



# TECHNICAL MODEL OF MANAGEMENT

## DIVISION ANDINA - GERENCIA DE MINAS



21 de Mayo 2007, Phoenix Az USA  
Haulage & Loading 2007

Mine management of Andina Division, bases its Technical Model of Management on the Creation of Value. The value creation is sustained respecting: people safety, the equipment and facilities, environment and quality.

The contribution to added value of the Division by mine management side depends on the performance that this Management makes via maximization of assets performance that they are responsible of, in production logic.

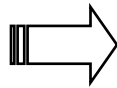
$$\text{Production} = \text{Performance} \times \text{Time}$$

The Mining Operation contributes to the aggregation of value only by efficiency via.

$$\text{EVA} = [(\text{Price} * \text{quantity}) - (\text{Direct Costs} + \text{Indirect Costs})] - \text{WACC}$$

The contribution to the value aggregation depends on the management that exerts as Workers, as well Supervision, focusing in the maximization of the performance of assets and the containment of costs.

**Workers**



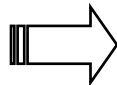
**Maximization of assets performance**

- To Minimize and control the unproductive times
- To maintain the performance the biggest quantity of hours in every shift.

**Contention of Costs**

- To use productively, safety and responsibly, the equipment and the facilities.

**Supervision**



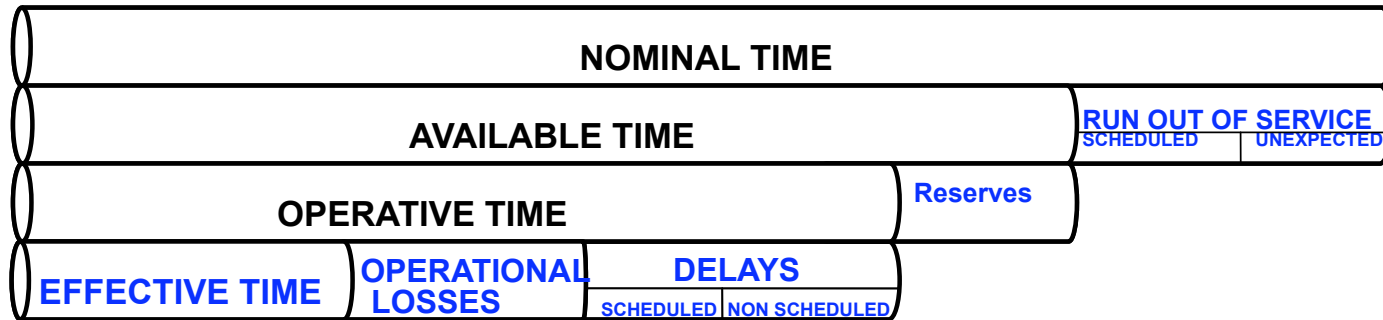
**Maximization of Assets Performance**

- To improve operative conditions that optimize the operational performances and the biggest quantity of hours in every shift
- To Control the correlations of different factors that affect production.
- To manage maintenance variables.

**Contention of Costs**

- To use the equipment and facilities only when is strictly necessary.
- To perform a productive administration in a safe and responsible way

# TIME DISTRIBUTION CHART



Time	Definition
Nominal	Total time of the period.
Run out of Service	Time in which the equipment is not available to make its functions due to have faults in its systems or for being given to maintenance or for being repaired.
Available	Time that the equipment is mechanically qualified to work.
Reserves	Time in which the equipment is mechanically qualified to work, but is not being used in operation.
Operative	Time in which the equipment is being used by an operator in some task.
Delays	Times of all the interruptions occurred in the productive process. They are divided in: Programmed delays, those that appear from shift to shift in operation and non Programmed Delays which are those that can or cannot appear from shift to shift operation.
Operational losses	Operative times in which, the interaction that more than a cycle produces delays. Example Shovels and/or loaders with extractions Trucks.
Effective	Time in which the equipment is really making the habitual production for which it was designed for.

