

Focusing on reliability to increase FeCr efficiency

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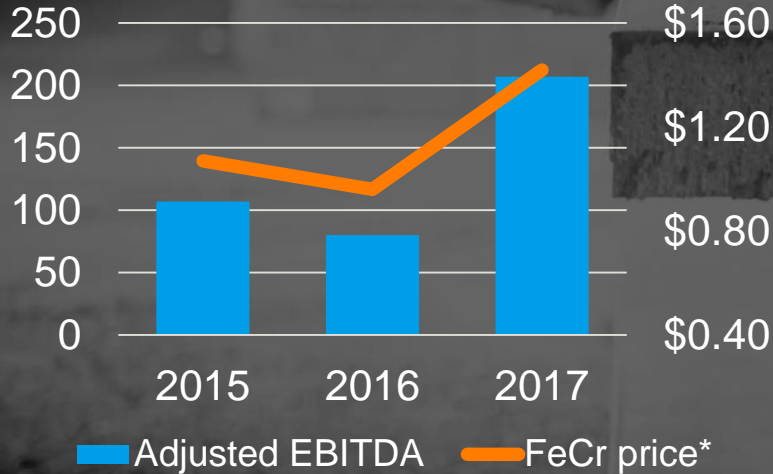


FeCr is an unique competitive advantage

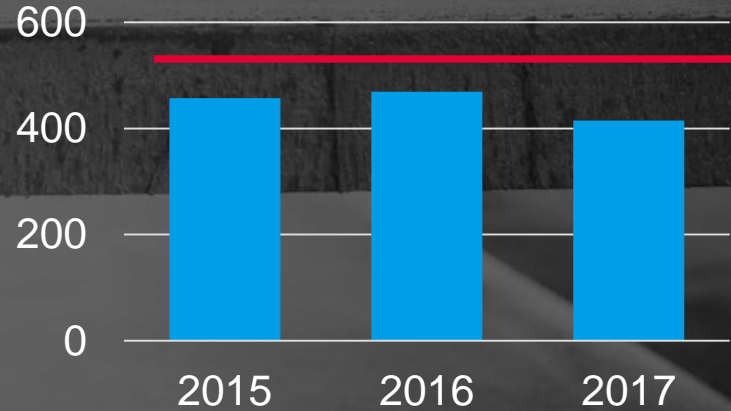
- We are the only Western player with own chromite mine and FeCr assets
- Stable source of income with confirmed chrome resources beyond 2040 and cost competitive FeCr smelters
- Unique synergies for whole Kemi-Tornio integration
 - optimized feed of concentrates
 - low logistic costs in FeCr due to closeness of mine and smelters
 - usage of liquid FeCr and FeCr fines in steel melting
 - usage of carbon monoxide instead of other fuels
 - shared services leading to less administration

Strong profitability in volatile market

BA Ferrochrome
Adjusted EBITDA, EUR million
Benchmark FeCr price, USD/lb



BA Ferrochrome
Production, 1,000 tonnes
Theoretical capacity 530,000 tonnes



SAF3 stabilization

- H1/2017, unstable production due to several operational reasons
- July 2017, emptying and restarting of furnace
- Furnace operation currently very stable
- Key actions to keep SAF3 under control
 - Root causes clarified and lessons learned
 - Furnace operations updated with latest technical development
 - On line cameras assembled inside the furnace
 - IBM Watson used to assist furnace operations
 - Tight process control with immediate corrective actions

Utilization of IBM Watson in SAF's process control

Target

- improve predictability of the Ferrochrome Submerged Arc Furnace (SAF) performance
- increase SAF efficiency and decrease process downtime
- develop visualized dashboards for operators

IBM Watson is a cognitive tool to gain a deeper understanding of structured and unstructured data.

SAF2 electrode control and **SAF3 stability** models developed

Achieved results

- New insights of SAF's performance
- Discovered new process thresholds
- Stabilized furnace operation
- Extended furnace lifecycle
- Identified new potential development areas

Continuous improvement in concentrating plant

- Target to reduce cash conversion costs and ensure sustainable use of mineral reserves
- Concentration plant recovery improvement project started in 2017
- Overall and fine concentrate recovery has been increased over 5% compared to the baseline in 2016
- Key actions:
 - Right ore types for heavy media separation and fine concentrating
 - Optimization of heavy media separation at first stage
 - Stabilization of the fine concentrating plant

Kemi Mine concentration plant recovery, 2016 baseline 100

