Research and Discussion on High Quality Technology Upgrade Plans for Chinese Smelters under New Government Policies

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Abstract

In recent years, under the background of new policies for China's aluminum smelters, the hot topic is how smelters can align high-quality technology upgrade plans to government policies, and find the best balance between meeting new policy requirements and creating good economic benefits, and thus achieve their own sustainable development. The authors take some typical smelters in China as examples to propose and conduct in-depth research and demonstration of some high-quality upgrading and transformation models and plans for discussion, and reference by industry peers at home and abroad.

Keywords: Aluminium electrolysis, Smelter technical upgrades, China's new government policy for aluminum smelters.

1. Introduction

In recent years, the primary aluminum industry under new policy background in China has confronted with challenges and opportunities both. Smelters urgently need to choose high-quality technology upgrading schemes which are suitable for themselves and seek for the best balance between catering to the new policy requirements and creating good economic benefits, so as to realize the sustainable development of smelters.

To go for customized technology upgrading schemes depends on external conditions of each domestic aluminum producers, namely in terms of production : the energy price is restricted to the external environments such as the source of power, the national or regional mandatory regulations and etc.; alumina and anodes are subject to raw material quality, market fluctuations; operation management level by operators are prone to the smelter's treatments and culture; the sale cost of hot metal is constrained by factors like surrounding aluminum processing enterprises operated and product price fluctuations. In terms of technical design, the potroom configuration of different aluminum producers is given with the design features according to the on- site implementation conditions, introducing some difference.

Therefore, it is very prudent for various aluminum smelters to choose and implement technology upgrading schemes which are only suitable for its own characteristics. By this way, the indeed high-quality technology upgrading realized will achieve ultimate goals and results.

The author, with reference to kinds of policies issued by Chinese ministry and commissions in recent years, studies and demonstrates the rationality of high-quality technology upgrading schemes adopted by a couple of typical aluminum smelters. Those technology upgrading modes and schemes can be used for discussion and reference in the industry.

2. Policy Background

2.1 China's Dual Carbon Policy

In September 2020, Chinese leader announced at the United Nations General Assembly 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, Chinese leader 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. It stated also that forest stock volume would increase by 6 billion cubic meters, also non-fossil energy would account for about 25 percent of its primary energy consumption, with a total installed capacity of wind and solar power that would reach over 1200 GW.

2.2 Differentiated Stepwise Electricity Charges for Aluminum Smelters

In August 2021, the National Development and Reform Commission (NDRC) issued and improved policies on differentiated electricity charges for the electrolytic aluminum industry, which encourage aluminum smelters to improve the utilization level of non-water 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 aluminum industry, the NDRC has gradually introduced a differentiated electricity charges policy for the electrolytic aluminum 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 aluminum production) in year of 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 the case of every 20 kWh increase, the electricity price per kWh for production will be risen by 0.01 yuan, equivalent to 0.0013 USD.

2.3 Policy of Benchmark Level and Base Line of Energy Consumption by Aluminum Smelters

In October 2021, NDRC and other sectors has released a notice aimed at issuing the “Benchmark Level and Base Line of Energy Efficiency in Key Areas of Energy-Intensive Industries” (2021 edition), which has explicitly addressed the proposed and under construction projects shall be implemented against the Benchmark Level, striving to reach Benchmark in full aspects. For existing smelters, which have operated at a lower level of energy efficiency than Base Line, it is reasonable to set up a transition period for policy implementation, and guide smelters to carry out energy conservation and carbon reduction technologies in an orderly manner, improve the efficiency of operation, and resolutely shut down outdated production facilities, backward process and products.

It is clearly stated that the top level of the electrolytic aluminum industry is 13 000 kWh/t Al of AC power consumption of hot metal, the average level is 13 350 kWh/t Al of AC power consumption of hot metal. It is worth noting that the AC power consumption of hot metal is generally obtained from the DC power consumption of the electrolytic cell divided by the rectification efficiency of the rectifier.

Table 5. Technical upgrading for environment-friendliness.

SN	Existing	Targeting	Effects to be achieved
1	Fugitive emission from butts in potroom	Increase of butt cooling down device and cooling chamber	Emission will be improved.
2	Severe fugitive emission of pot overhaul workshop	The functional zoning will be given to pot overhaul workshop including of delining area, SPL temporary storage area, superstructure maintenance area and potlining construction area. Also closing-up dust points and dust collecting	The environment of workshop will be greatly improved.
3	Poor dust-collection of facilities like cast station, medium frequency induction furnace, thimble press machine etc.	Introducing more dust collecting system as well as closing up dust points.	The environment of workshop will be greatly improved.
4	The alumina storage warehouse is poor of closure, the spillover of alumina powder from discharging chute of belt conveying outlet	Installing the electric door of the workshop, the alumina conveying feeding area is separated from the alumina storage by isolation measures, and upgrading the gas collector and dusting until of the belt conveying outlet	The environment of workshop will be greatly improved.

6. Conclusions

With reference to various energy consumption and environmental protection policies issued for aluminum industry in China in recent years, this paper has deeply studied and discussed the three typical high-quality technology upgrading models of aluminum smelters. Three types of technology upgrading models have their own characteristics, all of which have been implemented by GAMI.

Insisting on the basic principle of "To create the greater benefit for aluminum smelters, less investment, significant achievements", GAMI has referred to the different features from them and proposed the customized upgrading and retrofitting. The smelter after upgrading and retrofitting operates potline comprehensive AC power consumption of hot metal between 13 000 ~ 13 300 kWh/t Al, which is able to fully meet the requirements by China stringent electrolytic aluminum energy consumption policy.

The "high-quality technology upgrading" schemes promoted by GAMI has enabled the smelters to keep the optimum balance between catering to the new policy requirements and creating good economic benefits, finally in favor of smelters for a sustainable development.

7. References

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