Credit Trading Scheme (CCTS). Recent industry estimates place the Indian carbon credit market at around USD 5.9 billion (over ₹50,000 crore) and expect significant growth in the future. The circular economy strives to achieve maximum efficiency of resources through reduction, reuse, recovery, recycling and regeneration of resources. This for the mining sector comprises overburden use, fly ash, mine water re-use, renewable energy integration and sustainable mine closure.

Projects to afforest or reclaim mines, collect methane, deploy renewable energy and to utilise trash concurrently cut emissions and promote circular resource utilisation. Environmental management thus becomes a strategic commercial opportunity rather than a compliance duty. CMPDI is well placed to enable India to move towards a low carbon future through carbon inventory preparation, MRV, sustainability reporting, circular economy assessments and carbon credit project creation. What was once waste now is becoming a resource. An environmental expense is turning into an economic advantage.

प्रकृति संकल्प :धरती को बचाने का महाअभियान और हमारा नैतिक दायित्व

राजेश, मुख्य प्रबन्धक (खनन), क्षेत्रीय संस्थान 4-, नागपुर

प्रकृति संकल्प (Nature Pledge) केवल शब्दों का एक समूह नहीं है, बल्कि यह हमारे अस्तित्व को बचाने की दिशा में उठाया गया एक क्रांतिकारी कदम है। आज जब हमारी धरती जलवायु परिवर्तन, ग्लोबल वार्मिंग और अनियंत्रित प्रदूषण के संकट से जूझ रही है, तब प्रकृति के साथ अपने रिश्तों को नए सिरे से परिभाषित करना बेहद जरूरी हो गया है।

यह लेख विस्तार से यह समझाएगा कि प्रकृति संकल्प क्या है, इसकी आवश्यकता क्यों है, और विश्व पर्यावरण दिवस 2026 की वैश्विक प्राथमिकताओं को ध्यान में रखते हुए हम अपने दैनिक जीवन में इसे कैसे उतार सकते हैं।

1. प्रकृति संकल्प क्या है?

सरल शब्दों में कहें तो प्रकृति संकल्प अपनी जीवनशैली को इस तरह ढालने का एक दृढ़ वादा है जिससे पर्यावरण को कम से कम नुकसान हो और हम उसके पुनर्जीवन में योगदान दे सकें।

यह संकल्प हमें याद दिलाता है कि हम प्रकृति के मालिक नहीं, बल्कि उसके एक छोटे से हिस्से हैं। जब हम यह प्रतिज्ञा लेते हैं, तो हम केवल एक व्यक्ति के रूप में नहीं, बल्कि इस पूरी पृथ्वी के एक जिम्मेदार नागरिक के रूप में सोचना शुरू कर देते हैं। यह हमारे भीतर "पर्यावरणीय चेतना" का निर्माण करता है, जिससे हमारे हर फैसले में प्रकृति की सुरक्षा का भाव शामिल हो जाता है।

2. विश्व पर्यावरण दिवस 2026 की थीम और इसकी प्रासंगिकता

पर्यावरण संरक्षण की इस वैश्विक जंग को दिशा देने के लिए संयुक्त राष्ट्र पर्यावरण कार्यक्रम (UNEP) द्वारा हर साल एक खास थीम चुनी जाती है। इस वर्ष, विश्व पर्यावरण दिवस 2026 (5 जून 2026) का वैश्विक आयोजन अज़रबैजान (Baku) की मेजबानी में किया जा रहा है।

इस साल की आधिकारिक थीम है:

"प्रकृति से प्रेरित। जलवायु के लिए। हमारे भविष्य के लिए।"

(Inspired by Nature. For Climate. For Our Future.)

इस थीम के तीन मुख्य पहलू हैं जो हमारे 'प्रकृति संकल्प' की रीढ़ हैं:

- प्रकृति से प्रेरित) Inspired by Nature): विज्ञान यह मान चुका है कि जलवायु संकट के सबसे बेहतरीन समाधान खुद प्रकृति के पास हैं। जंगल कार्बन सोखते हैं, आर्द्रभूमि)Wetlands) तूफानों को रोकती है और मैंग्रोव तटों की रक्षा करते हैं। हमें प्रकृति को एक संसाधन समझने के बजाय एक गुरु और साथी के रूप में देखना होगा।
- जलवायु के लिए) For Climate): वैश्विक तापमान) Global Temperature) लगातार रिकॉर्ड तोड़ रहा है। यह स्तंभ हमें सचेत करता है कि अब हमारे पास धीरे-धीरे चलने का समय नहीं है, जो कुछ भी करना है, वह अभी करना है।
- हमारे भविष्य के लिए) For Our Future): आज हम जो भी निर्णय लेंगे या जो भी संकल्प लेंगे, वही यह तय करेगा कि आने वाली पीढ़ी को एक हरा-भरा ग्रह मिलेगा या फिर जहरीली हवा और पानी।

3. आज इस संकल्प की ऐतिहासिक आवश्यकता क्यों है?

