Successful Potline Operation During Reduced Power at Egyptalum

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Abstract

The Aluminium company of Egypt was forced to reduce its energy consumption within 25 days from 18 January to 11 February 2010 during the peak electricity consumption hours (17:00 h to 23:00 h) during the second shift (starting at 15:30 h and ending at 23:30 h). The main goal of Egyptalum was to secure the six prebaked potlines from any harm and to keep the thermal balance as stable as possible. This paper shows the efforts of Egyptalum to deal with the crisis and to get a fast return to normal operation. The cell parameters were studied before, during and after the crisis period. As a result of the individual actions in each potline, varying results were obtained regarding anode effect frequency, cryolite ratio (CR), voltage addition, cell resistance, iron content in the aluminium metal and the total energy consumption.

Keywords: Energy reduction, power shut-down, anode effects, iron content in the metal, cryolite ratio

1. Introduction

The Egyptian government was interested in building an aluminum smelter "Egyptalum" at of Nag Hammadi desert, main reason for this was the construction of the high dam and surplus of electricity at that time. After many industrial expansions at Egypt and increasing population density, Egypt became in need of multiple sources of electricity after the smugglers generated from the high dam were not enough [1] Egypt has already diversified its sources of electricity and has a unified electricity network with multiple sources.

Egyptalum has six potlines which produces primary aluminium and each line have two potrooms, and each potroom cell has 46 cells, number of cells at the smelter 552 cells and the total production capacity of Egyptalum has reached 320 000 tons of metal per year. Potlines power consumption equals 520 MW and when energy supply reduced the Ministry of Electrical and Energy enforced Egyptalum to reduce its power consumption from 520 MW to 440 MW. This reduction is for eight hours per day throughout the problem period, and the main cause of the reduced energy was heavy rains which knocked out some of high voltage transmission lines from Aswan Governorate to Nag Hammadi city. Egyptalum depends basically on the hydroelectric power which supplied from the high dam, then Egyptalum found itself facing a big problem, that needed a quick solution strategy. Egyptalum has four power stations (A, B, C, D), as shown in Figure 1 which are supplying the electricity to the production lines. Electrical power station A is supplying potlines 1 and 2, electrical power station B is supplying Potline 3, electrical power station C is supplying potlines 4 and 5 and electrical power station D is supplying potline 6.

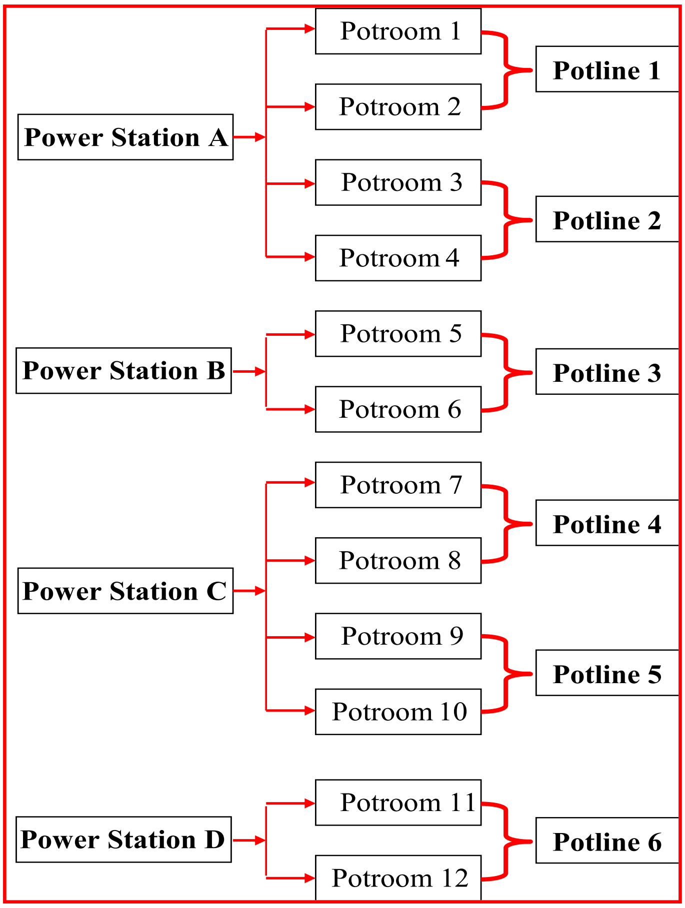

Figure 1. Power stations and potlines.

2. Strategy

The suggested strategy depended on two possible action plans:

1. Shutdown some pots. In this action Egyptalum must shutdown some pots which compensate the amount of energy reduction.
2. Alternate current off (maneuver) from one potline or more to another for two hours and reduce current for some potlines.

The aluminium company of Egypt chose the second action and in the same time faced many of problems but we successfully overcame these hard times in trying to maintain the thermal balance as stable as possible and reducing the anode effect frequency.

2.1. Production Sectors Plan for the Second Action Plan

First: The effect of power reduction on the cell performance:
A disturbance in the thermal balance of the cell had happened before which cooled the cell with the result:

- Increased cell ledge [2],
- Extensive ledge toe,
- Increased cell instability,
- Increased anode effect frequency,
- Reduced bath height.

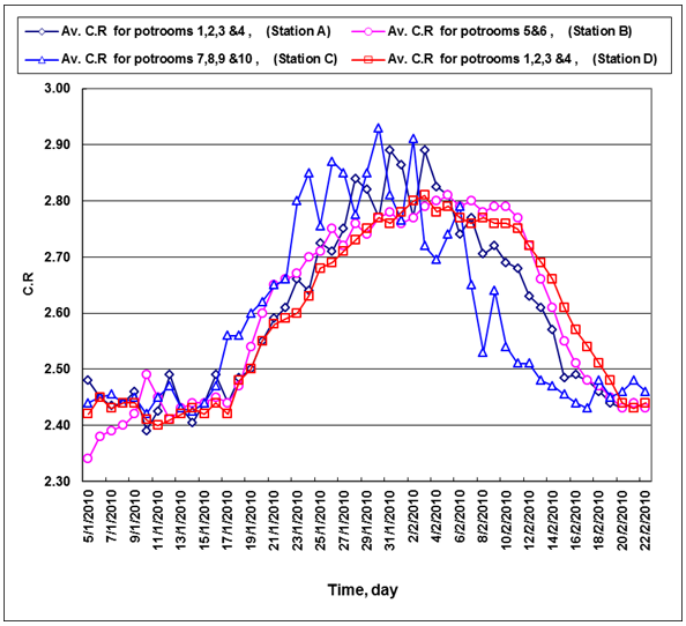

Figure 12. Average cryolite ratio for power stations A, B, C and D.

4. Conclusions

The actions taken were effective to maintain the control of the pots and to survive the critical power reduction. Of course, we faced operational difficulties such as increased number of anode effects which we decided to quenched manually.

This was a very hard time for Egyptalum team and the successful outcome was the result of good teamwork where the skills, and strengths of everyone were put together.

5. Acknowledgement

We would like to thank Mr. Said Abd EL Wahab (CEO) for unconditional support he gave us during this period. Special thanks also to the sectors and all the workers of Egyptalum for extra effort to pass the crisis of reduced power.

6. References

1. S. El-Raghy et al., Report # 2 Global Warming Gases (Green House Gases) Emission at Egyptalum, July 2008.
2. Morten Sørlie and Harald Øye, *Cathodes in aluminium electrolysis*, 3rd Edition, Aluminium –Verlag GmbH, Dusseldorf, 2010.
3. Hânderson Penna Dias, Brazil 2001 Energy Crisis – The Albras Approach, *Light Metals* 2004, 227-231.