Challenge for the Engineering Cup

LEAN MINE

Focus area

Solutions in the field of underground mining efficiency and technological reliability of equipment

Objective

To develop a technology-based solution powered by artificial intelligence that reduces equipment accident rates, improves production efficiency, and fosters a culture of lean production in mining operations.

Company overview

SUEK is the largest coal company in Russia and one of the leading coal and energy companies in the world. It is among the top five largest coal suppliers to the global market.
In 2021, the company was included in the Forbes ranking of the "200 Largest Private Companies in Russia," taking 17th place with revenue of 483.3 billion rubles.

Founded in 2001, SUEK was created with the idea of consolidating previously fragmented coal enterprises across Russia to form a major industry holding.
In 2006, SUEK became the largest coal exporter in Russia. The company produces 110 million tonnes of coal per year, and its proven reserves amount to 7.5 billion tonnes (No. 5 globally).

More than 70,000 people work across SUEK's coal, energy, and transport facilities in 12 regions of Russia.
SUEK operates 8 underground mines and 19 open-pit mines in Siberia and the Russian Far East, producing around 24% of all coal in Russia (as of 2019).
The company produces high-calorific coal with low sulphur and nitrogen content, adhering to international standards of environmental and industrial safety.

Context and relevance

Reducing production costs is one of the key priorities for any modern mining company.
In a highly competitive environment with rising equipment maintenance costs, it is especially important to prevent emergency downtime, which directly affects production output and overall profitability.

Most unplanned stoppages occur due to unpredictable equipment failures and inefficient maintenance strategies. Losses caused by downtime represent a significant share of operational expenses.
The use of artificial intelligence, data collection systems, analytics, and forecasting technologies can significantly improve equipment reliability and reduce the number of emergency stoppages.

Problem

According to data from the mining site, the total emergency downtime of equipment in 2024 amounted to **164 days (3,936 hours)**.
The average production rate of the enterprise is **1,000 tonnes of coal per hour**, and the value of one tonne is **8,000 rubles**.
Every hour of downtime results in direct financial losses and reduced production efficiency.

The company aims to implement a lean production approach and increase equipment utilisation efficiency through the adoption of digital technologies.

Challenge for participants

Develop a digital system based on artificial intelligence technologies that will allow:

- collecting and analysing equipment performance data;
- predicting failures and technical malfunctions;
- providing recommendations for maintenance and component replacement;
- minimising emergency downtime.

The solution must be technologically feasible, economically justified, and suitable for integration into ongoing production operations.
Main objective: to reduce emergency equipment downtime by half.

Initial data

- Emergency downtime in 2024: 164 days (3,936 hours)
- Average production rate: 1,000 tonnes of coal per hour
- Value of 1 tonne of coal: 8,000 rubles
- Type of site: underground longwall mining section
- Production cycle: 24/7 (8,760 hours per year)

Constraints

- The solution must be compatible with existing equipment control systems
- No suspension of mining operations is allowed during implementation
- Compliance with industrial safety and occupational health requirements is mandatory

Expected Deliverables

Participants should provide:

1. A concept for the digital solution or equipment monitoring system
2. A data collection and analysis algorithm (prototype model or AI logic)
3. A sample visual interface or operator/engineer dashboard
4. An economic assessment and calculation of impact (downtime reduction, productivity increase, project payback)
5. An implementation plan - stages, timeline, expected performance indicators

The final result must be presented in the form of a **presentation** and an **explanatory note**, including a brief concept, the technical solution, and the expected effect.

Additional materials

Appendix 1. Information about SUEK

Information About SUEK

1. Name

Siberian Coal Energy Company (SUEK)

2. Industry

Mining industry, energy, and logistics

3. Mission and Key Values

SUEK's mission is to improve people's quality of life by ensuring safe and sustainable energy supply.
The company adheres to the following values:

- occupational safety and responsibility for human life;
- integrity and professionalism;
- efficiency and technological advancement;
- sustainable development and environmental stewardship.

4. Number of Employees

More than 70,000 employees across Russia.

5. Brief Description of Operations

SUEK is the largest coal company in Russia and one of the leading coal producers globally.
Its core activities include:

- open-pit and underground coal mining and processing;
- generation and supply of electricity and heat;
- transportation and export of coal through its own logistics infrastructure.

SUEK's facilities are located in Siberia, the Russian Far East, Kuzbass, and other regions of Russia.
The company actively implements innovations, digital technologies, and solutions in engineering, sustainable development, and environmental management.