पिछली दो सदियों में औद्योगिक क्रांति और तकनीकी प्रगति ने मानव जीवन को आसान तो बनाया, लेकिन इसकी बहुत बड़ी कीमत हमारी प्रकृति को चुकानी पड़ी है। आज हम एक ऐसे ऐतिहासिक मोड़ पर खड़े हैं जहां तत्काल कदम न उठाए गए तो परिणाम विनाशकारी होंगे:

क) जलवायु परिवर्तन का खतरा (The Climate Emergency)

वैश्विक तापमान लगातार 1.5°C की खतरनाक सीमा को पार कर रहा है। जंगलों की आग, ग्लेशियरों का पिघलना, भीषण हीटवेव और बेमौसम मानसून अब सिर्फ खबरें नहीं, बल्कि हमारी रोजमर्रा की हकीकत बन चुके हैं।

ख) जैव विविधता का तीव्र ह्रास (Loss of Biodiversity)

मनुष्य की अंधी दौड़ के कारण प्रजातियों के विलुप्त होने की दर सामान्य से सैकड़ों गुना तेज हो गई है। जब एक भी कीट या पौधा विलुप्त होता है, तो पूरी खाद्य श्रृंखला (Food Chain) हिल जाती है।

ग) प्रदूषण का जानलेवा स्तर (Fatal Pollution Levels)

माइक्रोप्लास्टिक आज इंसानी खून और बादलों तक में पाया जा रहा है। शहरों की हवा में सांस लेना कई सिगरेट पीने जितना नुकसानदेह हो चुका है। इन संकटों से निपटने का एकमात्र जरिया "सामूहिक जन-आंदोलन" और "व्यक्तिगत संकल्प" ही है।

4. भारतीय संस्कृति और प्रकृति का अंतर्संबंध

भारत में प्रकृति संरक्षण की अवधारणा नई नहीं है। हमारी सनातन संस्कृति और वैदिक ग्रंथों में प्रकृति को सर्वोपरि स्थान दिया गया है:

- 'माता भूमिः पुत्रोऽहं पृथिव्याः' – अथर्ववेद का यह मंत्र सिखाता है कि भूमि हमारी माता है और हम इसके पुत्र हैं।
- हमारे यहाँ नदियों को 'गंगा मैया', पेड़ों को) पीपल, बरगद, तुलसी (पूजनीय और जीवों को देवताओं के वाहन के रूप में देखा गया है।
- राजस्थान का प्रसिद्ध बिश्नोई समाज इसका सबसे बड़ा उदाहरण है, जिन्होंने सदियों पहले पेड़ों और वन्यजीवों को बचाने के लिए अपने प्राणों की आहुति दे दी थी।
- हाल ही में भारत सरकार द्वारा शुरू किया गया" एक पेड़ माँ के नाम) "Ek Ped Maa Ke Naam) अभियान इसी सांस्कृतिक भावना को आधुनिक रूप देता है, जहां पर्यावरण संरक्षण को एक भावनात्मक जिम्मेदारी से जोड़ा गया है।

5. प्रकृति संकल्प के 7 मुख्य स्तंभ

वर्ष 2026 की थीम "Inspired by Nature" को ध्यान में रखते हुए, हम अपनी व्यावहारिक जीवनशैली में इन सात स्तंभों के जरिए प्रकृति संकल्प को उतार सकते हैं:

स्तंभ 1: प्रकृति-आधारित समाधान और वृक्षारोपण (Nature-Based Solutions)

2026 की थीम स्पष्ट रूप से कहती है कि पेड़ पौधे लगाना जलवायु परिवर्तन का सबसे कारगर इलाज हैं।

- संकल्प :सिर्फ पौधा लगाना ही नहीं, बल्कि उसके पेड़ बनने तक) कम से कम 3 वर्ष (उसकी पूरी देखभाल करना
- तरीका :अपने हर विशेष अवसर) जन्मदिन, त्योहार (पर एक स्थानीय प्रजाति) जैसे नीम, पीपल, जामुन (का पौधा लगाएं जो वहां के वातावरण के अनुकूल हो

स्तंभ 2: जल का विवेकपूर्ण उपयोग (Water Conservation)

पानी जीवन का आधार है, लेकिन इसके स्रोत तेजी से सूख रहे हैं।

- संकल्प :पानी की हर बूंद को बेशकीमती समझना और वर्षा जल के संरक्षण को प्राथमिकता देना।
- तरीका :घरों में आरओ) RO) फिल्टर से निकलने वाले वेस्ट वॉटर को स्टोर करके पोंछा लगाने या गाड़ी धोने में इस्तेमाल करें। टपकते नलों की तुरंत मरम्मत करवाएं।

स्तंभ 3: प्लास्टिक प्रदूषण पर पूर्ण विराम

प्लास्टिक कचरा हमारे महासागरों और मिट्टी को बर्बाद कर रहा है।

- संकल्प :अपने जीवन से सिंगल-यूज प्लास्टिक को हमेशा के लिए बाहर करना।
- तरीका :घर से बाहर निकलते समय हमेशा अपने पास कपड़े या जूट का थैला रखें। प्लास्टिक की पानी बोतलों की जगह स्टील या तांबे की बोतलों का उपयोग करें।

स्तंभ 4: हरित ऊर्जा और बिजली की बचत

ज्यादातर बिजली आज भी कोयला जलाकर बनती है, जो सीधे तौर पर ग्लोबल वार्मिंग को बढ़ाती है।

