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How Family Owners, Boards, Governments and Financial Institutions can Come Together to Free up Mineral Oil Gas Integrated (MOGI) Stuck Assets and Make them Alive Again!

Jayanta Bhattacharya

Former Professor, Department of Mining Engineering, Indian Institute of Kharagpur, Kharagpur - 721302, West Bengal, India; jayantaism@gmail.com

Abstract

There are innumerable workable, old, recoverable mining, mineral, oil and gas properties lying idle all over the world. They can be operationalised first by freeing up, bringing in new investors, and making innovative uses that promise revenue. Though not in significant numbers, there is a growing sign of different old and new stakeholders taking up these properties with the help of the local and central governments. To facilitate different market-based instruments are being thought of. Property inheritance is a big issue here and the companies that are family owned they suffer from overindulgence to the progeny. There are good examples where the companies are doing the good work when the situation is right, not keeping it for the future to sort it out itself. Freeing up properties stuck in long legal disputes or with deceased owners requires a combination of legal, financial, and administrative solutions. Litigation escrow is a financial arrangement in which a neutral third party, known as an escrow agent, holds funds or assets on behalf of disputing parties. These funds or assets are securely deposited into an escrow account until specific conditions, such as the conclusion of a trial, settlement, or court order are met. Loss of documents, maps, and asset identifiers in old and abandoned coal, mineral, ore, oil, and gas assets is a major challenge worldwide. It leads to unclaimed reserves, ownership disputes, and financial losses. This article describes the state of the art solutions with the problems at hand.

Keywords: *Progeny, ADNOC, Aramco, Abandoned Fields, Coal, Gas, Mineral, Legal Disputes, Oil, Reliance, Rio Tinto, Tata*

1.0 Introduction

Overdependence on progeny to manage and carry forward legacy assets in the minerals, oil, and gas sector can be a major risk. It can lead to mismanagement, loss of value, succession conflicts, and lack of innovation if the next generation is either unprepared, uninterested, or incapable of handling complex industrial operations.

Risks of Overdependence on Progeny

1. **Lack of Expertise & Industry Knowledge**
   - The energy and mining sectors require technical, legal, and financial acumen that heirs may lack.
   - Without proper mentorship, they might struggle with regulatory complexities, resource management, and geopolitical risks.
2. **Failure to Adapt to Industry Changes**
   - Legacy businesses that do not modernize or diversify risk becoming obsolete.
   - Younger successors might lack vision for green energy transitions, automation, and digitalization in mining and oil operations.
3. **Succession Conflicts & Leadership Gaps**
   - Family disputes over control can weaken decision-making.

- Dividing assets among multiple heirs can fragment ownership, leading to inefficiencies and legal battles.

4. **Financial Mismanagement & Declining ROI**
   - Inexperienced successors might misallocate capital or fail to optimize operations, reducing profitability.
   - Over-reliance on a single family line can discourage external investors from funding modernization efforts.

2.0 Strategies to Reduce Overdependence on Progeny

1. **Professional Management & Governance**
   - Appoint experienced CEOs, CFOs, and legal advisors to oversee operations.
   - Implement a corporate governance framework to balance family interests with professional expertise.
2. **Diversified Succession Planning**
   - Instead of a single heir model, create a board of directors including family members and industry experts.
   - Train younger generations in business strategy, energy transitions, and resource economics.
3. **Gradual Transition & Mentorship**
   - Progeny should work across different departments before assuming leadership.
   - Assign mentors from within or outside the company to guide them in operational complexities.
4. **Joint Ventures & Strategic Partnerships**
   - Instead of full family control, partner with institutional investors or global energy firms for sustainability.
   - Encourage public-private partnerships (PPPs) to diversify risks and gain governmental support.
5. **Modernization & Green Energy Investment**
   - Shift some legacy assets towards renewable energy (solar, hydrogen, carbon capture) to future-proof the business.
   - Invest in digital mining, AI-driven exploration, and automated drilling to enhance efficiency.
6. **Legal & Financial Structuring**
   - Set up trust funds or holding companies to manage assets more strategically.
   - If heirs are uninterested, explore buyouts, IPOs, or asset leasing to external operators.

3.0 Some Case Studies

Here are a few case studies of family-owned or legacy-driven companies in the minerals, oil, and gas sector that navigated succession challenges, modernization, and sustainability transitions:

3.1 Reliance Industries (India) – Smooth Succession & Diversification

Challenge:

- Founded by Dhirubhai Ambani, Reliance was India's largest energy and petrochemical company.
- After his passing, a family dispute erupted between his two sons, Mukesh and Anil Ambani, leading to a division of assets.
- Concerns over whether the heirs could sustain the energy empire and modernize it.

