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Envisioning a **New Future** *for* **Old Coal Mines**

An Overview of Global Experiences

E3 Analytics

Acknowledgements

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The Future of Old and Existing Mines is a Generational Challenge

- India is in the midst of an historic transition in its power sector, as well as in its heavy industries such as steel.
- With several hundred mining sites spread throughout India, most of which are publicly owned, the topic of how to repurpose these coal mines is rising further up the political agenda.

Re-envisioning a New Future for Old Coal Mine Sites is About Forging a New and Viable Economic Future for the Village, and the Region

- When a coal mine closes, it often triggers a series of job losses ”downstream”: the port, the rail operator, hotels, restaurants, etc.
- Funding for community services such as water supply, sports facilities, fire prevention, and a host of others can suffer.
- Property values can decline.
- Furthermore, the demographic future of the community can be thrown into doubt.

An Overview of Practices Around the World Shows Many Different Approaches

- Some jurisdictions have adopted highly **top-down approaches** with very little community engagement, or consultation.
- Other jurisdictions have implemented more **bottom-up approaches**, and have sought to include communities from the start, inviting local citizens, workers, and other stakeholders into discussions to re-envision the future of the community together.
- Still other sites have done neither, leaving sites fallow.

There are Five Broad Pathways for Coal Mine Repurposing

1	**The Cultural Heritage & Tourism Pathway**	This pathway repurposes coal mines into cultural complexes featuring museums, educational tours, and art exhibits. The primary aim is to preserve the cultural value of the site and to communicate the history of the region, and its people.
2	**The Clean Energy & Storage Hubs Pathway**	This pathway repurposes coal mines into sites of renewable energy production such as solar farms, wind farms, or other forms of renewable energy production, including energy storage.
3	**The Digital, Educational & Innovation Zones Pathway**	This pathway repurposes coal mines into educational or innovation centers, including institutions of higher learning, and includes secondary uses such as data centers and research institutes.
4	**The Real Estate Pathway**	This pathway aims to harness local land value to repurpose coal mine sites by converting the site (or parts of it) into real estate, building new homes and/or laying the foundations for new communities.
5	**The Rewilding & Regeneration Pathway**	This pathway repurposes coal mines into areas of rewilding, for parks, for recreation, and/or for agricultural use.

Note: pathways are not mutually exclusive; some elements can and do overlap

PATHWAY 1 / OVERVIEW

The Cultural Heritage & Tourism Pathway

- This pathway transforms former coal mines into destinations that celebrate the region’s industrial heritage.
- Historic structures, machinery, and landscapes are preserved and repurposed into museums, art spaces, and educational trails. In many cases, the surrounding areas are converted into parks and recreational spaces for the local community.
- By combining culture, tourism, and nature protection, these sites foster community pride, attract visitors and investment, and create a living memory of the region’s mining legacy.

PATHWAY 1 / EXAMPLES

The Cultural Heritage & Tourism Pathway

- **Ruhr Area in Germany**, containing Ruhr Museum[1], Zollverein[2] and surrounded by nature parks[3] with lakes and hiking trails.
- **St. Aidan's[4] in West Yorkshire, UK**: nature park designed for both people and wildlife; open for a wide range of activities, from bird watching, cycling, jogging, horseback riding and dog walking.
- **Konin[5], Poland**: Two open air museums displaying mining machinery and equipment, surrounded by nature and a water reservoir for recreation, as well as an airport for private aircraft.

RANGE OF INVESTMENT COST

5–20

million EUR

PATHWAY 2 / OVERVIEW

Clean Energy & Storage Hubs

- The clean energy pathway’s goal is to repurpose coal mines into sites of renewable energy production and/or energy storage.
- This can come in the form of solar farms, wind farms, or other facilities such as energy storage (batteries, hydrogen production, etc.) being built on or near former coal mine sites.
- These new projects can create jobs and opportunities for those formerly employed by coal mining, and draw new workers in.

PATHWAY 2 / EXAMPLES

Clean Energy & Storage Hubs

- **Solar** (e.g. Musswellbrook Solar Farm[6], NSW, Australia)
- **Wind** (e.g. Klettwitz Wind Farm[7], Germany)
- **Battery Energy Storage System (BESS)** - especially powerful solution in combination with old coal plants (e.g. UK's last coal-fired power station[8])
- **Gravity Energy Storage System (GESS)** (e.g. Minierie d'Energia[9], Sardinia, Italy)
- **Underground Hydro Pumped Storage** (e.g. Swedish Tech company SENS[10])
- **Geothermal heating** (e.g. Bochum[11], Germany)

The combination of storage and renewable electricity generation is becoming increasingly common (e.g. Garzweiler[12], Germany).

