

# Automation system of steelmaking plant successfully upgraded at Hadeed Saudi Iron & Steel

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# Automation system of steelmaking plant successfully upgraded at Hadeed Saudi Iron & Steel

**As part of a turnkey project, the level 2 process automation system and the level 3 production planning system for the steelmaking, refining and casting plants at Hadeed Saudi Iron & Steel have been completely replaced and made ready for Industry 4.0. The new process models enable noticeably more efficient steelmaking and refining. The implemented solution is scalable to accommodate further progressive digital enhancements.**

The key question about the modernization project at Hadeed Saudi Iron and Steel was how to prepare a steel plant

with legacy equipment partly dating back to the 1990s for Industry 4.0 while keeping downtime to an absolute minimum. Within a very short time, SMS group implemented a state-of-the-art automation infrastructure.

The new intelligent analysis tools add leverage to Hadeed's experience in production management, quality control and business intelligence including a perfect integration of the pre-existing data to the new fault-tolerant database. Through the collaboration between the metallurgists from Hadeed and SMS group, a wealth of empirical experience



*The Al-Jubail steelworks of Hadeed comprises three EAF meltshops with ladle furnaces and three multi-strand continuous bloom casters.*

was fed into the new self-learning process models. This has resulted in significant cost optimization and quality improvements. To ensure future-proof, recurring returns on investment, SMS group supplied virtualization techniques to provide Hadeed independence from specific hardware components with great flexibility in spare parts sourcing. Thus with this revamp, a comprehensive asset life cycle optimization with attractive ROI was achieved.

**The modernization project at Hadeed**

Saudi Iron & Steel Corporation Hadeed, a subsidiary of Saudi Arabian SABIC, contracted SMS group to modernize the electrical installations and automation systems at the Al-Jubail steelworks in Saudi Arabia. As part of the turnkey project, the level 2 process automation system and the level 3 production planning system for three electric arc furnaces (160 t, 110 MVA), two ladle furnaces (153 t, 22 MVA) and two of the three continuous casters (four and six strands respectively), as well as the maintenance section with equipment management system were completely replaced with the SMS group products X-Pact® Process Optimizer and X-Pact® MES 4.0. The core elements also included a business intelligence system with interactive analysis possibilities and a highly extensive, modern web reporting system that provides very clearly structured and comprehensive dashboard visualization of the production processes and the use of associated inputs, in addition to processing the information in the desired level of detail. The challenge was

to channel the enormous amount of detailed data into relevant information packages at one central point for intuitive analysis and strategy development.

The central best practice management facilities allow Hadeed to develop the metallurgical strategies centrally and apply them to the different furnaces. Through the modernization, Hadeed has not only replaced the old hardware and system software with new technology but also received a sustainable platform scalable for integration of innovative modules in connection with Industry 4.0. Such modules can be easily added, progressively increasing system performance with every new solution module.

