



**Subject: Technology Tie-up for Air Cooled Condenser.**

**1) Introduction:**

This Expression of Interest (Eoi) seeks response for technology tie-up from design and engineering company of Air Cooled Condenser (ACC), who are meeting the requirements of this Eoi and are willing to be associated with BHEL through a License & Technology Collaboration Agreement on long term basis to enable BHEL to design, engineer, assemble, quality control, test, repair, service, retrofit, erection, commissioning, Performance Guarantee test, troubleshooting all systems / sub-systems and components for direct Air Cooled Condenser (ACC).

**1.1 About Bharat Heavy Electricals Limited (BHEL):**

BHEL is a leading state owned company, wherein Government of India is holding 63.06% 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 equipments account for more than 57% (approx. 180 GW) of the total thermal generating capacity in India. BHEL is also listed in Indian stock exchanges. BHEL has 17 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 2016-17 was US\$ 4.45 Billion\*. BHEL's highly skilled and committed manpower of approx 38000; 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 include 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); 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); 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](http://www.bhel.com).

**1.2 Heavy Electrical Equipment Plant (HEEP), Haridwar:**

HEEP was established in 1965 in northern part of India at Haridwar in the state of Uttarakhand. HEEP is one of the premiere manufacturing unit of BHEL. It has an impressive product line of major power plant equipments. The core business of HEEP caters to entire gamut of solution ranging from designing to performance guarantee of its equipments to after sales service for large size Steam & Gas turbines, Turbo Generators, Heat Exchangers, Condensers and Auxiliaries. Additionally, HEEP is also manufacturing defence equipments and environment related apparatus & instruments.

(\*Note: Currency conversion rate considered: 1 US \$= Rs. 65 (approx.) as on 31st March 2018)



### 1.3 Heavy Power Equipment Plant (HPEP), Hyderabad

HPEP is one of the major plants of BHEL located at R.C Puram, Hyderabad in the state of Telangana, India. The plant was started in 1965 and is presently engaged in manufacturing of Gas turbines, Electrical Generators, Pumps, Heat Exchangers, Switchgear, Pulverisers and Oil rigs.

Heat exchangers division of HPEP is engaged in the business of heat exchangers for Condensers, Deaerators, Feed water heaters, Inter-stage gas coolers etc. for wide range of applications including utility, industrial plants, sub-critical, super-critical thermal power plants, petroleum refineries, fertilizer plants etc. HPEP has supplied water cooled surface condensers both round as well as rectangular condensers up to 150 MW.

#### 2) Scope of cooperation:

BHEL is seeking response from Design and Engineering company for direct Air Cooled Condenser through an exclusive License and Technology Collaboration Agreement in India.

Prospective collaborator shall be responsible for transferring necessary know-how & know-why to BHEL to design, engineer, assemble, quality control, test, repair, service, retrofit, erection, commissioning, Performance Guarantee test, troubleshooting all systems / sub-systems and components for direct Air Cooled Condenser (ACC) the scope of which starts from LP Steam Turbine exhaust and ends at Condensate Extraction Pump.

Interested reputed Design and Engineering company meeting the Pre-Qualification Requirements (PQR) are invited to submit their offer in response to this Eol. Indicative scope of technology transfer is stipulated in **Annexure-1**.

Upon receipt of responses against this Eol, BHEL will review the responses to ascertain suitability of the offer and shortlist prospective collaborator for further discussions. Detailed discussions on commercial and other terms and conditions to finalize the Technology Collaboration Agreement (TCA) shall be held with shortlisted prospective collaborator. The detailed terms and conditions for such a paid-up license agreement shall be mutually agreed upon.

#### 3) Pre-Qualification Requirements (PQR):

Prospective Collaborator should meet all the following PQRs:

- 3.1 Prospective Collaborator should have designed and engineered at least two (02) numbers of direct Air Cooled Condenser (ACC) having single row tube bundles for a steam turbine of unit rating of 500 MW or above for the coal fired power stations which are located outside prospective collaborator's country of origin (incorporation). Out of these two (02) numbers of direct ACC, one (01) should have completed one (01) year of successful operation as on date of submission of response to this Eol.

AND

- 3.2 Prospective Collaborator should have designed and engineered at least two (02) numbers of direct Air Cooled Condenser (ACC) having single row tube bundles for a steam turbine of unit rating between 40 MW to 150 MW. Out of these two (02) numbers of direct ACC, one (01) should have completed one (01) year of successful operation as on date of submission of response to this Eol.