Solution:

- Corporate Structuring: Assets were split; Mukesh Ambani took control of oil, petrochemicals, and telecom, while Anil managed power and finance.
- Professionalization: Mukesh Ambani modernized operations, investing in data-driven oil exploration and green energy.
- Diversification: Shifted from reliance on fossil fuels to investments in hydrogen, solar energy, and AI-based automation.

Outcome:

- Reliance is now a global leader in oil refining, and its shift to renewable energy has strengthened its long-term prospects.
- The controlled succession strategy helped Reliance adapt and grow rather than remain stagnant under family control.

3.2 ExxonMobil (USA) – Corporate Overhaul & ESG Transition

Challenge:

- Generational resistance to change; a corporate culture focused only on oil and gas.
- Mounting environmental lawsuits and investor pressure to transition toward green energy.

- Leadership conflict—heirs of former executives and board members resisted modernization.

Solution:

- External Leadership: Appointed Darren Woods, a non-family executive, to lead the transformation.
- Green Energy Pivot: Investments in carbon capture technology, biofuels, and hydrogen energy.
- ESG-Focused Shareholder Engagement: Added environmentally conscious board members under pressure from investors like Engine No. 1.

Outcome:

- ExxonMobil is now diversifying beyond oil while retaining its leadership in fossil fuels.
- Shareholders gained confidence as the company adapted to global climate policies.

3.3 Tata Group (India) – A Non-Family CEO Model

Challenge:

- Tata Sons, a multi-sector conglomerate, faced succession struggles after Ratan Tata's retirement.
- Family-driven decision-making risked stagnation in the fast-evolving energy and mining industries.

Solution:

- Instead of passing control to a family member, Tata appointed N. Chandrasekaran (a non-family executive) as chairman.
- Focused on renewable energy, mining efficiency, and digitalization.
- Expanded into lithium battery production and green hydrogen projects.

Outcome:

- Tata successfully modernized its mining and energy businesses while avoiding family-driven inefficiencies.
- The company remains globally competitive in steel, minerals, and energy production.

3.4 Koch Industries (USA) – Family-Controlled but Strategically Professionalized

Challenge:

- One of the largest privately-owned energy and commodity trading businesses.
- Leadership transition from Fred Koch to Charles Koch created concerns over long-term governance.

Solution:

- Retained family leadership but ensured key divisions were run by industry professionals.
- Expanded from traditional oil refining into natural gas, petrochemicals, and renewable energy.
- Used AI-driven operational strategies to optimize legacy assets.

Outcome:

- Koch Industries remains one of the most successful privately held energy firms in the world.
- By blending family leadership with professional management, the company sustained growth.

3.5 Adnoc (UAE) – Government-Led but Family-Influenced Energy Evolution

Challenge:

Abu Dhabi National Oil Company (Adnoc) was heavily state-controlled with a family-driven legacy model. Over-reliance on fossil fuels posed a risk to long-term economic sustainability.

Solution:

- Brought in non-family CEOs and global experts to oversee modernization.
- Invested in hydrogen production, advanced drilling technologies, and AI-based resource management.
- Created joint ventures with renewable energy firms to diversify energy portfolios.

Outcome:

- Adnoc now plays a crucial role in the Middle East's transition to cleaner energy while maintaining its oil dominance.
- Successfully shifted from a legacy-driven bureaucracy to a globally competitive energy enterprise.

Key Takeaways from These Case Studies

1. Professionalization is Key: Companies that blend family influence with external expertise perform better.
2. Diversification Ensures Survival: Transitioning to renewables, digital tech, and AI-driven exploration prevents stagnation.
3. Governance Matters: Effective governance structures (e.g., corporate boards, independent CEOs) enhance long-term stability.
4. Green Energy is the Future: Companies investing in hydrogen, carbon capture, and battery minerals outperform fossil-fuel-reliant firms.

5. Legal & Financial Structuring Reduces Risk: Using trusts, holding companies, and joint ventures can prevent succession conflicts.

Instead of blindly passing down mineral, oil, and gas assets, companies should combine family legacy with professional expertise. This ensures sustainable growth, prevents financial decline, and adapts to the evolving energy landscape.

4.0 Freeing up Properties

Freeing up properties stuck in long legal disputes or with deceased owners requires a combination of legal, financial, and administrative solutions. Here are some key approaches:

1. Clearing Legal Disputes

Mediation & Arbitration: Encouraging out-of-court settlements to resolve ownership disputes quickly.

Title Search & Verification: Ensuring all ownership records are accurate and identifying encumbrances.

Litigation Acceleration: If the case is in court, parties can push for fast-track hearings or settlements.

2. Handling Properties of Deceased Owners

Probate Process: If the owner died intestate (without a will), heirs need to go through probate court to establish legal ownership.

Legal Heirship Certificates: In many jurisdictions, heirs can apply for a succession certificate or legal heirship certificate to claim ownership.

