



Subject: Expression of Interest for Technology Tie-up for Ash Handling System

1) Introduction:

This Expression of Interest (Eoi) seeks response from prospective collaborators who are meeting the requirements of this Eoi and are willing to be associated with BHEL through a License & Technology Collaboration Agreement (TCA) on long term basis to enable BHEL to design, engineer, manufacture, assemble, test, supply, erect, commission, retrofit, repair and service the Ash Handling System as specified in this Eoi.

1.1) About Bharat Heavy Electricals Limited:

BHEL is a leading state owned company, wherein Government of India is holding 63.17% of its equity. BHEL is an integrated power plant equipment manufacturer and one of the largest engineering and manufacturing organization in India, catering to the core infrastructure sectors of Indian economy viz. energy, transportation, heavy engineering industry, defense, renewable and non-conventional energy. The energy sector covers generation, transmission and distribution equipment for thermal, gas, hydro, nuclear and solar photo voltaic. BHEL has been in this business for more than 50 years and BHEL supplied equipment's account for more than 59% (approx. 190 GW) of the total thermal generating capacity in India. BHEL is also listed in both major Indian stock exchanges. BHEL has 16 manufacturing units, 4 power sector regions, 8 service centers, 3 overseas offices and 15 regional offices besides host of project sites spread all over India and abroad. The annual turnover of BHEL for the year 2018-19 was around USD 4.25 billion. BHEL's highly skilled and committed manpower of approx. 35000; state-of-the-art manufacturing facilities and latest technologies helped BHEL to deliver a consistent track record of performance since long. To position leading state owned companies as Global Industrial giant and as a recognition for their exemplary performance, Government of India categorized BHEL as "Maharatna Company" in 2013.

Our ongoing technology tie-ups with leading technology providers are GE Technology GmbH, Switzerland (for Once through Boilers and Coal Pulverisers); Siemens, Germany (for Steam Turbines, Generators and Condensers); Metso Automation Inc., Finland (for Control & Instrumentation); MHI, Japan (for Pumps); MHPs, Japan (for Flue Gas Desulfurization Systems); Vogt Power International, USA (for HRSG); OTO Melara, Italy (for SRGM); GENP, Italy (for Compressors); TLT Turbo GmbH, Germany (for Fans), Sheffield Forge Masters International, UK (for Forgings); ISRO, India (for space grade li Ion cells); BPE, USA (for SCR System), NANA O, Korea (for SCR Catalyst); HLB Power Co. Ltd., Korea (for Gates and Dampers) and Kawasaki Heavy Industries Ltd., Japan (for Stainless Steel Metro Coaches & Bogies).

More details about the entire range of BHEL's products and operations are available at www.bhel.com

1.2) About Industrial Systems Group (ISG)

BHEL through its unit named Industrial Systems Group (ISG) based at Bangalore, (State: Karnataka) has been supplying material handling systems and automation systems to thermal power plants and steel industry on EPC basis. The material handling systems include Coal handling system and Ash Handling System for Thermal power plants and Raw material handling system for steel plants.



2) Scope of cooperation:

BHEL is seeking responses from reputed Original Equipment Manufacturer (OEM) of Ash Handling System for technology transfer and collaboration on a long term basis to design, engineer, manufacture, assemble, test, supply, erect, commission, retrofit, repair and service the Wet Bottom Ash Handling System and Fly ash conveying (pressure and vacuum) system.

BHEL intends to manufacture these Ash Handling System under a long term license & technology transfer agreement which could be operationalized with transfer of technology. Interested parties/prospective collaborator meeting the requirements of this EoI are invited to respond to this EoI.

Upon receipt of responses against EoI from the OEM, BHEL will review the responses to ascertain suitability of the offer made by the Prospective Collaborators and shortlist the parties for further discussions. Detailed discussions on commercial and other terms and conditions to finalise the Technology Collaboration Agreement (TCA) shall be held with shortlisted parties/Prospective Collaborators. The detailed terms and conditions for such a paid-up license agreement shall be mutually agreed upon.

Indicative scope of technology transfer for Ash Handling System are given in Annexure-1.

3) Prequalification requirements (PQR):

The Prospective Collaborator shall meet following qualification requirements as on the date of submission of this EoI.

