

Evaluation and Actions that can Assure a Stable Management of the Open Pit Mine “ELLATZITE”-Main Elements, Measures of the Success.

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ABSTRACT The mine “ELLATZITE” is one of the biggest active open pit mines on the Balkan peninsula for copper and ore extraction. The annual production rate for 2008 reached 56 million tonnes of material mined. The developments of the mine works in 2009 conforms to the state of the world metal markets and to the possibilities for the development of the mine without discredit its existence until 2022 – the deadline of the concession. The need to maintain a balanced level of extraction imposed the elaboration of a methodology that helps the decisions taking process and the fulfilling of procedures for improving the organization of work. As basics are taken the indicators for the main mining equipment: Availability, Utilization, Production Efficiency, Overall Equipment Effectiveness, that are formed by processing the information, related to the main production equipment, provided by the GPS-based Fleet management system of the mining complex “Sky Links”. The results of the taken decisions are seen in: stable increase of the extraction in 4 consequent years, reduction of the fuel consumption, increase of the productivity of the main mining equipment and reduction of the cost of mining.

1 INTRODUCTION

The copper–porphyry deposit “ELLATZITE” is situated in the south peripheries of the west Balkan structure –metalogene zone near the Srednogorie zone.

The mine “ELLATZITE” is known as one of the biggest functioning open-pit copper mines on the Balkan Peninsula.

The annual production rate for 2008 reached 56 million tonnes of material, from which approximately 12.8 million tonnes of low-grade copper ore.

The project for development of the mine for 2009 conforms to the beginning of the economical crisis in the last three months in 2008 that became deeper. In this sense it stipulates reaching production levels at about 42 million tones of material mined, keeping the same level of ore production. Those production levels aim to ensure the life of the

mine for the next 7-14 years.

The methodology created in 2004 for the evaluation of the production process, on the base of which are planned and fulfilled the procedures for improvement of the work is ratified as efficient to be able to maintain a constant, balanced level of extraction.

The procedures that created the possibility to reach to a successful determined production tasks are a complex of measures in the following areas: organization of work, innovation in the work /providing new mining equipment/ and others.

In the basis of the taken decisions are indicators that are as follows: Availability, Utilization, data for them are formed after processing the information for the main production equipment from the GPS-based Fleet management system of the mining complex “Sky Links” in use since

01.11.2003.

The results are visible as increase of the extraction compared to every previous year, reduction to fuel consumption, increase of the productivity of the main mining equipment and the labour productivity.

2 PRINCIPAL ELEMENTS OF THE PRODUCTION

While analyzing the production activity of the complex is taking in mind the contact between the following elements:

1. Organization and state of the production technique and mechanization
2. Organization and state of the maintaining technique and mechanization
3. Organization of the repair activities
4. Plan and control of the production processes
5. Organization and hierarchic structure in production management

Their state is determined from the values of the following indicators: Availability, Utilization, Production Efficiency, and Overall Equipment Effectiveness, which are reviewed in details below.

2.1 Availability, Utilization

2.1.1 Availability

The proportion of time the equipment is in condition to be used according its intended purpose.

$$= \frac{\text{TotalHours} - \text{MaintenanceHours} - \text{DowntimeHours}}{\text{TotalHours} - \text{MaintenanceHours}} \times 100 \% \quad (1)$$

2.1.2 Utilization

The proportion of the time that the equipment is available that it is used according its intended purpose.

$$= \frac{\text{TotalHours} - \text{DowntimeHours} - \text{StandbyHours}}{\text{TotalHours}} \times 100 \% \quad (2)$$

The traditional view of Availability and Utilisation maintains that achieving high equipment Availability is a Maintenance responsibility, while achieving high utilisation is a Production responsibility. By maintaining both high equipment utilisation and high equipment availability, maximum output will be achieved from the equipment.

