Fierce competition in Indian emissions control market

With revised compliance deadlines for coal plant emissions limits that are much more realistic than those proposed in 2015, emissions control technology suppliers are looking to the Indian market. **Ravi Krishnan,** Krishnan & Associates (ravi@krishnaninc.com)

In December 2015 the Indian Ministry of Environment and Forests introduced new emissions requirements for Indian coal plants requiring compliance within two years, giving plants very little time for implementation.

The regulations were challenged by the Indian power industry causing delays and eventual extension of the compliance deadline to 2022.

Among factors taken into account were:

- lack of compensatory tariffs for many IPPs for FGD capital & operating costs;
- capital, operating and auxiliary costs for scrubbers considered too high;
- short implementation timeline for FGD (when compared with estimated average installation times of about 30 months);
- lack of existing CEMS data from power plants for pollutants (eg, SO_x, NO_x);
- no infrastructure to supply limestone and for disposal of gypsum;
- no experience in the selection, procurement, commissioning, operation, maintenance or commercial evaluation of AQCS systems.

On 11 December 2017, the Indian Central Pollution Control Board (CPCB), after expiry of the original deadlines, issued notices to power stations asking them to take action to comply with the same limits specified in the 2015 notification, but with a new deadline, shifted to 2022.

India's economic growth is expected to be a driver for continued coal-fired generation as intermittent renewables are not expected to meet demand and will not be cost-competitive compared with fossil fuels for some time, even though prices for renewables are dropping.

Around 163 GW of coal generation capacity is subject to the new limits and will need to implement emissions control measures by 2022.

There are also limits on specific water consumption at coal plants, to be covered in next month's issue.

Favoured technologies

The current preferred approach for NO_x retrofit projects is generally to deploy combustion modifications and SNCR (selectively). SNCR is used as a trimming technology beyond in-furnace NO_x control. However, ammonia and urea, the primary reagents for SNCRs, are currently in short supply in India and largely imported, making it a relatively expensive option for Indian power plants.

Selective catalytic reduction is being specified for all new units and some existing units depending on their vintage. However, the ash impact on SCR catalyst deactivation and erosivity is under investigation, with many pilot programmes underway at NTPC power plants. The verdict on this issue will be known very shortly.

Particulate matter retrofits consist predominantly of ESP upgrades and rebuilds, especially in the case of older units having to meet a PM emissions target of 50 ppm.

For SO_x control, all units above 500 MW built after 2003 will require flue gas desulphurisation technology. Units below 500 MW may require FGD technology, especially those located in densely populated areas (defined as in excess of 400 people/km^2), while there will be prioritised installation of FGD technology for power stations in states neighbouring Delhi.

The favoured technology for SO_x control is predominantly wet FGD, which is generally the preferred technology due to the size of the units. However, dry systems would be ideally suited to Indian market conditions, particularly for smaller units, ie, below about 600 MW. Dry FGD has lower initial cost compared with wet FGD. In addition, dry FGD has lower power and water utilisation costs. Indian coal also is low in sulphur content, typically less than 1%, a further advantage for dry systems in the Indian context.

There has been some discussion about the availability of lime, the primary reagent for dry FGD, but our research shows it is available in some rural parts of India where many of the mine mouth coal fired plants are located.

In many cases smaller units (600 MW and less) are also relatively old and require an ESP rebuild anyway. In this case a dry FGD system with a baghouse is worth considering because overall it can potentially be a cost effective option, depending on particular plant circumstances.

However, wet FGDs remain the dominant technology as the Indian market has very limited awareness of the potential benefits of the dry system in the Indian context.

MOEF notification of emissions limit requirements for Indian coal fired plants, issued December 2015

Pollutant	Units installed before 31 December 2003*	Units installed after 1 January 2004 up to 31 December 2016*	Units installed from 1 January 2017**
Particulate matter	100 mg/Nm^3	50 mg/Nm^3	30 mg/Nm^3
SO_2	600 mg/Nm^3 (units < 500 MW) 200 mg/Nm^3 (units ≥ 500 MW)	600 mg/Nm^3 (units < 500 MW) 200 mg/Nm^3 (units ≥ 500 MW)	100 mg/Nm^3
NO_x	600 mg/Nm^3	300 mg/Nm^3	100 mg/Nm^3
Mercury	0.03 mg/Nm^3(for units of 500 MW or more)	0.03 mg/Nm^3	0.03 mg/Nm^3

**Units required to meet the limits within two years from date of publication of the notification.*
***Includes all units which have been given environmental clearance and are under construction.*

Technology procurement

A number of companies with experience of markets where AQCS technologies are well established and have been deployed for many years (notably USA, Europe, China, Korea and Japan) have partnered with Indian companies through licensing/JVs or appointed distributors/agents to supply equipment to Indian power plants and to make technology available.

