EXECUTIVE SUMMARY

1. The principle of electrostatically precipitating dust from a gas stream is known for over a century and this has not undergone any change even today. The commercial application of the principle in the form of ESPs was introduced to the industry for dust collection/cleaning of the gas, about 65 years back. The Lignite Plant at Neyveli, Tamil Nadu, seems to be one of the early users of ESPs of Lurgi design, in India.

2 In ESP, an electrical field is built-up between two sets of differently shaped electrodes, viz. wire/strip discharge electrodes and specially contoured plate collecting electrodes. The discharge electrode is connected to negative D.C. high voltage of the order of 45 to 110 KV peak and collecting electrodes are earthed. The corona around the discharge electrode ionises the gas molecules, which in turn, after collusion, impart charge to the dust particles in the gas. The negatively charged dust particles are accelerated towards the positive collecting electrodes and deposit on it. The discharge and collecting electrodes are rapped periodically to dislodge the accumulated dust, which is collected in the hoppers below the ESP for further disposal.

3. The size and precipitation efficiency of an ESP depends on a number of factors, like physical and chemical properties of the dust, electric field strength applied, spacing between the electrodes and design of discharge electrode.

4 ESPs are used in the industry for dust collection or cleaning of the gases for achieving cleaner environment and ecological protection. The largest area of application is dedusting of stack gases of coal fired boilers used in power generation/process steam, followed by cement, steel and other industries.

5 At present there are about 16 manufacturers in the country who can offer ESPs manufactured under collaboration agreements with internationally reputed manufacturers.

6 BHEL, Flakt, ACC-Babcock Ltd.(ABL), Voltas and Andrew Yule have large number of ESP installations to their credit in the country and have produced approximately 516, 250, 110, 100 and 80 ESPs respectively, till date. L&T, GEC, Orient Engineers, Thermax and Andhra Pradesh Heavy

Machinery & Engineering Ltd; are recent entrants in the field of ESP manufacture and till date have produced only a few units.

7 ESP manufacturers, except for BHEL and Flakt, normally do not have a factory/workshop for manufacturing ESPs exclusively. The practice seems to be that the structural equipment and mechanical/electrical sub-assemblies are procured from the sub-vendors and are assembled at purchaser's site as per design/assembly drawings and under supervision from the ESP supplier. BHEL, however, manufactures all the critical mechanical and electrical components in their own factories.

8 For a tailor-made equipment like an ESP, norms like licenced and installed capacity, production in physical/financial terms and capacity utilisation, are difficult to specify and ascertain. However, one indigenous manufacturer has indicated that the total sales volume of this product in the country could be around Rs.150 crores per annum currently.

9 When introduced in industry in earlier days, the main purpose of an ESP was to collect dust from the gas streams and reuse the same in process wherever feasible. However, with rapid industrialisation all over the world, industries were getting located near the habitable areas. This prompted the Governments world over, including India, to come out with stringent regulations for environmental and ecological protection.

10 The application of ESPs, especially in cement industry, has undergone considerable changes over the years with the advent of dry process technology for manufacture of cement and equipment like vertical mills for raw material, clinker, coal/lignite grinding. The vertical mills, which are air swept, use an ESP for collection of the ground product. Thus, ESPs have been assigned process line functions, in addition to their application as pollution control equipment. This means, that an ESP has to be operationally very reliable as any other equipment in the manufacturing process and, at the same time, its operation and maintenance costs have to be minimal with sustained precipitation efficiency.

11 This prompted the ESP manufacturers the world over to strengthen the R&D efforts and come out with innovations on mechanical, electrical and control system components of the ESPs, to achieve following objects:

— To make ESPs operationally reliable
— Higher precipitation efficiency

— Optimisation of ESP size
— Suitability for high resistivity dust applications
— Reduction in operation/maintenance costs

12 Some of the practical innovations that have been introduced in the industry, and are also available to Indian users through the indigenous ESP manufacturers, are:

— Microprocessor based controllers for voltage control and energy conservation
— Microprocessor based rapper control gear
— Increased gap between electrodes and higher operating voltages
— Pulse energised precipitators for high resistivity dust
— On-line emission monitoring & ESP management system for energy conservation

13 The indigenous ESP manufacturers have encountered no major difficulties in absorption/adaptation of the technology as such. However, some of the manufacturers depend on their collaborators for assistance in application/basic engineering & import of special components like :

— Discharge electrodes or raw material for the same
— High tension insulators for high temperature application
— Microprocessor based controllers for voltage control and rapper control
— High tension pulse generators
— Emission monitoring equipment.

14 BHEL, Hind Rectifier, Advani Oerlikon and ABB have recently developed indigenous microprocessor based controllers for voltage & rapper control and their field trials are reported to be satisfactory. BHEL manufactures this equipment for their own use.

