

УДК 622.648: 621.867.7/.8

Єгорченко Р.Р., доцент кафедри транспортних систем та енергомеханічних комплексів
(національний технічний університет «Дніпровська політехніка», м. Дніпро, Україна)

GLOBAL EXPERIENCE IN UTILIZING MINED SPACES OF ORE MINES AND QUARRIES

Global Experience in Utilizing Mined Spaces of Ore Mines Demonstrates that many countries are actively repurposing these areas for new infrastructure, tourism, and environmental projects. Closed mines are transformed into tourist attractions, research centers, or energy storage sites. Successful projects that utilize mined spaces include:

•**Germany: Zollverein Coal Mine** (Essen, Ruhr Region) [1]:

The Zollverein mine, which operated until 1986 extracting coal and ore, exemplifies successful mine space reconversion. The mine has been transformed into a cultural and museum complex, housing a modern art museum, exhibition halls, and cultural spaces. In 2001, it was designated a UNESCO World Heritage Site.

•**Canada: Kidd Creek Mine** (Ontario) [2]:

Kidd Creek Mine, one of the world's deepest mines, is now partially used for waste storage post-extraction, but a significant portion of the tunnels has been repurposed for scientific research. Experiments in particle physics and cosmic ray studies are conducted here.

•**United Kingdom: Great Slate Mine** (Wales):

Former ore mines in the UK, such as Great Slate, have become tourist attractions. They are open to visitors, who can explore underground corridors and old mining structures. Some are also used for extreme sports, such as underground climbing or spelunking.

•**France: Lorraine Mines** (Lorraine) [3]:

After iron ore extraction ended, the Lorraine mines in France were converted into industrial and research centers. Zones for geothermal energy research were established here, and projects for renewable energy storage are in development.

•**Sweden: Falun Mine** (Falun)

Falun Mine, which for centuries was one of the largest copper sources globally, is now part of a cultural complex protected by UNESCO. It has become a tourist attraction, showcasing mining equipment and the history of mining.

•**Poland: Wieliczka Salt Mine** (Kraków):

The Wieliczka Salt Mine is one of the most renowned examples of mine reclamation. After salt extraction ceased, it was transformed into a tourist site. Inside, there are underground chapels carved from salt and museums that attract millions of visitors from around the world.

•**USA: Homestake Mine** (South Dakota):

Previously the largest gold mine in the United States, Homestake Mine, after its closure in 2002, became a scientific research facility. A laboratory was established here to study neutrinos and conduct particle physics experiments, as the underground environment is ideal for such research.

•**Chile: Chuquibambilla Mine:**

In Chile, following the end of extraction in some mines, local authorities plan to use these spaces for renewable energy infrastructure development. For example, there are discussions about installing solar and wind power plants on the sites of old mines.

•**Ukraine: Kryvyi Rih Mines:**

Ukraine also has examples of repurposing mined ore spaces. In Kryvyi Rih, some abandoned mines have been turned into tourist routes. These underground areas are open to visitors, providing insight into the history of mining and ore extraction technologies.

Global Experience with Quarry Reclamation Demonstrates that mined quarries can be successfully transformed into new functional spaces. Such projects help minimize the ecological impact of resource extraction while creating infrastructure that fosters socio-economic development. Four primary ways that mined quarries are used in different countries include:

1. Environmental Rehabilitation and Reducing Environmental Impact.

After extraction ends, quarries are often ecologically vulnerable. Without reclamation, they may cause soil erosion, dust pollution, water contamination, and biodiversity loss. Successful projects, like the Eden Project in the UK [4], show that these areas can be integrated into ecosystems, even enhancing their biodiversity value.

2. Socio-Economic Opportunities.

Quarry reclamation can be a powerful driver of tourism development and job creation. For instance, the Intercontinental Shanghai Wonderland [5] has become a popular hotel complex, attracting tourists and boosting regional development.

3. Cultural and Educational Initiatives.

Mined quarries are often used to create unique cultural spaces, such as the Dalhalla concert hall in Sweden or museums across Europe [6], which help preserve the legacy of extraction activities and support educational development within communities.

4. Sustainable Development and New Urban Approaches.

Utilizing abandoned quarries aligns with sustainable development goals, as it reduces the need for new land allocations and promotes the reuse of already disturbed areas [7]. This approach demonstrates that problematic landscapes can be seen as resources rather than burdens.

Thus, transforming mined quarries is not only an ecological responsibility but also an economic and cultural opportunity, creating unique spaces for communities and improving quality of life.

Given the number of abandoned quarries, Ukraine should consider international experience in the recreational and cultural use of mined spaces. This will help improve citizens' quality of life and foster environmental restoration in the regions.

Список використаних джерел

1. Kang, D. J. (2007). Reuse methodology for abandoned mines as industrial heritage. *Journal of the Korean Institute of Landscape Architecture*, 34(6), 111-129.
2. Politi, C. (2023). Potential application of RES and underground H₂ storage in abandoned mines. *Materials Proceedings*, 15(1), 30. <https://doi.org/10.3390/materproc2023015030>
3. Ha, M. K., Kim, A. H., & Lee, H. C. (2013). A study on the spatial planning of community in urban underground space for sustainable urban regeneration. *Korean Institute of Interior Design Journal*, 22(3), 205-216. <https://doi.org/10.14774/JKIID.2013.22.3.205>
4. Palmer, A. (2016, March 15). Adaptive Re-Uses for Old Mines. *Mental Floss*. Отримано з <https://www.mentalfloss.com/article/76571/15-adaptive-re-uses-old-mines>
5. ArchDaily. (n.d.). Revitalizing Abandoned Landscape in China: Quarries as Unconventional Spatial Resources. Отримано з <https://www.archdaily.com/983995/quarries-as-space-and-resource-tiantian-xu-carves-into-the-rocks-to-revitalize-abandoned-landscape-in-china>
6. Whitbread-Abruta, P. (2020). *101 Things to Do with a Hole in the Ground* (2nd ed.). Eden Project Books. <https://shop.edenproject.com/products/102-things-to-do-with-a-hole-in-the-ground>
7. SpringerLink. (n.d.). Re-Build Landscape: Design for the Reuse of Abandoned Quarries. Отримано з https://link.springer.com/chapter/10.1007/978-3-030-59743-6_50