Estate Planning & Trusts: Setting up a trust in advance can avoid delays after the owner's death.

3. Using an Escrow Account

Litigation escrow is a financial arrangement in which a neutral third party, known as an escrow agent, holds funds or assets on behalf of disputing parties. These funds or assets are securely deposited into an escrow account until specific conditions, such as the conclusion of a trial, settlement, or court order are met. The escrow agent ensures that funds are released only when all agreed-upon terms are satisfied, providing security and confidence to both parties involved in the litigation.

How Does Litigation Escrow Work?

The process of setting up and using litigation escrow typically involves the following steps:

a. Agreement to Escrow

Both parties agree to establish an escrow account and define the terms under which funds or assets will be deposited and released. The terms are documented in an escrow agreement.

b. Selection of an Escrow Agent

A trusted third party, such as a bank, law firm, or escrow service provider, is appointed as the escrow agent.

c. Deposit of Funds or Assets

The disputed funds or assets are deposited into the escrow account by the parties involved. The escrow agent secures the deposits until the conditions for release are met.

d. Resolution of Dispute

Upon settlement, arbitration, or a court ruling, the escrow agent releases the funds or assets as per the agreed terms.

5.0 Escrow Fees

The escrow agent charges a fee for their services, which is typically shared by the disputing parties. Escrow accounts can be a useful tool, particularly in the following scenarios:

Ongoing Legal Cases: If multiple parties claim a property, funds from a sale can be held in escrow until a resolution is reached.

Disputed Inheritance: If heirs disagree on the distribution, an escrow account can hold funds while negotiations or legal proceedings continue.

Foreclosure or Tax Liens: An escrow arrangement can help in clearing debts or unpaid taxes before transferring property ownership.



Figure 1. Escrow account: How it works

6.0 Government or Legal Intervention

Abandoned Property Laws: Many countries allow local governments to reclaim and auction abandoned or disputed properties.

Adverse Possession: In some legal systems, if a third party occupies the property for a certain period without opposition, they can claim legal ownership.

Land Banking: Governments or private entities can acquire legally stuck properties, clear disputes, and resell them.

1. **Taking a leaf from the City Planning**

Urban Renewal Projects: Cities like Detroit used land banks to repurpose vacant, disputed, or foreclosed properties.

Real Estate Investment Trusts (REITs): Some REITs acquire legally encumbered properties and use escrow to resolve disputes before resale.

Commercial Transactions: Developers sometimes use escrow accounts to acquire disputed properties, ensuring a clean transfer of funds upon legal resolution.

2. **How to bring back properties in circulation**

Here's how these types of properties can be brought back into circulation, inspired by successful global examples:

Unused Mine Lands

Mines often face legal hurdles, environmental concerns, or unclear ownership. These lands are vast and can be repurposed for industrial, commercial, or green initiatives.

Solutions:

Reclamation & Environmental Cleanup Funds: Many governments have laws requiring mining companies to set aside cleanup funds, which can be used to restore land for new uses. *Example:* Germany's Ruhr Valley transformed abandoned coal mines into green energy hubs and industrial parks.

Special Economic Zones (SEZs): Old mines can be designated as SEZs, attracting industries like renewable energy, logistics, or manufacturing. *Example:* Australia has repurposed depleted mines into solar farms.

Eco-Tourism & Adventure Parks: Some abandoned mines become attractions for extreme sports, underground museums, or resorts. *Example:* A former salt mine in Poland was converted into a tourist destination, the Wieliczka Salt Mine.

Land Trusts & Carbon Credits: Governments or private companies can acquire old mines and reforest them, earning carbon credit revenue. *Example:* The UK turned former coal sites into the National Forest.

7.0 Unused Oil Fields

Oil fields often remain **unused due to depletion, legal disputes, or geopolitical concerns**. However, they still have economic potential.

Solutions:

Geothermal Energy Conversion: Depleted oil wells often have geothermal heat, which can be harnessed for electricity generation. *Example:* California has transformed old oil fields into geothermal plants.

Underground Gas Storage & Hydrogen Hubs: Old oil reservoirs can be used for natural gas storage, CO_2 sequestration, or hydrogen production. *Example:* The Netherlands is using old gas fields for hydrogen storage.

Real Estate & Infrastructure Projects: If safe, oil field land can be repurposed for housing, industrial parks, or airports. *Example:* Houston's old oil lands have been converted into logistics hubs.

Escrow for Legal Resolution: When oil-rich lands have multiple claimants, escrow funds can be used to settle disputes before re-leasing them. *Example:* Nigeria's oil-rich lands sometimes use escrow to resolve land disputes between communities and corporations.

