

Consistent Plant Performance Through Operator Centered Visual Daily Management

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Abstract

Rusal Aughinish (AAL) refinery is situated on the west coast of Ireland. The plant, which commenced operation in 1983, currently produces 1.99Mt/year of metallurgical grade alumina. The refinery functions with a Safety Management System (ISRS), Environmental Management System (ISO14001), Quality Management System (ISO9001), Energy Management System (ISO50001) and the Rusal Business System. Significant investments have been made to ensure on-going competitiveness. Performance is primarily in the hands of the plant operators. Great knowledge in organisations is often “locked in” or poorly shared. When knowledge is shared, information can remain unclear or misunderstood. Where great efforts are made to record and transfer knowledge, poor infrastructure can hinder clear communication. The AAL approach to this “knowledge” challenge has been to inform that knowledge on a daily basis. We have learned that knowledge needs to be accessible and the information that builds that knowledge be recorded and presented effectively using standardised and visualised formats. We wanted to develop solutions that were operator-centered, rather than engineer-centered. Therefore, we employed a design consultancy to “better listen” to the operators and then work with our Technical group. Today we believe that our solutions for sharing knowledge openly is one of the keys to our success.

Keywords: Alumina refinery, visual daily management, design consultancy, operator centered design.

1. Introduction

Rusal Aughinish (AAL) refinery is located on the west coast of Ireland. The plant commenced operation in 1983 with a current production capability of 1.99mt/yr.

2. Performance

Key to the survival and prosperity of an alumina refinery is its performance. The non-negotiable objectives are excellent safety and environmental results. These are followed by the requirement to have an acceptable product quality.

As the business is essentially a commodity industry, the key to survival and prosperity is cost performance. This is dependent on a key number of strategic and operational issues. The critical measurement is cost per tonne of product.

What was important to the Owner of AAL is that the production units, as agreed with refinery management, are delivered at the budgeted cost or better.

AAL has delivered its budgeted cost on a regular basis and this is underlined by a continuous increase in production rate over the years.

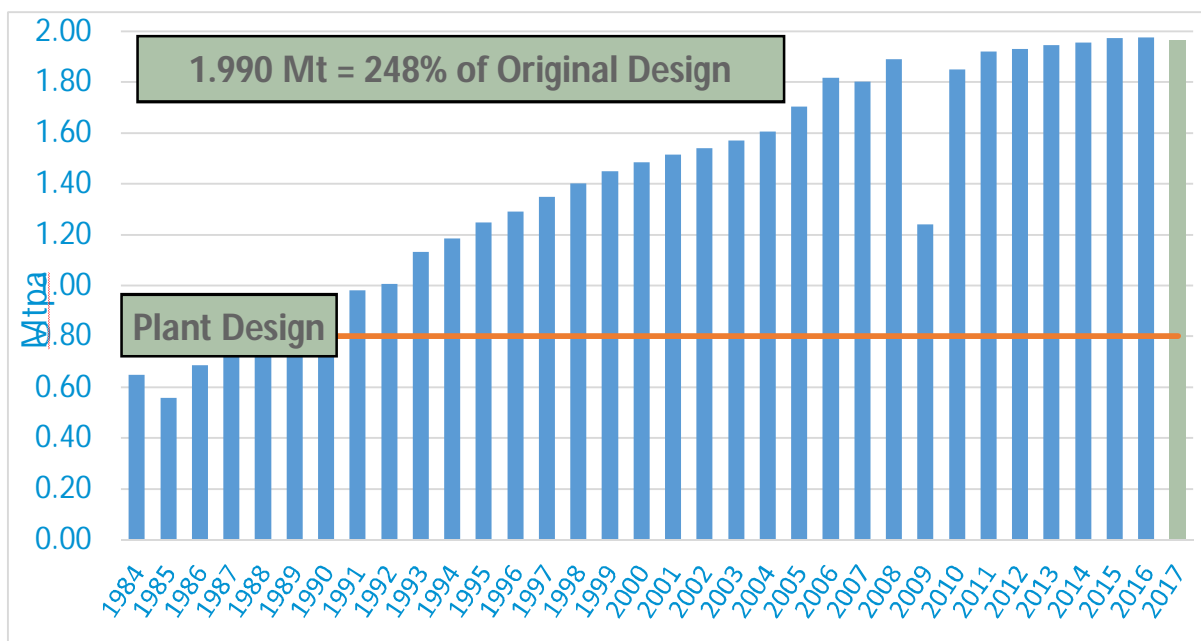


Figure 1. Production increase at the Rusal Aughinish refinery.

