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Sustainability In the Shadow of Development: Indian Legal Responses to Mining and Power Plant Challenges

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Sustainability is not just about adopting the latest energy-efficient technologies or turning to renewable sources of power. Sustainability is the responsibility of every individual every day. It is about changing our behavior and mindset to reduce power and water consumption, thereby helping to control emissions and pollution levels.

Joe Kaeser

Abstract-
Mining and smelting can cause serious environmental harm due to the waste generated throughout the processes. Traditionally, industry relied on end-of-pipe technologies to manage waste after it was released. However, stricter environmental laws and the ineffectiveness of these systems have led to the adoption of better cleaner technologies and practices. This shift has improved the mining industry's approach from reactive pollution control to proactive pollution prevention and cleaner production. Mining activities, especially those focused on coal, generate dust and small particles that contribute to air pollution. This pollution can result in respiratory issues and other health problems for those living close by. Moreover, mining can enable harmful metals, acids, and different pollutants to enter both surface and underground water, compromising water quality and rendering it unsafe for agriculture or consumption.
Mining efforts can also result in the clearing of forests, sinking land, and alterations in how land is used, affecting the surrounding environment and local ecosystems. The socioeconomic consequences can be profound, impacting jobs, farming, and the overall health of communities near mining locations.
India plays a major role in producing mining waste, making it vital to manage this waste effectively to minimize environmental damage and potential health risks. Mining may also create Acid Mine Drainage (AMD), a severely contaminated water discharge, which needs clean-up initiatives to stop further pollution. Additionally, it can lead to enduring changes in the environment, such as alterations in plant life, land shapes, and soil health.
India plays a key role in earning foreign exchange by exporting minerals like iron ore, chromite, bauxite, and manganese. Furthermore, the nation's vast untapped mineral resources provide significant possibilities for expansion and innovation in the mining sector. India's energy transformation and self-sufficiency in sectors such as electric vehicle batteries and renewable energy depend more and more on the exploration and extraction of key minerals like lithium and cobalt. The mining industry is moving toward increased sustainability and self-reliance as a result of technological improvements and changes, which are consistent with the "Atmanirbhar Bharat", or self-reliant India, ideal.Thermal power is a key contributor to India's energy security since it produces the majority of the nation's power.
In India, thermal power plants that burn coal are the cornerstone of electricity generation and contribute a large portion of the country's total energy supply. Due to the country's enormous and increasing energy needs, notably for industry and infrastructure development, this reliance on thermal energy is unavoidable. The critical importance of the industry was made clear when coal output increased to 90. 62 million tons in November 2024.
Thermal power plants provide a reliable and affordable electricity supply, which is essential for the expansion of industry and sustains important industries like transportation, infrastructure, and manufacturing. The industry generates both direct and indirect job prospects, which helps the economy as a whole. In addition, thermal power plants generate income that goes toward state revenues, which may be utilized to fund infrastructure improvements and social welfare initiatives.
India is taking measures to lessen the environmental effects of thermal power facilities by enacting various legislation, especially those that run on coal, even if they do produce greenhouse gas emissions. This involves utilizing cleaner technology, making investments in pollution control gear, and looking at alternative fuels. To lessen the dependency on fossil fuels, the government is also vigorously promoting the development and integration of renewable energy sources.
India is dedicated to diversifying its energy mix and expanding its renewable energy capacity. The nation intends to have a total capacity of 500 GW for producing electricity without using fossil fuels by the year 2030.

Keywords: Mining pollution, Thermal pollution, Sustainability, Legislation

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Introduction

The word "environment" comes from the French term "environ," which signifies "to surround." It includes both biotic (living) and abiotic (non-living) aspects. Essentially, the environment is the space where organisms live. Nature consists of two intricate and active elements: the environment and the organisms. The lives of all organisms, including humans, are influenced by their environment. Compared to other living beings, humans engage with their surroundings more intensely. Generally, the term environment refers to the materials and forces that envelop living creatures.[1]

P. Gisbert describes the environment as everything around an object that influences it, while E. J. Ross adds that it is an external force shaping our lives. The environment consists of various factors, including psychological aspects, interactions with others, living beings, and physical elements. It includes the atmosphere, lithosphere, hydrosphere, and biosphere, which can be categorized into micro and macro environments, as well as biotic and physical environments.

The microenvironment refers to an organism's immediate surroundings, while the macroenvironment encompasses all external influences. The biotic environment includes living things like plants and animals, whereas the physical environment consists of non-living elements such as light, temperature, and minerals.