- संकल्प :कम से कम ऊर्जा की खपत करना और नवीकरणीय ऊर्जा को अपनाना
- तरीका :जरूरत न होने पर लाइट, पंखे और कंप्यूटर को प्लग से बंद करें) ताकि फैंटम लोड न बढ़े(। अपने घरों

या सोसाएटी की छतों पर सोलर पैनल) Solar Panels) लगवाने की ओर कदम बढ़ाएं

स्तंभ 5: कचरा प्रबंधन और 3R का नियम

स्तंभ 6: कार्बन फुटप्रिंट को कम करना

स्तंभ 7: जागरूक उपभोक्ता बनना

हम जो कुछ भी खरीदते हैं, उसका सीधा असर प्रकृति पर पड़ता है।

- संकल्प :केवल वही सामान खरीदें जिसकी वास्तव में आवश्यकता हो।
- तरीका :स्थानीय स्तर पर उगने वाले मौसमी फलों और सब्जियों को खरीदें, जिससे पैकेजिंग और दूर से आने वाले ट्रांसपोर्टेशन का कार्बन फुटप्रिंट कम होता है। केमिकल युक्त फ्लोर क्लीनर्स की जगह बायोडिग्रेडेबल विकल्पों को चुनें।

6. प्रकृति संकल्प का सामाजिक प्रभाव: छोटा बदलाव, बड़ा असर

जब आप अकेले यह संकल्प लेते हैं, तो शुरुआत में यह बहुत छोटा कदम लग सकता है। लेकिन इसे 'बटरफ्लाई इफेक्ट' (Butterfly Effect) के रूप में समझें:

- प्रेरणा का चक्र :जब आपके मित्र या पड़ोसी आपको कपड़े का थैला ले जाते हुए या अपनी छत पर बागवानी करते हुए देखते हैं, तो उनके भीतर भी पर्यावरण के प्रति जिम्मेदारी जागती है।
- बाजार में बदलाव :जब उपभोक्ता सामूहिक रूप से पर्यावरण को नुकसान पहुंचाने वाले सामानों) जैसे प्लास्टिक रैपर वाले उत्पाद (का बहिष्कार करना शुरू करते हैं, तो कंपनियों को मजबूरन अपनी पैकेजिंग बदलनी पड़ती है।
- आर्थिक लाभ :पानी, बिजली और अनावश्यक संसाधनों की बचत न केवल पर्यावरण को बचाती है, बल्कि आपके घरेलू बजट को भी काफी कम कर देती है।

7. मिशन लाइफ (LiFE): पर्यावरण के लिए जीवनशैली

भारत सरकार का मिशन लाइफ (Lifestyle for Environment) आंदोलन भी पूरी तरह से इसी प्रकृति संकल्प पर आधारित है। यह वैश्विक आंदोलन लोगों को 'नासमझ उपभोग' (Mindless Consumption) के बजाय 'विवेकपूर्ण उपयोग' (Mindful Utilization) की ओर ले जाने का प्रयास करता है। विश्व पर्यावरण दिवस 2026 की थीम "Inspired by Nature" भी इसी बात का समर्थन करती है कि हमें अपनी दैनिक आदतों में प्रकृति के नियमों का सम्मान करना सीखना होगा।

8. निष्कर्ष: आज ही लें अपना प्रकृति संकल्प

प्रकृति के बिना मानव जीवन की कल्पना भी असंभव है। हवा, पानी, मिट्टी और पेड़-पौधों ने हमें करोड़ों साल से बिना कुछ मांगे सब कुछ दिया है अब समय आ गया है कि हम उस कर्ज को चुकाएं।

प्रकृति संकल्प कोई कठिन तपस्या नहीं है। यह सिर्फ एक सजग शुरुआत है। आज इस ब्लॉग को पढ़ने के बाद, खुद से एक वादा करें—चाहे वह रोज एक बाल्टी पानी बचाने का हो, सप्ताह में एक दिन गाड़ी न चलाने का हो, या हर महीने एक पौधा लगाने का हो।

महान वैज्ञानिक और दार्शनिकों ने भी कहा है कि—"धरती हमारी जरूरतों को पूरा करने के लिए पर्याप्त संसाधन देती है, लेकिन हमारे लालच को पूरा करने के लिए नहीं।"

आइए, इस विश्व पर्यावरण दिवस 2026 पर एकजुट हों और पूरे गर्व से कहें। हम प्रकृति का शोषण नहीं, बल्कि उसका पोषण करेंगे!