8.0 Property is of no Value if it Does not Bring Rent or Return

Idle property or legacy assets that do not generate rent, returns, or cash flow are liabilities rather than assets. In the minerals, oil, and gas sector, many companies struggle with unproductive or under-litigation assets that fail to yield revenue.

How to Make Legacy Assets Profitable

1. **Monetizing Underutilized Land & Resources**
   - **Lease or Sell to Specialized Operators**: If an oil field, mine, or gas reserve is under litigation, lease it to third-party firms with the expertise and legal bandwidth to operate it. Enter into profit-sharing agreements instead of holding onto non-revenue-generating property.

- **Convert Idle Land into Revenue-Generating Assets:** Old mining sites can be repurposed into industrial zones, logistics hubs, or solar farms. Abandoned oil fields can be converted into geothermal energy projects.

2. **Financial Structuring for Maximum Yield**
   - **Real Estate Investment Trusts (REITs) for Industrial & Energy Assets:** Convert legacy oil fields, gas plants, or mining land into a real estate-backed investment and issue shares to investors. Use a royalty-based financial model where investors earn returns from mineral rights.
   - **Securitization of Natural Resource Assets:** Bundle future coal, oil, or mineral extraction rights into tradable financial instruments. This allows early monetization without waiting for legal resolution or full-scale mining.

3. **Transforming Stranded Assets into Green Projects**
   - **Carbon Credits & ESG Monetization:** Sell carbon credits by restoring mined land and converting oil fields into carbon capture zones. Use old mining pits for lithium battery mineral processing, attracting clean-energy investors.
   - **Renewable Energy Hubs:** Convert non-productive oil fields into hydrogen production or solar/wind farms. Example: Shell and BP are repurposing old refineries into biofuel plants.

4. **Litigation & Risk Management for Legacy Assets**
   - **Settlement & Arbitration to Unlock Value:** Prolonged litigation depletes asset value. Opt for fast-track settlements to unlock stranded assets.
   - **Joint Ventures with Government & Investors:** Governments often provide subsidies for brownfield redevelopment. Partnering with them ensures profitability.

9.0 Case Studies

Here are some real-world case studies of how companies have successfully monetized legacy assets in the minerals, oil, and gas sector,

1. **Shell's Repurposing of Oil Refineries into Biofuel Plants (Europe & Asia)**

Several old oil refineries were becoming unprofitable due to declining fossil fuel demand. Environmental regulations made it expensive to maintain them. Selling the refineries as-is not viable due to low demand for outdated assets.

Solution:

- Instead of shutting down, Shell converted refineries into biofuel processing plants.
- Partnered with governments and private investors to fund the transition.
- Used the existing infrastructure to produce hydrogen, biofuels, and synthetic fuels.

Outcome:

- Shell's Pulau Bukom refinery (Singapore) and Rheinland refinery (Germany) now focus on low-carbon energy, generated new revenue streams from green energy while reducing legal and environmental liabilities.

2. **Peabody Energy's Abandoned Coal Mines Repurposed for Solar Farms (USA)**

Peabody Energy, once the world's largest private coal producer, faced **bankruptcy** due to declining coal demand. Many of its old coal mines became stranded assets, costing millions in maintenance. Partnered with renewable energy firms to convert former coal mine lands into solar farms. Used existing power infrastructure to distribute electricity, reducing new capital costs. Received government incentives for transitioning to clean energy.

Outcome:

- The company cut environmental liabilities while generating new income from renewable energy.
- Created a model for stranded coal assets to be monetized rather than abandoned.

3. **ExxonMobil's Carbon Capture Project on Old Oil Fields (USA & Canada)**

ExxonMobil had several depleted oil fields that were no longer producing commercially viable crude oil. Simply abandoning these fields would result in massive environmental liabilities.

Solution:

Repurposed the fields for carbon capture and storage (CCS), injecting CO_2 underground. Earned revenue by selling carbon credits and receiving government subsidies. Used carbon capture to extend the life of certain oil wells through enhanced oil recovery (EOR).

Outcome:

- ExxonMobil created a profitable business model from old assets that would otherwise be a financial drain.
- Attracted ESG-focused investors looking for sustainable energy transition projects.

4. BHP & Rio Tinto's Mining Land Redevelopment for Urban & Agricultural Use (Australia & South America)

Large-scale iron ore and copper mines in Australia and South America reached the end of their economic life. The cost of environmental rehabilitation was significant, and the land held little traditional value.

Solution:

- Partnered with real estate developers to convert former mining sites into industrial hubs and agricultural land. Leased sections of reclaimed mining land for solar farms and data centres. Used residual resources (tailings, secondary minerals) for low-cost material production.

Outcome:

- Increased **return on investment** from previously abandoned land.
- Strengthened relations with **local governments and communities** by providing economic opportunities.

