

*Broner Metals Solutions*



# ***Agile Manufacturing for ALUMINIUM SMELTERS***

## **White Paper**

This White Paper describes how Advanced Information Management and Planning & Scheduling solutions for Aluminium Smelters can transform production performance, leading to greater responsiveness, increased profitability and improved customer satisfaction

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# Agile Manufacturing for ALUMINIUM SMELTERS

***How Advanced Information Management and Planning & Scheduling solutions for Aluminium Smelters can transform production performance, leading to greater responsiveness, increased profitability and improved customer satisfaction***

The smelter is characterized by very complex process conditions. Although smelter plants are made up of separate production areas which may operate as separate units (carbon, reduction, cast house, power plant), the interdependencies are so significant that problems in the operation of one area can bring the smelter operation to a halt, resulting in high costs and great losses. Therefore, optimization of smelter performance needs to take into account all production areas, model each process accurately and at the appropriate level of detail and also capture interoperability.

The combination of batch, semi-batch and continuous processes creates a very dynamic environment. Changes in one part of the process have significant effect on other parts. The management of the hot metal stream is a key concern. It is not enough to ensure continuous processing of the hot metal produced at the reduction area. The question of which product to produce and when, is crucial given the hot metal quality and demand requirements, not only in terms of quality but also of timing. Downgrading the metal to produce commodity products instead of value-added products results in significant losses and margin reduction.

At the business level, aluminium smelting companies – just like other industries – are trying to adapt to an ever changing, highly competitive business environment, marked by changing commercial landscapes through expansions, mergers and acquisitions. Customer requirements are becoming increasingly demanding. Customer mobility is also increasing, adding to the already high market volatility. Energy costs and environmental considerations are two more constraining factors that push for more efficient manufacturing. Transportation is another dimension of complication, as usually there are high costs and long lead times associated with the provision of raw materials as well as getting products to the market. It is difficult enough to take into account all these factors in an effort to improve quality, performance and profitability. Adding the ever increasing uncertainty in market behaviour and operating conditions makes this a very complicated exercise.

The typical situation in today's smelter manufacturing environment is that you have islands of automation, i.e. local systems based on older technology, which address a specific problem. These may be integrated with databases and ERP systems for data transfer, but they are not integrated from a functional and business point of view. This means that they don't share common business objectives and it is difficult to align them, as there is no automatic flow of information between business processes

The desired status is to adopt standard, fully integrated **plant** and **business** solutions to replace these islands of automation. This will enhance the smelters' manufacturing agility capabilities.

## Agile Manufacturing for Aluminium Smelters

### Manufacturing Agility

One major differentiator from the competition is agile and intelligent manufacturing, which allows aluminium smelting companies to respond quickly to unexpected and unplanned events, changes and disruptions in market conditions, customer requirements and/or the production environment. Having the most cost effective processes is not sufficient in today's highly competitive business world if they can't ensure on-time delivery and high customer satisfaction in the most efficient way overall.

Agility should be extended to the whole business, production and operational environment. It is not enough to have agility in certain parts of the production area if distribution can't react in an agile manner. The various parts of the business should be linked in a tight yet flexible manner, so that the effect of changes in one part can be evaluated across the enterprise and the appropriate corrective or responsive actions can be determined and evaluated.

This requires the latest, state of the art technology but also a design which meets the business needs and ensures that best practices and appropriate business processes are taken care of by the technology.

### Cutting Edge Technology Solutions for Smelters



Today's technology offers solutions that can address these complex issues both at the plant level as well as at a business planning level and enable aluminium smelters to achieve their goals. These are real-time, fully integrated, enterprise wide tools using common and consistent models and data structures that consistently apply business rules and industry best practices. They provide accurate, up-to-date, actionable information. Seamless integration with the plant control and instrumentation systems, as well as data repository systems such as ERP and databases, offers synchronization and single data entry, thus eliminating errors caused by data or action duplication. Web based applications, such as portals and other tools supporting collaboration, speed up information updating and promote cooperation internally as well as with suppliers and customers.

The key objectives of such solutions are to:

- provide visibility of process and business conditions at any time and in a business-wide context
- retrieve and store real time information in a meaningful manner
- process this information intelligently in order to provide insight into causes and effects both upstream and downstream
- provide the possibility to run simulations
- offer real optimization capabilities, revealing the true potential of the business and operations
- optimize operations based on the real market demand, aligning the plant with the business objectives and targets
- provide the means to create, save, retrieve and compare scenarios
- use economic criteria

## Agile Manufacturing for Aluminium Smelters

Key considerations when designing and building such solutions:

- Dependability, accuracy and consistency
- Ease of use, configurability and flexibility in data representation and reporting
- Extract knowledge and deep understanding from current operational performance
- Provide clarity of limitations or constraints of current performance
- Comprehensive representation of effects and consequences
- Ability to proactively manage process & business disruptions
- Mapping to the business processes at all levels – strategic, tactical and operational
- Sharing best practices
- Seamless functional integration with the ERP and plant control systems
- Cross group collaboration

### Advanced Demand Management, Planning and Scheduling for Aluminium Smelters

The reduction area lies at the heart of the smelter, producing the hot metal flow which feeds the cast house and consuming the products of two other areas, the power generation plant and the carbon plant. Therefore, a key issue of smelter production management and optimization is management of the efficiency of the pot lines and optimization of their performance. Production operations in the pot are very complicated processes and many factors need to be modeled and their effects taken into consideration. Timing requirements, laboratory information, quality of the final product to be delivered to the customer, constraints related to the downstream processing of the hot metal stream, bottlenecks imposed by the tapping crane and by the cast house operations schedule etc.