Consider, however, the situation where a haul truck is operating, but, because of a problem with the engine, it can only haul at 80% of its normal speed. The truck is available, and being utilised, according to our definitions, but clearly maximum output is not being achieved.

Another situation: a shovel trips, causing a 15 minute delay while it is reset.

During this time, the haul trucks queue at the shovel. Once again, those trucks are available, and being utilised, but maximum output is not being utilised.

Clearly, we need a better measure of overall equipment performance.

This is achieved with the introduction of a new indicator, named Production Efficiency.

2.1.3 Production efficiency

The ratio of actual output from a machine (which meets the required quality standards) to its rated output, during the time that it is operating

$$= \frac{\text{Actual Production}}{\text{TotalHours} - \text{DowntimeHours} - \text{StandbyHours}} \div \text{RatedCapacity}(\text{units / hour}) \times 100 \% \quad (3)$$

Poor reliability, while having some impact on equipment availability, is likely to have a bigger impact on Production Efficiency, due to the inefficiencies associated with starting up and shutting down equipment, and the time and effort that it takes to get the production operation back to a steady state situation. It is fair to say that the costs of poor reliability generally show up in lower production efficiency. This is a measure that is often not given the same emphasis as Availability or Utilisation measures, and in any case is generally considered to be a Production responsibility, with the impact of Maintenance on this figure generally being ignored.

The Overall Equipment Effectiveness is the 'next step measure' to assess the effectiveness of the utilization of the asset and can be defined using the following formula:

2.1.4 Overall equipment effectiveness

$$= \text{Availability} \times \text{Utilization} \times \text{Production Efficiency} \quad (4)$$

Overall Equipment Effectiveness is closely linked to the accounting measure, Return on Assets, and provides us with an indication of how well we are using our investment in Plant and Equipment.

If Availability, Utilisation and Production Efficiency were all equal to 90%, we might be tempted to think that we are doing a pretty good job, but in fact, the Overall Equipment Effectiveness for this example only equals 73%. This means we are only getting 73% of the total potential output out of this equipment.

Increasing this figure will mean that we can produce more with the same equipment, or potentially, could produce the same amount with less equipment – with an investment of in excess of \$1m required for a large haul truck, the savings could be considerable and could be used in other directions.

3 PRODUCTION RESULT OF THE COMPLEX FOR 2008

The idea of introducing the above mentioned indicators in the management of the production process came with the implementation on-site of the GPS-based Fleet management system of the mining complex “Sky Links” since month of November 2003, which gave us all the necessary data for helping the decision making process. We collected enough information to manage to give an impartial assessment of the usage of the main equipment (shovels and trucks) and the distribution of its non-production time.

The previous year, 2008, is characterized as the best year in the 20th history of the mining complex, taking into consideration that the initially discovered and approved for extraction ore reserves were actually mined in the year 2004. We were able to attain those results thanks to:

1. Technical measures: It was approved and financed a new Project for the development of the mine called: “140+20 million tones of ore”. That gave us the

possibility to create a high productivity working areas with preliminary determined indicators for the exploitation of the equipment.

2. Innovation: During the last two years were bought two shovels HITACHI EX-2500 and the fleet of trucks was basically renewed with: BELAZ 75131 /130 tones/ and HITACHI EH -1700.

3. Organisation: Increase of the productivity rate of the equipment and at the same time reduction of the operational costs, especially for the fleet working in the overburden area.

4. Market: Favourable prices of the copper on the London Stock Exchange for the metals.

As a result of all mentioned above in 2008 was created an organization for stable mining for more than 4 000 000 tones of material per month. Those factors, as well the accomplishment of the working project for 2008, contributed to achieve the main target of the management to assure the mining activities until 2022.

In Table 1 is presented the summary of the achieved mining production in “Ellatzite” for the previous four years 2005, 2006, 2007 and 2008.

Table 1. Mining production.

