Extension of EoI due date

Subject: Expression of Interest (EoI) for technology tie-up for Excitation System for Synchronous Machines

This has reference to the Expression of Interest (EoI) published on BHEL's website i.e. www.bhel.com, Ref no. EoI No: **BHEL/AA/TL/0703** dated **3rd December, 2024** seeking Interest from Prospective Collaborator(s) of Excitation System for Synchronous Machines, who are meeting the requirements of this EoI and are willing to be associated with BHEL through a long term Technology Collaboration Agreement (TCA) to enable BHEL to design, development, engineering, manufacture, assembly, quality control, testing, field installation, commissioning, repair, service, maintenance, operation and retrofitting of Excitation System for Synchronous Machines to meet market requirements.

The due date for receiving the proposals against the EoI has now been extended up to **28th February, 2025 (Friday)**. The interested Prospective Collaborator(s) shall ensure that their duly filled and complete response along with annexures are received by BHEL on or before the due date.

The response shall necessarily be accompanied with following details:

1. Company Background
2. Technical features/ product catalogue
3. Details of current manufacturing facilities and relevant certificates
4. Reference list of Customers
5. Audited Annual Accounts along with Statutory Auditor's report for last 3 (three) years

Contact details:
The respondent shall submit their response with supporting documents (soft/hard copy) duly signed at the following address:

Additional General Manager
Corporate Technology Management,
Bharat Heavy Electricals Limited (BHEL),
BHEL House, Siri Fort, New Delhi 110 049
Tel: +91-11- 6633- 7377/ 7198
Mobile: +91 99581 81792
E-Mail: techeoi@bhel.in

Date of Issue: **31.01.2025**

Extension of EoI due date

Subject: Expression of Interest (EoI) for technology tie-up for Excitation System for Synchronous Machines

This has reference to the Expression of Interest (EoI) published on BHEL's website i.e. www.bhel.com, Ref no. EoI No: **BHEL/AA/TL/0703** dated **3rd December, 2024** seeking Interest from Prospective Collaborator(s) of Excitation System for Synchronous Machines, who are meeting the requirements of this EoI and are willing to be associated with BHEL through a long term Technology Collaboration Agreement (TCA) to enable BHEL to design, development, engineering, manufacture, assembly, quality control, testing, field installation, commissioning, repair, service, maintenance, operation and retrofitting of Excitation System for Synchronous Machines to meet market requirements.

The due date for receiving the proposals against the EoI has now been extended up to **31st January, 2025 (Friday)**. The interested Prospective Collaborator(s) shall ensure that their duly filled and complete response along with annexures are received by BHEL on or before the due date.

The response shall necessarily be accompanied with following details:

6. Company Background
7. Technical features/ product catalogue
8. Details of current manufacturing facilities and relevant certificates
9. Reference list of Customers
10. Audited Annual Accounts along with Statutory Auditor's report for last 3 (three) years

Contact details:
The respondent shall submit their response with supporting documents (soft/hard copy) duly signed at the following address:

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BHEL House, Siri Fort, New Delhi 110 049
Tel: +91-11- 6633- 7377/ 7198
Mobile: +91 99581 81792
E-Mail: techeoi@bhel.in

Date of Issue: **30.12.2024**

BHARAT HEAVY ELECTRICALS LIMITED

(A Government of India Undertaking)

Delhi – 110 049

India

Notice for Inviting

Expression of Interest (EoI)

for

Technology tie-up for

Excitation System for Synchronous Machines

EoI Ref No.: BHEL/AA/TL/0703

Date: 03.12.2024

INDEX

SECTION-1

DISCLAIMER

The information contained in this Expression of Interest (EoI) document provided to the Prospective Collaborator(s), by or on behalf of Bharat Heavy Electricals Limited (BHEL) or any of its employees or advisors, is provided to the Prospective Collaborator on the terms and conditions set out in this EoI document and all other terms and conditions subject to which such information is provided.