Pollution takes many forms, including air, plastic, noise, soil, radioactive, and water pollution. Air pollution involves harmful particles and chemicals in the air, while plastic pollution refers to harmful plastic waste. Noise pollution comes from various sources, and soil contamination occurs from chemicals. Radioactive pollution results from nuclear activities, and water pollution arises from dumping waste into water bodies, affecting human and environmental health. Thermal pollution occurs when human activities alter the temperature of natural water bodies, such as using water for cooling in power plants.

Thermal power plants in India contribute to pollution through air and water contamination, as well as ash disposal. Several industrial areas have been identified as critically polluted due to industrial and mining activities, with thermal power plants being a significant contributor.

The United Nations has set Sustainable Development Goals (SDGs) that focus on various important issues, including a particular aim for affordable and clean energy (SDG 7). This goal highlights the importance of utilizing energy sources that are both clean and good for the environment.[2]

[1] (Mukhopadhyay, 2016)
[2] https://stakeholderforum.org/sdg-7-ensure-access-t...

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LITERATURE REVIEW

Environmental pollution has been a significant concern since the industrial revolution in the 19th century. It occurs when harmful substances, which are not naturally found in the environment, cannot be safely broken down. These substances can take a long time to decompose, affecting essential natural resources like air and water that all life depends on.

Research by **Sato and Sada (1992)** found that emissions from power plants increased harmful trace elements in nearby soil, with the highest levels found 3 km north of the plant. **Ripley (1996)** noted that sediment increase leads to higher water turbidity, which harms aquatic plants' ability to photosynthesize and disrupts food sources for predators and fish habitats. **Johnson (1997)** highlighted sedimentation issues at mining sites, as heavy rainfall can wash disturbed materials into streams, degrading water quality.

Moreover, **Kishor et al. (2009)** examined the benefits of using fly ash in farming, which can improve soil quality if applied correctly. **Chauhan and Joshi (2010)** found that air pollution negatively impacts the growth and yield of crops like wheat and mustard, linking pollutant presence to reduced agricultural productivity.

Additionally, **Cropper et al. (2012)** reported that coal-burning power plants significantly contribute to local pollution, resulting in thousands of deaths each year due to toxic emissions. In India, the quality of thermal coal used in power plants has declined, impacting emissions and health outcomes. Studies have shown that mining activities also pose health risks, such as respiratory diseases among workers.

Historical development

The body of international law pertaining to environmental protection, mainly through bilateral and multilateral international agreements, is known as international environmental law.

In 1963, the World Conservation Union invited nations to protect endangered species, leading to the creation of CITES by 80 countries to regulate trade in these species. Since its start in 1975, CITES has gained support from 172 states. In 1968, representatives from 60 nations met in Paris at the UN Biosphere Conference to discuss pollution and resource exhaustion. The first major environmental conference, UNCHE, occurred in Stockholm in 1972, resulting in important agreements. The Rio Declaration, created during the 1992 Earth Summit, outlined nations' rights and responsibilities regarding the environment. The Kyoto Protocol, established in 1997, aimed at reducing greenhouse gas emissions. The Earth Summit 2002 in Johannesburg focused on sustainable development. While there is no international law governing mining, various treaties, agreements, and declarations exist. These documents contain clauses related to environmental safety and sustainable development relevant to mining in India. These are some of them: The 1972 Stockholm Declaration asserts that while nations can manage their own resources based on their environmental policies, they must also ensure that their actions do not negatively impact the environments of other countries or areas outside their national control.The 1982 United Nations Convention on the Law of the Sea regulates activities related to mining and exploring the deep-sea bed.Established in 1992, the Convention on Biological Diversity encourages countries to promote development that is eco-friendly and sustainable, particularly near protected regions.

The 1992 United Nations Framework Convention on Climate Change and the 1997 Kyoto Protocol focus on the need to lower emissions of greenhouse gases.[3]

The Minamata Convention of 2013 which aims to safeguard people from hazardous mercury emissions.

The New York Convention and Geneva Conventions, which pertain to international arbitration, are also signed by India.

Methodology

The goals of the study are achieved in this scholarly and methodical work. The report's methodology relies on documentary research, which collects and analyzes data on the global pollution caused by coal-fired power plants and mining, India's energy and climate regulations, the negative health consequences of coal combustion, and the responsibility of businesses to respect the human rights of those impacted. Additionally, it covers issues like environmental damage and human rights violations caused by coal mining and thermal power plants, as well as other linked subjects. to determine if the plants are adhering to the prescribed procedure, the laws governing the management of pollution brought about by mining and thermal power plants are different. the environmental consequences of getting rid of this waste.

