

Technical and Economic Advantages and Application Progress of NEUI600 High-Amperage Aluminium Reduction Cells

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Abstract

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Aluminium reduction cell is the core equipment for primary aluminium production. Increasing the amperage of the cells has been the main technology development direction in the past few decades. High amperage 600 kA cell technology has been widely applied in last 10 years in China due to its significant technological and economic advantages such as low unit capital expenditure, high single potline capacity, high labour efficiency and faster returns on investment and recovery of construction costs for greenfield smelters. Through optimized design and iterative upgrading of materials and equipment, including new busbar configuration and cell design, the magneto-hydrodynamic (MHD) stability and thermal balance of NEUI600 have made further breakthroughs. The key performance indicators (KPIs) have continuously improved; specific energy consumption has been reduced to 12 300 kWh/t Al and current efficiency increased to over 94 % in the most advanced design using RuC cathodes, which resulted in significant energy-saving and production increase. Using novel high-quality cathode carbon blocks and lining materials, the cell lining life is predicted to exceed 2 500 days, reducing the frequency of cell shutdowns. Low energy consumption and long cell lining life reduce operating and maintenance costs. Optimized fume hooding structure and high purification efficiency reduced pollutant emissions, which meet low emission environmental protection standards.

As one of the early companies in the global aluminium industry which developed and implemented 600 kA cell technology, NEUI600 technology has been widely used in domestic capacity replacement and expansion projects. At the end of 2024, the technology was used in 15 potlines, with a total capacity of 6.180 Mt/a. Following the first successful 600 kA potline in Shandong Weiqiao Aluminium smelter at the end of 2014, the longest operating time is over 10 years. The highest amperage can reach 630 kA or above, and rich experience in design, construction and operation has been accumulated. With the continuous iteration and upgrading of NEUI600 technology and the application of new technologies, the overall maturity continues to improve, and the KPIs have reached the world leading level. NEUI600 has become the preferred cell technology for domestic and overseas projects, contributing to the high-quality and low-carbon primary aluminium production.

Keywords: NEUI600 high-amperage aluminium cell, Technical and economic advantages of high amperage technology, NEUI600 implementation progress.

1. Introduction

Based on NFC/NEUI's experience in cell engineering design, construction and operation, the cell technology progressed from 160 kA to high amperage of 600 kA [1] as brand names NEUI160, NEUI200, NEUI300, NEUI400, NEUI500, and NEUI600 , Figures 1–4 compare the effects of large-scale production on the productivity per unit area of the cell, labour productivity (based on annual production of 500 kt), unit capacity investment, and single potline production.

In the same equipment configuration and 500 kt/a of aluminium production capacity, for every 100 kA amperage increase from 200 kA to 600 kA, the average productivity per unit area of the cell increased by 4.0 % (Figure 1), the average labour productivity increased by about 22.5 % (Figure 2), the average unit investment decreased by 8.6 % (Figure 3), and the single-line capacity increased by 32 % (Figure 4). If we compare 600 kA technology with 160 kA technology, the production per unit cell area increased by 19.5 %, labour productivity increased by 1.5 times, unit investment reduced by 36.7 %, and maximum single line capacity increased from 160 kt/a to 600 kt/a. This is why we are in the era of 600 kA technology now.

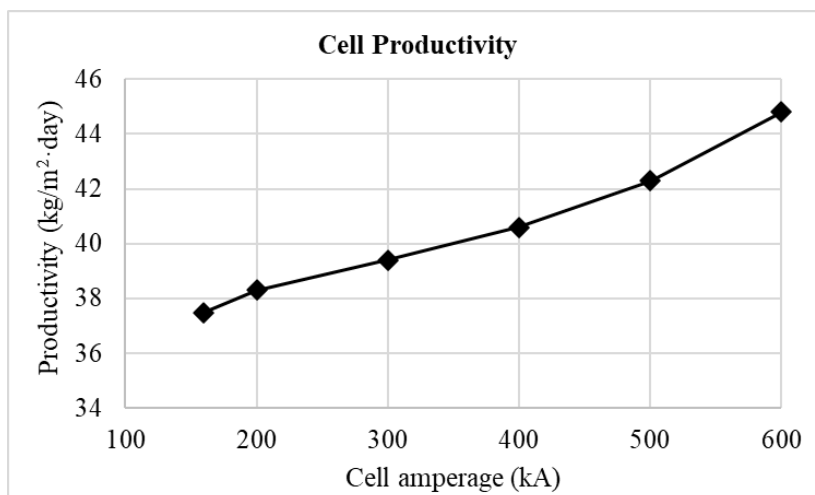


Figure 1. Productivity per cell area for different cell amperages.