5. Saudi Aramco's Refinery-to-Hydrogen Plant Conversion (Saudi Arabia)

Aging **petroleum refineries** in Saudi Arabia faced declining profit margins as the world shifted toward **green energy**. The government wanted to reduce reliance on oil while still maximizing asset value.

Solution:

Converted refineries into **blue and green hydrogen production plants**. Partnered with **international investors** (including Japan and China) to secure funding. Used **existing oil pipelines and storage facilities** to distribute hydrogen.

Outcome:

- Created a **new energy export market** for hydrogen, attracting **billions in foreign investment**.
- Retained the value of legacy infrastructure while pivoting toward **future-proof energy**.

Key Lessons from These Case Studies:

1. **Repurposing Assets is Better than Abandoning Them** – Whether it's converting coal mines into solar farms or oil fields into carbon storage sites, there are always ways to extract value.

2. **Governments & Investors Support Transitions** – Companies that modernize legacy assets **attract subsidies, tax benefits, and ESG investors**.

3. **Infrastructure is Valuable Beyond Its Original Purpose** – Oil pipelines can be used for hydrogen, refineries for biofuels, and mines for industrial parks.

4. **Stranded Assets Can Generate Cash Flow** – Even under litigation or nearing depletion, assets can be **leased, securitized, or repurposed** for new revenue streams.

If a property **does not generate rent, royalties, or returns**, it's a **liability, not an asset**. The best strategies involve **leasing, securitization, renewable conversion, or financial restructuring** to **unlock hidden value**.

10.0 Documents, Maps, and Asset Identifiers

Loss of **documents, maps, and asset identifiers** in **old and abandoned coal, mineral, ore, oil, and gas assets** is a major challenge worldwide. It leads to **unclaimed reserves, ownership disputes, and financial losses**. Below is an overview of key regions affected:

1. Major Issues Due to Loss of Asset Records

a. **Legal Disputes & Ownership Conflicts** – Lack of proper documentation results in legal battles over abandoned resources.

b. **Unaccounted Reserves** – Many abandoned mines and fields still have untapped resources, but without records, they remain undiscovered.

c. **Environmental Risks** – Without maps and geological data, legacy sites pose serious safety hazards (e.g., underground mine collapses, oil well leaks).

2. Region-Wise Case Studies & Impact

Canada

Thousands of orphaned oil & gas wells have incomplete ownership records, causing C$1 billion+ in liabilities. Alberta has over 90,000 inactive wells, many with missing records, delaying cleanup and redevelopment.

Australia

Abandoned gold & iron ore mines in Western Australia lack clear asset identifiers, delaying repurposing efforts. The government has introduced blockchain-based mineral tracking to prevent future losses.



Figure 2. The issues of lost documents, maps, and asset identifiers are huge in all the countries.

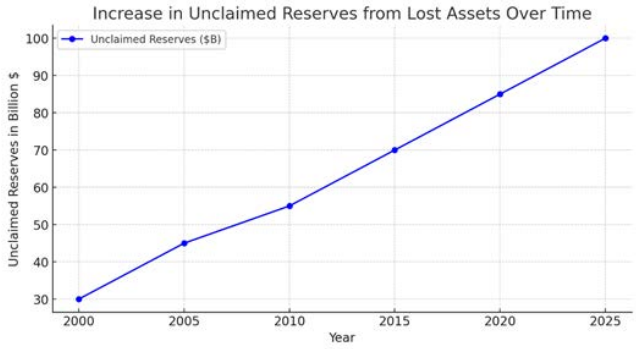


Figure 3. Lost documents resulted in unclaimed reserves and it is growing.

India

Old coal mines from British colonial times have missing records, leading to unclaimed mineral reserves. Jharkhand and Chhattisgarh have undocumented closed coal mines, making rehabilitation challenging.

USA

Over 500,000 abandoned mines, many without proper documentation, result in billions of dollars in unclaimed minerals. Texas and California have orphaned oil wells with unknown ownership, increasing methane emissions.

Saudi Arabia

Historic oil wells lack clear ownership after decades, making redevelopment difficult. Old phosphate & gold mining sites have incomplete records, preventing asset valuation.

Russia

Soviet-era oil & gas fields have missing asset registers, complicating investment in redevelopment. Eastern Siberia has unmapped coal deposits, slowing extraction.

Qatar

Offshore oil rigs & gas wells have limited historical data, impacting future resource planning. GIS technology is now being used to map old energy infrastructure.

Brazil

Iron ore mines in Minas Gerais have lost geological reports, making exploration costly. Abandoned offshore oil rigs lack asset tracking, causing financial and environmental risks.

11.0 Solutions to Recover Lost Asset Records

a) **Blockchain & Digital Ledgers** – Secure asset tracking for minerals, oil, and gas reserves.
b) **AI & Satellite Imaging** – Helps locate and assess unregistered mining/oil assets.
c) **Government Data Archives** – Restoring missing land & ownership records.
d) **Public-Private Partnerships** – Joint efforts to digitize historical mining and drilling data.

