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**INDIAN BOILERS MANUFACTURERS' ASSOCIATION
TRADE MISSION**

**United States of America
June 18 - July 1, 1994**

Prepared for:

US - ASIA ENVIRONMENTAL PARTNERSHIP



WORLD ENVIRONMENT CENTER

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I. EXECUTIVE SUMMARY

On June 18 through July 1, 1994 a seven member delegation from the Indian Boilers Manufacturers' Association (IBMA) visited the United States under the sponsorship of the U.S.-Asia Environmental Partnership (US-AEP) through its cooperative agreement with the World Environment Center (WEC). The goals of their mission were to:

- Create a better awareness in the global community of the range and depth of India's economic reforms
- Explore the potential for export of boilers and boiler components
- Seek strategic alliances, preferably joint ventures, with arrangements for buyback or reexports
- Study the latest developments in the arena of boilers and boiler related products and examine their suitability for Indian conditions, and
- Learn from the experiences of industries in technologically advanced countries to ensure that rapid industrialization and urbanization do not lead to environmental and ecological degradation.

To achieve these goals, the IBMA participants visited the American Boilers Manufacturers' Association as well as numerous manufacturers specializing in boiler related technology. As a result of their mission, the participants believe that a good market exists in India for pollution control equipment, and they intend to organize a workshop for related industries.

Participants included:

Ms. D.B. Baldawala, President, IBMA
Director, Industrial Boilers Ltd.

Mr. G. Trivedi, Director
Thermax Ltd.

Mr. N.K. Desai, Chief Executive
Laxmi Boilers

Mr. B.P. Trivedi, Partner
Jayant Welding & Engineering Works

Mr. V.N.G. Rao, Mg. Director
Ignifluid Boilers India Ltd.

Mr. M.S. Walia, Director
Walia Engineering Assoc. Pvt. Ltd.

Mr. C.R. Engineer, V.P. Marketing
Industrial Boilers Ltd.

Funding for this project was provided through a Cooperative Agreement between the World Environment Center (WEC) and the United States-Asia Environmental Partnership (US-AEP).

II. INTRODUCTION

The Indian Boilers Manufacturers' Association (IBMA) is the only apex body in India representing boiler manufacturers and industries ancillary to boiler manufacturers in the organized sector of the country. IBMA members design, develop, manufacture, and market world class boilers in terms of both quality and efficiency. The boiler manufacturing activity began in the early 1960's and has evolved to meet the burgeoning needs of Indian industry.

India manufactures an energy efficient spectrum of boilers, including: coal firing, oil, gas, lignite, and agro-waste boilers, that meet stringent standards. The quality of boilers manufactured in India has been made possible through research and development efforts, joint ventures in technology with world leaders in the field and, through a deep commitment to understanding and meeting clients' needs. The Indian boiler industry has access to some of the country's best talents produced by its business and engineering schools. Rapid strides have been made in recent years by India positioning itself in a challenging and rewarding business arena. The Indian boiler industry also has been exporting boilers to the Middle East, Africa, and other Asian markets. This is the result of India establishing its position in areas such as technology manufacturing infrastructure, sales and services, and human resources.

The Indian Boilers Act of 1923 has been updated and amended periodically to incorporate strict inspection rules for the manufacture and use of boilers, and ensures that every manufacturer complies with these rules. Quality standards are further strengthened through the presence of international inspection agencies operating in India, specifically Lloyds, Bureau Veritas, ASME, and ISO.

Rapid industrialization and urbanization generally result in environmental and ecological degradation. The members of IBMA are investing in design and manufacture of eco-friendly equipment. They are continuously searching for the latest in technology both at home and abroad and their mission to the U.S. sponsored by US-AEP through its Cooperative Agreement with WEC was a timely step in that direction.

III. DISCUSSION AND FINDINGS

While in the U.S., the IBMA participants visited the American Boilers Manufacturers' Association and numerous manufacturers in the boiler industry field. A summary of these visits is provided below.

