







Energy Management in The Colombian Mining Industry – An approach for Energy Characterization

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I. Introduction

More with less Reduce operating costs with higher quality levels

- 1) Measure, recording and monitoring.
- 2) Interpret, decipher and process.
- 3) Predict through historical records.
- Create strategies and plans to upgrade energy efficiency.





II. Methodology

1) Identify SEUs

2) Technology implementation

3) Data collection

4) Application of ISO 50006

II. Methodology Obtaining relevant energy performance information from the energy review Defining the energy Defining and Defining and Defining and quantifying the quantifying relevant quantifying static performance indicators energy flows boundaries variables factor Identifying energy performance indicators Identifying users of energy performance Determining the specific energy performance aga fácil por Internet en www.chec.com.co characteristics to be quantified indicators Continuous Improvement AM A D & Establishing energy baselines Determining a suitable baseline period Determining and testing energy baselines Using energy performance indicators and energy baselines Determining when Calculating energy Communicating changes in performance improvements energy performance normalization is needed

Fig. 1: Overview of energy performance and its continuous assessment.

Maintaining and adjusting energy performance indicators and energy baselines



II. Methodology Obtaining relevant energy performance information from the energy review Defining the energy Defining and Defining and Defining and quantifying the quantifying static performance indicators quantifying relevant energy flows boundaries variables factor Identifying energy performance indicators Identifying users of energy performance Determining the specific energy performance indicators characteristics to be quantified Continuous Improvement Establishing energy baselines $KPI_2 = \frac{Ton_trit}{kWh}$ Determining a suitable baseline period Determining and testing energy baselines $KPI_3 = \frac{kg_oro_fundi}{kWh}$ Using energy performance indicators and energy baselines Determining when Communicating changes in Calculating energy performance improvements energy performance normalization is needed

Fig. 1: Overview of energy performance and its continuous assessment.

Maintaining and adjusting energy performance indicators and energy baselines



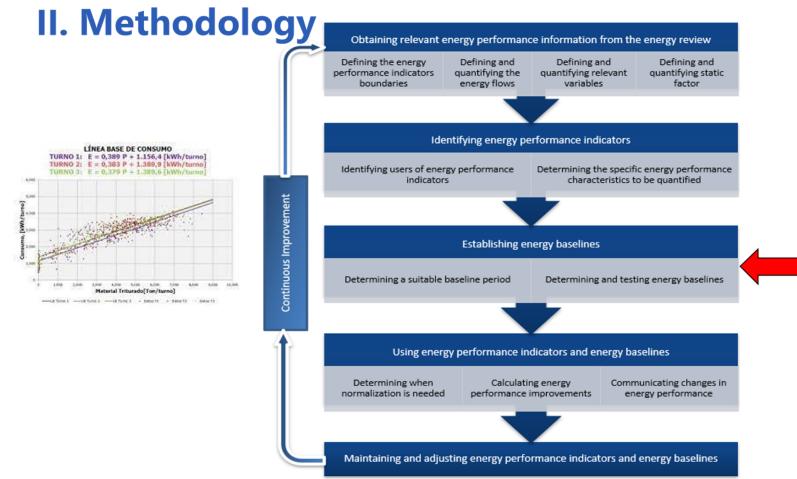
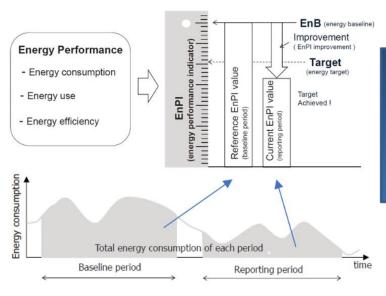


Fig. 1: Overview of energy performance and its continuous assessment.



II. Methodology



Continuous Improvement

Fig. 2: Relationship between energy performance, EnPIs, EnBs and energy targets



Fig. 1: Overview of energy performance and its continuous assessment.