3.1 The Prospective Collaborator should be a supplier of Ash Handling Systems and should have executed Ash Handling Systems involving design, engineering, manufacture, supply, erection and commissioning for:

- a. Wet Bottom Ash Handling system designed for the following conveying capacity for pulverized coal fired boilers:
 - i) A Jet Pump System in conjunction with water impounded Bottom Ash Hopper: 50 tonnes/hour (dry ash basis) or more per jet pump.
AND
 - ii) A submerged Scraper Chain Conveyor system: 20 tonnes/hour (dry ash basis) Chain Conveyor System or more per Conveyor.

The Prospective Collaborator shall submit references for both the types i.e. Jet pump system and Submerged scrapper chain system

AND

- b. Pneumatic fly Ash Handling System for conveying fly ash from ESPs of single pulverized coal fired boiler unit by:
 - i) Pressure conveying system designed for 30 TPH or more conveying capacity.
AND
 - ii) Vacuum conveying system designed for 30 TPH or more conveying capacity per vacuum extractor.

The Prospective Collaborator shall submit references for both the types i.e. vacuum system and pressure system.

AND



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- c. Pneumatic Fly Ash Transportation System for transporting fly ash from single pulverised coal fired boiler unit having capacity of not less than 20 TPH for a conveying distance of not less than 500 meter.
The Prospective Collaborator shall submit references for the Pneumatic Fly ash transportation system.

AND

- 3.2** The systems mentioned at 3.1 above should have been in successful operation in at least one (1) plant for at least two (2) years prior to the date of closing of EoI. For the purpose of qualification, the experience as specified at Clause 3.1a(i), 3.1a(ii), 3.1b(i), 3.1b(ii) and 3.1c above in separate plants is also permissible. Prospective Collaborator should have supplied at least two no's (02) Ash Handling Systems comprising of Bottom Ash Handling System (Jet pumping system or submerged scraper conveyor system) and Pneumatic Fly Ash Handling System (Vacuum Conveying system or Pressure conveying/transportation system) within last 15 years from closing date of EoI.

Prospective Collaborator to provide relevant certificate(s)/ document to substantiate the PQRs.

4) Brief Description of EoI Process:

The interested prospective collaborators shall ensure that their response along with following annexures are received by BHEL on or before **13.08.2019**:

Annexure-1- Indicative Scope of Technology Transfer

Annexure-2- Indicative technical features of Ash Handling System for which the Transfer of Technology is sought

Annexure-3- Prospective Collaborator's experience in the field of Ash Handling System

Annexure-4- Complete reference list of Ash Handling System

The response shall necessarily be accompanied with details on:

- I. Company background,
- II. Technical features/product catalogue,
- III. Reference list,
- IV. Audited annual financial reports for last 3 (three) years including auditor's report etc.

In case any amendment/corrigendum issued to this EoI, it shall be notified only at www.bhel.com

5) Schedule of EoI & contact details:

5.1 Schedule of EoI:

The schedule of EoI shall be as follows -

Sl. No.	Description	Date
1.	Issue of EoI document	16.07.2019
2.	Last date for submission of EoI response	13.08.2019



5.2 Contact Details:

The respondent shall submit their response with all annexures duly signed to the following official:

Deputy General Manager (Technology Licensing)
Corporate Technology Management
Bharat Heavy Electricals Limited
BHEL House, Siri Fort
New Delhi - 110049, India
Phone: +91 11 66337213 / 7339
Fax: +91 11 26492974
Email: techeoi@bhel.in

6) Miscellaneous:

6.1 Right to accept or reject any or all Applications:

- a) Notwithstanding anything contained in this Eol, BHEL reserves the right to accept or reject any Application and to annul the Eol Process and reject all Applications, at any time without any liability or any obligation for such acceptance, rejection or annulment and without assigning any reasons thereof. In the event that BHEL rejects or annuls all the Applications, it may, at its discretion, invite all eligible Prospective Collaborators to submit fresh Applications.
- b) BHEL reserves the right to disqualify any Applicant during or after completion of Eol process, if it is found there was a material misrepresentation by any such Applicant or the Applicant fails to provide, within the specified time, supplemental information sought by BHEL.
- c) BHEL reserves the right to verify all statements, information and documents submitted by the Applicant in response to the Eol. Any such verification or lack of such verification by BHEL shall not relieve the Applicant of his obligations or liabilities hereunder nor will it affect any rights of BHEL.

6.2 Governing Laws & Jurisdiction:

The Eol process shall be governed by, and construed in accordance with, the laws of India and the Courts at New Delhi (India) shall have exclusive jurisdiction over all disputes arising under, pursuant to and/or in connection with the Eol process.