## INDICATORS AND CORRELATIONS

$$Availability, \% = \left( \frac{Available\ Time}{Nominal\ time} \right)$$

$$Use, \% = \left( \frac{Effective\ Time}{Nominal\ Time} \right)$$

$$Effective\ use\ (UE\%), \% = \left( \frac{Effective\ Time}{Available\ Time} \right)$$

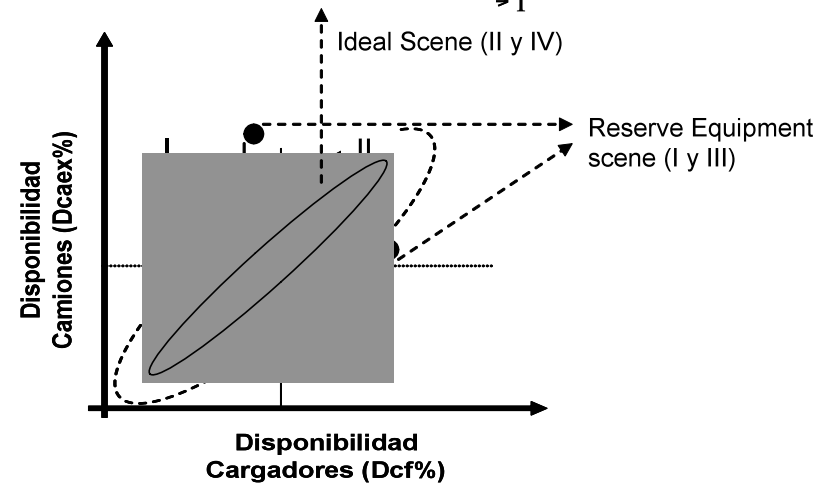
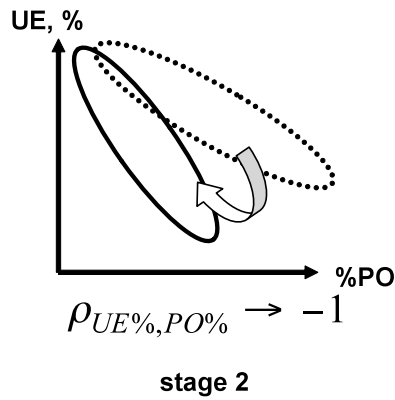
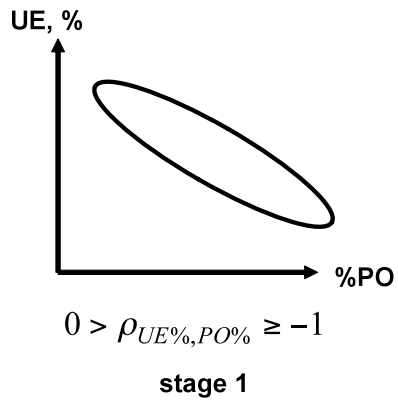
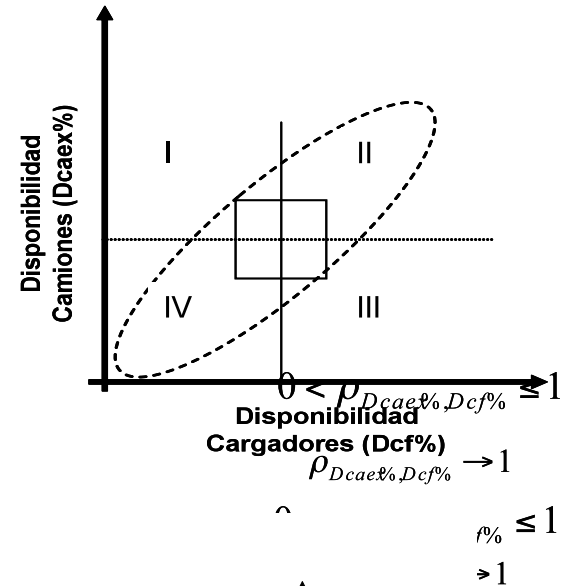
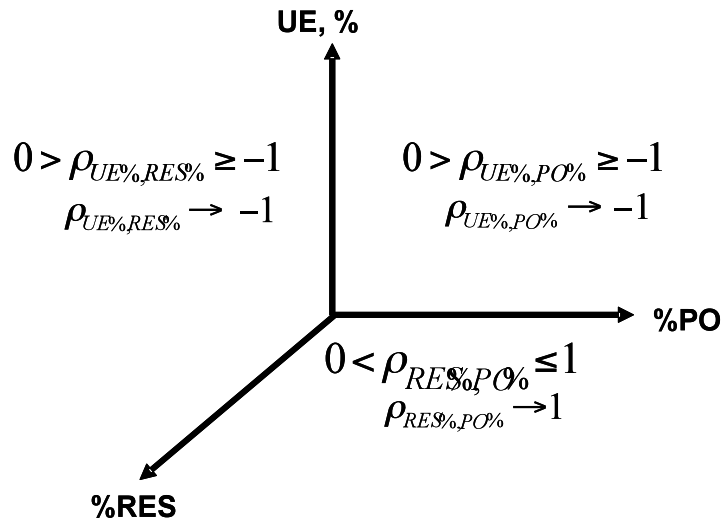
$$\%PO, \% = \left( \frac{Operational\ losses\ time}{Available\ Time} \right)$$