Indian Legislation for Sustainability in Mining and Power Plant

In India, global warming, deforestation, and pollution threaten the environment and people's health. Human actions harm not only humans but also plants and animals. Population growth has increased the pressure on natural resources, leading to problems like over-farming and water pollution. The rise of industries and consumerism has created sprawling cities with waste and sewage issues. Without change, India and the Earth risk becoming deserts due to pollution and careless waste disposal.

According to the Indian Constitution, the state is responsible for protecting and enhancing the environment as well as preserving the nation's forests and animals. Additionally, every citizen is obligated to safeguard and improve the natural environment, which includes forests, lakes, rivers, and animals. These changes have encountered numerous obstacles, even though Indian laws have frequently changed to address changing needs. Despite certain advancements, it is obvious that there is still a lot to be done. In order to control human conduct and maintain social order, legislation is necessary. Since the original Constitution did not use the word Environment, it was imperative to change it with clauses designed to adequately protect the environment from harm.

The Indian Constitution, which was implemented in 1950, did not initially include measures for environmental preservation or pollution regulation until a modification that was made in 1976. Existing laws were integrated into the revised legal framework under Article 372(1) of the original text. It states that every law that was in effect prior to the Constitution's adoption will continue in force until it is changed, repealed, or repealed by a competent legislature or authority, with the exception of other constitutional provisions and the repeal of some of the legislation listed in Article 397. As a result, several of these laws remain unchanged even fifty years after independence. The Central Government in India implemented a range of detailed environmental laws. It was the Stockholm Declaration of 1972 that prompted the Indian Government to take a broader view on environmental protection. Some of the legislation for environment protection are detailed under:

The Wildlife (Protection) Act of 1972 focused on effective and modern management of wildlife.[4]

In 1972, the National Council for Environmental Policy and Planning was created; this later developed into the Ministry of Environment and Forests (MoEF) in 1985.

The Water (Prevention and Control of Pollution) Act, passed in 1974, established pollution control boards at both the national and state levels to monitor and manage pollution.

To combat deforestation and the conversion of forest land for non-forestry uses, the Forest (Conservation) Act of 1980 was introduced, promoting social forestry as well.

Under the Public Liability Insurance Act of 1991, it is required to have insurance to provide immediate assistance to individuals affected by accidents involving hazardous materials.

The Air (Prevention and Control of Pollution) Act of 1981 was enacted to reduce air pollution through pollution control boards.

The Environment (Protection) Act of 1986 serves as a comprehensive piece of legislation aimed at environmental protection and addressing gaps in current laws.

The Public Liability Insurance Act (PLIA) of 1991 focuses on insurance for incidents involving hazardous materials. Property owners must provide compensation for accidents causing injury or death and are required to obtain insurance policies for protection.

The Biological Diversity Act of 2002 stems from India's effort to uphold the United Nations Convention on Biological Diversity (CBD) from 1992.

The National Green Tribunal (NGT) plays a key role in improving environmental law and justice, aligning with the UN's 2030 Sustainable Development Goals. In 1972,

The UN Conference on the Human Environment in Stockholm led to the creation of the National Council for Environmental Policy and Planning, which later became the Ministry of Environment and Forests.

[3] https://issues.org/friedman/

[4] https://www.law.cornell.edu/wex/supremacy_clause

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Disposal of Fly Ash Notification (1999) Objective of the notification is to protect the environment by conserving top soil and managing the disposal of fly ash from coal or lignite-based power plants.

Institutional Framework for Environmental Governance

Central pollution and state pollution control board

Central Pollution Control Board

The Ministry of Environment, Forest, and Climate Change oversees the operation of the Central Pollution Control Board (CPCB). The Water (Prevention and Control of Pollution) Act of 1974 created it, and it is also responsible for enforcing the Air (Prevention and Control of Pollution) Act of 1981. Under the Environmental Protection Act of 1986, the CPCB functions as both a technical support provider to the Ministry and a field agency. In order to settle disagreements and provide technical support, it works with State Pollution Control Boards (SPCBs).

The Environmental Protection Act gave the CPCB a broader mandate, concentrating on data collection and pollution management in order to aid in the development of national regulations. The CPCB organizes training and designs environmental improvement initiatives. Its primary location is in New Delhi, with five labs and seven zonal offices providing research and environmental evaluations. The CPCB establishes national standards for several environmental legislation and collaborates with local governments, businesses, and other stakeholders to manage pollution.

The CPCB oversees air and water quality to guarantee the availability of clean resources nationally. It monitors air quality at 621 sites in 262 towns and cities as part of the National Air Quality Monitoring Programme, concentrating on four main pollutants: sulfur dioxide, nitrogen oxides, suspended particulate matter, and respirable suspended particulate matter, while also gathering meteorological data.

