

4.3

Country Report: China

Electron beam application in gas waste treatment in China

Haifeng WU

INET Tsinghua University, Beijing, China

Abstract

In the most recent decade, Electron beam waste treatment technology attracted serious attention from environment policymaker and industrial leaders in power industry in china. Start in middle of 1980's, Chinese research institute began experiment on Electron beam treatment on flue gas. By the end of 2000, two 10,000 cubic meters per hour small scale Electron beam gas purifying station were established in Sichuang province and Beijing. Several Electron beam gas purifying demonstration projects are under construction. With robust economy and strong energy demand, Needless to say, in near future, Electron beam gas purifying technology will have a bright prospect in china.

Historically Chinese power industry relied heavily upon raw-coal, it remains true today though a lot of other power systems like nuclear power plant and hydro-power plant were build during past few decades. Every year millions tons of toxic exhaust were given away into air by hundreds power plants in china, the majority of which are SO₂, that is the result of burning raw-coal. In china average coal used in power plant has about 1.2% sulfur. In year 2000, 80% of total 1.4 billion tons of raw-coal were burned, that is about 13 million tons sulfur were burned along with carbon in coal, produced about 26 million tons hazardous SO₂, of which about 37.3% was contributed by power plants. Massive SO₂ exhaust has caused serious environmental disasters.

Today china is the third severe acid rain region after Europe and northern America, and SO₂ is the major cause in the coastal china. The SO₂ pollution has become one of the major issues in Chinese environment protection plan, as the consumption of raw-coal is increasing year by year backed by more and more power demand. Steel works are major SO₂ producers too in china, and coal-burn heating center is another major cause of SO₂ pollution in northern china in winter.

1. Research of Electron Beam gas purification technology in china

In 1985, Shanghai atomic energy institute carried out an experimental research on electron beam treatment on flue gas to desulfurize the gas exhaust from power plant. 1998, first Chinese experimental industrial electron beam gas purification station was developed by china engineering physics institute in Shichuang province, with maximum treatment of 12000M³/h.

In 2000, another experimental facility of electron beam gas purification was installed in Tsinghua University in Beijing, whose maximum rate is 10000 M³/h, to develop new electron beam treatment process.

2. Industrial application of Electron Beam gas purification technology in china

In 1995, a cooperative project between Chinese government and Japanese Ebara Co. was signed to demonstrate the feasibility of electron beam gas purification technology in Chendu power plant in Shichuai province, the maximum gas treatment capacity is 300,000 M³/h. The project was finished and qualified in September 1997, and put into operation in Jan 1998. This is the first industrial EB project in china. With success of this project, some four other power plants had already applied to government to adopt EB technology, including one in Beijing, One in Shangxi province One in Zhejing province, and one in Guangxi autonomy region. And other 98%+ power plants are actively evaluating the EB method, as they will have to pay expensive penalty bill if they couldn't meet the reduced SO₂ exhaust quotes in next few years.

3. Economical analysis of Electron beam gas purification process in China

Electron beam gas purification technology is recognized better solution to the SO₂ pollution as comparing with other alternatives in China. It's much more cost effective than other methods, at Chengdu power plant EB project, average operation cost for one ton SO₂ reduction is about \$100, initial investment of EB system for a 100MW power plant is about 10 million US dollar. It's believed that the cost of EB system will be reduced to about one third to half of current level in next five years, as technology became more mature and more and more companies join to compete in this profitable business.

4. Development of Electron beam gas purification equipment in china

In order to make EB gas purification system more affordable for Chinese power producers, a lot Chinese institutes and companies are researching and developing equipments and components that new generation EB system may need. In 1996, the first demonstration project—Chendu EB system, about 61.4% of all components and subsystems are domestically made. Now, in new demonstration EB projects, more than 90% of all components are manufactured in china, some made 100%. Still a lot of work need to be done in order to produce the key component in the EB system, a large current electron accelerator whose reliability and lifetime can match those of one imported from Russia and Japan.

Conclusion

Electron beam gas purification technology has been proven successful to reduce SO₂ exhaust from power plant in china. It has also been recognized best approach to reduce SO₂ pollution.

As SO₂ pollution is becoming big concern in china, power plants already felt pressure from government and public to reduce SO₂ emission. For power industry leaders, decision has to be made, either to pay expensive environment penalty bill or to take action to cut SO₂ exhaust. For EB system vendors, and technology providers, competitive offering both in product and price are key to win lion share in huge Chinese market.