There have been many cases of technology licences being signed with Indian companies. For example BHEL has recently entered into a technology collaboration agreement with Babcock Power Environmental of the USA on SCR systems and with Nano of Korea for design and manufacture of SCR catalyst. BHEL already had a technology collaboration agreement with MHPS in the FGD area, and is a major player in the supply of wet FGD in India.

Another feature of the Indian market is the reverse auction, not widely used in the environmental market globally, but becoming common in India, especially with NTPC projects. India is a very price sensitive market and the global softening of the air pollution control market has prompted the use of reverse auctions in India where sellers are underbidding each other to get business.

For example, there are typically 10+ competitors bidding for wet FGD projects, and in one recent NTPC auction there were around 30 bidders.

NTPC has nearly 25 FGD projects that it is awarding in lots and five companies have been successful so far: GE; BHEL; MHPS; ISGEC; and L&T-Chiyoda. There are perhaps 30-35 emissions control technology vendors around the world focusing on the Indian market because of dwindling prospects globally for coal power and coal plant emissions technology.

Indian industry observers were surprised by the low price recorded in the reverse auction that led to the first Telengana award to GE – equivalent to about $35/kW.

As FGD reverse auctions have progressed, prices have been moving upwards, reaching $130/kW. The scope for each project varies somewhat but usually includes absorber system, limestone preparation system and gypsum dewatering system, along with material handling system and wet stack.

The bottom line: a lot of suppliers and a lot of price competition for NTPC projects (although for non-NTPC projects, mainly IPPs and state GENCOs, the story is slightly different, and we have not been seeing reverse auctions).

The Chinese are not being preferred yet and there are many Western suppliers in the race. BHEL has been winning the lion's share, although other companies, such as GE, ISGEC, etc, are winning some projects.

Recent contract wins for GE and BHEL

GE Power reports that it has recently been awarded four orders by NTPC to supply and install wet FGD systems (combined value of INR 1783 crore (USD 247 million)) for four NTPC coal fired plants: Solapur - 2 x 660 MW; Tanda Stage II – 2 x 660 MW; Feroze Gandhi - 1 x 500 MW; and Meja – 2 x 660 MW (jointly owned by NTPC and UPRVUNL).

GE has completed installation and performance guarantee tests for wet FGD at NTPC's Vindhyachal Stage V Unit 13, 1 x 500 MW, plant and was awarded the contract for wet FGD at NTPC's 2 x 800 MW Telangana coal plant earlier this year.

GE has also just won its first order for its (formerly Alstom's) low NO_x firing system in India. The low NO_x combustion system, classified as a "primary" NO_x reduction measure, has been selected for installation on NTPC's 2 x 490 MW Dadri coal fired plant and on a 136 TPH Tata Chemicals coal fired boiler in Mithapur, Gujarat.

Meanwhile,"amidst stiff competitive bidding", Bharat Heavy Electricals also reports recent substantial orders (total value INR 2900 (USD 400 million)) from NTPC, for wet FGD systems at the following coal fired units: North Karanpura - 3 x 660 MW; Mauda Stage 1 - 2 x 500 MW; Barh Stage I - 3 x 660 MW; and Barh Stage II – 2 x 660 MW.

BHEL notes that it was "one of the earliest entrants in the Indian market for emission control equipment", having executed the wet FGD system at Tata Power's Trombay unit 8 in 2008. With these recent orders, BHEL is currently installing FGD systems for 17 units owned by NTPC and its JVs, other projects being at: Bongaigaon - 3 x 250 MW; National Capital Power Station, Dadri - 2 x 490 MW; and Maitree - 2 x 660 MW (Bangladesh).

Biomass co-firing

A new factor likely to further influence emissions control strategies at India's coal fired plants in the coming years is biomass co-firing. NTPC, which has a total coal fired installed capacity of about 40 GW, has said it plans to adopt biomass cofiring at all its coal units.

It has already trialled 7% biomass cofiring at its Dadri power plant.

Another technology of potential interest in the Indian context for utility applications, due to its inherent low emissions design and multi-fuel firing capability, is the CFB, to be the topic of a future article.