This production increase has been achieved with significant improvements in other key efficiencies. Energy consumption will serve as an example.

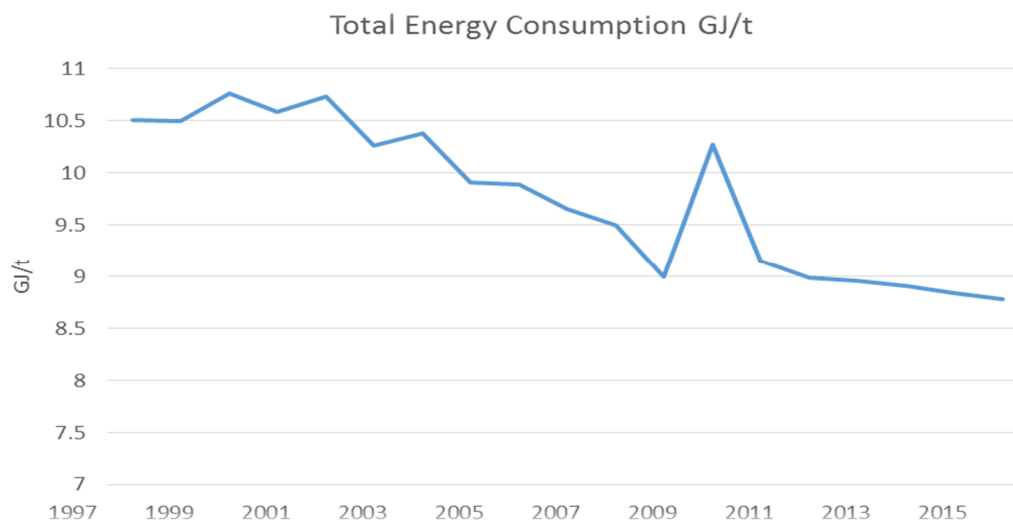


Figure 2. Total energy consumption reduction at the Rusal Aughinish refinery.

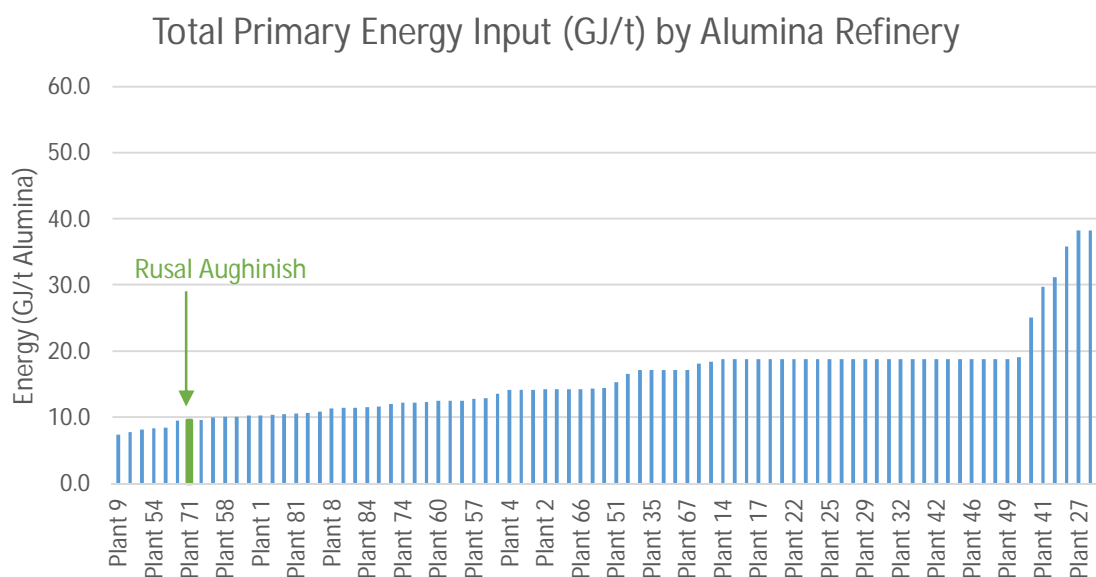


Figure 3. Total energy efficiency by alumina refinery (Source IAI 2015).

