ADE Solutions: Smart plants of the future

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In 2021, the demand for primary aluminium reached an estimated 68.7 million tonnes, which is an increase of 8% compared to 2020[1]. This growth is part of a larger trend, as world aluminium demand has grown at an average annual rate of 5% between 2012 and 2021[2]. Aluminium smelters must adopt Industry 4.0 to meet demand. The transition to smart manufacturing can be challenging due to complex operations and critical equipment, but integrating advanced technologies and digital solutions can improve efficiency and productivity.

WSP's Advanced Development Environment (ADE) helps aluminium smelters transition to advanced manufacturing. It provides a comprehensive range of functions for developing, testing, and maintaining automation systems, integrating control, visualisation and communication to improve industrial process efficiency.

ADE is the foundation of a smart plant, offering real-time data analysis that reduces downtime and increases output quality. By logging all actions, ADE enables factories to optimise operations, increase efficiency, and remain competitive.

Learn how ADE can help your aluminium smelter achieve operational excellence and transition to Industry 4.0. Discover key features and real-world examples of improved operations. Become a smart plant, reduce costs, and increase efficiency with ADE.

ADE Solution in terms of industry 4.0

ADE is the foundation of smart plants, enabling aluminium smelters to use new technologies to improve industrial processes while reducing costs and waste. It fills gaps left by human-machine interface (HMI) software and programmable controllers[3], providing a comprehensive solution with added functionalities. ADE offers a structured environment based on a library of "Add-On Instructions," with corresponding HMI faceplates and objects[4].

Productivity Aspect

One of the key benefits of ADE is that it reduces the number of alarms, enhancing normal operations, increasing productivity, and improving efficiency. It also eliminates cascading alarms for quicker problem detection, identification, and resolution. In addition, ADE "ensures complete operator autonomy by providing maximum information on the operator interface[5]" enabling informed decision-making without relying on external sources. This is crucial for aluminium smelters where quick decisions based on real-time data are necessary for a smooth production process. Centralising all systems on a single interface[6] with ADE provides a comprehensive overview of operations, simplifies identifying areas for improvement and implementing changes on a single platform for quicker and more efficient processes. This improves overall performance and maintains a competitive edge.

Quality Aspect

ADE's advanced monitoring and analysis capabilities allow companies to quickly identify equipment failures and other issues, reducing the risk of costly production errors and downtime. ADE's centralised interface and failure analysis tools provide operators with maximum information and autonomy, enabling them to diagnose and resolve issues more quickly and efficiently. Moreover, the process control PID loop function incorporated in ADE plays a crucial role in delivering high-quality products. Several advanced control features enhance the quality of production, resulting in fewer errors and reduced waste. By reducing waste and enhancing quality, companies can save on raw materials and energy costs, while simultaneously boosting their overall efficiency.

Security Aspect

ADE brings numerous benefits to the aluminium smelter industry in terms of Industry 4.0, not least of which is improved security. ADE employs system-wide global management to ensure that all actions are secured, and users can only access equipment in read mode when navigating beyond the boundaries of their responsibility[7]. This is achieved through three concurrent restriction levels:

1. Security based on user group.
2. Security based on sector or department.
3. Security based on operator station.

This multi-layered approach provides enhanced protection against unauthorised access and ensures that critical operations are only accessible by authorised personnel.

Sustainability of Industrial Processes Aspect

The ADE's advanced PID plays a fundamental role in optimising industrial processes. Initially developed to provide advanced process control with Allen-Bradley Control Logix, the PID has evolved to become a standard product with all the functionalities required for different ADE-supported platforms.

The PID's optimisation capabilities enable industries to maximise the efficiency of their processes while minimising energy consumption. ADE PID features allow for a straightforward and comprehensive handling of cascading loops therefore considering process limits and unusual operating modes. Also, built-in external reset feedback allows for deadtime compensation, optimal loop synchronisation in override control schemes as well as other advanced control strategies. Moreover, an alternate PID algorithm is available to handle intermittent process signals. Increasingly, results from lab testing are used as process variables for closed-loop control which is often essential for advanced product quality control. Such signals are typically updated a few times per day or, at best, a few times per hour and require a dedicated PID algorithm which can be enabled on any PID loop with a single click