1. The purpose of this EoI document is to provide the Prospective Collaborator with information to assist the formulation of their proposal. This EoI document does not purport to contain all the information each Prospective Collaborator may require. This EoI document may not be appropriate for all persons, and it is not possible for BHEL, its employees or advisors to consider the business/investment objectives, financial situation and particular needs of each Prospective Collaborator who reads or uses this EoI document. Each Prospective Collaborator should conduct his own investigations and analysis and should check the accuracy, reliability and completeness of the informationin this EoI document and where necessary obtain independent advice from appropriate sources.
2. BHEL, its employees and advisors make no representation or warranty and shall incur no liability under any law, statute, rules or regulations as to the accuracy, reliability or completeness of the EoI document.
3. BHEL may, in its absolute discretion, but without being under any obligation to do so, modify, amend or supplement the information in this EoI document.
4. The issue of this EoI does not imply that BHEL is bound to select and shortlist any or all the Prospective Collaborator(s). Even after selection of suitable Prospective Collaborator BHEL is not bound to proceed ahead with the Prospective Collaborator and in no case be responsible or liable for any commercial and consequential liabilities in any manner whatsoever.
5. The Prospective Collaborator shall bear all costs associated with the preparation, technical discussion/presentation and submission of response against this EoI. BHEL shall in no case be responsible or liable for these costs regardless of the conduct or outcome of the EoI process.
6. Canvassing in any form by the Prospective Collaborator or by any other agency on their behalf shall lead to disqualification of their EoI.
7. 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 theapplications, it may at its discretion, invite all eligible Prospective Collaborator(s) to submit fresh applications.

8. 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.
9. 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 affects any rights of BHEL.

SECTION-2

SCHEDULE OF EoI PROCESS & CONTACT DETAILS

A. SCHEDULE OF EoI PROCESS

The schedule of activities during the EoI Process shall be as follows -

S No.	Description	Date
1.	Issue of EoI	03.12.2024
2.	Last date of submission of response against EoI	30.12.2024

B. CONTACT DETAILS:

Additional General Manager
Corporate Technology Management,
Bharat Heavy Electricals Limited (BHEL),
BHEL House, Siri Fort, New Delhi 110049
Tel: +91-11- 6633- 7377/7198
Mobile: +91 9958181792
E-Mail: techeoi@bhel.in

SECTION-3

DETAILS OF EXPRESSION OF INTEREST (EoI)

3.1 INTRODUCTION:

BHEL seeks Expression of Interest from Prospective Collaborator(s) of Excitation System for Synchronous Machines, who are meeting the requirements of this EoI and are willing to be associated with BHEL through a long term Technology Collaboration Agreement (TCA) to enable BHEL to design, development, engineering, manufacture, assembly, quality control, testing, field installation, commissioning, repair, service, maintenance, operation and retrofitting of Excitation System for Synchronous Machines to meet market requirements.

3.2 ABOUT BHEL:

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 enterprise in India, catering to the core infrastructure sectors of Indian economy viz. energy, transportation, and heavy engineering industry, defence, renewable and non-conventional energy. The energy sector covers generation, transmission and distribution of equipment for thermal, gas, hydro, nuclear and solar photo voltaic power plant. BHEL has been in this business for more than 50 years and BHEL supplied equipment account for approx. 200 GW of the total thermal generating capacity in India. BHEL is also listed in Indian stock exchanges. BHEL has 16 manufacturing units, 2 repair units, 4 regional offices, 8 service centres and 15 regional marketing centres besides host of project sites spread all over India and abroad. BHEL has its footprint in all the inhabited continents with references in 89 countries including Malaysia, Oman, Iraq, Syria Sudan, Libya, Cyprus, Malta, Afghanistan, Bangladesh, Bhutan, New Zealand etc. The cumulative overseas installed capacity of BHEL manufactured power plants nearing 10,000 MW. The annual turnover of BHEL for the year 2023-24 was around US$ 2.9 Billion*. BHEL's highly skilled and committed manpower of approx. 28000; state-of-the-art manufacturing, R&D 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.

The high level of quality & reliability of BHEL products is due to adherence to international standards by acquiring and adapting some of the best technologies from leading companies in the world, together with technologies developed in its own R&D centers.