In terms of water quality, the CPCB's objective is to safeguard India's scarce freshwater resources, which are vital for agriculture, industry, and human use. It has created a network of 1,019 water quality monitoring sites in 27 states and six Union Territories, gathering data every quarter for surface water and every two years for groundwater. Additionally, the CPCB monitors environmental data, paying special attention to the state of air and water quality in rivers and ponds since they are vital resources.

STATE BOARD OF POLLUTION CONTROL

Following the Water (PCP) Act of 1974 and the Air (PCP) Act of 1981, the Odisha State Prevention and Control of Pollution Board was formed to oversee pollution control in the state. The State Pollution Control Board of Odisha was established on July 15, 1983, and given its current name in 1999. The whole state of Odisha has been designated as an Air Pollution Control Area since July 18, 2002.

The Board's primary objectives are to lessen pollution, safeguard water resources, and enhance air quality. The Board carries out a variety of responsibilities in order to achieve these objectives, such as planning and carrying out initiatives to prevent and reduce pollution. It monitors businesses to make sure they adhere to environmental rules and offers the state government recommendations on similar issues.

The Board gathers and disseminates knowledge about pollution and provides environmental no objection certifications fornew businesses. It regulates sources of noise pollution and keeps an eye on compliance with groundwater and air quality standards. In addition, the Board examines sewage treatment facilities to make sure they are functioning properly and analyzes plans for any required remedial measures.

Furthermore, the Board has the authority to shut down industrial facilities that fail to meet regulations or disconnect their water or electricity. It sets and modifies effluent criteria for sewage and industrial waste. The Board seeks out cost-effective methods for treating sewage and commercial wastewater. It works with the Central Pollution Control Board to provide training programs on pollution prevention and carries out public education campaigns. Additionally, it gathers and examines samples of air emissions and sewage for certain pollution characteristics.

ENVIRONMENTAL IMPACT ASSESSMENT

Previously, environmental repercussions were frequently overlooked in development projects, which resulted in widespread pollution and harm to ecosystems. The Environmental Impact Assessment (EIA) process was developed in order to address these concerns by forecasting and proposing methods to lessen the negative environmental consequences of development. The 1994 Notification on Environmental Impact Assessment governs EIA in India, which started in 1978 for river valley schemes.Before any of the project types that need EIA can advance, they must first get an Environmental Clearance (EC). This approval procedure is overseen by the Impact Assessment Agency, which is a division of the Indian Ministry of Environment and Forests. Projects requiring approval from the central government include nuclear power programs, river valley projects, infrastructure and Coastal Regulation Zone projects, thermal power facilities, mining operations, and a variety of industries. It's important to note that this clearance is required for mining projects larger than 5 hectares and thermal power plants.

The EIA performs a variety of tasks, such as using scientific approaches, taking into account both short-term and long-term consequences, ensuring public participation, and serving as a transparent environmental tool that can be used for any project with possible effects. An EIA must evaluate the existing environmental situation, ecosystem variables, and negative effects on the environment and local population.

EIA offers many advantages. It aims for sustainable development by connecting development with environmental protection, guaranteeing that plans are environmentally sound, promoting mitigation methods, facilitating well-informed decision-making before project implementation, and helping to lessen the negative consequences of development.

LEGISLATION PERTAINING TO MINING

The Supreme Court of India ruled in February 2018 that the second renewal of mining leases in Goa was unlawful. In accordance with the Mines & Minerals (Development and Regulation) Act of 1957, the Court held that mining could not resume until new leases and environmental permits had been granted, not on the basis of the renewals. The mining industry in India operates under a federal model in which the central and state governments share responsibilities. The Seventh Schedule of the Indian Constitution lists the various ways in which this is described. State governments also have regulatory authority over mines, but it is constrained by the central government, which may regulate them if it is deemed to be in the public interest. The primary law governing mineral sector regulation, with the exception of petroleum and natural gas, is the MMDR Act of 1957.Major and minor minerals are distinguished by the MMDR Act. Major minerals are resources such as coal and iron ore, while minor minerals include materials like gravel and building stones. Major revisions were made to the MMDR Act in 2015 to clarify the procedure for awarding mineral concessions, and additional revisions were made in 2016 to enable the transfer of specific mining leases.

In addition, a number of laws and regulations support the MMDR Act. The granting of concessions and application procedures are governed by the Mineral Concession Rules 1960; the Mineral Conservation and Development Rules 2017 ensure environmentally friendly mining; the Mineral (Auction) Rules 2015 establish guidelines for online auctions for major minerals; the Mines Act 1952 outlines safety and working conditions in mines; the Mines Rules 1955 focus on the welfare of miners; the Offshore Areas Mineral (Development and Regulation) Act 2002 and its rules regulate offshore mineral resources; the Mines and Minerals (Contribution to District Mineral Foundation) Rules 2015 specify contributions to mineral foundations; the Coal Block Allocation Rules 2017 detail auction processes for coal blocks; and the Foreign Direct Investment Policy governs investment in the mining sector.