$$\%RES, \% = \left( \frac{Reserve\ Time}{Available\ Time} \right)$$

$$\text{Correlation coefficient} \quad \rho = \frac{Cov(x, y)}{\sigma_x \sigma_y}$$

$$1 \geq \rho_{x,y} \geq -1$$

# INDICATORS AND CORRELATIONS



# EFFICIENCY FACTOR

From the Technical Model of Management, we will define a Factor of Efficiency (b) for Open pit Mine that allows us to quantify the contribution to the aggregation of value from Mine Management of Andina Division.

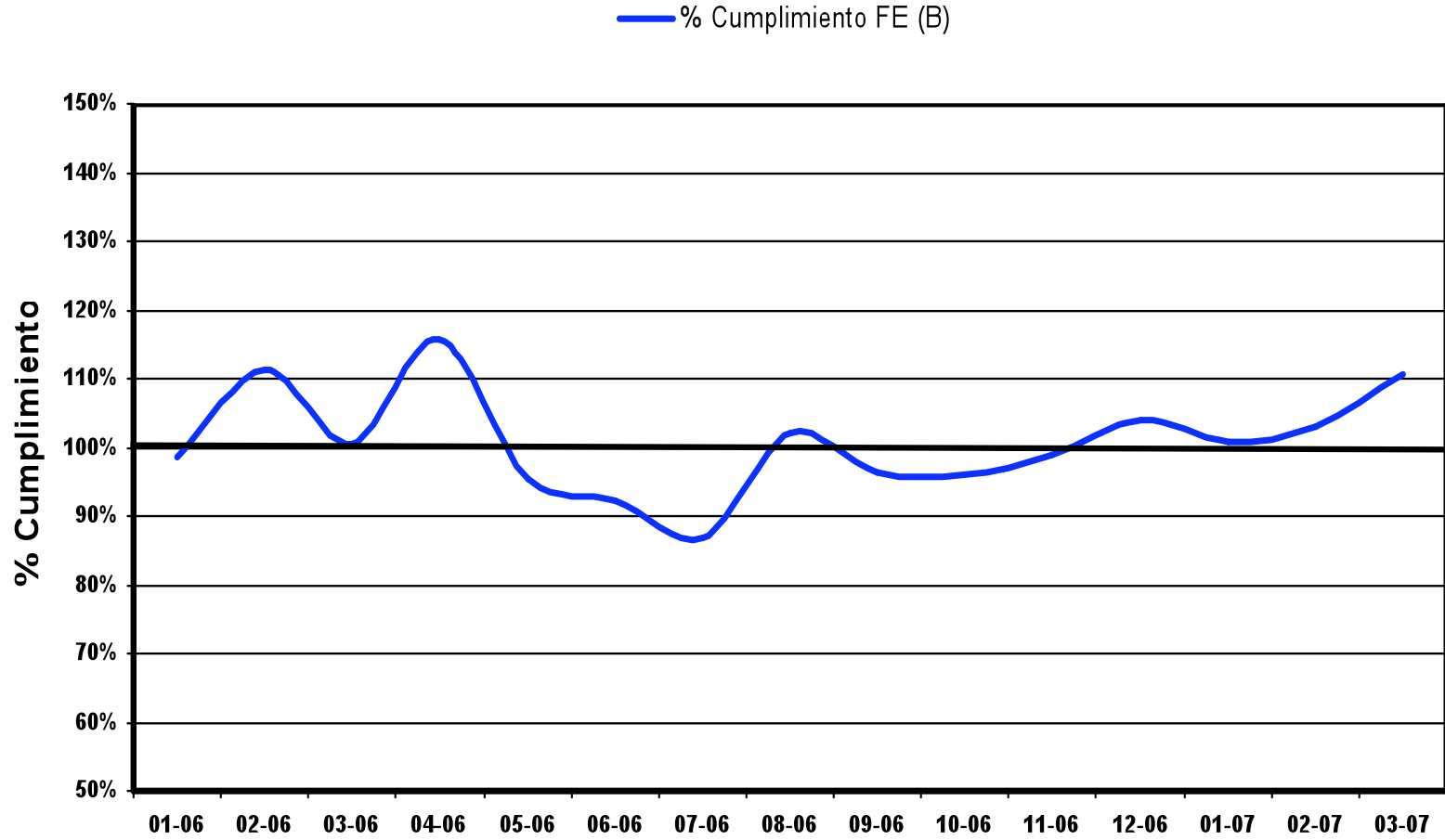
$$B = \left[ \alpha \frac{\text{Real Performance}}{\text{Performance plan}} \right] - \left[ \beta \text{ Operational losses} + \chi \text{ Economic losses} \right]$$

Thus the factor of efficiency (B), for Rajo Mine, will be:

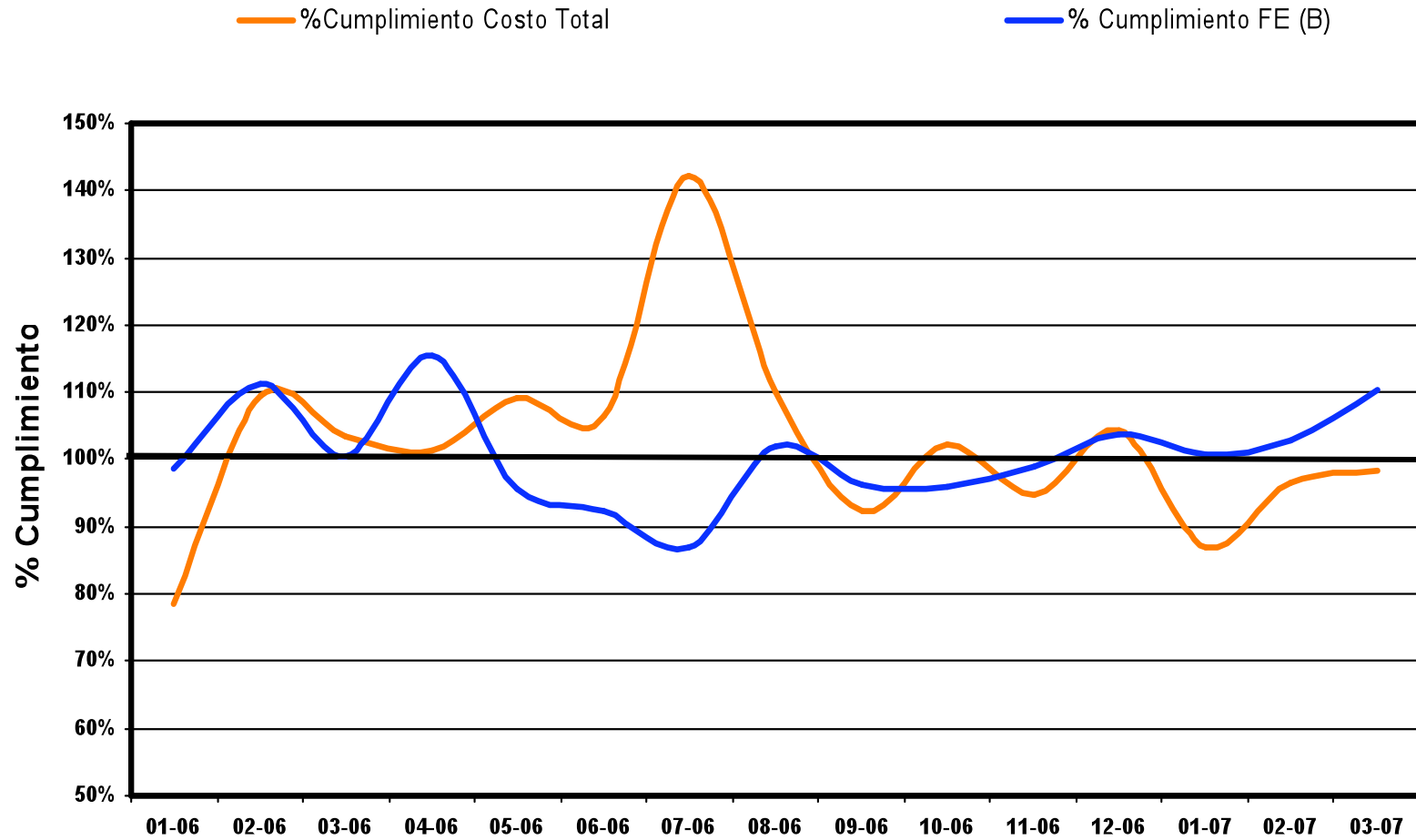
$$B = \left[ 0,5 * \left( \frac{\text{Rend RealCaex}}{\text{Rend Plan Caex}} + \frac{\text{Rend Real CF}}{\text{Rend Plan CF}} \right) - (0,5 * (\%POCaex + \%PO CF) + US \$ Losses) \right]$$

The efficiency factor promotes making a work under a certain standard of performance, by the greater of possible working time in shift obtaining an increase of Effective Use (UE%) by a diminution of the Operational Losses (%PO) and taking care of our equipment and facilities without incurring economic losses.