A. THE AMERICAN BOILERS MANUFACTURERS' ASSOCIATION (ABMA), ASHEVILLE, NORTH CAROLINA

The participants attended the ABMA's A.G.M. The meeting provided good insight to the association's structure and operation, and provided a forum to meet the boiler, burner, and ancillary manufacturers of the U.S. and other countries to exchange views.

The ABMA has an Air Pollution Committee which works very closely with government agencies. The main focus of this committee is its "strategy 2000" and its goal to determine how the existing pollution problems can best be overcome. IBMA can gain a lot from the latest information available on technological developments in the environmental area.

B. POLLUTION CONTROL EQUIPMENT

Approximately 40,000 boilers currently exist in India. Of that number, hardly 12-15 percent have pollution control equipment, particularly the large size boilers for which such equipment is cost prohibitive. To attain better pollution control, India needs compact electrostatic precipitators that can be cost competitive. The participants reviewed pollution control equipment, including: wet electrostatic precipitators, Venturi scrubbers, compact hybrid particulate collectors (COHPAC) and reverse gas fabric filters, manufactured by two U.S. companies.

1. Beltran Associates, Inc.

There are three main air pollution control equipment technologies for boilers:

- Bag filters
- Scrubbers
- Electrostatic precipitators.

Of these three alternatives, electrostatic precipitators are comparatively cost prohibitive. Their cost some times doubles that of the boiler and, therefore, the use of electrostatic precipitators is marginal in India. In addition, most of the existing technology is for large size utility boilers. Beltran has technology for small

and medium size industrial boilers and proper study has to be made to adopt this technology to suit Indian conditions.

Beltran states that since its technology is wet electrostatic precipitation the gas coming from the flue gas can be quenched, thereby the size of the precipitator can be reduced, making it cost effective. Beltran is also ready to install a demonstration plant in India. The company is interested in the Indian market and would like to have some representation to be followed by a joint venture project in India.

A visit to two municipal waste treatment and incineration plants was very useful and found that the plants can be adapted to Indian conditions. The visit emphasized the advantages of wet electrostatic precipitation for such an application. Some IBMA members have shown interest in the wet electrostatic precipitation technology and would like to initiate dialogue after doing the preliminary work.

2. Research Cottrell

Research Cottrell has already signed a Memorandum of Understanding (MOU) with ACC India for their scrubber and electrostatic precipitation technology. However, the following technologies are open for negotiation:

- Continuous emission monitoring system
- Fire detection system
- CO₂ monitoring system
- Chimney.

All these technologies will be very relevant in the coming years for India.

Indian coal presents a special problem. A high ash content in the coal (up to 60 percent) presents many problems for electrostatic precipitators. It is unclear whether a hybrid system will do the job. To find an optimum solution for the burning of Indian coal, heavy fuel (LSHS), and agro-waste, it is suggested that a "book shelf research" be conducted. The findings will greatly boost India's environmental efforts. Research Cottrell is ready to undertake a technology assessment study costing approximately \$20,000, if funding is available from an independent agency. IBMA members have initiated a dialogue after doing the preliminary work.

C. HEAT RECOVERY SYSTEMS

Heat recovery systems include:

- Heat recovery steam generators
- Municipal solid waste fired boilers
- Incinerators

The participants visited three companies that concentrate exclusively on high temperature heat transfer technology and special design boilers. The technologies can be adapted to use municipal waste and to generate power.

1. American Schack

American Schack is owned by GEC Alsthorm Group which has expertise in high temperature, dirty gas, heat recovery systems and incineration. This technology is of relevance for India since heavy dirty fuel firing is common.

The blast furnace gas fired boilers are very relevant and applicable to India. The air preheaters save energy and help in pollution control. Their CEO, Mr. C. P. Natrajan (Ex-BHEL), being of Indian origin, has an in-depth understanding of the Asian, and especially the Indian, market.

The participants also visited American Schack's fabrication source, Minotta Corporation. This visit provided insight to the skill and competency of U.S. industry. American Schack is ready to provide process technology, and would also like to entrust the manufacture of equipment to an Indian partner. They are ready to appoint a representative in India on a commission basis through a non-exclusive arrangement.