पर्यावरण पर भूभौतिकी के अनुप्रयोग एवं प्रभाव

विवेकानंद गुप्ता, उप प्रबंधक भूविज्ञान, गवेषण विभाग, सीएमपीडी .मुख्यालय रांची

भूभौतिकी (Geophysics) पृथ्वी की सतह एवं उसके आंतरिक भागों के भौतिक गुणों के अध्ययन का विज्ञान है। इसे पृथ्वी का **"MRI या CT स्कैन"** भी कहा जा सकता है, क्योंकि यह बिना खुदाई किए भूमिगत संरचनाओं एवं संसाधनों की जानकारी प्रदान करता है। आधुनिक समय में भूभौतिकीय तकनीकों का उपयोग केवल खनिज एवं ऊर्जा संसाधनों की खोज तक सीमित नहीं है, बल्कि पर्यावरण संरक्षण एवं प्रबंधन में भी इसकी महत्वपूर्ण भूमिका है।

भूकंपीय (Seismic), विद्युत प्रतिरोधकता (Electrical Resistivity), चुंबकीय (Magnetic) तथा गुरुत्वीय (Gravity) जैसी भूभौतिकीय विधियों के माध्यम से भूजल स्रोतों की खोज, भूजल प्रदूषण की निगरानी, भूमि धंसाव (Land Subsidence) का अध्ययन तथा अपशिष्ट निपटान स्थलों का मूल्यांकन किया जाता है। इन तकनीकों की सहायता से बिना व्यापक खुदाई के भूमिगत संरचनाओं एवं पर्यावरणीय समस्याओं का पता लगाया जा सकता है, जिससे समय, लागत तथा पर्यावरणीय क्षति में कमी आती है।

पर्यावरणीय दृष्टि से भूभौतिकी प्राकृतिक आपदाओं जैसे भूकंप, भूस्खलन एवं ज्वालामुखीय गतिविधियों के अध्ययन और जोखिम आकलन में भी महत्वपूर्ण योगदान देती है। इससे संभावित खतरों की पहचान कर प्रभावी आपदा प्रबंधन योजनाएँ तैयार की जा सकती हैं तथा जन-धन की हानि को कम किया जा सकता है।

हालाँकि, संसाधनों की खोज हेतु किए जाने वाले कुछ भूभौतिकीय सर्वेक्षणों से सीमित स्तर पर ध्वनि, कंपन तथा स्थानीय पारिस्थितिकी तंत्र पर अस्थायी प्रभाव पड़ सकता है। इसलिए भूभौतिकीय कार्यों के दौरान पर्यावरणीय मानकों, सुरक्षा उपायों तथा सतत विकास के सिद्धांतों का पालन करना आवश्यक है।

निष्कर्ष

भूभौतिकी पर्यावरण संरक्षण, प्राकृतिक संसाधन प्रबंधन तथा आपदा न्यूनीकरण का एक प्रभावी वैज्ञानिक उपकरण है। इसके विवेकपूर्ण एवं पर्यावरण-अनुकूल उपयोग से सतत विकास को बढ़ावा दिया जा सकता है तथा भविष्य की पर्यावरणीय चुनौतियों का बेहतर समाधान संभव है।

From Mining Waste to Green Concrete: The Circular Economy Revolution at Damoda Colliery, BCCL

Kumar Vaibhav Mgr (Env) & Navin Kumar, Mrg (CD), RI-II, CMPDI

Introduction

For decades, coal extraction has driven global energy security while leaving behind a challenging environmental legacy: massive landscapes of overburden (OB)—the rock, soil, and shale displaced to access coal seams. Concurrently, the booming global construction sector faces an acute shortage of natural river sand, an aggregate critical to infrastructure but increasingly restricted due to river ecosystem degradation.

In the heart of India's Jharia Coalfields (Dhanbad, Jharkhand), a pioneering shift is taking root. At Bharat Coking Coal Limited's (BCCL) 575-hectare Cluster-I mining lease, the Damoda Colliery is to transform millions of tonnes of mine waste into high-grade manufactured sand (M-Sand).

Spearheaded by End2End Urja Solutions Private Limited in collaboration with technology partner CDE Asia Limited, this "OB to Sand" project will provide a scalable blueprint for a profitable circular economy.

Operational Context & Technological Architecture

Damoda Group of Mines operates under a peak production limit of 1.17 million tonnes per annum (MTPA) of coal as per available EC. Positioned near the Jamunia River, the site follows all environmental mandates, including backfilling decoaled voids to safeguard surrounding villages. The advanced OB processing plant intercepts this waste loop, extracting structural value from overburden before final reclamation.

The facility features an IoT-enabled, mobile processing setup consisting of two mirror-layout units handling 200–240 tonnes per hour (TPH). Avoiding traditional dry crushing, which creates severe dust emissions, the plant deploys CDE Asia's patented wet-processing technology under the global CFIo brand.

Partnering for Sustainable Compliance: CMPDI's Environmental Consultancy

Crucial to navigating the complex regulatory landscape of this pioneering venture is the Central Mine Planning & Design Institute Limited (CMPDI). Acting as the premier environmental consultant for the Damoda Colliery project, CMPDI has successfully providing end-to-end consultancy for obtaining the critical Environmental Clearance (EC) from the Ministry of Environment, Forest and Climate Change. With decades of unmatched expertise in mine planning, environmental imact assessments (EIA), and cutting-edge sustainable solutions, CMPDI ensures that ambitious circular economy projects meet the highest standards of regulatory compliance and ecological stewardship.