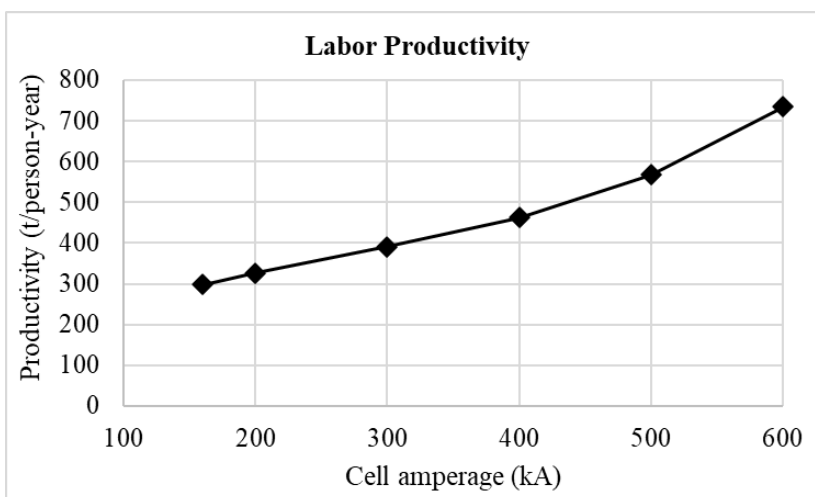


Figure 2. Labour productivity for different cell amperages.

6. References

1. Junman Qin et al., Development of China's aluminium industry and NFC/NEUI aluminium smelting technology development and applications, *Proceedings of the 41st International ICSOBA Conference*, Dubai, 5–9 November 2023, *Travaux* 52, 1283–1291.
2. Junman Qin et al., Development and industrial application of NEUI600 high efficiency aluminium reduction cell, *Light Metals* 2018, 705–713.
3. Xiquan Qi et al., Successful commercial operations of NEUI400 potline, *Light Metals* 2010, 359–363.
4. Yungang Ban et al., Cathode structure optimization research for aluminium reduction cell, *Light Metals* 2018, 1345–1352.
5. Jing Liu et al., Study on optimization of anode structure for aluminium reduction cell, *Light Metals* 2018, 1275–1284.
6. Xizhong Cui et al., Application of RuC technology in 600 kA aluminium reduction cells, *Proceedings of the 43rd International ICSOBA Conference*, Nanning, China, 26–31 October 2025, *Travaux* 54 (this conference).
7. Ron Knapp, China Hongqiao Group – a Leading Global Aluminium Producer Moving from Heavy to Zero Carbon, *Proceedings of the 40th International ICSOBA Conference*, Athens, 10 - 14 October 2022, *Travaux* 51, 75–83.
8. ASI, Hongqiao Group Co., Ltd. subsidiary operation Yunnan Hongtai New Material Co., Ltd. against Performance Standard, *ASI*, <https://aluminium-stewardship.org/asi-certifies-china-hongqiao-group-co-ltd-subsi-dary-operation-yunnan-hongtai-new-material-co-ltd-against-performance-standard>, (accessed on 26 August 2025).
9. Weiqiao Pioneers with Successful Launch of World's First NEUI600+ Super Electrolyzer Production Line at Yunnan Honghe New Material Co., Ltd., *SMM*, <https://news.metal.com/newscontent/103424325/Weiqiao-Pioneers-with-Successful-Launch-of-Worlds-First-NEUI600-Super-Electrolyzer-Production-Line-at-Yunnan-Honghe-New-Material-Co-Ltd>, (accessed on 26 August 2025).