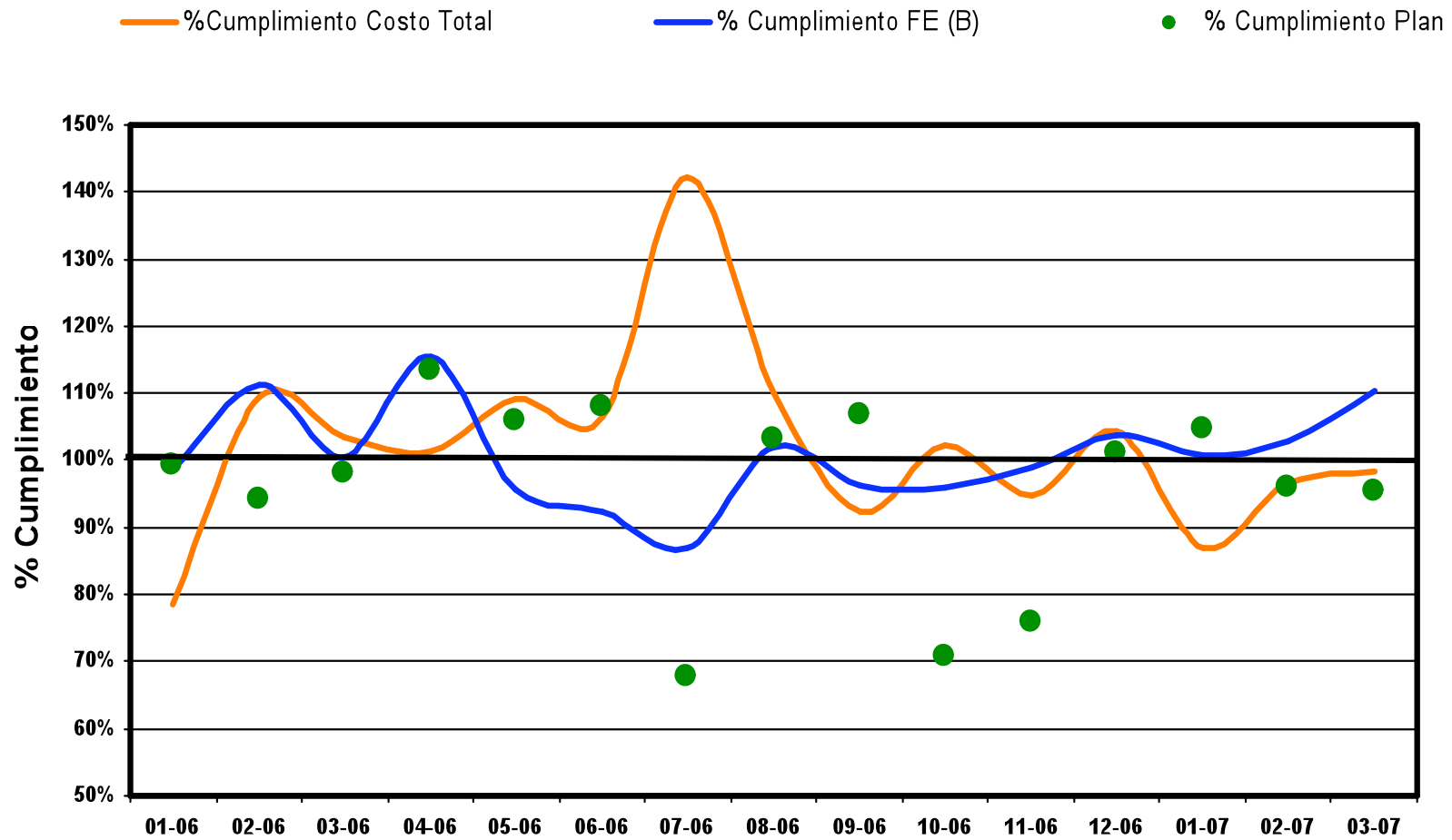
# Efficiency Factor (B)