India's mining regulatory bodies include a number of important institutions. Under the MMDR Act, state governments have the power to award mineral concessions and levy associated fees. The majority of mining operations are under the control of the Ministry of Mines (MoM), which includes the exploration and regulation of non-ferrous metals. The Indian Bureau of Mines (IBM), which operates under the MoM, guarantees the orderly growth of the mining industry while preserving resources and protecting the environment. The Ministry of Coal (MoC) is primarily concerned with coal exploration and infrastructure development for coal supply. The Ministry of Petroleum and Natural Gas (MoPN) regulates petroleum and natural gas resources, overseeing their production and pricing. The Ministry of Environment, Forest and Climate Change (MOEFCC) must approve all mining operations' environmental clearance.

THERMAL POWER PLANTS AND THEIR ENVIRONMENTAL IMPACT

PROCEDURE FOR ESTABLISHING THERMAL POWER PLANTS

To establish and operate a new power plant, two stages of clearance are required: site clearance and final environmental clearance.

Stage I focuses on the plant's location, ensuring it is not near airports, at least 500 meters from flood plains, highways, and major railways. An Environmental Impact Assessment (EIA) must consider various impacts, including on metropolitan areas and sensitive regions.

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Vol. 36 Issue 2, 2026, Pages 989-994

Stage II requires an EIA report that includes site details, land needs, rehabilitation plans, and environmental assessments. After the plant starts, operators must manage waste, monitor emissions, and ensure safety and compliance with regulations.

ENVIRONMENTAL REGULATIONS

Coal Based Thermal Power Plants

Standards for discharge of liquid effluents

i. If a new thermal power plant begins operation after June 1, 1999, it must employ cooling towers if it uses water from rivers, lakes, or reservoirs. Plants that use seawater must bring the water temperature down at the discharge point, but the rise in the temperature of the receiving water should be limited to no more than 10°C. For improved thermal discharge mixing, the discharge point should ideally be located at the bottom and in the middle of the body of water. A proper marine outfall should be constructed with the help of the appropriate authorities when releasing into the ocean. It is forbidden to discharge in vulnerable locations like estuaries, mangroves, and coral reefs.

ii. **Fly-ash use**

In order to promote the
usage of Fly Ash and minimize the amount of land necessary for its disposal, the Ministry of Environment, Forest & Climate Change (MoEF&CC) has issued notif ications. The first notification occurred on September 14, 1999, and was modified in 2003, 2009, and 2016. On November 3, 2009,
a critical announcement established the objective of 100%
In the first year following the notice, older Thermal Power Plants must achieve a fly ash usage goal of 50%, followed by 60% in the second year, 75% in the third, 90% in the fourth, and 100% in the fifth. The goals for newer thermal power plants vary, ranging from 50% in the first year to 70% in the second, 90% in the third, and 100% in the fourth year following commissioning. Additionally, the minimum fly ash content requirements for construction materials were specified.

Building Materials or Products	Minimum % of Fly Ash by weight
Fly Ash bricks, blocks, tiles, etc. made with Fly Ash, lime, gypsum, sand, stone dust, cement, etc. (without clay).	50% of total raw material.
Paving blocks, paving tiles, checker tiles, mosaic tiles, roofing sheets, pre-cast elements, etc. wherein cement is used as binder.	Usage of PPC (IS-1489: Part 1) or PPC (IS-455) or 15 % of OPC (IS-269/8112/12269) content.
Cement.	15% of total raw materials.
Clay based building materials such as bricks, blocks, tiles, etc.	25% of total raw materials.
Concrete, mortar and plaster.	Usage of PPC (IS-1489: Part 1) or PPC (IS-455) or 15 % of OPC (IS-269/8112/12269) content.

Remedial measures for affected people

Provision for Compensation for Displaced People

The acquisition of land for projects by Public Sector Units under the Ministry of Power follows the Government of India Land Acquisition Act of 1894 and state laws. It also adheres to the guidelines from the National Policy on Resettlement and Rehabilitation for Project Affected Families from 2003, the National Rehabilitation and Resettlement Policy of 2007, and the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act of 2013. The LARR Act 2013 aims to provide fair compensation and support for affected land owners and families.