RANGE OF INVESTMENT COST

10–300+

million EUR

PATHWAY 3 / OVERVIEW

Digital, Educational & Innovation Zones

- The goal of this pathway is to transform former coal mines into hubs for research, entrepreneurship, education, and digital infrastructure.
- By combining the unique underground conditions ideal for data centres—naturally cool, stable, and protected environments—with above-ground innovation spaces for universities, startups, and creative industries, these zones can help anchor a new knowledge-based economy.

PATHWAY 3 / EXAMPLES

Digital, Educational & Innovation Zones

- **Lefdal Mine Data Centre[13] in Norway:** one of the lowest cost of operations and most sustainable data centres in Europe.
- **San Romedio Mine[14] in Trento, Italy:** underground data centre in an active mine.
- **Homestake Gold Mine in the US:** transitioned into Sanford Underground Research Facility[15], an underground physics laboratory.
- **C-mine[16], Genk, Belgium:** creative hotspot with schools, university of art, theatres and events spaces for entrepreneurs and artists.

RANGE OF INVESTMENT COST

10–1000

million EUR

PATHWAY 4 / OVERVIEW

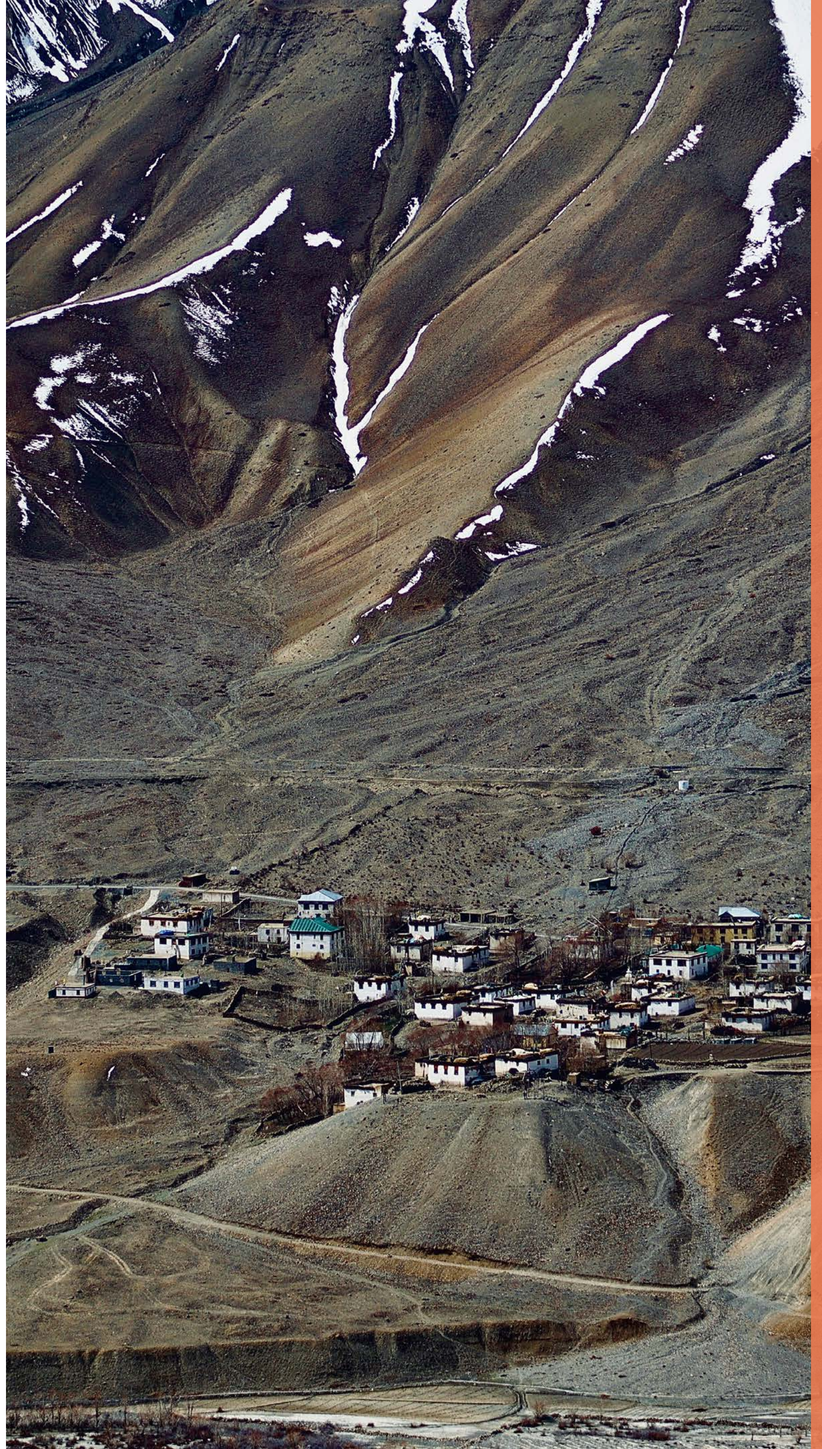
The Real Estate Pathway

- The aim of this pathway is to **harness local land value** to establish new homes and communities on (or around) former mining sites.
- Leveraging mines' large open spaces can provide considerable latitude for innovative architectural and urban planning designs.
- In some cases, it may be possible to repurpose local materials into building materials, reducing investment costs.