[*Note: Currency conversion rate considered: 1 US $=Rs. 83.38 as on 31st March 2024]

Our ongoing major technology partnership include agreements with Siemens Energy Global GmbH & Co. KG., Germany (for Steam Turbines, Generators and Condensers); Mitsubishi Heavy Industries Ltd., Japan (for Flue Gas Desulfurization Systems); Leonardo S.p.A, Italy (for Super Rapid Gun Mount);GE Technology GmbH, Switzerland (for Steam Turbine for Nuclear Power Plant and for Gas turbines); Indian Space Research Organization (ISRO) (for Space Grade Lithium-Ion Cells); CSIR-IIP (PVSA based Medical Oxygen Plant); NANO Company Ltd., Korea (for SCR Catalysts); HLB Power Company Ltd.,Korea (for Gates and Dampers); Kawasaki Heavy Industries Ltd., Japan (for Stainless Steel Coaches for Metros); Valmet Automation Oy, Finland (for DCS System); Babcock Power Environmental Inc., USA (for Selective Catalytic Reduction Systems); Sumitomo SHI FW Energia Oy., Finland (for Circulating Fluidized Bed Combustion Boilers); HIMA Middle East FZE, Dubai (for KAVACH System/Train Collision Avoidance System) and Bhabha Atomic Research Centre (BARC) (for 50 kW Alkaline Water Electrolyser System for Hydrogen Production).

^ More details about the entire range of BHEL's products and operations can be viewed by visiting our web site www.bhel.com

3.3 MARKET IN INDIA:

The current trend in country is for adoption of higher size units in the range of 660 MW – 800 MW, as majority of new thermal plants will be with super critical technology. The country aspires to add another 70 GW of power generating capacity within next ten years in the areas of Thermal, Hydro, Nuclear, Industry and Gas based plants including installation of large size Super Critical Power Plants. The customers in India, however, generally insist for proven equipment by specifying in the qualification requirements of the tender.

3.4 ABOUT ELECTRONICS DIVISION (EDN):

The Electronics Division (EDN) (www.bheledn.com) of BHEL has been operating in the areas of Automation and Power Electronics since 1976. Most of the power plants and industries in the country today are equipped with electronic products and systems which have been manufactured and supplied by BHEL EDN. BHEL also has a good international reference by way of exports to European, Middle-East and South-East Asian markets. BHEL EDN has been accredited with ISO 9001, ISO 27001, ISO 14001 and OHSAS 18001 standard certifications.

As part of Power Plant automation, BHEL-EDN has been manufacturing Excitation System from 1978. Over 2200 units of Excitation System covering all types of applications have been designed, manufactured and supplied by BHEL (both direct and indirect type), based on different hardware platforms and are in operation in India as well as abroad. This includes about 1500 sets (both direct and indirect type) supplied with well proven microprocessor-based hardware presently being used by BHEL.

3.5 SCOPE OF COOPERATION:

BHEL is seeking Expression of Interest (EoI) from Prospective Collaborator(s) for long term Technology Collaboration Agreement (TCA) for latest & proven technology of Excitation System for Synchronous Machines.

The TCA shall enable BHEL to design, development, engineering, manufacture, assembly, quality control, testing, field installation, commissioning, repair, service, maintenance, operation and retrofitting the Excitation System for synchronous machines of rating ranging from 1 MW to 800 MW with the proposed hardware platform. TCA shall also cover the manufacture & testing of PCB's and subassemblies used in the Excitation System by BHEL at its works. The documentation and training shall be in English.

Prospective Collaborator(s) shall be responsible for transferring necessary know-how & know-why to BHEL for Excitation System for Synchronous Machines. Interested Prospective Collaborator(s) with proven Excitation System technology are invited to submit their response to this EoI, as per indicative scope of technology transfer given in **Annexure-1**.

Upon receipt of responses against this EoI, BHEL will review the responses to ascertain suitability of the offers and shortlist Prospective Collaborator(s) for further discussions. Detailed discussions on commercial and other terms and conditions to finalize the Technology Collaboration Agreement (TCA) shall be held and mutually agreed with the shortlisted Prospective Collaborator(s).

Business sharing option, during the initial period of technology assimilation by BHEL may also be considered.