Management has overall responsibility for delivering this performance.

Cost competitiveness depends on investment and daily performance, often based on production systems.

The work of delivering this performance is essentially fulfilled by operators, mostly operating away from the normal work-week. The operators are organised in self-directed work teams distributed in five main operating areas. It is their day-to-day decisions and activities that deliver the daily results that accumulate to weekly, monthly and annual performance.

3. Investments

AAL had five Owners and each has invested in creating the refinery of today. To concentrate on the period since 2000 when there has been two Owners.

There are four key areas that combine to achieve a high performance and ensure cost competitiveness. The four key areas of strategic focus are operational excellence, energy optimisation and environmental compliance (with special emphasis on bauxite residue disposal), and bauxite cost and utilisation.

Glencore provided the funding to expand the refinery from a production output of 1.4 Mt/year to 1.8 Mt/year and to build the CHP facility. Glencore invested over USD\$200 million in the refinery and was confident that the on-site management team had the capability to deliver on the investment. They had no presence on site to oversee this investment programme.

Glencore sold its alumina assets, and hence the AAL refinery, to United Company Rusal (UCR) in 2007.

The global financial crisis of 2008/2009 then struck. UCR worked closely with AAL, enabling AAL to survive the crisis by being flexible; production was reduced to a third of capacity and short-time working for all employees was introduced overnight.

UCR were in the very difficult position of trying to provide essential investments in difficult times. However, whilst UCR had many issues to address during the global crisis, it nevertheless sourced and invested in completing the refinery conversion to gas followed by the expansion of the BRDA. These plus ongoing sustaining capital works meant that UCR invested over USD 100 million in the refinery.

UCR is now in the process of further investment in AAL. The new Dian Dian mine in Guinea is presently under construction and this will initially supply bauxite to AAL. AAL is being upgraded to receive this bauxite as evidenced by the recent delivery of a new bauxite unloader.

4. Production Systems

AAL has a structured management approach to all aspects of the operation of the business.

Many management systems are used, including International Safety Rating System accreditation for safety, ISO 14001 for environment, ISO 9001 for quality, Continuing Professional Development (CPD) for employee development, Further Education and Training Awards Council (FETAC) certification for employee training and in-house maintenance management and project management systems.

AAL was the first company to utilise an energy management system in Ireland – copying the Danish system. This is now replaced by the Energy Management system (ISO50001).

5. Rusal Business System

Since 2007, AAL has used the Rusal Business Systems which is based on the Toyota Management system. It includes the quality management tools of 5S and visualisation, standardisation, TPM, improvement culture and daily management.

Visual examples and more details are provided in the slides at the conference presentation.

6. IT Systems

Due to Alcan's strong engineering ethic since refinery start-up, there was always a solid operation, maintenance and process control capability in the refinery. A key cornerstone of the plant improvement has been the development of information systems and of instrumentation, control and automation.

During the late 1980s to early 1990s significant work was completed to future proof the Distributed Control System (DCS) and Business systems, including:

- The Taylor Mod III system was upgraded to a Honeywell DCS System
- The Fibre Optic communication network was installed and expanded
- A Process data historian was installed – the Plant Information (PI) system
- An Intranet based IT network was built
- Microsoft Windows operating system was introduced for the business network
- Control rooms were reduced from 7 to 4, with a new central Operations Monitoring room.

The introduction of the Plant Information system (PI) developed by OSISoft made it possible for employees to view and optimise the process while having visibility of the entire plant. Transparency of control room operator actions and inter control room communications and performance improved due to enhanced connectivity.