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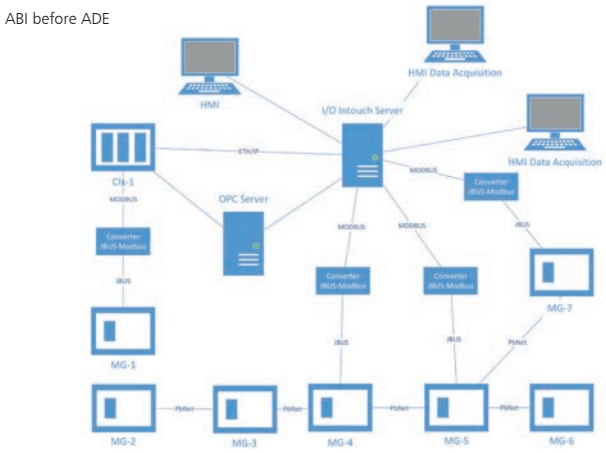

Fig 1. Aluminum smelter Network Architecture prior to ADE

Fig 2. Aluminum smelter Network Architecture with ADE

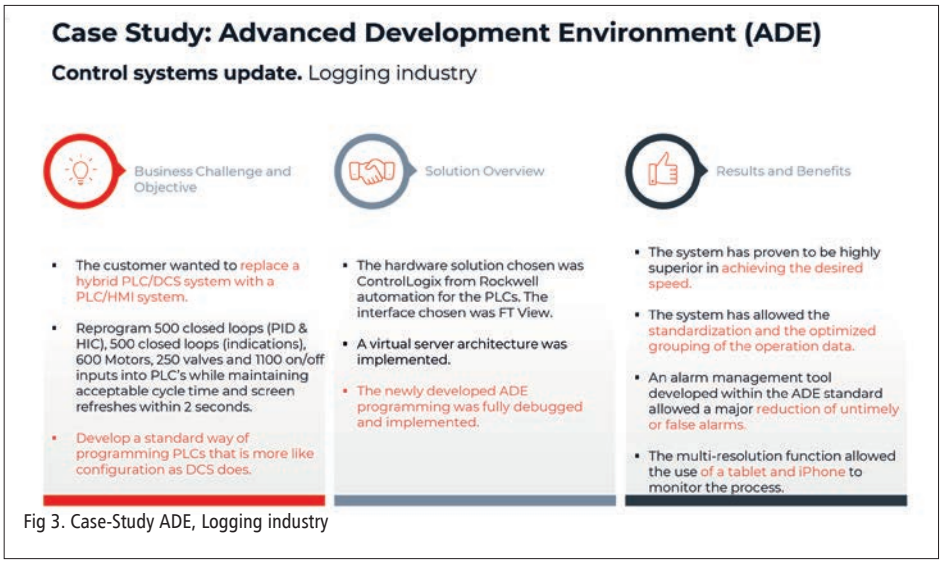

Fig 3. Case-Study ADE, Logging industry

in ADE. By optimising processes, industries can reduce their carbon footprint and contribute to a more sustainable future.

Traceability and Accountability

ADE provides traceability and accountability for industrial settings, particularly factories. Complete records of all actions taken in the factory are logged in ADE to ensure safe and efficient production processes. This includes operator commands, parameter changes, and PLC logic-initiated actions. ADE also logs all alarms and events. This level of traceability helps factories quickly identify and correct issues, and provides valuable data for optimising operations. Analysis of the logged data helps identify areas for process improvement, resulting in increased productivity.

Reducing Cost Aspect

ADE uses advanced technology to provide powerful tools that streamline operations, reduce costs, and extend the life of factory machinery. This allows factories to avoid purchasing new equipment and save money by optimising and modernising existing machinery using ADE.

ADE's pre-configured functionalities offer key advantages to factories, including security, navigation, configuration, and more, without requiring additional resources or development time. This streamlines the development process, saves time and money, and includes analog and digital inputs, process control functionalities, group start/stop management, and code generator, all working seamlessly to optimise operations and reduce costs.

The advantage of ADE in terms of cost reduction lies in its ability to allow operators to solve problems independently during production. For instance, if a non-critical equipment whose process has already been established that it can be bypassed fails overnight, operators can bypass it via the HMI without calling an electrician, ensuring continuous production and saving costs. The next day, electricians can easily understand the bypassed equipment thanks to ADE's HMI graphics, clearly listed and visually displayed, making a significant contribution to the aluminium smelters' bottom line.