3.6 PREQUALIFICATION REQUIREMENTS (PQRs):

The Prospective Collaborator(s) shall meet the following qualification requirements as on the closing date of this EoI:

a) The Prospective Collaborator shall have an experience of minimum 10 years in the design, engineer, manufacture and installation of Excitation System (both direct & indirect Excitation System)

AND

b) The Prospective Collaborator shall have designed, engineered, manufactured, erected and commissioned (Erection & Commissioning could be directly or through associates) Excitation System, with any hardware platform, for 50 sets or more, consisting of direct and indirect Excitation System, for different types of machines (hydro, gas, thermal and nuclear) of various ratings. Out of the sets so supplied, at least 2 (two) sets each of brushless and static type for generator of 200 MW or above should have

successfully operated for a period of 2 (two) years or more as on the closing date of this EoI.

(Prospective Collaborator is required to substantiate the above PQRs by providing #suitable document as documentary proof)

 # Note: Relevant documentary evidence like Purchase Order (PO) and documentary evidence of PO executed by Prospective Collaborator, Performance Certificate from the End user self-certified supply reference list duly authenticated by the CEO/authorized representative of Prospective Collaborator on company letter head etc to substantiate the fulfillment of above requirements to be furnished along with response.

3.7 RESTRICTIONS ON SPECIFIED TRANSFER OF TECHNOLOGY WITH AN ENTITY FROM A COUNTRY WHICH SHARES A LAND BORDER WITH INDIA:

3.7.1 Prospective Collaborator(s) from a country which shares a land border with India will be eligible to respond to this EoI only if Prospective Collaborator(s) is registered with Competent Authority (Registration Committee constituted by the Department of Promotion of Internal Trade (DPIIT) of Govt. of India). Such registration should be at least valid for the entire period of EoI due date or any extension thereof.

3.7.2 Prospective Collaborator(s) from a country which shares a land border with India means: a) An entity incorporated, established or registered in such country; or b) A subsidiary of an entity incorporated, established or registered in such country; or c) An entity substantially controlled through entities incorporated, established or registered in such country; or d) An entity whose beneficial owner is situated in such a country; or e) An Indian (or other) agent of such an entity; or f) A natural person who is a citizen of such a country; or g) A consortium or joint venture where any member of the consortium or joint venture falls under any of the above.

3.8 INSTRUCTIONS:

3.8.1 The interested Prospective Collaborator shall ensure that their duly filled and complete response along with following annexures are received by BHEL on or before **30th December, 2024 (Monday).**

Annexure-1: Indicative scope of technology transfer
Annexure-2: OEM's experience in the field of Excitation System
Annexure-3: Information on various technical features of Excitation System
Annexure-4: Reference projects list

The response shall necessarily be accompanied with following details as applicable:

1. Company Background
2. Technical features/ product catalogue
3. Details of current manufacturing facilities and relevant certificates
4. Reference list of Customers
5. Audited Annual Accounts along with Statutory Auditor's report for last 3 (three) years

3.8.2 **Language:** All correspondences and documents related to the EoI response shall be in English language, provided that any printed literature furnished by the Prospective Collaborator may be written in another language, as long as such literature is accompanied by a translation of its pertinent passages in English language in which case, for purposes of interpretation of the bid, the English translation shall govern.

3.8.3 The Prospective Collaborator shall abide by the terms & conditions, as applicable,of the EoI.

3.8.4 All pages of the response against this EoI shall be duly signed by the authorized signatory.

3.8.5 Multiple proposals from the same Prospective Collaborator should not be submitted.

3.8.6 BHEL at its discretion shall inspect the Prospective Collaborator's works / office / reference site premises for the purpose of evaluation, as deemed necessary before selection of Partner. BHEL's decision in this regard shall be final.

3.8.7 Any Prospective Collaborator which has been debarred/blacklisted by Indian Central/State Governments or by any entity controlled by Indian Central/State Governments from participating in any of their project, as on date of submission of EoI, shall not be eligible to submit the EoI.

BHEL shall receive applications pursuant to this EoI in accordance with the terms setforth herein, as modified, altered, amended and clarified from time to time by BHEL and all applications shall be submitted in accordance with such terms on or before the date specified in this EoI for submission of applications. In case any amendment / corrigendum to this EoI is issued, it shall be notified only at www.bhel.com

3.9 CONFIDENTIALITY:

Information relating to the examination, clarification, evaluation and comparison of EoI and recommendations shall not be disclosed to Prospective Collaborator. Any effort by Prospective Collaborator to influence BHEL in processing of EoI or selection decisions may result in the rejection of the response against EoI.