Some of the main features of the LARR Act of 2013

- Fair Market Value as the Basis for Compensation – The law mandates that land compensation be determined by its real market value, not by arbitrary values.
- Rehabilitation and Resettlement (R&R) – People who are displaced are entitled to additional financial aid, housing assistance, and help to re-establish their means of subsistence.
- Higher Compensation Multiples – The Act raises the compensation amount for landowners, particularly in rural areas where their income is highly dependent on land.
- Land Acquisition Process That Is Transparent – Before acquiring land for private projects, the Act mandates a fair and open process, including social impact assessments, public consultations, and consent criteria.
- Reduction in Land Conflicts - The Act aims to minimize legal disputes that arise during land acquisitions by ensuring equitable compensation, which would lessen opposition.

One of the most significant provisions of this legislation is the four-fold compensation rule, which guarantees that rural landowners are paid fairly when their property is seized for public purposes.

JUDICIAL INTERPRETATION

The Indian judiciary is essential in enforcing environmental legislation, particularly with regard to mining and power facilities, which pose risks to both the environment and human rights. Major court cases and judicial actions through Public Interest Litigations (PILs) have established important ideas like sustainable development and the polluter-pays principle. These measures are essential for striking a balance between economic expansion and environmental and social obligations. These judicial principles have mandated environmental compliance, imposed accountability on violators, and directed policy even in cases where executive mechanisms have failed.

In India, judicial oversight has been especially crucial in instances of unlawful mining, tribal displacement, and forest land diversion. As an example, the judiciary has asked for comprehensive compliance reports from both state and central authorities and has raised concerns about procedural irregularities in the granting of environmental approvals. Even if these measures have not always led to a total cessation of illegal conduct, they have increased transparency and discipline in law enforcement.

The judiciary uses site inspections, environmental assessments, and expert committees to improve legal judgments pertaining to environmental matters. Established in 2010, the National Green Tribunal (NGT) is instrumental in handling matters pertaining to mining by promptly addressing issues brought by impacted communities and environmental organizations.

Articles 21, 48A, and 51A(g) of the constitution allow for judicial intervention in environmental issues. When regulations are unclear, courts may now take action thanks to the extended interpretation of Article 21 as the Right to Life, which now includes the Right to a Clean and Healthy Environment. These safeguards are crucial in Odisha, where mining affects the environment and tribal rights.

Some reviewers are concerned that the courts' actions may impede economic development and meddle in the operations of other government agencies. But when regulatory agencies fail, the judiciary frequently intervenes to handle major problems such as environmental damage, biodiversity loss, and threats to public health.

The upcoming analysis will examine judicial rulings that have influenced pollution regulations for mining and coal power plants in India. It will look at how courts interpret laws, respond to community actions, and enforce environmental standards. This research aims to show the strengths and weaknesses of legal solutions for pollution caused by mining.

Key cases, like *Vanashakti vs. Union of India*, reveal challenges in environmental law, with the Supreme Court ruling against ex post facto Environmental Clearances, emphasizing the right to a clean environment. This decision sets a vital precedent for future environmental regulations.

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The necessity of using appropriate methods in environmental assessments for sustainable development was emphasized in the Supreme Court case of *Hanuman Laxman Aroskar and Others vs. Union of India.* It brought up significant problems with the Environmental Impact Assessment procedure for the Mopa airport project. Without adequate consideration, the Court prioritized ecological protection over rapid development by suspending the Environmental Clearance.

MSW MANAGEMENT -Multidisciplinary, Scientific Work and Management Journal
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Vol. 36 Issue 2, 2026, Pages 989-994

Additionally, this decision establishes a crucial precedent that may be used to mining operations in Odisha, where similar issues with EIA procedures may surface, notably when it comes to preventing future thermal pollution brought about by industrial operations. It is imperative to concentrate on striking a balance between development goals and environmental protection, and all project proponents must be careful to provide accurate information during their evaluation phases.

In the case of *Sterlite Industries (India) Ltd. vs. Union of India (02. 04. 2013 - SC),* a different approach to regulatory compliance is offered regarding current operations in the face of concerns about environmental harm and procedural compliance. Although the Supreme Court decided against closing Sterlite's copper smelting facility on procedural grounds, it also recognized historical harm resulting from non-compliance with environmental laws and established substantial financial responsibility through compensation for restoration efforts.