The expansion of the business network and introduction of personal computers (PCs) coincided with the deployment of products such as PI Process Book and PI Datalink supplied by OSISoft, which enabled site-wide visibility of plant data to all levels within the organisation. These products enabled the identification of performance gaps and facilitated process optimisation.

By 2000, the use of the PI system expanded from 10,000 process data points to 20,000. The business network grew to in excess of 100 PCs, which were capable of delivering process data to every desktop. Process data was being used to support daily process management decisions. IT commenced development of an online SharePoint based intranet communication and performance tracking tool called the BPI system. This user designed platform quickly became the vehicle for sharing of information across the plant.

The business network has seen significant growth in the adoption of PCs with over 350 PCs on site for a workforce of 450. The PI system has grown to 60,000 points.

BPI now is the hosting platform for all IT solutions, removing barriers to data and improving information sharing. The IT team is now seen as a plant performance enabler in its use of new technologies for user solutions. It has a clear plant focus on delivering innovative solutions using best practice methodology.

7. What is Visual Daily Management?

AAL has highly developed and user-friendly IT systems for sharing information in an open fashion. As part of the Rusal Business System, we also employed daily management meetings to share information.

However, there was still a major problem, and indeed a major challenge.

Although much information has been captured, it is often locked in or poorly shared. Even though great efforts are made to allow the open sharing of information, it is often unclear or misunderstood. Furthermore, poor infrastructure can hinder efforts at clear communication. Our goal became a breakthrough improvement in where and how both information is shared and communication occurs.

Our solution lay in developing a major improvement in daily management using visualisation.

We needed to work smarter at informing the knowledge base daily. We learned that knowledge needs to be accessible. We also learned that the information that builds that knowledge must be recorded and presented daily and effectively in the operations environment using standardised formats. To improve communication and understanding, we pioneered, trialled and applied a Visual Daily Management approach to our reports and operational documents, our visual displays and controls and critically our five plant operator rooms.

Integral to our approach to visualising daily management information and procedures has been the adoption of a 5S approach to information display and operator room layout.

8. How is it Achieved?

Firstly, we ensured that the customer was the operator, because he/she truly delivers the plant performance on a daily basis.

Secondly, we decided to engage a trained and competent “designer” and give him the lead role in the project. Traditionally, this would have been the role of an AAL engineer. We believed

that the “designer” would give us a better and breakthrough solution to the challenge. As it was design led, it resulted in prototyping solutions, many interactive discussions, evaluations but always with the operator as the core customer.

Thirdly, we tackled one Department at a time. The next department could then use the learning from the previous department. This was in line with both participation and continuous improvement.

Fourthly, we pushed for standardised designs but allowed for local innovations.

Finally, the project was Gemba based, allowing testing of solutions in the plant before final adoption. This resulted in a high level of ownership by the operators.

An engaged workforce coupled with good technical and information availability and a continuous improvement ethic is a solid base for future performance. The presentation at the conference provides a visual history of the project over a period of over 12 months. It covers three departments with photographs showing the operator rooms before and after the project. It also includes a similar collection of photographs for a number of support department rooms.

The presentation provides a case study for the operator room in Port Department. It shows the prototyping, design work as well as before and after photographs in order to give an insight into the design work involved.

9. Conclusions

AAL plant performance is entrusted to plant operators. Various Systems (especially IT based) are in place to aid the operator. Yet too often knowledge to do the job is hidden, poorly shared, unclear or misunderstood. Infrastructure can greatly hinder or greatly aid better communication.

A breakthrough improvement is possible in where and how the information is shared and communication occurs by developing a major improvement in daily management using visualisation.

We employed a design-led approach with the operator as the customer to implement Visual Daily Management in operator rooms in the AAL plant. This has enabled us to make information more open and communication clearer in a simple, standardised and visualised way to compliment other systems (especially IT systems).

This approach certainly leads to improved plant reliability and cost effectiveness by reducing errors and accidents through clarity of information and improved understanding.

10. Acknowledgements

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