Moreover, two key batch processes overlap at each pot: the anode lifecycle and the electrolysis operation. The quality of the hot metal and consequently of the final products at the end of the cast house depend on both batch operations. It is crucial to be able to trace final product properties to a particular pot of the reduction area, to the batch of anodes used for the hot metal production and even further back to the carbon plant operations that produced the anodes.

A dynamic production scheduling solution, which will compute the optimal tapping schedule based on the final product quality and delivery requirements is of great value to the smelter production management, as it ensures the optimal tapping sequence and hot metal flow management. Such a pot line scheduling solution coupled with a dynamic production scheduling solution for the cast house furnaces and casting machines ensures that synchronization of the two key production areas of the smelter is achieved.

Contract management or managing the buy vs. make situation can be achieved efficiently using a smelter wide planning solution, which can couple market demand with production and transportation capabilities and constraints, external supplier contract terms and status, and spot purchase options. Such a solution can provide long-, mid- or short-term plans at a user defined granularity in terms of products and time.

If the plans and schedules are based on a reliable demand forecast, produced by an advanced demand management tool which is able, not only to compute a statistical forecast but also incorporates market intelligence from the demand management team and the collaborative interaction of the

## Agile Manufacturing for Aluminium Smelters

sales force, then optimal production plans are based on dependable market information. Such a solution would also allow the smelter to operate in an agile manner, enabling it to react to unforeseen and unplanned fluctuations of the market and/or production environment. Moreover, the production and demand managers are able to act in a proactive rather than a reactive manner, since such solutions provide visibility into future plant and market behaviour.

Such an integrated solution, as provided for example, by the Broner Planning & Scheduling suite, facilitates collaboration between sales, production and logistics teams in building optimised inventory levels that balance the objectives of reduced inventory cost and improved on-time delivery

## Manufacturing Execution Systems for Aluminium Smelters



In the area of plant data acquisition and management, beyond process data acquisition and historian systems, many solutions are available for smelter operations.

Examples would include a plant-wide mass balance application which can provide an accurate metal position, inventory management, event and alarm monitoring and reporting, environmental sustainability and compliance related applications, statistical process control, quality analysis and management, tracking and visibility of objectives & performance via scorecards, alerts, specific organizational metrics, operator interfacing and web-based consolidated reporting etc...

In order for the information to be used effectively, it needs to:

- have a role based presentation, not driven by source system; information should be presented to the user in the context of the business process and adapted to the needs of the specific role
- be presented at a level of detail that is meaningful to the role's responsibilities
- allow the user to drill down into more detail if needed to get a deeper understanding of root causes of an issue or event
- limit/filter the information to what is relevant to the task
- automate workflow wherever possible, leaving the user to intervene only on information that requires human intervention
- be presented in the same framework from which the user doing the role can directly trigger action to resolve

One example is the MES solution from Broner, which transforms the raw process data into the information needed for operational management of the plant, whether it is real-time monitoring and control, work tracking, quality management, warehouse management or other information based decision support activity.

## Agile Manufacturing for Aluminium Smelters

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### Business Wide Visibility and Collaboration

Enterprise operations management solutions provide the framework for data and business integration of the various other solutions discussed above. They can significantly enhance business processes, provide enhanced ability for performance scorecarding, KPI monitoring as well as look forward analytics. They facilitate the integration of the business performance goals with operational execution.

### Benefits of Advanced Technology Solutions Based on Real Time Information

Real-time information not only reveals what are the issues, alternatives and decisions the business is facing. It can provide the decision makers with dynamic trending and performance measures, so that they can:

- spot emerging problems before these have significant impact to the business or process
- review and understand the consequences of the response
- take proactive, corrective action

The ideal solution is a fully integrated solution. For example the Broner MES and Advanced Planning & Scheduling solutions can automatically integrate process automation systems, LIMS and other plant systems with decision support systems in near real-time. This means that ERP, planning and scheduling systems always have the latest status of orders, materials, and consumption data from each process.

Tangible commercial benefits can also be derived by such real time solutions for the manufacturing environment including reduction in variation, rejected product, costs, cycle times as well as improvement in quality, customer service, profit margins, and eventually competitiveness and profitability.

Business objectives and principles such as profitability, sustainability, interoperability, responsiveness, flexibility, best practices, compliance with environmental regulations, operational excellence, increased profitability and shareholder value can be measured and achieved using advanced technology solutions that understand and inherently model the smelter operations.

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## About Broner Metals Solutions

Broner Metals Solutions is dedicated exclusively to delivering value to the Steel and Aluminium industries through the application of Supply Chain Planning, Scheduling and Manufacturing Execution Systems. We deliver value to our customers through: reduced inventory; shorter manufacturing lead times; increased throughput; improved delivery performance and better customer service.

All Broner Metals Solutions products have been developed specifically for the Metals industry. Our product range includes Demand Management, Sales and Operation Planning, Availability To Promise, Capability To Promise, Advanced Planning and Scheduling and Manufacturing Execution solutions.

The Broner Metals Solutions team has almost 20 years experience in improving the performance of metals supply chains worldwide.

- Dedicated to Metals industry – 100% focus on the metals industry and nothing else
- Metals-specific solutions are a better fit to business needs and deliver results quicker
- Standard solutions encapsulate detailed knowledge of metals best practice and operational rules.
- Only company with proven solutions for complete metals supply chain functionality APS to MES
- Metals-industry specialists deliver quicker results
- Flexible, Low risk solution - Wide range of modular, packaged solutions for metals companies

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