Indicative Scope of Technology Transfer

a)	License & transfer of technology relating to design, engineer, manufacture, assembly, test, supply, erect, commission, retrofit, repair and service the Ash Handling System as specified in this EoI.
b)	Assistance during procurement of new machines, special tools, Jigs & Fixtures, setup of test facility etc. required for manufacturing and testing of components /equipment required for Ash Handling System at BHEL works.
c)	Transfer of applicable and relevant knowledge and information/ Know-how and Know-why pertaining to design, engineer, manufacture, assembly, test, supply, erect, commission, retrofit, repair and service the Ash Handling System as specified in this EoI.
d)	Preparation of manufacturing drawings for all components, sub-assemblies required for Ash Handling System as specified in this EoI. Preparation of purchase specification and quality plan for all applicable bought out items for which manufacturing drawings are not prepared by proposed collaborator.
e)	Transfer of all design, design calculations, manufacturing drawings, process and instrumentation diagram, control write up, control logic diagram etc of Ash Handling System. Transfer of all applicable computer programs.
f)	Technical and quality surveillance assistance and supervision during design, engineer, manufacture, assembly, test, supply, erect, commission, retrofit, repair and service the Ash Handling System as specified in this EoI.
g)	Transfer of typical documents of Ash Handling System, as specified in this EoI already supplied by Prospective Collaborator such as General Arrangement drawing, layout drawings, technical data sheet, quality assurance plan, spare parts, special tools etc.
h)	Transfer of improvements/modifications/developments/up gradations to be carried out by the Prospective Collaborator during the period of Technology Collaboration Agreement for taking care of new market requirements and obsolescence of Ash Handling System. Subsequent updates required due to component obsolescence or updates implemented by Prospective Collaborator due to safety consideration would also be provided.
i)	Transfer of information regarding sub-vendors to enable BHEL to procure items.
j)	Training of BHEL engineers to enable them to design, engineer, manufacture, assembly, test, supply, erect, commission, repair, service and retrofit the Ash Handling System.
k)	Deputation of Prospective Collaborator's experts to assist BHEL in absorbing the technology for Ash Handling System.

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Indicative technical features of Ash Handling System for which the Transfer of Technology is sought

A) Bottom Ash Handling System -

The bottom ash handling system shall evacuate ash from bottom ash hopper and economizer hoppers at the desired rate and convey the ash slurry to ash slurry pump house.

A.1) Jet Pump System (Intermittent removal):

In case of intermittent or batch removal system, the bottom ash and economizer ash shall be stored in a water filled bottom ash hopper. The stored ash slurry shall be crushed in a clinker grinder and transported to Ash Slurry pump house by means of jet pumps.

- 1) Capacity of Jet pump = 70 to 100 TPH (dry ash basis)
- 2) Slurry transportation distance = 250 to 500 meters
- 3) Capacity of all other equipment = To suit the jet pump conveying rate

The following equipment are the minimum requirement for this conveying scheme:

- 1) Bottom Ash Hopper
- 2) Feed gate
- 3) Clinker grinder
- 4) Jet pump
- 5) Bottom ash overflow tank and pumping system
- 6) Flushing system for the Economiser hopper
- 7) Expansion joint and Knife gate valve
- 8) Piping, valves etc.

A.2) Submerged Scrapper Chain conveying system (Continuous removal):

In case of continuous type bottom ash removal system, the bottom ash from the boiler falls via the dry ash hopper-cum-transition chute into the water filled trough provided with a continuously moving scrapper chain conveyor. The wet ash is crushed in clinker grinder and gets discharged into the sloping ash trenches provided beneath them and from these trenches, aided by high pressure water jets, the slurry is led to the bottom ash slurry sump provided near the boiler. The ash slurry from economizer hopper is also fed to this sump. The combined slurry (bottom ash and economizer ash) is then transported from this sump to the main ash slurry pump house by means of centrifugal pumps.

- 1) Capacity of scrapper chain conveyor = 30 to 50 TPH (dry ash basis)
- 2) Linear speed of chain = 2 meters/min (maximum)
- 3) Drive and Chain tensioning arrangement = Hydraulic
- 4) Interchanging Working and stand-by conveyors with the boiler on load should be possible.
- 5) Capacity of all other equipment = To suit the conveying rate

The following equipment are the minimum requirement for this conveying scheme:

- 1) Transition chute below boiler
- 2) Submerged scraper chain conveyor
- 3) Clinker grinder
- 4) Flushing system for the economiser hopper
- 5) Expansion joint and knife gate valves
- 6) Centrifugal pump
- 7) Piping, valves etc.