12.0 Repurposing Abandoned and Inactive Oil, Gas, Coal, and Mineral Assets

Here are some successful case studies of repurposing abandoned and inactive oil, gas, coal, and mineral assets into sustainable and economically viable projects:

1. **Oil & Gas: Turning Abandoned Wells into Geothermal Energy Sources**



Figure 4. The geothermal opportunity of 150,000 abandoned oil and gas wells in Alberta/ Canada

Case Study: Alberta, Canada

An Alberta town plans to pull a different kind of energy from the abandoned oil and gas wells that ring its outskirts. Hinton, west of Edmonton on the edge of the Rocky Mountains, is teaming up with academic researchers and the private sector to install what may be Canada's first geothermal heating system in its downtown core. And some say it could change the ground rules for industry all over Alberta. "It would be a huge boon for the economy of this province," said Johnathon Banks, a University of Alberta geologist who's working on the project. The town and Calgary-based Epoch Energy propose to re-open an abandoned gas well near the community and use heat from the bottom of the hole to warm municipal buildings. Water five kilometres down simmers at 120 C. It would be pumped topside and used to warm another fluid, which would be piped downtown to the networked buildings. The water would then be re-injected.

- Project: The Alberta No. 1 Geothermal Project
- What happened?: Old oil and gas wells were repurposed for geothermal energy production.
- Outcome: The project generates clean energy while reducing methane emissions from abandoned wells.
- Why it worked?: Infrastructure was already in place, reducing costs.

2. Coal Mines: Converting to Renewable Energy & Water Reservoirs

Case Study: Prosper-Haniel Coal Mine, Germany

- Project: Pumped Hydroelectric Energy Storage

The Prosper-Haniel coal mine in Bottrop, Germany is being converted into a pumped-storage hydroelectric reservoir to store energy. The project will help Germany transition to renewable energy and provide reliable power.

How it works

- The project will create reservoirs above and below the closed mine.
- When there is excess power from wind and solar, water will be pumped into the upper reservoir.
- When there is a need for power, water will be released from the upper reservoir, turning turbines that generate electricity.

Benefits

- The project will help Germany meet its goal of increasing renewable energy to 30% of its power mix by 2025.
- It will create economic activity in the region.
- It will help maintain power reliability when wind and solar power are intermittent.

Project partners

- The University of Duisburg-Essen
- RAG AG, the mine owner
- Bochum Universities
- DMT, a subsidiary of TÜV NORD GROUP
- The North Rhine-Westphalia Climate Protection Ministry
- What happened?: An old coal mine was transformed into an underground hydroelectric power plant.
- Outcome: Generates 200 MW of renewable energy, stabilizing the grid.
- Why it worked?: Deep mine shafts were ideal for hydro storage.

Case Study: Sutton Manor Coal Mine, UK

- Project: The Dream Sculpture Park



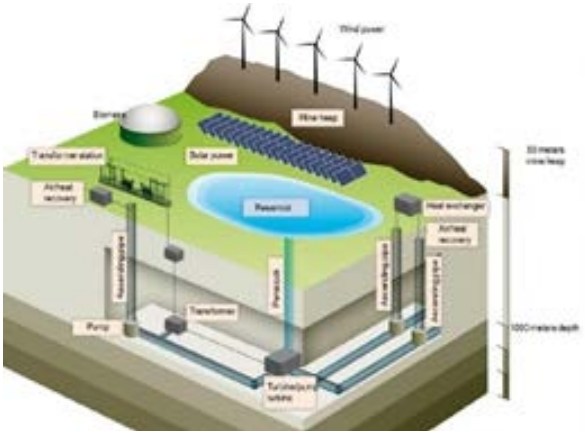


Figure 5. Prosper-Haniel Coal Mine, Germany Pumped Hydroelectric Energy Storage

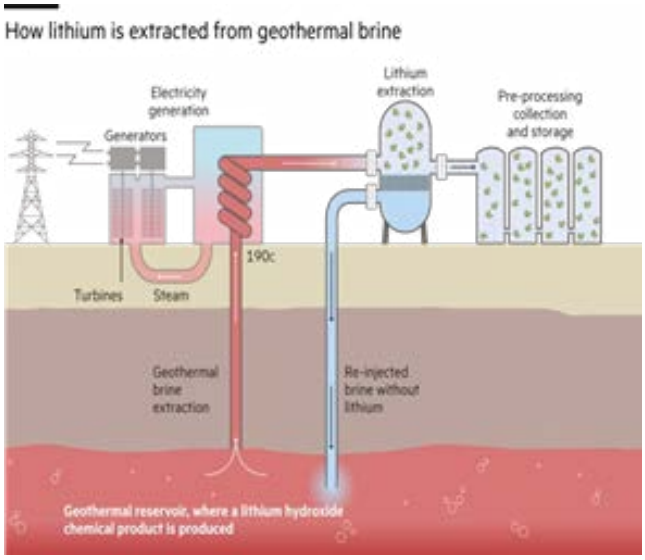




Figure 6. Lithium mining in Cornwall, UK and the process

- What happened?: An abandoned coal mine was turned into a public park with a 66-foot sculpture.
- Outcome: Boosted tourism and local economy.