Legal frameworks like the Mines and Minerals (Development and Regulation) Act of 1957 and the Environment (Protection) Act of 1986 support environmental regulation, but judicial interpretation enforces these laws. Key cases, such as *Naveen Chandra Pant vs. State of Uttarakhand and CharidesaKrusak Surakhya Sangha vs. State of Orissa*, illustrate this.In the Naveen Chandra Pant case, villagers claimed illegal mining was damaging the environment and threatening their homes. The court found that mining led to soil erosion and river contamination. The Uttarakhand High Court called for sustainable development, applying the precautionary principle and the public trust doctrine to protect natural resources. A High-Powered Committee was formed to assess the damage and a temporary ban on mining was imposed until findings were submitted. This case shows the judiciary's crucial role in environmental management and community involvement in legal actions.The case of *CharidesaKrusak Surakhya Sangha versus the State of Orissa* involved land acquisition by the Industrial Development Corporation of Odisha (IDCO) for a thermal power plant by KVK Nilachal Pvt. Ltd. Local farmers and activists raised concerns about the lack of environmental and wildlife permits, the project's proximity to the Kapilash Wildlife Sanctuary, and potential ecological damage. They argued that the project violated the Forest Conservation Act and the Wildlife Protection Act, claiming construction started without necessary approvals.

The Orissa High Court found that KVK had obtained environmental clearance before the sanctuary was designated, and the site was outside the buffer zone, thereby keeping the clearance valid. However, the court required wildlife clearance before any forest land activities. It dismissed challenges on non-forest land but allowed challenges related to forest classification, focusing on procedural compliance and expert reports.

The case highlights the complexities of environmental regulations in Odisha and the court's pragmatic approach to balance development with ecological protection. The judicial focus extends to mining and coal-based power plants, which face scrutiny regarding their environmental impacts, illustrated by landmark cases such as Singrauli Super Thermal Power Station, where procedural fairness was emphasized.

The *M.C. Mehta* case is a landmark in Indian environmental law, focusing on the protection of historical sites, public health, and the environment from pollution. It specifically addressed issues around the Taj Mahal area and led to a ruling that required 292 firms to switch to cleaner fuels or relocate to reduce emissions harming the area. The Supreme Court established three principles: sustainable development, the "polluter pays" principle, and the precautionary principle. This decision emphasized judicial engagement in environmental monitoring, considering both environmental protection and socio-economic impacts, especially for communities affected by mining in Odisha.

The judicial approach to pollution caused by mining and coal power plants in India has changed significantly, showing more awareness of environmental issues and the need for legal control. The Supreme Court has been key in interpreting environmental laws, enforcing regulations, and making sure mining activities protect ecological health. Important court cases, such as *Mohammed Haroon Ansari vs. The District Collector and State of Meghalaya vs. All Dimasa Students Union*, highlight the Court's focus on balancing development with environmental protection.

In its decision in October 2017, the Madras High Court addressed these concerns and stated that the notification should be interpreted strictly. By stating that granting such permits may jeopardize previous environmental reviews, the Court emphasized the necessity of enforcing environmental regulations.

The effects of this decision were enormous. It had an impact on later judgments, such as the Supreme Court's decision in the Vanashakticase, which outright banned the practice of issuing ECs after the fact. The Court ruled that compliance with environmental legislation is a constitutional requirement and that no development is acceptable if it results in environmental destruction. It stressed the importance of adhering strictly to past EC requirements and that no amount of redress or recompense can undo the harm caused by unauthorized conduct.

SUSTAINABILITY IN MINING AND POWER PLANT

Sustainability's primary benefits are that it fosters a Future for All, reduces energy use, and makes the environment healthier for everyone. It demonstrates that environmentally friendly methods really do contribute to the betterment of society. Your carbon footprint and the number of pollutants discharged into the environment will be reduced by your dedication to sustainability, which will also make it safer. Regardless of our identity, location, or occupation, we all have a moral obligation to one another, our future generations, and other species to protect the environment by giving priority to sustainability, which improves the planet as a whole and enables us to live in cleaner, healthier environments. Future generations will be greatly impacted by the choices we make today. Sustainability in mining will be achieved through following methods:

Capturing Carbon: The mining business might decarbonize using cutting-edge carbon capture and storage methods. According to some experts, new technology may even be able to assist miners in moving toward carbon neutrality. Experts have discovered techniques to capture or store carbon during the mining process, counteracting the industry's carbon footprint, by modifying or speeding up natural processes such as mineralization.

The goal of land reclamation is to undo the effects of mining once a project is finished by planting trees and managing trash. By working more closely with neighboring communities, the impact of mining on a community may be lessened or even made beneficial.

Implementing sustainable practices: Tailing reuses residual metals retrieved from prior mining operations, reducing waste and impact. Furthermore, disasters can be avoided by making sure that waste is handled responsibly and effectively.