AND



3.3 Prospective Collaborator should have designed and engineered at least one (01) number of direct Air Cooled Condenser having multi row tube bundles for a steam turbine of minimum unit rating of 20 MW.

Prospective Collaborator should submit certificate(s)/ end user certificate(s) for different Air Cooled Condenser installation(s) to establish Pre-Qualification Requirements stipulated in clause 3.1, 3.2 & 3.3. (as suggested in Annexure- V).

**Note (applicable for clause 3.1, 3.2 and 3.3)**

Design and engineering activity should have been carried out by bidder itself. Design and engineering in bidder reference station should necessarily cover the following:

- i. Equipment sizing calculation- Thermal, Mechanical and Hydraulic.
- ii. Technical specifications for procurement of bought out components (like Fan, Motor, Instrumentation items etc.).
- iii. Generation of Process and Instrumentation Diagram (P&ID).
- iv. Generation of General Arrangement (GA) drawing and layout.
- v. Foundation load plan.
- vi. Exhaust duct sizing & mechanical design including flexibility analysis from turbine to ACC.
- vii. Supervision for erection, commissioning and guarantee test.
- viii. Assemble, quality control, test, repair, service, retrofit, erection, commissioning, PG test, troubleshooting.

**4) Brief Description of Eol Process:**

The interested prospective collaborators shall ensure that their response along with following annexures are received by BHEL on or before **25<sup>th</sup> May 2018**:

- i. Annexure-1- Indicative Scope of Technology Transfer
- ii. Annexure-2- Broad technical capabilities of prospective collaborator for direct Air Cooled Condenser
- iii. Annexure-3- Experience in the field of direct Air Cooled Condenser
- iv. Annexure-4- Complete reference list of direct Air Cooled Condenser
- v. Annexure-5- Sample format for End User Certificate

The response shall necessarily be accompanied with details on company background, product profile, Air Cooled Condenser being offered along with its technical details, reference list of customers, relevant certificates and annual audited financial reports for last three (03) years including auditor’s report.

In case any amendment/ corrigendum issued to this Eol, it shall be notified only at [www.bhel.com](http://www.bhel.com) .

**5) Schedule of Eol & contact details**

**5.1 Schedule of Eol:**

The schedule of Eol shall be as follows -

Sl No.	Description	Date
1.	Issue of Eol document	25.04.2018
2.	Last date of submission of Eol response	25.05.2018

**5.2 Contact Details:**

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



General Manager  
Technology Licensing, Joint Ventures, Mergers & Acquisitions,  
Corporate Technology Management,  
Bharat Heavy Electricals Limited (BHEL),  
BHEL House, Siri Fort,  
New Delhi 110049 (India)  
Tel: +91 11 6633-7210  
E-Mail: techeoi@bhel.in

**6) Miscellaneous:**

**6.1 Right to accept or reject any or all Applications:**

- i. Notwithstanding anything contained in this Eoi, BHEL reserves the right to accept or reject any application and to annul the Eoi 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.
- ii. BHEL reserves the right to disqualify any applicant during or after completion of Eoi 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.
- iii. BHEL reserves the right to verify all statements, information and documents submitted by the applicant in response to the Eoi. 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 Eoi 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 Eoi process.