3. **Lithium is extracted from abandoned tin mines in Cornwall, England. Cornish Lithium is a company that is extracting lithium from these mines and geothermal brine.**

How is lithium extracted in Cornwall?

- **Reopening disused mines**: Cornish Lithium is reopening disused china clay quarries to mine lithium.
- **Geothermal brine**: Cornish Lithium is drilling into granite to access ancient underground reservoirs of brine that contain dissolved lithium salts.
- **Direct Lithium Extraction (DLE)**: Lithium is extracted from geothermal waters deep underground.
- **Hard rock extraction**: Lithium is extracted from hard rock at repurposed china clay pits.
- **Chemical methods**: Lithium is extracted from water drawn to the surface using chemical methods.
- **Mining maps**: Cornish Lithium used old mining maps to help them find lithium deposits.
- **3D mapping**: Cornish Lithium used 3D mapping technology to help them identify mining locations.

4. **Mineral Mines: Creating Tourist Attractions & Research Centres**

Case Study: Eden Project, UK (Old Clay Mine)

- Project: Sustainable Botanical Garden

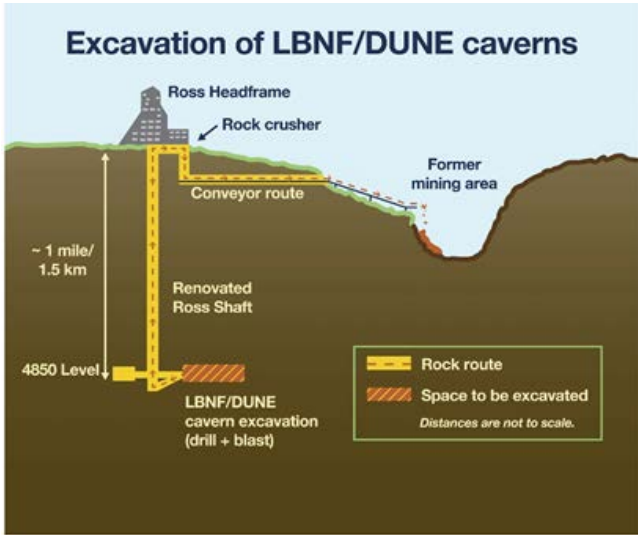
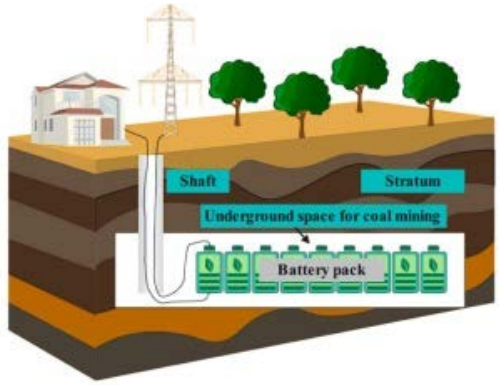


Figure 7. The Deep Underground Neutrino Experiment (DUNE), a neutrino experiment under construction.

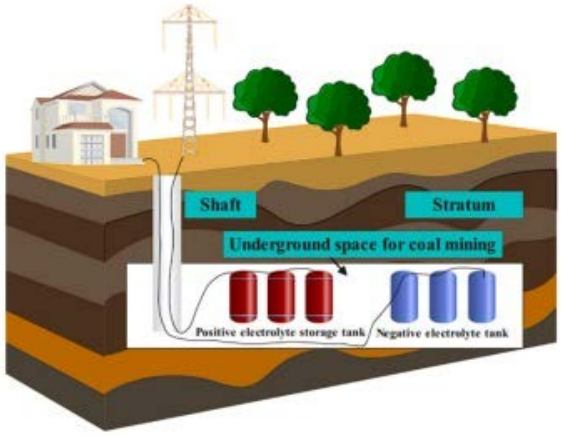
- What happened?: An abandoned clay pit was converted into the world's largest indoor rainforest.
- Outcome: Major tourist attraction, generating millions in revenue.

Case Study: Homestake Gold Mine, USA

- Project: Deep Underground Neutrino Experiment (DUNE)
- What happened?: A former gold mine was turned into a world-class physics research lab.
- Outcome: Advances in particle physics research.