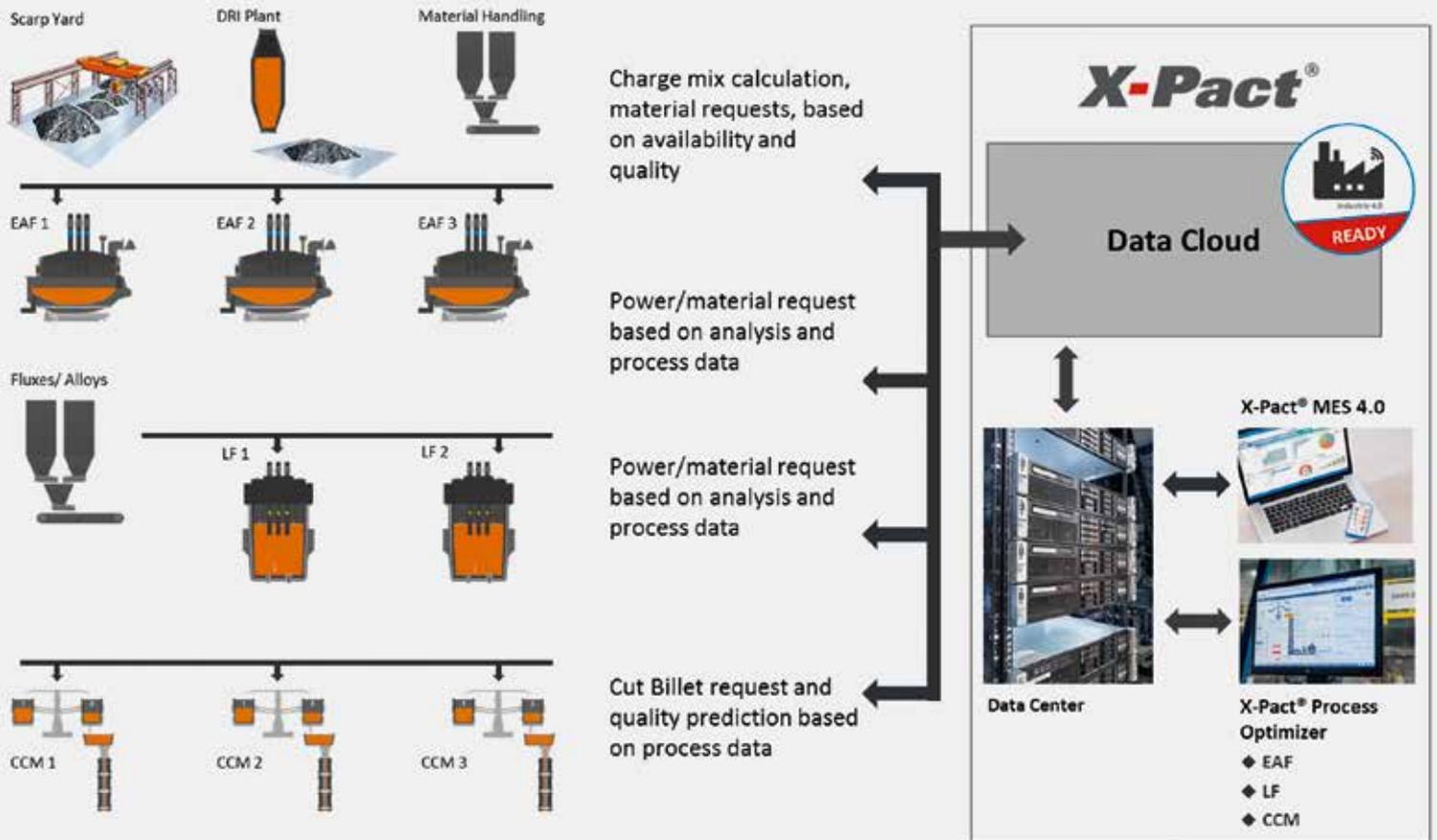
The new system provides Hadeed consistent improvement in process performance, intuitive technological operator guidance with model-based process control, while achieving cost reductions by savings on consumables and energy and improving and stabilizing process results. The strategic KPIs can now be deployed across all operator teams with data dashboards allowing close monitoring and follow-up of the targets.

**Exemplary for modern steelworks**

Michael Bruns, project manager at SMS group: “At the start of the project, Hadeed featured automation systems typical of today’s ‘mature’ steelworks. We discovered a wide variety of data sources provided by different systems. As in many



SMS group has developed a uniform HMI for the new level 2 and level 3 automation systems.



*The new automation system integrates data flow and data processing for the whole steelworks .*

similar cases, the IT infrastructure at Hadeed had developed over the years. The process control models, if any, were not aligned with one another. In steel plants, great savings potential often results from the synchronized deployment of the process models across the entire process chain, leveraging the mathematical models based on the heuristics of the experienced personnel. We estimate that with a modernized electrical and automation system, steelworks can save between 5 to 10 % of their yearly operational costs. X-Pact® MES 4.0-based solutions streamline the material and energy flows along the entire value chain of the steelworks with features and facilities enabling continuous improvements.”

### New productive life for existing plants

At Hadeed, the experts from SMS group started with a one-month fact-finding phase that formed the basis of the implementation strategy for the modernization concept. The strategy took into account the existing third-party plant engineering and field systems, integrating them seamlessly into the new, modern automation infrastructure. Furthermore, the existing data base – and hence Hadeed’s wealth of ex-

perience – was transferred from a large number of different sources and formats into the new automation system, adding leverage through new intuitive business intelligence tools. The automation specialists from SMS group developed a uniform production planning system (on the basis of X-Pact® MES 4.0) for the whole steelworks that interacts with the models of the X-Pact® Process Optimizer – the material tracking and reporting system. Subsequently, the whole new automation solution was subjected to a “plug & work” integration test before delivery. This integration test was performed by SMS group together with Hadeed using simulations. Bernd Weber, process automation specialist at SMS group: “The customer has a profound understanding of the processes in the works. During our integration test, they could thus convince themselves of our capability of fulfilling all their functional demands by modern IT.”