3.10 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.

Annexure-1

INDICATIVE SCOPE OF TECHNOLOGY TRANSFER

1.	Licensing & transfer of latest technology relating to the design, development, engineering, manufacture, assembly, quality control, testing, field installation, commissioning, repair, service, maintenance, operation and retrofitting of the Excitation System.
2.	Information to enable manufacture & testing by BHEL of all types of electronic cards/sub-assemblies required to be used in the Excitation System, as per the present design of the OEM.
3.	Information and assistance to be provided for planning & establishing the new manufacturing, assembly and testing methodologies, facilities & processes/ suitable augmentation at BHEL's existing facilities/processes by way of expert advice in terms of identifying, sizing & selection and preparation of specification of equipment / machinery required for manufacturing, their layout and foundation etc. Deputation of Prospective Collaborator's expert for establishing the manufacturing facilities, design of special tools and dies, jigs & fixtures etc. Prospective Collaborator should also provide OEM authorization certificates to BHEL for sourcing these corresponding components later.
4.	Transfer of information to enable BHEL to source/procure those items, which Prospective Collaborator sources from other vendors (if these are not manufactured by the Prospective Collaborator) for use in Excitation System. Support through engineering services from Prospective Collaborator's design office / manufacturing facilities for Excitation System.
5.	Transfer of applicable Proprietary hardware / software/computer programs including logics and source code.
6.	Information to enable manufacturing by BHEL of all types of power modules viz. Thyristor/IGBT/SiC stacks being used by the OEM at present to meet the different requirements economically.
7.	Transfer of improvements/modifications/developments/up gradations to be carried out by the Prospective Collaborator during the period of proposed Agreement for taking care of new market requirements and obsolescence. Subsequent updates required due to component obsolescence or updates implemented by Prospective Collaborator due to safety consideration would also be provided.
8.	Training of BHEL engineers in design, development, engineering, manufacture, assembly, quality control, testing, field installation, commissioning, repair, service, maintenance, operation and retrofitting the Excitation System.

9.	Deputation of Prospective Collaborator's experts to assist BHEL in absorbing the technology for Excitation System.
10.	Technology being proposed should be the latest/ state-of-the-art being marketed by the Prospective Collaborator.
11.	Prospective Collaborator to ensure obsolescence management of systems and/or components considered in the design. Hence, Prospective Collaborator to consider minimum life time of the components at least 10 years and design the system accordingly. Component and/or system upgradation and updation in terms of hardware and software configuration for complete functionality has to be provided as Prospective Collaborator's scope which shall be dealt under obsolescence management.
12.	Transfer of Site feedback and troubleshooting information

Signature & Seal:

(Authorized Signatory of the Prospective Collaborator)

Annexure-2

OEM'S EXPERIENCE IN THE FIELD OF EXCITATION SYSTEM

Sl. No.	Requirements	Prospective Collaborator's response (YES/NO) and remarks if any
1.	Whether the Prospective Collaborator is an Original Equipment Manufacturer (OEM) of Excitation System owning the IPRs.	
2.	Whether the OEM has an experience of minimum 10 years in the design, manufacture and installation of Excitation System (both Direct & Indirect Excitation System).	
3.	Number of Excitation System supplied till date by the OEM: a) Direct (Static) Excitation System: b) Indirect (Brushless) Excitation System: (Please attach reference list)	
4.	Number of Excitation System supplied by the OEM in last 2 years: a) Direct Excitation System: b) Indirect Excitation System: (please attach list)	
5.	If more than one family of hardware is being used for Excitation System for different ratings or for Direct & Indirect Excitation System, OEM to provide following information:	
5.a	How many types of electronic hardware platform are being used concurrently?	
5.b	Whether all the above hardware platforms will be covered in the technology transfer to enable BHEL to meet all types of market requirements optimally?	
6.	Number of R & D and design engineers working exclusively on Excitation System:	
7.	Year of introduction of the Excitation System, being proposed for technology transfer, in market:	
8.	Number of Excitation System supplied with the version of Excitation system being proposed for technology transfer: A) Direct Excitation System:	