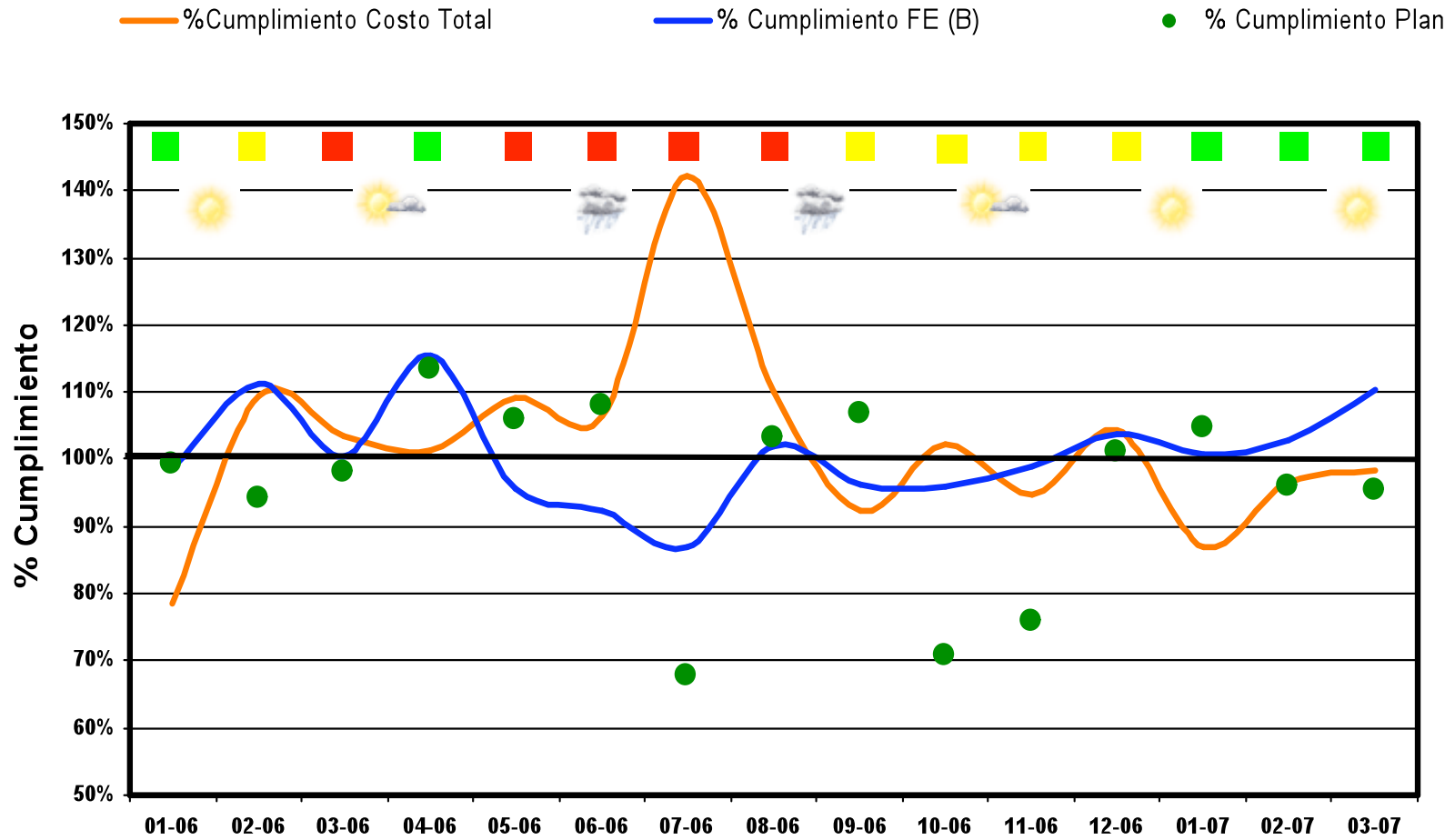
# Efficiency Factor (B)