Indicative Scope of Technology Transfer

1.	<p>Transfer of state-of-the-art technology for design, engineer, , assemble, quality control, test, repair, service, retrofit, erection, commissioning, PG test, troubleshooting, analysis by FEM and CFD of all systems / sub-systems and components for direct Air Cooled Condenser (ACC) from LP Steam Turbine exhaust to Condensate Extraction Pump.</p> <p>It includes basis of selection of tubes (circular, non-circular, single or multi row), exhaust steam system, air moving system, tube bundle system, air removal system, cleaning system, piping system, condensate system including storage tank and CEP, drain tank and drain pump, supporting structure, instruments, control valve, safety relief valves etc.as per the relevant international standards in vogue.</p>
2.	<p>Training of BHEL engineers at collaborator's design office to imbibe and assimilate the technology for direct ACC.</p> <p>Training should enable BHEL engineers to select materials, perform design calculations, detailed engineering, make drawings, finalise quality assurance/control practices, methodology of erection &amp; commissioning, PG test and trouble shooting for direct ACC.</p>
3.	<p>Transfer of improvements/modifications/developments/upgradations to meet market requirements and environmental norms / statutory requirements etc. during the period of collaboration.</p>
4.	<p>Transfer of knowledge / information to enable BHEL to source/procure bought out components, subcomponents and systems/ sub systems.</p>
5.	<p>Transfer of site feedback and troubleshooting information, if any. Sharing of methodology, to dispose these troubleshooting.</p>
6.	<p>Transfer of all proprietary computer programs including logics and source code related to ACC thermal, hydraulic and mechanical calculations and selection of the equipment for direct ACC, if any.</p>
7.	<p>Assist BHEL in identifying suppliers/sub-vendors to source/procure bought out components, subcomponents and systems/ sub systems for direct ACC.</p>
8.	<p>Provide technical assistance for tendering, detailed design, engineer, manufacturing, erection, commissioning, quality control, supervision and performance guarantee test for direct ACC.</p>
9.	<p>Provide assistance in getting customer approval for engineering documents including General Arrangement drawings, lay-out drawings and any other interface drawings required, preparation of techno-commercial offers, back-up bid guarantees etc.</p>
10.	<p>Provide support through engineering services from collaborator's design office for design vetting of engineering documents prepared by BHEL engineers for various customer orders.</p>
11.	<p>Deputation of collaborator's experts either at BHEL's works to assist in design, engineering, quality control etc. or at project sites to assist BHEL in erection &amp; commissioning, performance guarantee test etc.</p>



12.	Provide detailed write-up on control philosophy, operation and maintenance for direct ACC including service instructions and protocol for bundle cleaning system, handling arrangement for all equipment's etc., detailed manual (including animation with voice) for trouble shooting and problem solving methods.
13.	Provide performance test procedure for all components, system / sub-systems and guaranteed parameters including leakage test, pressure drop, differential pressure, vacuum, temperature etc. of direct ACC.
14.	Provide erection and commissioning instructions, start up and shut down procedures, sequential procedures and videos / slide shows on erection, field quality check list / manual, dos and don'ts etc.
15.	Provide operation procedures & practices for interface operation with turbine / main plant, pre-commissioning checks, procedures and practices.
16.	Provide list of commissioning, recommended spares for operation and maintenance for two years normal operation.
17.	Provide erection manual including 3D models and animations, presentation material, technical brochures, sales promotion videos and marketing information.

(SIGNATURE)

Broad technical capabilities of prospective collaborator for direct Air Cooled Condenser (ACC)

Sl. No.	Description	Response (YES/NO) and remarks if any.
1.	Whether prospective collaborator has designed and engineered direct Air Cooled Condenser (ACC) having single row tube bundles for a steam turbine of unit rating of 500 MW or above for the coal fired power stations which are located outside prospective collaborator's country of origin (incorporation).	Y/N
2.	Whether prospective collaborator has the capability for thermal design and sizing of components of direct Air Cooled Condenser having single row tube bundles for a steam turbine of unit rating between 40 MW to 150 MW.	Y/N
3.	Whether prospective collaborator has the capability for thermal design and sizing of components of direct Air Cooled Condenser having multi row tube bundles for a steam turbine of minimum unit rating of 20 MW.	Y/N
4.	Whether prospective collaborator has the capability to design structure for direct Air Cooled Condenser.	Y/N
5.	Whether prospective collaborator has the capability to design steam duct for direct Air Cooled Condenser.	Y/N
6.	Whether prospective collaborator has the capability to design exhaust transition device/ hot box for direct Air Cooled Condenser.	Y/N
7.	Whether prospective collaborator has the capability to design RCC column and foundations for direct Air Cooled Condenser.	Y/N
8.	Whether prospective collaborator has the capability for mechanical and system design of exhaust system, condensate system, air removal system, fin cleaning system, piping and accessories, layout and interface system engineering in direct Air Cooled Condenser using single row and multi row tube bundles.	Y/N
9.	Whether prospective collaborator has the capability to provide supervision during erection, commissioning and performance testing at site.	Y/N
10.	Whether prospective collaborator has the capability to define the control philosophy and write control logics, start up and shutdown procedures, erection manual, field quality plans, commissioning procedures and operation and maintenance manual.	Y/N