Real-world applications

ADE provides an efficient approach to Industry 4.0 tech implementation, as demonstrated by in WSP's project for an aluminium smelter. ADE consolidates the factory's systems, enabling better communication and memory capabilities. This enables the implementation of IoT, AI, and data analytics, improving efficiency and productivity. ADE streamlines communication to just two channels, providing a solid foundation for future growth and innovation. **Figs 1** and **2**.

The first ADE project was very successful, yielding impressive results such as scan time optimisation, data standardisation, reduction of nuisance alarms and a unique multi-resolution feature that allowed for mobile tracking. These results demonstrated the potential for future implementations. **Fig 3**.

ADE's recent project for a paper mill factory resulted in decreased downtime, fewer false alarms, improved equipment usage, and extended equipment life. This success highlights ADE's potential to improve productivity in industrial settings. Moreover, this case study demonstrates the versatility of ADE's technology, as it can be successfully implemented in several types

1. Natural Resources Canada. (2023, February 24). Aluminum Facts. Retrieved from Government of Canada: https://natural-resources.canada.ca/our-natural-resources/minerals-mining/minerals-metals-facts/aluminum-facts/20510. 2 (Natural Resources Canada, 2023). 3. WSP Canada Inc. (2018). ADE – The Solution for an Integrated System. Brochure. 4. (WSP Canada Inc, 2018). 5. WSP Canada Inc. - Smart Industry. (2018). Advanced Development Environment (ADE). PowerPoint Presentation.6. (WSP Canada Inc. - Smart Industry, 2018). 7. (WSP Canada Inc. - Smart Industry, 2018)

of factories, regardless of their specific manufacturing processes. ADE's ability to adapt to different industrial settings and provide exceptional results demonstrates its potential to revolutionise operations across a wide range of industries. **Fig 4**.

Summary

WSP's ADE is a crucial tool for aluminium smelters shifting to Industry 4.0. It reduces alarms, centralises systems, and ensures complete autonomy which can improve efficiency, boost productivity, and maintain competitiveness.

ADE has advanced monitoring and analysis capabilities to track faulty equipment and improve output quality. It eliminates PLC program interventions, and features advanced security functions to reduce errors and oversights, ensuring reliability and efficiency. ADE also offers real-time data collection and analysis, leading to sustainable industrial processes, improved productivity, reduced downtime, and increased savings. It optimises operations and ensures competitiveness in a dynamic market.

Aluminium smelter factories can benefit from adopting WSP's ADE for increased efficiency, reduced downtime, and improved profitability. ■

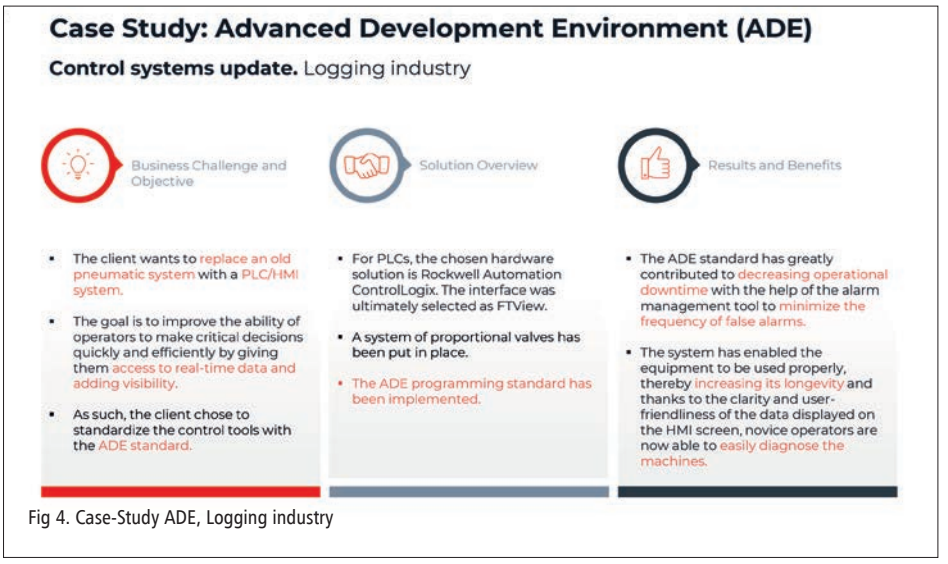

Fig 4. Case-Study ADE, Logging industry

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