Year	2005		2006		2007		2008	
	tonnes	%	tonnes	2005-2006	tonnes	2006-2007	tonnes	2007-2008
Ore, kt	11 857	100	12 584	106%	13 005	103%	12 756	98%
Waste, kt	21 864	100	26 606	122%	38 981	147%	43 089	111%
Metal production, kt	45,6	100	44	97%	46,1	105%	44,5	97%
Waste:Ore	1,844		2,114		2,997		3,378	

Shovels – below are presented the relative distribution of the reasons for downtime standby (Fig.1) and the values of the indicators for Availability and Utilization (Fig.2) for 2004, 2005, 2006, 2007, 2008 and the first 5 months from 2009.

Trucks – below are presented the relative distribution of the reasons for downtime standby (Fig.3) and the values of the indicators for Availability and Utilization

(Fig.4) for 2004, 2005, 2006, 2007, 2008 and the first 5 months from 2009.

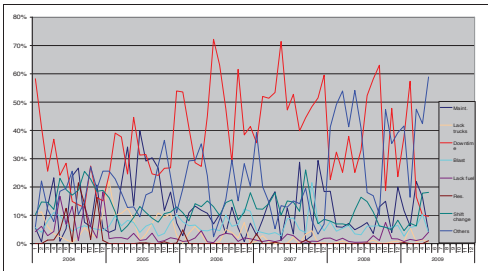


Figure 1. Relative distribution downtime/standby.

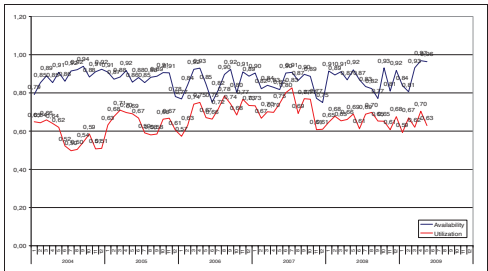


Figure 2. Availability and utilization.

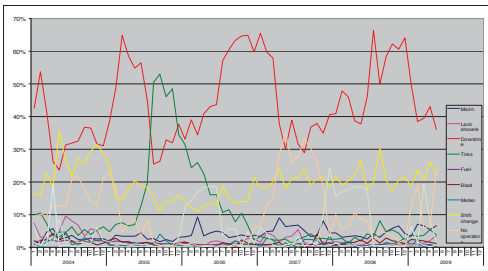


Figure 3. Relative distribution downtime/standby.

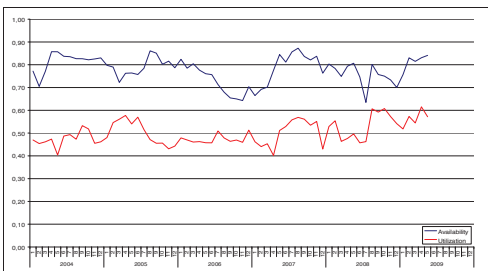


Figure 4. Availability and utilization.

The presented figures give us good initial information about the main reasons for the downtime/standby of the equipment. On them we can see the results from the undertaken measures related to the organization, as well as, introduction of new equipment. Those periods are clearly defined and reflected in the increase of the Availability in the corresponding months. The results of the organizational measures, related to the shift-change in place can be clearly seen in the beginning of the year.

4 PERSPECTIVES

The management of the mining company “Ellatzite” is facing the great challenge to keep maintaining a stable production policy in the dynamically changing environment of the world-spread economical crisis by achieving its production targets of: Availability – 90 % and Utilization – 75 %.

5 CONCLUSION

The presented methodology gives an idea for the assessment of the management of the mine, while trying to introduce the best available techniques, regarding the utilization of the main mining equipment. It gives a possibility to analyze every factor, influencing the observed processes, and to define the cracks, weak points in the management and the organization of the mine.

It ensures a consecutive control over the results from the determined procedures, related to the improvement of the production process.

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Production information from “ELLATZITE –MED” AD.