## Expression of Interest (Eoi) for Technology Tie-up for Air Cooled Condenser

11.	Whether prospective collaborator has the capability to define specifications, instructions and documents for procurement of all sub vendor items (bought out items) including the quality plans.	Y/N
12.	Whether prospective collaborator has the capability to do FEM and CFD analysis of complete Direct Air Cooled Condenser.	Y/N
13.	Whether prospective collaborator has the capability to design air moving system i.e fan selection with twin speed motors & VFD driven motors.	Y/N

(SIGNATURE)



**Prospective collaborator experience in the field of  
direct Air Cooled Condenser (ACC)**

Sl. No.	Requirement	Response (YES/NO) and remarks if any
1.	Whether prospective collaborator is a designer for direct ACC.	Y/N
2.	Whether prospective collaborator offers exclusive right in India to BHEL for direct ACC.	Y/N
3.	Whether prospective collaborator has designed and engineered at least two (02) numbers of direct ACC having single row tube bundles for steam turbine of unit rating of 500 MW or above for coal fired power stations.  Whether such direct ACC is installed by the prospective collaborator outside its country of origin (incorporation).  Whether one such direct ACC has completed one (01) year of successful operation as on date of submission of response to this Eoi.	Y/N  Y/N  Y/N
4.	Whether prospective collaborator has designed and engineered at least two (02) numbers of direct ACC having single row tube bundles for a steam turbine of unit rating between 40 MW to 150 MW.  Whether one (01) such ACC has completed one (01) year of successful operation as on date of submission of response to this Eoi.	Y/N  Y/N
5.	Whether prospective collaborator has designed and engineered at least one (01) number of direct Air Cooled Condenser having multi row tube bundles for a steam turbine of minimum unit rating of 20 MW.	Y/N
6.	Whether prospective collaborator has experience in single row non-circular tubes design for direct ACC.	Y/N
7.	Whether prospective collaborator has experience in multi row tubes design for direct ACC.	Y/N
8.	Whether prospective collaborator has erected, commissioned, associated in Performance Guarantee test of direct ACC, having single row tube bundles for a steam turbine unit rating of 500 MW or above for coal fired power stations.	Y/N
9.	Whether prospective collaborator has erected, commissioned, associated in Performance Guarantee test of direct ACC having single row tube bundles for a steam turbine of unit rating between 40 MW to 150 MW.	Y/N
10.	Whether prospective collaborator has erected, commissioned, associated in Performance Guarantee test of direct Air Cooled Condenser having multi row tube bundles for a steam turbine of minimum unit rating of 20 MW.	Y/N



## Expression of Interest (Eoi) for Technology Tie-up for Air Cooled Condenser

11.	Whether prospective collaborator has listed all reference plants as per Annexure-4, which meets each of the PQR requirement as mentioned in Cl 3.1, 3.2 and 3.3.	Y/N
12.	Whether the prospective collaborator owns the Intellectual Property Rights (IPR) for the technology being offered 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.	Y/N
13.	Whether company background and its product profile, technical details of direct ACC being offered under the TCA, enclosed.	Y/N
14.	Whether the prospective collaborator has any experience in establishing a new manufacturing, testing and assembly facilities, if so please specify.	Y/N
15.	Whether prospective collaborator's annual audited financial reports including auditor's report for last three (03) years, enclosed.	Y/N
16.	Whether the direct ACC design technology offered for technology transfer is the latest being marketed by the prospective collaborator.	Y/N
17.	Whether end user certificate or relevant document as per Annexure-5, enclosed.	Y/N

(SIGNATURE)



Complete reference list of direct Air Cooled Condenser

Sl.No.	Name of project/ Customer	Country	MW rating	Year of commissioning	Single row/Multi row tubes	Circular/Non circular tubes	Remarks



Sample format for End User Certificate

Owner / Customer Letter Head with address

Ref:  
Date:

To

Whom so ever it may concern

Subject : End user certificate

Name of the project :  
Location :  
Name of supplier :  
Date of order :  
Date of commissioning :  
Unit rating, MWe :  
Type of Tube design : Single Row tube or Multi Row tube  
Circular/Non circular tubes

“ M/s ABC” has successfully designed, engineered, erected/supervised erection, commissioned / supervised commissioning the above Direct Air Cooled Condenser Project/Plant and it is in operation for not less than 1 year.”

Sign with seal, address and contact details.