PATHWAY 4 / EXAMPLES

The Real Estate Pathway

- Examples of houses built on old coal mines: **Kentucky, US**[17] and **Stoke-on-Trent**[18]**, UK**.
- **Thoresby Vale**[19]**, UK:** individual plots sold to private home builders.
- **Lakeview Village**[20]**, Toronto, Canada:** village-of-the future 8.000 homes for an estimated 20.000 people.
- Potential of using gypsum at an old mine site as a building material, as done in **South Africa**[21].



RANGE OF INVESTMENT COST

Cost ranges depend on the size of the plot, and the total scale of the investments planned

PATHWAY 5 / OVERVIEW

Rewilding & Regeneration

- The goal of this pathway is to use the land of former coal mines for rewilding, for parks, for recreation, and for agricultural use, helping to restore degraded land in the process.
- Pioneer crops and trees are able to naturally clean the grounds, while also providing value in the form of biomass or edible crops.

PATHWAY 5 / EXAMPLES

Rewilding & Regeneration

- **Energy Willows[22] in Bosnia & Serbia*:** replanted with fast-growing energy willows for bioenergy — restoring degraded land while cutting coal emissions.
- **Endesa – Puertollano mine[23], Spain:** restored into 560 ha of productive farmland — now hosting 28,000 olive trees, cereals, and pastures, yielding 250,000 kg of olives annually.
- **Renaturation of Schleenhain open cast mine[24]:** starting with pioneer trees, the plans envision adding oak and fruit trees over time.

RANGE OF INVESTMENT COST

1–100+

million EUR

Strategies and Ideas to **Mobilize Private Capital**

How to make post-mine repurposing efforts more attractive for private investors

- **Hybrid options** enable multiple investors from different sectors to implement their preferred approach, making coal mine repurposing more economically viable through shared risks, and a model built around multiple income streams.
- **Every mine is unique:** an accurate map of characteristics per mine site increases options and information for investors (e.g. West Virginia University solution[25] & Shropshire brownfield land register[26]).
- **Ring-fence the remediation burden:** investors may not want to bear the risks, costs, and responsibilities associated with cleaning and strengthening the mine site – to increase the chances of success, these costs should be covered via separate channels, such as funds earmarked for site remediation.

Mobilizing Private Capital Example: Range Impact in Appalachia, USA

Range Impact's[27] strategy is to acquire, reclaim and repurpose large former coal mine complexes into new land developments supporting sustainable, next generation uses.

Overview of the strategy:

- Acquire distressed mine land (often at a discount), both acquiring and managing mining permits.
- Monetize existing assets (royalties, leases, even incidental mining).
- Use cash flow to pay for reclamation and release bonding obligations.
- Repurpose the land for next-generation uses (solar, logistics, agriculture, housing, carbon storage).
- Build long-term recurring revenue through **projects**, **leases** and **partnerships**.

Range Impact (US): Select Projects

Fola Mine Complex *into* Sky View

- Purchase price around $3 million: 13.000 acres of surface land and 107.000 acres of mineral interest, for a total of approximately 120.000 acres of real property interests. 15 mining permits with an estimated reclamation obligation of $29.3 million, as well as an obligation to manage an additional 21 mining permits at the site.
- Sky View is anticipated to be redeveloped into a new multi-use complex that includes a 1.000-acre (200 MW) solar farm, a next generation agricultural business involving biochar, complementary light industrial uses, recreation, and voluntary carbon credits.

Hobet Mine Complex *into* Rock Creek

- 2.000 acres surface interest for a purchase price of $900.000, without associated mining permits or reclamation bond obligations, but actively involved in reclamation process.
- Rock Creek is anticipated to be redeveloped into a new multi-use complex that includes a 3.500-acre (700 MWh) solar farm, light commercial and industrial uses, recreation, and residential, providing employment for over 100 people.

Conclusion:
Future Pathways for Repurposing Coal Mines in India

Community and citizen engagement are vital to ensure the success and flourishing of post-mine plans

- Top-down initiatives can generate ill-will among community members, and even fuel the exodus of community members.
- In much of Europe, governments (including EU-level, national, and local governments) make funding available for civil society organizations (CSOs) to conduct local engagement and outreach activities.
- **Engagement with and among community members can help support a stronger vision for post-mine repurposing efforts.**

Multiple pathways should be tested

- Re-developing old mine sites is a complex endeavor.
- Done well, repurposing mine sites can help rekindle economic activity, and generate new pathways for growth, for innovation, for research, for recreation, and even for investments.
- Governments can play a vital enabling role, including via key ministries such as the Ministry of Coal.

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