2. John Zink Company

John Zink's hydrosonic gas scrubber has a unique technology to solve the exhaust gas cleaning problems with the highest efficiency while keeping the cost very low. These scrubbers remove the particles from contaminated air or process waste streams very efficiently, including those in the submicron range. The company also specializes in refinery burners, at times supplying burners to 95 percent of the U.S. refineries.

John Zink's No_x IDIZER is very reliable and available for limiting No_x formation in incineration and nitrogen-bearing wastes.

3. Sellers Engineering Company

The Sellers Engineering Company manufactures small industrial oil and gas fired boilers, deaerators, immersion fired boilers, and hot water boilers. They have a uniquely designed combustion system for gas fired boilers. The burner takes 20 percent excess air and is a low No_x burner. It can be imported into India for gas fired boilers.

The deaerators may also have a good market in India. The boiler design incorporates a multiple burner system that immerses into smoke tubes. This reduces the cost of the boiler, but maintains a high efficiency.

4. Henry Vogt Machine Company

The Henry Vogt Machine Company manufactures large heat recovery steam generator units for utility boilers, high pressure vessels, ice machines, high pressure water tube boilers, and fluid equipment. Recently, Vogt received a \$180 million order for the Enron project in India for 6 heat recovery steam generators, and is expecting an order for the Gandhar Project in the near future.

One of the terms of the contract is to off-load 15 percent of the contract value to an Indian company; this amounts to \$3 million per contract. Some IBMA members have shown an interest in procuring a subcontract from Vogt.

Vogt has the technology for ice machines, and they are looking for Indian partners for joint venture arrangements. The advantage of these machines is that the power consumption is very low. IBMA will circulate this information for the benefit of other members. Vogt also seeks some representation in India to sell the complete range of high pressure valves. Some members have shown interest in this type of arrangement.

Vogt's small oil fired water tube boiler, ranging from 10 to 60 tons with approximately 600 psi, has an excellent market in India for cogeneration. Vogt is open for either technology transfer or joint venture, and members have shown interest in this technology.

D. FLY ASH BRICKS

1. Houston Lighting & Power Company and Castone International Ltd.

Castone International Ltd. manufactures equipment for fly ash brick plants. The company also purchases fly ash from the Houston Power Company for their brick manufacturing plant. Castone has a unique, simplified technology compared to the

technology from Germany and Denmark. The plant's power consumption is very low since it has no presses, boilers, or autoclaves. The process relies mainly on vibration and vacuum injection.

The total power generation in India is 70,000 megawatts, of which 70 percent is produced by coal based plants. The Indian coal contains a great deal of ash, therefore, the amount of fly ash generated yearly is voluminous. The power plants are facing several problems in storing the fly ash, so many research institutes in India are working desperately to find uses for the fly ash. One of the uses is to make construction material, but until now what the Indian brick manufacturers have come up with has to face severe competition with red clay bricks. If the new U.S. technology can bring down the cost of manufacturing the bricks, the industry would have a tremendous market in India.

The Indian fly ash is totally different from that in the U.S., so it is advisable to analyze the chemical and physical composition of fly ash to determine whether this technology is suitable for Indian fly ash. The party is interested in a joint venture in India.

E. CATALYTIC CONVERTOR SYSTEMS

The exhaust emission from automobiles creates photochemical smog problems in big cities. Engine modifications alone could not reduce these exhaust emissions sufficiently. The only solution is the catalytic convertor which abates carbon monoxide, unburned hydrocarbons, and nitrogen oxides. In India, the population of four-wheelers and two-wheelers increases every year along with the problem of pollution in the form of CO, HC, and Nox.

1. Johnson Matthey

The IBMA participants visited Johnson Matthey's Catalytic System Division. This company is a leader in the automotive emission control catalyst. Already, one automobile company in India is using their convertors for their export market and, in the near future, cars sold locally will also need such conversions. Johnson Matthey is also a major supplier of catalytic convertors for two-wheelers, which have a huge market in India.