(a)Electrochemical energy storage is done at the coal mine underground area.



(b)Transformation of underground space of coal mining into electrolytic cell

Figure 8(a&b). Repurposing examples.

13.0 A Share or Commodity Market (like Structure) for Inactive and Abandoned Oil, Gas, Coal, Mineral Properties

A market-like structure for abandoned and inactive oil, gas, coal, and mineral mines is possible, and some countries have already implemented similar systems. These markets function in various ways, such as mine auctions, secondary mineral rights trading, and repurposing markets[1]. Here's how they work and which countries have implemented them:

13.1 Possible Market Structures for Inactive Mines

1. **Mine Rights Exchange (Like a Stock or Commodity Market)**

Mining rights exchanges are platforms that facilitate the trading of mining rights, minerals, and related services. Some examples of mining rights exchanges include the Shanghai International Mining Exchange (SHUMX) and the China Beijing International Mining Exchange (CBMX).

- A platform where companies and investors can buy and sell rights to abandoned and inactive mines.
- Works like a commodity futures market, where investors speculate on potential mineral yields.
- Government-backed exchanges could facilitate trading.

2. **Mine Lease Auctions (Like a Land or Oil Block Auction)**
   - Governments periodically auction inactive mines to investors.
   - Companies bid based on expected mineral value and rehabilitation commitments.
   - Similar to how oil and gas blocks are auctioned today.
3. **Mineral Rights Tokenization (Like Digital Asset Trading)**
   - Mines are divided into digital shares (tokens), and investors can buy/sell fractional ownership.
   - Uses blockchain technology for transparency.
   - Future production revenue is distributed to token holders.
4. **Mine Repurposing Market**
   - A market where companies specializing in clean energy, tourism, and real estate can bid to transform abandoned mines.
   - Governments set up online platforms listing potential investment opportunities.

13.2 Countries with Market-Based Approaches to Inactive Mines

1. **China: Secondary Mining Rights Market**
   - Provinces like Shanxi and Inner Mongolia allow companies to trade the rights to inactive coal mines.
   - Investors purchase rights on government-backed exchanges to restart or repurpose sites.
2. **United States: Mine Auctions & Secondary Rights**
   - The Bureau of Land Management (BLM) and state agencies auction old mineral deposits.
   - The U.S. has a "brownfield redevelopment market" where companies can buy inactive industrial and mining sites for repurposing.

3. **Australia: Resource Exchange & Repurposing Market**
   - Western Australia and Queensland have digital marketplaces for buying/selling inactive mining assets.
   - Investors can purchase mining licenses and tailing deposits.
   - Government-run portals list old mines available for rehabilitation and commercial reuse.
4. **India: Auction-Based Allocation for Inactive Mines**
   - The Indian government auctions abandoned coal, iron ore, and bauxite mines via a transparent e-bidding system.
   - The National Mineral Exploration Trust (NMET) helps investors identify valuable abandoned sites.
5. **Russia: State-Led Secondary Resource Market**
   - Russian mining companies, under state supervision, can lease inactive mineral sites for redevelopment.
   - The government is experimenting with public-private partnerships to reopen Soviet-era mines.
6. **Canada: Exploration Rights Trading**
   - Provinces like Ontario and British Columbia have a structured marketplace where companies can trade mineral exploration permits.
   - Government lists abandoned mines eligible for rehabilitation and investment.

13.3 Challenges & Considerations

- **Valuation Issues:** Determining the value of abandoned mines is complex due to uncertain mineral reserves.
- **Environmental Liabilities:** Many old mines require costly rehabilitation before they can be resold.
- **Legal & Regulatory Frameworks:** Some countries lack proper legal backing for mine trading markets.
- **Market Liquidity:** Unlike stocks or commodities, inactive mines take time to develop, making trading slower.

13.4 Future of Mine Trading Markets

- Blockchain-based mineral rights trading could make transactions more transparent.
- AI-driven valuation models can help investors estimate potential mineral yields in old mines.
- Carbon credit markets may encourage repurposing mines for green energy projects.

A commodity market like structure for abandoned and inactive oil, gas, coal, and mineral mines is possible, and some countries have already implemented similar systems. These markets function in various ways, such as mine auctions, secondary mineral rights trading, and repurposing markets. Here's how they work and which countries have implemented them,

Possible Market Structures for Inactive Mines

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Final words

Freeing up properties stuck in long legal disputes or with deceased owners requires a combination of legal, financial, and administrative solutions. For freeing up old landed properties, unused mine lands, and oil fields, states and countries have employed innovative legal, financial, and administrative strategies. They show how these types of properties can be brought back into circulation, inspired by successful global examples.

Reference

1. https://www.firstexchange.com/mineralrights