15 The import content at present varies from 2-10% for all the indigenous manufacturers as indicated by them. High tension pulse generators are a recent development for special application involving higher resistivity dust and have been supplied by L&T only to a few cement plants. BHEL also supplied multi pulse TR Sets for high resistivity fly ash dust in Ennore Thermal Power Station.

16 The R&D efforts put in by Indian manufacturers, except for BHEL and Flakt, by way of facilities are reported to be marginal and have to go a

long way to obtain improved performance and to match the efforts put in by their collaborators. BHEL has established its own R&D laboratory at its manufacturing plant at Ranipet at a cost of Rs. 150 lacs and has all various necessary facilities.

17 A thrust on the R&D efforts in the ESP field to implement the innovations and to design economical ESPs is very important and relevant to the country, since most of the coal deposits are of poor quality (high ash content upto 45-48% and low sulphur and alkali content).

18 The relative size of the ESPs for power sector, where the poor quality coal is burnt, and cement plants, where water is scarce for gas conditioning, can be 2 to 2.5 times compared to locations in other countries where better quality coal and adequate water respectively are available.

19 The collaboration agreements of all the Indian manufacturers have restrictive clause in respect of export of these units to the countries where the collaborators have their licencees. However, Andrew Yule, BHEL and Flakt have exported some units to developing countries, like Bangladesh, U.A.E., Kenya and Indonesia.

RECOMMENDATIONS

Keeping in view the general structure, status of technology development and absorption, R&D efforts, etc., the following recommendations are proposed to narrow down the existing gaps in the ESP technology.

i) There should be an agency to continuously monitor the technical developments taking place in the world in the ESP field and the status of Indian ESP industry, to establish the gaps if any, and suggest corrective measures. The composition of the agency could be experts drawn from the Pollution Control Board, ESP manufacturers, major users, research organisations, consultants, etc.

ii) The Government may support setting up of a central R&D laboratory with financial and technical support from the ESP manufacturers. The centralised R&D efforts should be directed towards the following areas.

   a) Study of high resistivity dust emitted from cement kilns with a view to eliminate the water conditioning towers which need sizeable amount of water and maintenance.

b) Conditioning of the gases from boilers with chemical agents to reduce the size of ESPs in power sector. Encouraging results have been reported by ESP manufacturers abroad in this field.

c) Pulse energisation technique to precipitate high resistivity dust encountered in above two applications.

d) Development of pulse energisation.

e) Increase of electrode spacing to 600 mm and above.

f) Development of HT insulators for high temp. application.

g) Improvement in material technology for mechanical and electrical components for better reliability.

h) Understand/develop application software for ESPs manufactured in the country, so that indigenously developed microprocessor controllers find use with all makes of ESPs.

i) Human resource development to understand/maintain electronic equipment.

j) Reliable emission monitoring instruments.

k) Improved fine particulate collection techniques for applications in ESP.

l) Improvement in quality of sheet steel used for collecting electrodes.

m) Use of additives to coal at the grinding stage to change the control of grain size/structure/particulate properties during combustion stage in furnace to improve collection in least number of fields.

n) Reduction of ESP size by use of chemical gas conditioning agents and increasing the electrode spacing, pulse energisation technique etc.

o) Facilities for testing behaviour of dust generated from new raw materials with the help of flow model test/pilot ESP.

The results should be available to all the ESP manufactuers at reasonable cost. The R&D unit of BHEl at Ranipet could be considered as the nucleus of the proposed Central R&D Laboratory.

iii) The assistance of the Bureau of Indian Standards (BIS) may be obtained for specifications to cover test procedures for monitoring performance of ESPs while in service.

iv) All manufacturers should endeavour to strengthen R&D efforts individually and collectively for absorbing/adopting/developing new technologies to reduce dependence on foreign collaborators.

v) Manufactuers should have a data bank so that at the end of collaboration agreement, they are in a position to carry out the basic design and engineering on their own and get the same only reviewed by the licensors, wherever required.

vi) Formation of ESP Manufacturers' Association where, in the national as well as mutual interest, they could meet periodically to discuss the technology aspects, sharing of special data, problems experienced in ESPs manufactured/commissioned and corrective measures adopted, etc. The proposed Association should also include the major sub-vendors of ESPs.

vii) A centralised training centre be created jointly by the ESP manufacturers for training of operating personnel, particularly in respect of microprocessor based controls and pollution monitoring procedures and equipment, at regular intervals.

All the collaboration agreements should have clauses covering, a time bound programme for developing indigenous capabilities for carrying-out basic design and engineering and availability of latest innovations in the ESP field as and when developed during currency of the agreement.

Some users have reservations on using closed type ESPs for dedusting of coal/lignite grinding mills due to fire hazards. There is a need to create competition for open type ESPs manufacturers, which will also result in improvement of quality of such ESPs.

The users should install microporcessor based controllers on new ESPs as well as retrofit in the existing installations for improvement/optimisation of dust precipitation, energy conservation and maintenance management.