The greatest challenges came after the successful completion of the integration tests at the customer’s site where a great part of the installation work was performed with the plant in operation. 18 new servers based on the X-Pact® high-availability concept were installed in Hadeed’s IT centre

in addition to more than 50 HMI clients with X-Pact® Vision throughout the works. Mario Ufermann, project manager at SMS group: “Close collaboration with the customer, thorough understanding of the existing infrastructure, knowledge of the safety requirements and environmental conditions in the steel industry were the keys to success in completing the installation and configuration of the process equipment, including the laying of more than 10 kilometres of IT cables through occupied cable routes, without any interruption of the regular operation before the plant shut-down.”

The new automation system from SMS group was first installed and tested under real-life conditions parallel to the existing legacy systems in the steelworks while the plant was running. This was performed to the full satisfaction of the frontline operators and Hadeed’s plant management. Then a scheduled plant shutdown not related to the revamp followed. Right after the shutdown, the complete new automation and business intelligence system, including all the new and modified interfaces, was immediately ready for the start of production. Also the training of all the operator teams took place during that short period. The intuitive user interfaces enabled a steep learning curve so that the new functions could be fully used by the operators immediately after the successful start-up of production. The SMS group completed the whole modernization project within a period of only 15 months after the order had been placed.

### **Combination of process knowledge and IT know-how**

A modernization as complex as in this project demands a combination of multiple qualifications: a strong project management, a flexible collaborative design team interacting with the customer across cultures and time zones and, most importantly, expert knowledge of the technological/metallurgical process including the value chains, combined with an in-depth understanding of the IT solutions available from one single source. SMS group, with its profound and long-standing expertise in metallurgical plants along the entire value chain, its commitment to innovative future-oriented solutions and its investment in an own electrics and automation business unit, is perfectly suited to cope with such challenges. This would be a task too complex to deal with for a mere IT supplier.

SMS group has succeeded in dealing with the complexity of the highly dynamic processes. For example, the production bottleneck, the two ladle furnaces, has been optimally overcome by the new production planning system. “The system also immediately reacts to faults in the plant by suggesting alternative process routes,” summarizes Wilfried Runde, manager Production Planning Systems at SMS group.

The SMS group automation specialists have implemented a visualization platform and a failsafe database solution at Hadeed using virtualization technologies. Irrespective of the availability of hardware spare parts, Hadeed will be able to continue using and maintaining the supplied automation systems in the future. This solution provides investment security as it provides the necessary flexibility and scalability for future needs.

### **Precise forecasts and online optimization**

Practice has already shown that the new automation system from SMS group meets the expectations and has noticeably improved plant performance. Improved and reproducible productivity and quality across all the operator teams is ensured by the model-based process control. At the electric arc furnaces and ladle furnaces, the production processes for the heats are determined in advance according to their target specifications with respect to analysis, temperature and steel weight in a precise forecast.

The whole sequence of processes with the required quantities of scrap and DRI, the provision in good time of the materials by means of anticipatory logistics, the required electrical energy and the required schedules are calculated on a continuous basis. By combining the control of energy supply, DRI and slag former charging as well as oxygen supply within the X-Pact® Process Optimizer, energy consumption has been reduced as a result of improved process control and minimized tap-to-tap times. During refining, the model receives all the relevant process data online and performs the corresponding optimizations, by way of which all the parameters are maintained within the required balance in order to achieve the target values in the most efficient way possible.

### **Conclusions**

Said Al-Gadhib, automation engineer at Hadeed, states: “Our operators are highly experienced and have very good insight into the process. Using the new automation system from SMS group, we were able to combine the best practices of the talented individual operators into plant-wide best practices. Instead of frequent manual and individual control activities, the focus is now on monitoring and evaluating the processes. In the event of changes, the operators are supported by intelligent assistance systems – uniformly for the whole steelworks.”

The modernization project at Hadeed has shown that great savings potentials can be achieved in steel plants and continuous casting plants. The metallurgical models in combination with the business intelligence expert system enable a noticeably more efficient use of the resources and more

precise achievement of the targets with respect to quality and weight than previously possible with conventional methods. A sustainable reduction has been achieved in raw material and energy input and in process costs. At the same time, SMS group has created a consistent and uniform system and data basis capable of providing clear reporting and effective quality assurance. With this solution, Hadeed has successfully introduced Industry 4.0 in its works – and the solution is scalable to integrate further progressive digital enhancements. Being more than just a system update, the innovative process models of SMS group's integrative automation system take into consideration the complex interactions and dynamic process values for optimized and efficient steel production.

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