Transitioning from coal-generated electricity to sustainable energy sources: Mines that switch from coal to renewable energy sources to power their operations may lower their emissions by utilizing the same technology they are developing. Mauritius, South Africa, and Chile are currently at the forefront of supplying renewable energy to mines. With an additional gigawatt under construction, mining sites around the world already have one gigawatt of renewable energy operational, indicating a positive move toward greener energy sources.

Technological breakthroughs: Mining is becoming much more sustainable thanks to technology. It enhances emergency response procedures, reduces waste, and improves the transportation of minerals and metals. Through waste management, water consumption, and energy consumption, technological advances also help the environment directly. Furthermore, methods like precision drilling enable more precise targeting of mining operations.

Thankfully, there are several simple choices you may make that will help you increase the stability of your life without sacrificing enjoyment. The following are some easy steps you may do to live a sustainable lifestyle on a daily basis. Deciding to live a sustainable lifestyle does not entail compromising anything or lowering your quality of life! Knowing that you're changing the world will undoubtedly make you happier and more satisfied.

The Best alternatives for Coal based power plant

- Solar and wind energy are becoming more affordable and efficient renewable energy sources that provide sustainable power production when combined with battery storage.
- Nuclear Power: Provides a steady baseload electricity supply with much reduced greenhouse gas emissions than coal.
- Plants for Natural Gas: Release roughly 50% less
- than coal and offers greater flexibility in balancing renewable intermittency.
- Geothermal Energy: By utilizing the heat from the Earth's subsurface, geothermal power generates a consistent and renewable source of heat and electricity with significantly lower emissions than coal.
- Repurposing existing coal plants to burn biomass (wood waste or agricultural residues) is a form of biomass conversion that makes use of current infrastructure.
- Hydroelectric Power: A dependable, low-carbon energy source that makes use of water flow from rivers and dams.
- Hydrogen Power: A potential future alternative that uses current coal locations to generate or utilize green hydrogen.

Major Considerations

Flexibility and storage: Although wind and solar are inexpensive, they need hydrogen or battery storage to make up for inconsistent production.

Repurposing Infrastructure: Using established grid connections and keeping the workforce, current coal sites can be transformed into renewable energy centers**.**

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Co-firing: A shift strategy that involves burning biomass with coal in order to lower total emissions.
The word sustainability is commonly used to refer to initiatives, plans, and methods that are aimed at preserving a particular resource. However, in actuality, it refers to four different areas referred to as the four pillars of sustainability: human, social, economic, and environmental.

CONCLUSION AND SUGGESTIONS

Conclusion and Suggestions

The Climate-Smart Mining Initiative represents a significant step toward reconciling the growing global demand for minerals and metals with the urgent need to safeguard environmental and climatic stability. By embedding sustainability into the very fabric of extraction and processing, the initiative seeks not merely to reduce ecological footprints but to transform mining into a driver of clean energy security. Its emphasis on technical assistance and targeted investment in resource-rich developing nations underscores a dual objective: enabling economic growth while ensuring that such growth does not come at the expense of environmental justice.
Yet, the broader energy transition brings its own challenges. Renewable sources such as wind and solar, while indispensable to a low-carbon future, remain constrained by volatility and higher unit costs. Their integration into existing grids often disrupts the performance of coal-fired plants originally designed for steady base-load operation. The forced shift toward cyclical and flexible functioning has exposed structural inefficiencies but has also catalysed innovation. Increasingly, affordable strategies are emerging to enhance grid flexibility, optimize plant operations, and mitigate environmental impacts. This adaptive process illustrates the dynamic interplay between traditional energy systems and renewable technologies.

Suggestions for Policy and Practice:

- **Strengthening Institutional Capacity:** Developing nations must be equipped with robust regulatory frameworks and monitoring mechanisms to ensure that mining activities align with sustainability goals. Independent oversight bodies should be empowered to enforce compliance.
- **Investing in Technological Innovation:** Greater emphasis should be placed on research and development of storage technologies and smart grids to counteract the volatility of renewable energy sources.
- **Promoting Just Transition:** Policies must balance economic growth with social equity, ensuring that communities dependent on mining and conventional energy are not marginalized in the shift toward renewables.
- **Encouraging International Collaboration:** Cross-border partnerships can facilitate knowledge transfer, financial support, and harmonization of standards, thereby strengthening the global response to climate challenges.
- **Integrating Flexibility into Energy Planning:** Coal-fired plants and other conventional sources should be retrofitted with adaptive technologies to complement renewable integration, minimizing both economic losses and environmental harm.

In sum, sustainability in mining and energy is not a static goal but a continuous process of adaptation. The Climate-Smart Mining Initiative, coupled with pragmatic strategies for renewable integration, offers a pathway toward a balanced energy future—one that secures technological progress while preserving ecological integrity.