Sl. No.	Requirements	Prospective Collaborator's response (YES/NO) and remarks if any
	a) Supplied: b) Commissioned: B) Indirect Excitation System: a) Supplied: b) Commissioned:	
9.	The highest rating of the machine that the OEM has supplied Excitation System for the following categories may please be furnished:	
9.a	Synchronous generators for thermal power plants: a) Direct Excitation System: b) Indirect Excitation System:	
9.b	Synchronous generators for hydro power plants: a) Direct Excitation System: b) Indirect Excitation System:	
9.c	Synchronous generators for gas turbine set: a) Direct Excitation System: b) Indirect Excitation System:	
9.d	Synchronous generators for nuclear power plants: a) Direct Excitation System: b) Indirect Excitation System:	
9.e	Synchronous motors in Pumped storage / Lift irrigation / Industry: a) Direct Excitation System: b) Indirect Excitation System:	
10.	Maximum field ratings (continuous) for which direct (static) Excitation System have been supplied:	
11.	Maximum rating of an individual power converter (stack) for a direct (static) Excitation System @ 55 ºC ambient.	
12.	Whether the electronic hardware is manufactured in-house by the OEM or sourced from outside.	
13.	Whether the OEM has supplied any Excitation System where the continuous field current requirement is above 7500A,700V DC or more. If yes please provide the details of the installation and the field current requirement.	

Sl. No.	Requirements	Prospective Collaborator's response (YES/NO) and remarks if any
14.	Whether the OEM owns IPR for the thyristor bridges of continuous rating of above 2500A,700V DC at 55 ºC ambient	
15.	Whether the OEM is including the license and documentation for manufacturing the Thyristor/IGBT/SiC bridges by BHEL in the Transfer of Technology (ToT).	
16.	Whether the OEM intends to introduce a new version of Excitation System within the next 2 years	
17.	The Prospective Collaborator shall have an experience of minimum 10 years in the design, engineer, manufacture and installation of Excitation System (both direct & indirect Excitation System) **Whether Prospective Collaborator meets above PQR and Suitable documentary evidence to substantiate the fulfilment of this PQR has been submitted.**	
18.	The Prospective Collaborator shall have designed, engineered, manufactured, erected and commissioned (E&C could be directly or through associates) Excitation System, with any hardware platform, for 50 sets or more, consisting of direct and indirect Excitation System, for different types of machines (hydro, gas, thermal and nuclear) of various ratings. Out of the sets so supplied, at least 2 (two) sets each of brushless and static type for generator of 200 MW or above should have successfully operated for a period of 2 (two) years or more as on the closing date of this EoI. **Whether Prospective Collaborator meets above PQR and Suitable documentary evidence to substantiate the fulfilment of this PQR has been submitted.**	

Signature & Seal:

(Authorized Signatory of the Prospective Collaborator)

Annexure -3

INFORMATION ON VARIOUS TECHNICAL FEATURES OF EXCITATION SYSTEM

Sl No.	Feature	Response Yes/No
1.	The Excitation System platform offered for technology transfer shall be the latest generation being marketed by the OEM and shall be suitable for use in both direct and indirect Excitation System.	
2.	The same family of hardware shall be suitable for both direct and indirect Excitation System from very low to very high ratings.	
3.	The microprocessor/microcontroller used in the main controller shall be of reputed make and at least 32 bits with floating point support.	
4.	The Excitation System shall be suitable to be configured to meet redundancy requirements in the electronic hardware (controller level as well as I/O) as well as control functions like dual auto channel (closed loop voltage/MVAR/PF) control and manual channel (field current regulator).	
5.	The Excitation System platform being proposed for TCA shall have Qualified for type test for environmental conditions, mechanical stability and EMI/EMC immunity. (List of all type test conducted on the proposed Excitation System to be submitted)	
6.	The Excitation System being proposed shall use standard AC/DC auxiliary power supplies. Ratings for the power supplies to be mentioned.	
7.	The Excitation System being proposed shall be suitable for operation up to an ambient temperature of 55 deg C and relative humidity of 95% non-condensing.	
8.	The regulation function in the Excitation System shall have the following features:	
9.a	Automatic voltage regulator function with	
	i. Reference value setting	
	ii. V/F limiter	
	iii. Active/Reactive current compensation	
9.b	Max. field current limiter	
9.c	Stator current Inductive limiter	
9.d	IX-MIN/IR limiter	
9. e	Stator current capacitive limiter	

