



Smart Solutions

Case study: Improving overall equipment efficiency

Application: *Surface, copper*

Location: *Antofagasta – Chile*

Products featured: *Electric Shovels*

Challenge: Improve efficiency

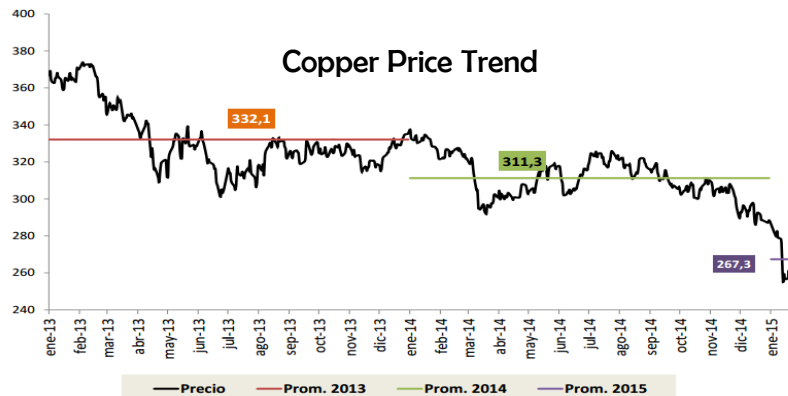
Tough market conditions have required customers to find opportunities for improvement.

A commonly used metric, Overall Equipment Efficiency (OEE,) focuses on aligning maintenance and operations towards improving system efficiencies.

Evaluated KPIs: Availability, utilization and performance

Contributing factors:

- Customer Organizational Adjustments
- Availability of new technologies
- Budget adjustments and reductions
- Tough market conditions



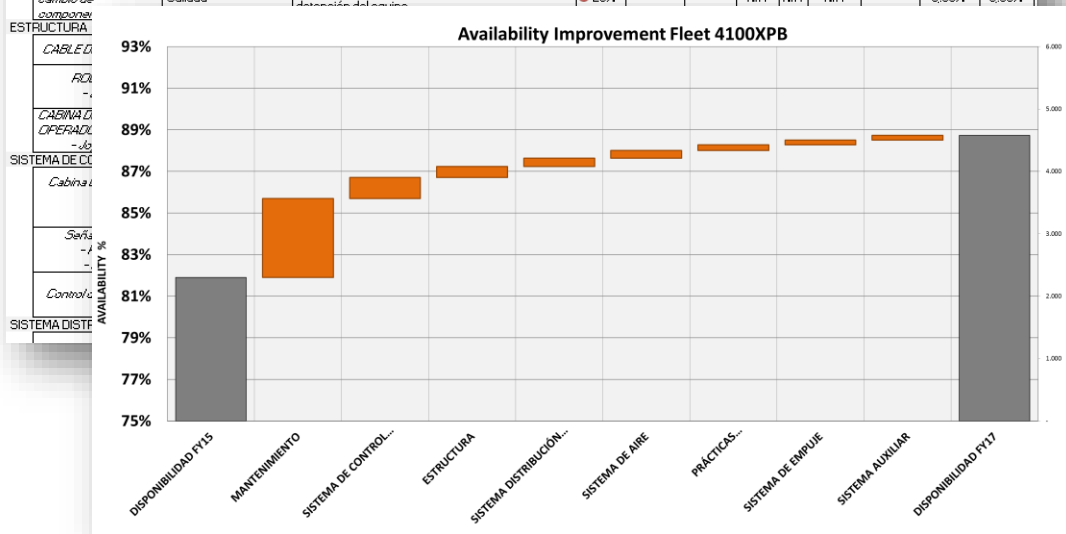
Engagement process: Understanding the challenge

High level executive commitment and alignment

Maintenance: Data access for analysis. Evaluating processes, personnel's knowledge, skills and machine audits.

Production: Operational reviews performed by applications engineering and operators reviews by operators trainer.

Sist. SubSistemas	Modo de Falla	Iniciativas	Inversión	Categori	Tpo De	n	MTTR	% Max. Potenci al Indisp. ibilitad	Sin Inversión	Con Inversión
MANTENIMIENTO								5,00%	2,55%	3,80%
Optimización de Mantenimiento Programado	Calidad	Optimización de Pausas - Frecuencia y secuencia - Contenido (Recursos y valores nominales) - Estrategia por sistema	80%			N/A	N/A	N/A	2,50%	2,50%
Optimización de Frecuencia	Calidad	Instalación de Sistema de Monitoreo	50%	x	Medio	N/A	N/A	N/A		1,25%
Mejora de tiempo en cambio de componentes	Calidad	Iniciativas que busquen reducir el tiempo de detección del error	20%			N/A	N/A	N/A	0,05%	0,05%



Solution: Maintenance and production improvement plan

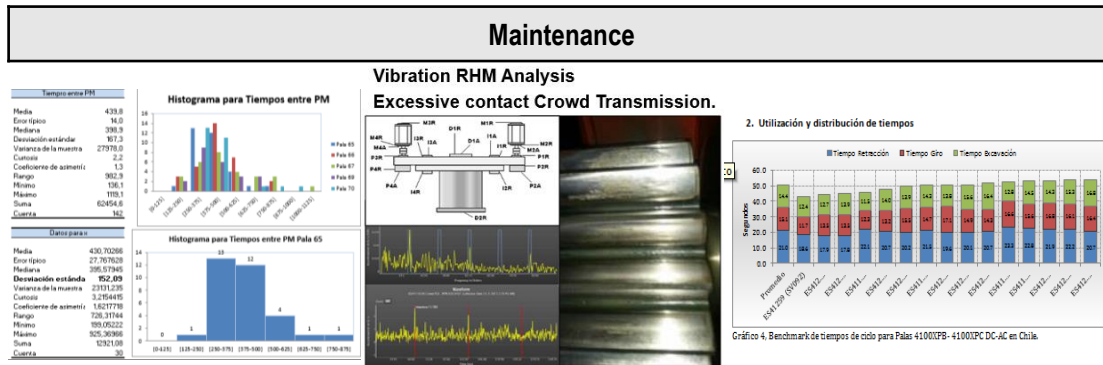
More than 2 years of data analyzed, identifying a necessary maintenance strategy changes and operational improvement opportunities.

Maintenance plan:

- Strategy change
- Upgrades
- Remote health monitoring
- Technical training

Production Plan:

- Onsite operational review
- Operator training
- Dipper expansion
- Remote operation analysis



Results:

The OEE for the shovel fleet **improved almost 6%**, and continues to show an increase in the average production of **over 220,000 tons per month per shovel**.

On a fleet of 8 shovels that is **more than 1.7 million additional tons/month** due to the systematic OEE approach.