A.3) Coarse ash handling system (APH and Duct):

The coarse ash collected in the air preheater and duct hoppers are to be disposed either in wet form or dry form. In case of evacuation in dry form, the ash shall be conveyed to buffer hoppers/intermediate silo by pressure conveying system. In case of evacuation in wet form, the coarse ash shall be mixed with water and slurry to be stored temporarily in a coarse ash tank in the boiler area. The coarse ash slurry shall further be transported to main ash slurry pump house by jet pumping system.

(i) Wet Form:

- 1) Capacity of jet pump = 60-80 tph (dry ash basis)
- 2) Slurry transportation distance = 250-500 meters
- 3) Capacity of all other equipment = To suit the jet pump

The following equipment are the minimum requirement for this conveying scheme:

- 1) Isolation valve / knife gate valve
- 2) Feeder ejector or any ash slurry conveying equipment
- 3) Expansion joint
- 4) Coarse ash tank
- 5) Jet pump
- 6) Piping and valves

(ii) Dry Form:

- 1) Capacity of ash conveying rate per stream = 5 to 10 TPH (dry ash basis)
- 2) Ash conveying distance = 100 meters

The following equipment are the minimum requirement for this conveying scheme:

- 1) Isolation valve/ slide gates / Knife gate
- 2) Material feed valve
- 3) Ash vessel
- 4) Piping, Sleeve couplings
- 5) Bag filters

A.4) Hydrobin Ash Handling System:

In case of intermittent or batch removal system, the bottom ash and economizer ash shall be stored in a water filler bottom ash hopper. The stored ash slurry shall be crushed in a clinker grinder and transported to hydrobins by means of jet pumps. The hydrobins shall be designed to decant water to settling tanks. After decantation of water from hydrobins, the moisture laden ash should be discharged through vibrating feeder.

The following equipment are the minimum requirement for this conveying scheme:

- 1) Bottom ash hopper
- 2) Feed gate
- 3) Clinker grinder
- 4) Jet pump
- 5) Hydrobin tanks
- 6) Settling tanks
- 7) Vibrating feeder
- 8) Bottom ash overflow tank and pumping system
- 9) Flushing system for the economiser hopper
- 10) Expansion joint and knife gate valve
- 11) Piping, valves etc.

B) Pneumatic conveying system (From ESP to Buffer hopper/Intermediate Silo)- Vacuum and Pressure system:

The fly ash collected in the ESP hoppers are to be evacuated at the desired rate to a buffer hopper or an intermediate Silo. This shall be accomplished either by a vacuum conveying system or a pressure conveying system.

- 1) Ash evacuation rate = 40 to 60 TPH (dry ash basis) per stream for vacuum conveying
- 2) Ash evacuation rate = 30 to 60 TPH (dry ash basis) per stream for pressure conveying
- 3) Number of cycles per hour = 15 to 20 in case of pressure conveying
- 4) Ash conveying distance = 100 to 500 meters in case of pressure conveying
- 5) Capacity of all other equipment = To suit the ash conveying rate

The following equipment are the minimum requirement for this conveying scheme:

- 1) Hopper isolation valve
- 2) Material handling valve / feed valve
- 3) Ash vessel / unloading vessel
- 4) Air intake valve, (as applicable)
- 5) Bag filter
- 6) Branch valves, tee- joints, sleeve couplings etc.
- 7) Instrument air system
- 8) Compressors / vacuum pumps

C) Pressure conveying system (From buffer hopper/intermediate silo to storage silo):

The fly ash collected in the buffer hopper or an intermediate silo are transported to main fly ash storage silos by pressure conveying system. The fly ash silos shall have outlets to load the fly ash to open trucks / closed tankers or wagons.

- 1) Ash evacuation rate per stream = 80 to 120 TPH (dry ash basis)
- 2) No. of cycles per hour = 15 to 20
- 3) Ash conveying distance = 800 to 1000 meters
- 4) Capacity of all other equipment = To suit the ash conveying rate

The following equipment are the minimum requirement for this conveying scheme:

- 1) Hopper isolation valve
- 2) Material handling valve / feed valve
- 3) Ash vessel
- 4) Bag filter
- 5) Branch valves, tee- joints, sleeve couplings etc.
- 6) Instrument air system
- 7) Compressors
- 8) Rotary feeders
- 9) Unloading spout / telescopic chute
- 10) Ash conditioners

D) Other technical requirements:

- 1) Process and Instrumentation drawings along with control write up shall be submitted.
- 2) Block logic diagram along with permissive, interlocks and trip conditions to be submitted.