The technology for catalytic incineration has a good application that saves fuel oil in burners. The catalytic system has the following applications:

- Chemical and petrochemical
- Metal coating

- Printing
- Paints and paint sprays
- Pharmaceuticals
- Wood paper fibre

Stationary engine catalytic convertors also have wide applications. The process for burning volatile organic compounds by catalytic combustion is energy efficient and pollution free. They are interested in selling the catalyst to India. IBMA suggested the Johnson Matthey do some preliminary study and application engineering to promote the concept of catalytic systems to suit the Indian conditions.

IV. RECOMMENDATIONS

Recommendation 1: Funding should be provided to conduct technology assessments and demonstration plant studies.

The IBMA believes that in order for Indian industry to increase its use of pollution control equipment, technology assessments and demonstration plant studies must be undertaken, and that funding for such studies should come from the international community.

Recommendation 2: A workshop should be organized to invite industries in the catalytic generator field.

The participants believe that the study and application engineering for catalytic generators is important to India. The IBMA intends to organize a workshop for related industries and believes that the Environmental Ministry has a lead role to play in implementing this technology.

Recommendation 3: Funding should be provided for fly ash projects.

APPENDIX A
ITINERARY

ITINERARY

June 18-21	Sat-Tue:	Attended A.G.M. of American Boilers Manufacturers Association (ABMA)
June 23	Thu:	Beltran Associates, New Jersey
June 24	Fri:	Research Cottrell, Somerville, New Jersey
June 27	Mon:	American Schack, Pittsburgh, Pennsylvania
June 28	Tue:	Johnson Matthey, Wayne, Pennsylvania
June 29	Wed:	Castone Houston, Texas and Houston Electric Power
June 30	Thu:	Sellers Engineers, Danville, Kentucky and Henry Vogt Machine Company, Kentucky
July 1	Fri:	John Zink Company, Tulsa, Oklahoma

APPENDIX B
PERSONS AND ORGANIZATIONS VISITED

PERSONS AND ORGANIZATIONS VISITED

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APPENDIX C

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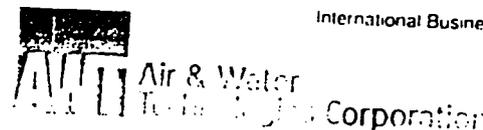
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WEC/US-AEP

Environmental Business Exchange (EBE) Trip Reports

February 22, 1995

Trip Reports as per Cooperative Agreement (CA) AEP-0015-A-00-2055-00 in Support of the U.S.-Asia Environmental Partnership

<u>EBE ID#</u>	<u>EBE DATES</u>	<u>TITLE OF TRIP REPORT</u>
INDI-1I	11/7-23/93	Oil Absorbent Demonstration
INDI-1K	12/6-29/93	Review of Incinerator Operations, Indian Thermal and Cyno Clean
INDI-2	4/23 - 5/6/94	Review of Pollution Prevention Control Technology in the Textile Industry
INDI-5	4/30 - 5/10/94	Clean Coal Technology Evaluation
INDI-1P (1&2)	5/94-8/94	Clean Technology for Paper Mills - Esvin - Parts 1&2
INDI-1R	6/18-30/94	Evaluation of Biological Formulations for Industrial Wastestreams Treatment (Premier Ziba)
INDI-1Q	6/18-7/1/94	Indian Boilers Manufacturers' Association Trade Mission
PHIL-8	9/27-10/6/94	Technical Assistance on H ₂ S Gas Abatement Systems (PNOC)
HONG-1	10/23-11/9/94	Coleman Energy and Environmental Systems Technology Transfer
KORE-1	12/9-22/93	Fuel Gas Desulfurization Technology Assessment (KEPCO)
INDI-1L	1/17-2/23/94	Corporate Environmental Mission (IT Corporation Exchange)
INDI-4	3/11-30/94	Evaluation of CS ₂ Recovery in Rayon Mills