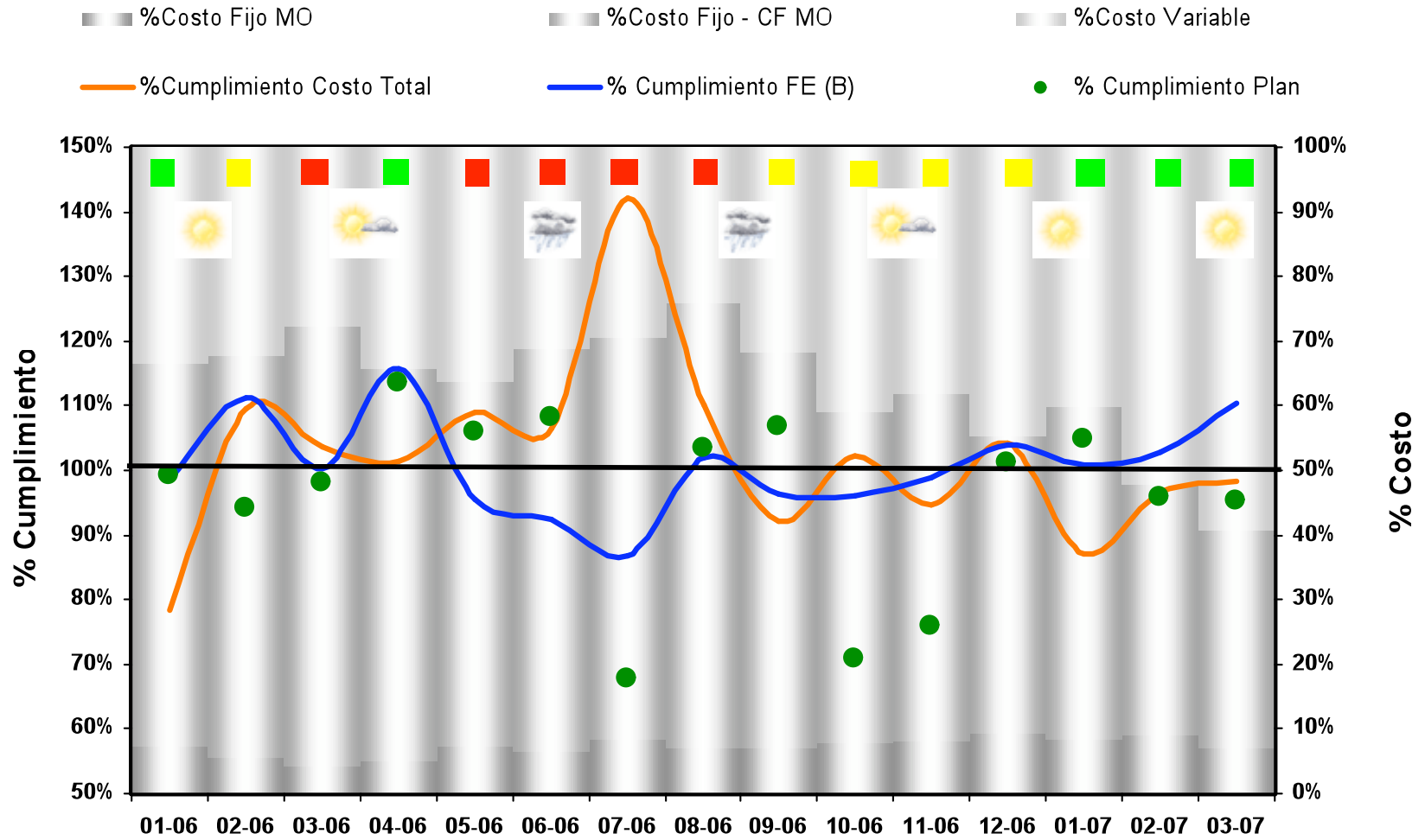
## Efficiency Factor (B)



# Efficiency Factor (B)



# Efficiency Factor (B)



## Conclusions

- The Business of Mining Operation Adds Value only by means of Efficiency.
- The production is a result of an optimal administration of operation critical variables.
- The use of dispatch systems, under a correct policy of management aligned with the objective of the mining business, are the key tool to reach the expected results.
- The Efficiency Factor is the management tool that Andina Division has decided to use to measure the variable incentives of its workers (Bonds).
- The Production can be obtained: with Less Resources or it is possible to be increased with the same resources level; “to do the same with less either doing more with the same one”.
- If our objective is to maximize the use of the assets, will be in addition necessary to be the owner of the assets?

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**Thanks You**



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