Feed Profile and Processing Circuit

The incoming raw material consists of coal mining overburden pre-screened to under 10 mm. Sieve

analysis reveals a complex aggregate profile engineered for maximum output:

Sieve Size	Mass Fraction (%)	Operational Destination
+5 mm	18.71%	Oversize Aggregate / Re-crushing
+1mm to +3 mm	23.80%	Coarse Sand Fraction
+150 µm to +600 µm	42.03%	Fine Concrete Sand Fraction
+75 µm	4.95%	Micro-fine Sand
-75 µm (Silt/Clay)	10.50%	High-Rate Thickener / Sludge

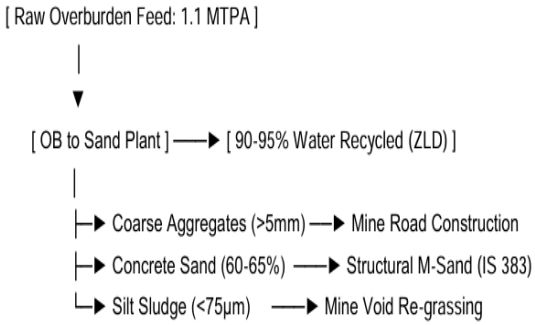
To address water conservation mandates, the project integrates an 8-meter-diameter High-Rate Thickener utilizing a chemical dosing sequence called the Easy Settle Process. By adding specialized polyelectrolytes, suspended clay and silt are rapidly flocculated, allowing 90–95% of process water to be recycled in a closed loop. The plant requires a minimal top-up of only 30–40 m³/hour sourced from mine pit water, guaranteeing Zero Liquid Discharge (ZLD) to the local river

system.

Pollution Abatement & Eco-Restoration

Because the OB matrix remains saturated throughout processing, windblown particulate matter (PM10 and PM2.5) is eliminated at the source. Furthermore, by avoiding impact crushers, noise levels stay well below the 75 dBA industrial threshold.

Solid residuals are completely reused: oversize particles (>5 mm) serve as mine road sub-base, while the nutrient-rich clay sludge is sent to drying beds to create a fertile substrate for mine void backfilling, re-grassing, and native agro-forestry.



In alignment with corporate environmental responsibilities, the project serves as a socio-economic catalyst for Dhanbad's coal-bearing communities. It may provide direct jobs for plant operators, technicians, and safety officers, alongside indirect opportunities in transport and logistics. By offering affordable M-Sand, it lowers construction costs and actively curbs illegal riverbed mining across the region.

The OB to Sand Project at Damoda Colliery proves that environmental protection and corporate operations can be successfully balanced. By merging CDE Asia's wet classification systems with End2End Urja Solutions' circular model, the plant demonstrates how industrial mining liabilities can be successfully transformed into green building assets for a sustainable future.

WAY FORWARD

Punam Singh, GM(Environment)

Dear Readers,

It is with immense joy and institutional pride that I welcome you to the inaugural edition of Prakriti Sankalp — launched on World Environment Day 2026 under the inspiring global theme "Inspired by Nature. For Climate. For Our Future." This first edition is not merely a publication; it is a statement of intent that CMPDI's Environmental Division will use every platform available to share knowledge, stimulate debate, and contribute to the intellectual commons that India's environmental governance urgently needs.

A Legacy of Environmental Stewardship

Over decades, CMPDI's Environmental Division has built one of the most diverse environmental practice portfolios in the Indian public sector, spanning EIA/EMP studies as a QCI-NABET accredited organisation; Carrying Capacity Assessments; Ecological & Biodiversity Studies; Greenhouse Gas Emissions Estimation; Epidemiological Studies in coal mining communities; evaluation of efficiency of pollution control measures; design of Effluent Treatment Plants & Sewage Treatment Plants; Soil Moisture Conservation; Sand Replenishment Studies; and a comprehensive Mine Closure Planning and Audit programme backed by NABL Accredited seven environmental laboratories across different Regional Institutes. This rich, multi-decadal institutional knowledge base is the foundation upon which our future ambitions are built.

Charting the Way Forward: Three Transformative Roles

1. **Third-Party Environmental Auditing (Environment Audit Rules, 2025):** MoEFCC's Environment Audit Rules, 2025 (notified 29 August 2025) institutionalise independent verification of industrial environmental compliance through Registered Environment Auditors (REAs) certified by a government-notified Designated Agency. CMPDI — with its CPCB-recognised laboratory, NABET-accredited EIA status, and decades of field monitoring experience — is ideally positioned to seek REA accreditation and emerge as a trusted third-party auditing agency for coal mines and allied industries.

2. **Accredited Carbon Verification Agency (Carbon Credit Trading Scheme):** India's fully operationalised CCTS, covering nine energy-intensive sectors and over 700 million tonnes of CO_2e, mandates verification of GHG emission data by BEE-accredited Accredited Carbon Verification Agencies. CMPDI's expertise in Greenhouse Gas Emissions Estimation, environmental data quality assurance, and its institutional neutrality make it a suitable institute for ACVA accreditation — placing CMPDI at the heart of India's emerging carbon market.

3. **AI-Powered Analytics and Intellectual Property Creation:** CMPDI's vast environmental databank — EIA studies, monitoring records, satellite imagery, ecological surveys, and mine closure assessments accumulated over decades — is a national intellectual asset. Deployment of AI and Machine Learning tools can compress timelines for complex technical studies, enable predictive environmental risk modelling, and generate proprietary decision-support tools that constitute valuable intellectual property. CMPDI is committed to leading this technological frontier.