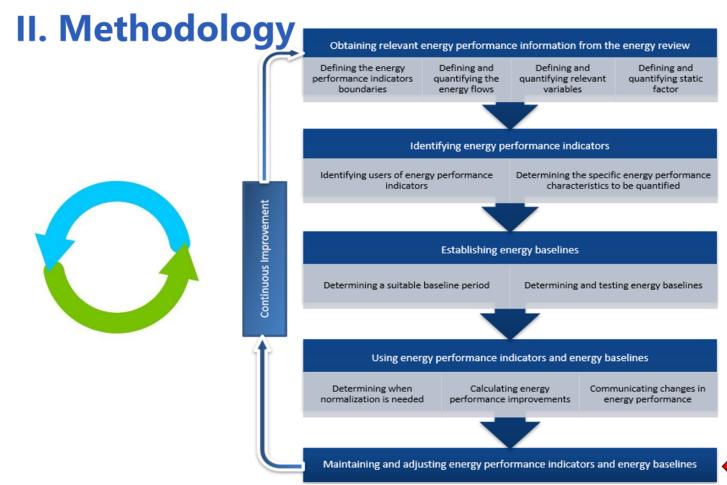


Fig. 1: Overview of energy performance and its continuous assessment.



III. Study Case: Gold Mine

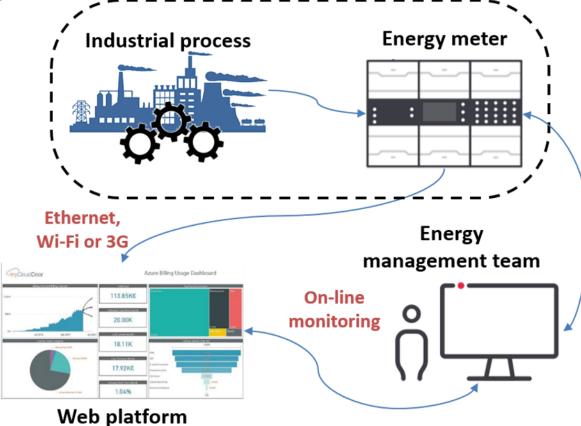


Fig. 3: Architecture of a system for monitoring electricity consumption.



III. Study Case: Gold Mine



Fig. 4: CIRCUTOR Line-EDS-Cloud

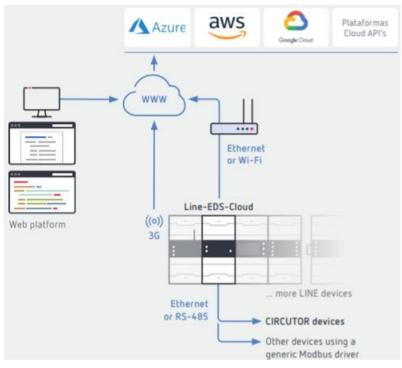


Fig. 5: Connectivity of CIRCUTOR Line-EDS-Cloud



IV. Results

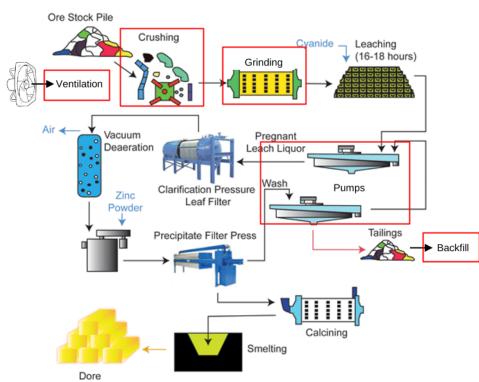


Fig. 6: Gold process description example

Electric users	Average power consumption [kVA]	Percentage of utilization
Pumps	2.183	13,9 %
Gravimetric concentration	23	0,1 %
Leaching	508	3,2 %
Conveyor	300	1,9 %
Backfill	1.693	10,8 %
Mobile and fixed equipment	1.300	8,3 %
Ventilation	1.985	12,7 %
General services	830	5,3 %
Crushing	657	4,2 %
Electrowinning	29	0,2 %
Agitators	490	3,1 %
Grinding	4.630	29,5 %
Filters	256	1,6 %
Compressors	322	2,1 %
Smelting	70	0,4 %
Others	407	2,6 %
Total	15.684	100,0 %

Table 1: Electrical users of the mining process aggrouped by its activity and their respective percentage of electrical energy consumption (plant and mine).

V. Conclusions

- The SEUs of the process are **grinding**, **backfill**, **ventilation** and **pumps**, which account for about 70% of the total energy.
- Each energy monitoring unit has a cost of US \$ 2.300.
- There are many process in the industry mining which use electricity, however its important to follow the adequate processes which represents the major energetic consumption.



VI. Questions