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Prospective Collaborator's experience in the field of Ash Handling System

Sl. No.	Requirement	Prospective Collaborator's response YES/NO and remarks if any
a)	Whether the Prospective Collaborator is an OEM of Ash Handling System.	
b)	Whether Prospective Collaborator has its own manufacturing facility for Ash Handling System. If not, furnish details of where these are being manufactured.	
c)	<p>Whether Prospective collaborator meets the criteria stipulated at PQR 3.1 as below:</p> <p>3.1 The Prospective Collaborator should be a supplier of ash handling systems and should have executed ash handling systems involving design, engineering, manufacture, supply, erection and commissioning for:</p> <p>a. Wet Bottom Ash handling system designed for the following conveying capacity for pulverized coal fired boilers:</p> <p>i) A Jet Pump System in conjunction with water impounded Bottom Ash Hopper: 50 tonnes/hour (dry ash basis) or more per jet pump.</p> <p>AND</p> <p>ii) A submerged Scraper Chain Conveyor system: 20 tonnes/hour (dry ash basis) Chain Conveyor System or more per Conveyor.</p> <p>The Prospective Collaborator shall submit references for both the types i.e. Jet pump system, Submerged scrapper chain system</p> <p>AND</p> <p>b. Pneumatic fly Ash Handling System for conveying fly ash from ESPs of single pulverized coal fired boiler unit by:</p> <p>i) Pressure conveying system designed for 30 TPH or more conveying capacity.</p> <p>AND</p> <p>ii) Vacuum conveying system designed for 30 TPH or more conveying capacity per vacuum extractor.</p> <p>The Prospective Collaborator shall submit references for both the types i.e. vacuum system and pressure system.</p> <p>AND</p> <p>c. Pneumatic Fly Ash Transportation System for transporting fly ash from single pulverised coal fired boiler unit having capacity of not less than 20 TPH for a conveying distance of not less than 500 meter.</p>	
d)	Whether Prospective collaborator meets the criteria stipulated at PQR 3.2 as below:	



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	<p>3.2 The systems mentioned at 3.1 above should have been in successful operation in at least one (1) plant for at least two (2) years prior to date of closing of Eol. For the purpose of qualification, the experience as specified at Clause 3.1a(i), 3.1a(ii), 3.1b(i), 3.1b(ii) and 3.1c above in separate plants is also permissible. Prospective Collaborator should have supplied at least two no's (02) Ash Handling Systems comprising of Bottom Ash Handling System (Jet pumping system or submerged scraper conveyor system) and Pneumatic Fly Ash Handling System (Vacuum Conveying system or Pressure conveying/transportation system) within last 15 years from closing date of Eol.</p>	
e)	Whether company background and its product profile along with technical details for Ash Handling System in thermal power plants being offered to BHEL under this Eol is enclosed.	
f)	Whether product data sheet, Flow diagrams and General Arrangement (G.A) drawings enclosed as per above PQR.	
g)	Whether Prospective Collaborator's detailed reference list as per Annexure-4 enclosed.	
h)	Whether Prospective Collaborator's audited annual financial reports including auditor's report for last 3 years enclosed.	
i)	Whether the Ash Handling System design offered for technology transfer is the latest being marketed by the Prospective Collaborator.	
j)	Whether Prospective Collaborator has provided relevant certificate/document to substantiate the PQRs at 3.1 and 3.2.	
k)	Whether the Prospective Collaborator owns the Intellectual Property Rights for the technology being proposed for transfer under the Technology Collaboration Agreement (TCA) or have an unencumbered right from the owner of the Intellectual Property Rights to sub-license the technology, if applicable. If yes, whether list of such Intellectual Property Rights enclosed.	
l)	Whether Prospective Collaborator has any experience in establishing a new manufacturing, testing and assembly facilities for Ash Handling System, if so please specify.	
m)	Whether information on market share of Prospective Collaborator for Ash Handling System enclosed.	
n)	Whether Prospective Collaborator has carried out erection and commissioning or supervision of erection and commissioning of the Ash Handling System in projects mentioned in their certificates/documents submitted in support of PQRs at 3.1 and 3.2 .	

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Annexure -4

Reference list of Ash Handling System supplied by Prospective Collaborator

Sl. No.	Project Name / Location	Customer & End user details	Type of Ash Handling System	Description of Sub-system	Capacity	Month and year supply	Year of commissioning

(SIGNATURE)