CMPDI will also look to contribute to Global Sustainable Development priorities by capitalising on its in-house capabilities and vast experience.

A Magazine as a Journey

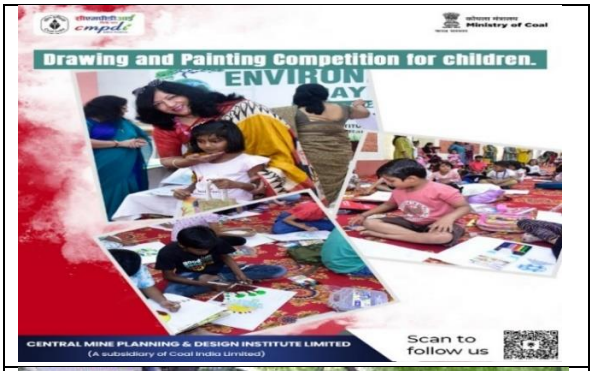
Prakriti Sankalp is, in the truest sense, a seed planted on World Environment Day — its future determined entirely by those who nurture it. I hope it grows into the most authoritative environmental Magazine in India's mining and industrial sectors, and a source of genuine pride for CMPDI and its family of professionals. My heartfelt best wishes to the Editorial Team, and to every reader: your contributions, your critical feedback, and your field wisdom are what will make this Magazine worthy of its occasion. Prakriti Sankalp belongs to all of us — and together, I am certain, it will help CMPDI reach new heights in its proud journey towards a greener and more sustainable India.

Environmental Stewardship and Sustainability Initiatives
CMPDI Activities 2025–26

CMPDI continues to strengthen its commitment towards environmental protection, sustainable mining practices, ecological restoration, and capacity building. During 2025–26, several significant initiatives were undertaken to promote environmental awareness, biodiversity conservation, regulatory compliance, laboratory excellence and knowledge sharing across the organization.

➢ World Environment Day 2025

CMPDI celebrated World Environment Day across its Headquarters and Regional Institutes under the global theme “Beat Plastic Pollution”. Various awareness programmes including tree plantation drives, quizzes, poster competitions, Jute bag distribution and essay contests were organized to encourage environmental responsibility among employees and communities.



➢ Vriksharopan Abhiyan 2025 & Ek Ped Maa Ke Naam

A large-scale plantation drive was conducted across CMPDI locations. Around 1,200 saplings of fruit-bearing and medicinal species were planted, while many more were distributed to students, local residents and security personnel. The campaign contributed to enhancing green cover and community participation in environmental conservation.

➢ **Environment Compliance Audit**

The Environment Division successfully completed the Third-Party Environment Compliance Audit for the Pakri-Barwadih Coal Mining Project. Detailed assessments confirmed adherence to environmental clearance conditions and demonstrated CMPDI's technical expertise in environmental monitoring.

➢ **NABL On-Site Surveillance Audit**

The Environment Laboratory, CMPDI (HQ), successfully completed the NABL Surveillance Audit as per ISO/IEC 17025:2017 standards. The achievement reflects the laboratory's commitment to quality assurance, reliable testing and continuous improvement.

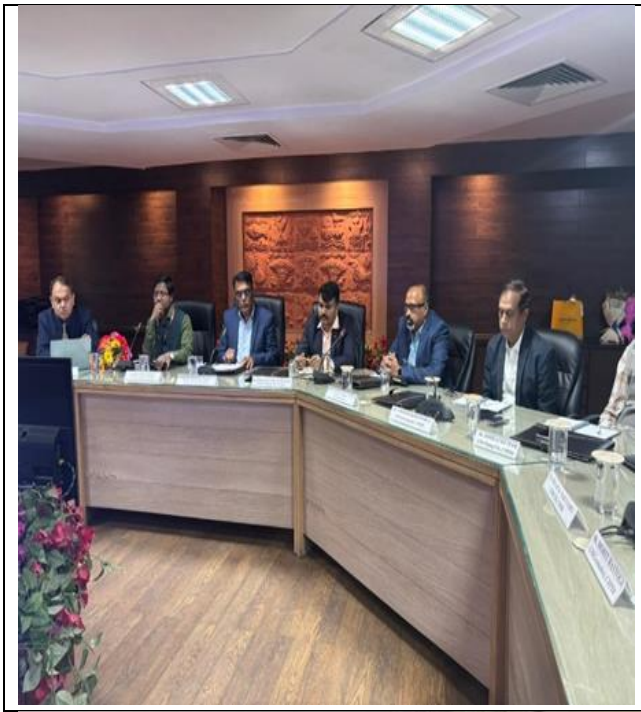
➢ **Rejuvenation of Traditional Water Bodies**

Expert teams conducted field inspections of traditional water bodies near mining areas for preparation of rejuvenation plans. The initiative aims to improve water availability, strengthen aquatic ecosystems, and create livelihood opportunities for surrounding communities.

- **Capacity Building and Technical Workshops**

CMPDI organized workshops on Environmental Clearance proposal preparation and greenhouse gas emission assessment. These programmes facilitated knowledge exchange among industry experts, government agencies, research institutions and mining professionals.

A) Interactive workshop on "Improvement in Submission of EC Proposals" at Koel Hall, CMPDI (HQ), Ranchi, on 3rd January, 2026.



