Technology Development and Application for Energy-Saving and Environmental Upgrades in Chinese Smelters Under New Policies

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Abstract

In recent years, under the new policy background of China's electrolytic aluminium industry, it has become a hot topic how smelters can tailor high-quality technology upgrade plans to find the optimal balance between meeting the new policy requirements and creating good economic benefits, thereby achieving low-carbon and green development. This paper presents the on-site renovation project of a 20-year-old smelter located in Sichuan, China as an example, and discusses some key energy-saving and environmental protection upgrade technologies, integration ideas and application effects in the project. After the upgrade, the smelter achieved its design goals, revitalized its machinery, and achieved high-quality development of the smelter.

Keywords: Aluminium electrolysis, Pot technology upgrade, China's Dual Carbon Policy.

1. Policy Background

1.1 China's Dual Carbon Policy

In September 2020, the Chinese President Xi Jinping announced at the General Assembly of the United Nations that China will increase its nationally determined contribution, adopt more effective policies and measures, and strive to peak its carbon dioxide emissions before 2030, and achieve carbon neutrality before 2060.

In December 2020, the Chinese President Xi Jinping further announced at the climate summit that by 2030, carbon dioxide emissions per unit of GDP would fall by more than 65 percent compared with 2005 levels, and increase its forest stock volume by 6 billion cubic meters; also, non-fossil energy will account for about 25 % of its primary energy consumption, the total installed capacity of wind and solar power will reach over 1200 GW.

1.2 Definition and Statistical Value of Various Electricity Consumptions in Smelters

There are many names for the composition of energy consumption in aluminium smelters, including DC energy consumption per tonne of aluminium, liquid aluminium AC energy consumption, liquid aluminium comprehensive AC energy consumption, aluminium ingot comprehensive AC energy consumption, etc. The definition and statistical value of each kind of electricity consumption are found in Chinese National Standard GB 21346-2022 [1], which has been implemented since January 2024. To facilitate the understanding of various energy consumption indicators, they are summarized in Figure 1.

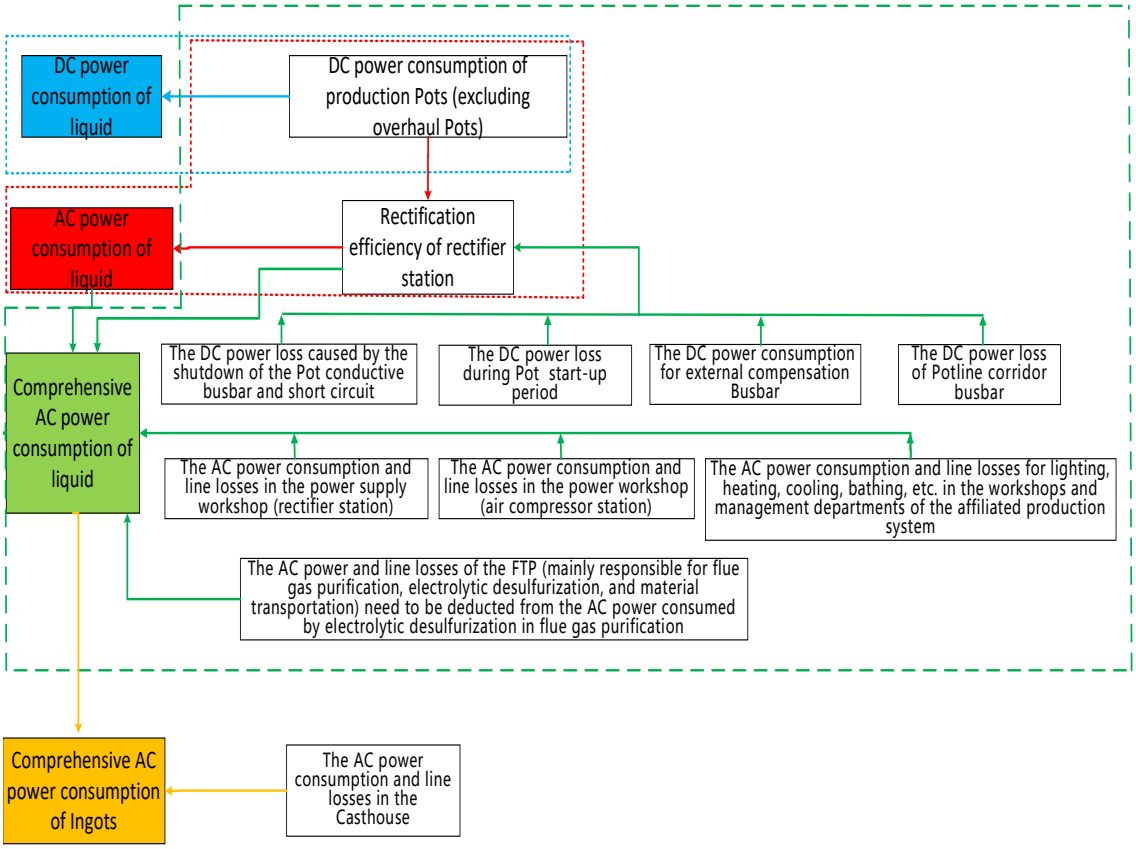

Figure 1. Calculation range of various power consumptions in smelters by Chinese standards.

From Figure 1, it can be seen that the definition range and statistical value of the comprehensive AC power consumption of aluminium liquid are the most practical and valuable.

1.3 Differentiated Stepwise Electricity Charges for Smelters

In August 2021, the National Development and Reform Commission (NDRC) issued and improved policies on differentiated electricity charges for the electrolytic aluminium industry, which encourage aluminium smelters to improve the utilization level of non-hydro renewable energy such as wind power and photovoltaic power generation, and reduce the consumption of fossil energy. To promote energy conservation and emission reduction in the electrolytic aluminium industry, the NDRC has gradually introduced a differentiated electricity consumption policy for the electrolytic aluminium industry; according to its requirements, the comprehensive AC power consumption of hot metal (composed of DC power consumption of pot and auxiliary power consumption in electrolytic aluminium production) in 2022, 2023 and 2025, shall respectively reach to 13 650 kWh/t Al, 13 450 kWh/t Al and 13 300 kWh/t Al. In case of every 20 kWh increase, the electricity price per MWh for production will be increased by 10 yuan, equivalent to 1.3 USD.

1.4 Policy of Benchmark Level and Base Line of Energy Consumption by Smelters

In July 2023, NDRC and other sectors released “Benchmark Level and Base Line of Energy Efficiency in Key Areas of Energy-Intensive Industries” (2023 edition), which has explicitly addressed the proposed and under-construction projects which have to fully implement the Benchmark Level. For the existing smelters, which have operated at a higher level of energy consumption than the Base Line, it is reasonable to set up a transition period for policy

meeting new policy requirements and creating good economic benefits for smelters, achieving sustainable development and gaining satisfaction and recognition from aluminium smelters. GAMI is willing to share and exchange ideas with domestic and foreign peers, make progress together, and strive for the sustainable development of the world's electrolytic aluminium industry.

8. References

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