B) Interactive workshop on “Assessing Fugitive Emissions from Coal Mines & Fuel Transformation” on 14th February 2026 at CMPDI, Ranchi.

Key Achievements of Environment Department (FY 2025-26)

The Environment Department of CMPDI continued to play a pivotal role in promoting environmentally sustainable coal mining practices and supporting Coal India Limited (CIL) and the Ministry of Coal (MoC) through technical studies, project appraisals, and specialized environmental assessments during FY 2025-26.

A) Appraisal of Coal Mining Project Reports

During the year, the Environment Division successfully appraised **27 Project Reports**, including Detailed Project Reports (DPRs), Conceptual Reports (CRs), and Revised Project Reports (RPRs) for various coal mining projects. These appraisals facilitated environmentally responsible planning and execution of mining operations across Coal India subsidiaries.

B) Sustainable Development Cell (SDC) Initiatives

As part of assignments entrusted by the Ministry of Coal under the Sustainable Development Cell (SDC), CMPDI prepared and submitted several strategic reports aimed at strengthening sustainable mining practices:

- Comprehensive Study Report on Mine Water Utilisation for Active and Abandoned Mine Voids of CIL.
- Model DPRs for rejuvenation of water bodies for four CIL subsidiaries – CCL, WCL, SECL, and MCL.
- Draft Assessment Report on the effectiveness of Eco-Parks developed by CIL.

- C) Special Studies and Environmental Assessments

The Environment Department undertook a wide range of specialized studies to support environmental management and climate resilience initiatives:

- Conducted a **Soil Moisture Conservation Study** for Balram Expansion OCP, MCL.
- Prepared and submitted **Greenhouse Gas (GHG) Emission Study Reports** for 12 mining projects as part of EIA & EMP reports.
- Completed **Carbon Assessment Studies** for Amrapali OCP (CCL), Ghonsa OCP (WCL), Kulda OCP (MCL), and Dipka OCP (SECL).
- Submitted the **Carbon Sequestration Study Report** covering the entire operational area of MCL.
- Completed the **Carrying Capacity Study of Riverine Ecosystem** for Amalgamated Gauri-Pauni OCP, WCL.
- Prepared **11 Mine Closure Plans**, supporting scientific mine closure and post-mining land reclamation.
- Two number of temporary mine closure plan (TMCP) for outside mines.
- 3 numbers of final mine closure plan
- 296 numbers of CDLP reports for different mines of Coal India Limited
- Study on use of locking cap / stem plug during blasting operation for two mines of NCL.

CMPDI's Growing International Role in Sustainable Mining and Environmental Governance

CMPDI has emerged as one of India's leading institutions providing multidisciplinary consultancy services in mining, environment, hydrogeology, remote sensing, mine closure, and sustainable development. Under the visionary leadership of Shri Choudhary Shivraj Singh, CMD, CMPDI, CMPDI is envisaging to venture into the International Consultancy through collaboration with Global agencies.

Global Recognition Through Technical Excellence

CMPDI's expertise in:

- Environmental Impact Assessment (EIA)
- Mine Closure Planning
- Hydrogeological Investigations
- Remote Sensing and GIS Applications
- Environmental Monitoring
- Mine Reclamation and Ecological Restoration

has positioned the organization as a valuable contributor to global discussions on responsible mining.

Alignment with International Sustainability Goals

CMPDI's work supports several United Nations Sustainable Development Goals (SDGs), including:

- SDG 6: Clean Water and Sanitation
- SDG 7: Affordable and Clean Energy
- SDG 13: Climate Action
- SDG 15: Life on Land

Contribution to Climate Action

CMPDI has been actively involved in:

- Mine water utilization studies
- Carbon sequestration through mine reclamation
- Renewable energy planning on mined-out lands
- Climate-resilient mine closure strategies

These initiatives contribute to India's commitments under international climate frameworks.

In a significant milestone towards advancing climate science and transparent greenhouse gas (GHG) accounting in the mining sector, CMPDI secured approval from the Ministry of Environment, Forest and Climate Change (MoEF&CC) for a pioneering project titled **"GHG Estimation from Abandoned Wells and Coal Mines"**, to be executed in collaboration with **IIT (ISM), Dhanbad**.

The initiative aims to develop scientific methodologies and robust datasets for quantification of greenhouse gas emissions from abandoned coal mines and wells, thereby strengthening India's climate reporting framework.

The project assumes strategic importance as it supports India's obligations under the **Enhanced Transparency Framework of the Paris Agreement** and contributes directly to the preparation of the country's **Biennial Transparency Reports (BTRs)**:

• **BTR-2:** Scheduled for completion by June 2026
• **BTR-3:** Scheduled for completion by June 2028

By leading this nationally significant initiative, CMPDI is positioning itself at the forefront of climate impact assessment, methane emission quantification, and evidence-based mitigation planning for the mining sector. The project further reinforces CMPDI's growing role in supporting India's climate commitments through scientific research, technological innovation, and international best practices in environmental governance.

Knowledge Sharing and Capacity Building

CMPDI regularly collaborates with:

- Academic institutions
- Research organizations
- Government agencies
- International technical forums

for exchange of best practices in sustainable mining and environmental management.

Current Technological Innovations Transforming Environmental Management in Mining

The mining sector is rapidly adopting advanced technologies to improve environmental performance, regulatory compliance, and sustainability outcomes. These innovations are helping mining companies move towards data-driven, transparent, and climate-conscious operations.

1. **Drone and UAV-Based Monitoring**

   Unmanned Aerial Vehicles (UAVs) are increasingly being used for:

   - Mine reclamation monitoring
   - Vegetation assessment
   - Overburden dump stability studies
   - Mine fire mapping
   - Topographic surveys

   Drone-generated high-resolution imagery provides accurate and real-time information, enabling faster environmental decision-making.

2. **Remote Sensing and GIS Applications**

   Satellite imagery and Geographic Information Systems (GIS) support:

   - Land-use and land-cover mapping
   - Monitoring of reclaimed areas
   - Biodiversity assessment
   - Watershed management
   - Carbon stock estimation

   These technologies facilitate large-scale environmental surveillance and long-term sustainability planning.

3. **Continuous Environmental Monitoring Systems**

   Real-time monitoring networks are being deployed for:

   - Ambient air quality
   - Water quality
   - Noise levels
   - Meteorological parameters

   Integration with CPCB/SPCB servers enhances transparency and regulatory compliance. Installation of CAAQMS at project sites help in continuous monitoring of air quality in the vicinity of the mining areas.

4. **Artificial Intelligence and Predictive Analytics**

   AI-based tools are assisting in:

   - Air pollution forecasting
   - Mine water management
   - Equipment energy optimization
   - Environmental risk assessment
   - Climate vulnerability analysis

   Predictive models help organizations proactively address environmental challenges. Environment Division, CMPDI is enabling AI-based tools for data digitisation and predictive analysis.

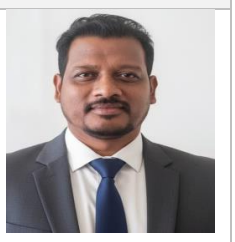
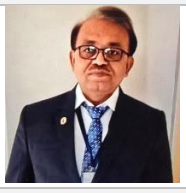
5. **Renewable Energy Integration**

   Solar power projects on reclaimed mine lands and mine closure sites are emerging as a sustainable solution for reducing carbon footprints while creating productive post-mining land use. Post-closure landuse utilising the mined out technically reclaimed lands are utilised by projects for installation of solar plants.

[WED- 2026 – A Glimpses]

प्रकृति संकल्प

Our Esteemed Contributors

					
Rajeev Kr Sinha Director(Tech/ES)	V. K. Pandey GM (Env)	Mrs. Punam Singh,GM (Env)	Dr. Manoj Kumar Chief Mgr (Min)	Mr. Abhishek Kr Singh SM (Env)	Dr. Amarjeet Singh SM (Env)
					
Mr. Nirbhay Manager (CD)	Mrs. Gargi Dy.Mgr(Env)	Mr. Abhisht Raj Dy Manager (Env)	Mrs Dipti MPillai AM (Env)	Mr. Shammi Kapoor Dy. Mgr (Env)	Mr. Sanjay Xaxa Cons (FAE-EB)
					
Mr. Rakesh Singh Advisor	Mr. VN Duppattawala RD	Mr. R.A.Khan GM (M)/HoD	Mr. Rajesh, RI-IV, CMPDI	Mr. Sandeep Sharma SM(Env),RI-III	Md M Rabbani SM (Env), RI-IV
					
Mr.Manish Yadav SM(Env) RI-VII	Mr. Neeraj K Singh SM (Env) ,CIL	Mr. K Das A M DM (Env), RI-VII	Mrs. Shalinie DM (Env), RI-VII	Mr.Vivekanand, Dy. Mgr(Geo)	Prem, Mgr (CD) RI-III
					
Mr. Amul, Dy. Mgr (Env)	Mr. V.K.Nagda SM(Env)	Mr. Utpal Kumar Sarkar, SM (E&M)	Mrs. Shilpa Hayal IIT Delhi	Mr. Shamal K IIFM, Bhopal	Mr. Vivek Kumar NIT Trichy
					
Mr. Mukesh Kr CM (E&M)	Mr. Rakesh Kr SM (E&M)	Mr. Navin Kr Mgr (CD)	Mr. Kr Vaibhav Mgr (Env)	Mr. Sudarshan Prasad, HoD (E&M)	Mr. Himanshu S. Sharma, Mgr (CD)

SERVICES OFFERED


Mineral Exploration & Drilling


Mine planning & EIA EMP studies


Drone Survey & Mapping


Baseline Generation Study


Ambient Air Sampling
(PM 2.5 & PM 10 Sampling)


Biodiversity Study (Flora & Fauna)


Carrying Capacity Study


Sand Replenishment Study


Drove Survey


Aquatic Ecosystem Study


Mine Closure


Engineering Services


Environment Management


Environment Laboratory


Consultancy & Advisory Services

Central Mine Planning & Design Institute Ltd.
(A Subsidiary of Coal India Limited)
CMPDI Headquarters :
Gondwana Place, Kanke Road,
Ranchi – 834008, Jharkhand, India
0651- 2230055
gmenv.cmpdi@coalindia.in
www.cmpdi.co.in

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