Sl No.	Feature	Response Yes/No
9. f	Load angle limiter	
9. g	Temperature dependent field current and stator current inductive limiter	
9. h	Minimum field current limiter	
9. i	Power system stabilizer (PSS): Types to be mentioned.	
9. j	Power factor (PF) controller mode of operation.	
9. k	MVAR controller mode of operation.	
9. l	Adaptability for Line charging operation.	
9.m	Line drop compensation.	
9. n	Reactive load discharge function	
9. o	P/Q limiter	
9. p	Field current regulation with reference value setting (for manual channel operation)	
9. q	Firing pulse generation and amplification.	
9. r	Pulse supervision (for pulses of all the operating channels)	
9. s	Follow up control feature for tracking the operating channel by the non-operating channels for bump less transfer of control.	
9. t	Soft start features during initial voltage build up.	
9. u	Monitoring of power converters like thyristor conduction monitoring, monitoring of cooling etc.	
9. v	Facility to directly write the reference value from the plant control system for MVAR/PF regulation function.	
9. w	Rotor Temperature Monitoring system both for brushless & static type Excitation System	
10.	The hardware shall be suitable for brushless Excitation System with PMG frequency of: 75 Hz, 150 Hz, 250 Hz, 300 Hz, 400 Hz. Designed and Supplied for any other PMG frequency than above (List of frequencies to be submitted)	
11.	The power converters shall be air cooled (natural or forced) & suitable for parallel operation (with equal current sharing) to meet the required rated field current requirements (up to 7500A) and also redundancy requirements with on line maintenance facility. The power converters along with the subassemblies shall be covered under TCA	

Sl No.	Feature	Response Yes/No
12.	The system shall have provision to use both conventional field discharge circuit breaker as well as electronic field suppression system with DC/AC circuit breakers and crowbar. The required subassemblies for field suppression system shall be covered under TCA.	
13.	The system shall have interface for connectivity with higher order control system / third party DCS system.	
14.	The Excitation System shall have suitable local and remote terminal for operation with GUI/HMI based software for parameter setting, commissioning, troubleshooting (trending & event recording) and upload/downloading the software. A GUI/HMI PC based Engineering tool shall be available for configuring project specific software. The system shall be capable of interfacing with third party devices under various open Standard Communication Protocols viz MODBUS/IEC 60870-5-103/104 IEC 61850.	
15.	The excitation shall have feature of capturing fast trends. Feature for capturing of Pre-& Post disturbance recording integral to the Excitation System proposed under TCA.	
16.	Feature of Performing Dynamic Simulation similar to PSS/E or PSCAD is integral to Excitation System proposed under TCA.	
17.	In addition to the above, the following features are asked for in Indian Market as part of Excitation System regularly. The OEM to confirm the availability of these features in the system being proposed for TCA. In case these features are not readily available in the system being proposed for TCA, the OEM shall agree to undertake development/joint development along with BHEL to meet these local requirements like: i. Auto tuned PSS like Adaptive PSS. ii. Independent manual channel (field current regulator) along with single or dual automatic channels (voltage regulator). iii. Any additional requirement of redundancies if asked in	

Sl No.	Feature	Response Yes/No
	customer`s tender requirement. iv. Meeting additional type test requirements. if asked in customer`s tender requirement. v. Adapting to the new requirement (if any) in case of updation of IEEE 421	

Signature & Seal:

(Authorized Signatory of the Prospective Collaborator)

Annexure -4

REFERENCE PROJECTS LIST

THE OEM SHALL FURNISH A REFERENCE LIST WITH THE HARDWARE PLATFORM BEING PROPOSED FOR TECHNOLOGY TRANSFER COVERING THE FOLLOWING:

Sl. No	Utility/ Project name/ location	Type of Generator (Turbo/Hydro/ Sync Motor)	Generator rating (MW)	Type of Excitation System (Direct/Indirect)	Generator/ exciter field current (Amp)	Year of supply	Year of commissioning	Hardware Platform

Signature & Seal:

(Authorized Signatory of the Prospective Collaborator)

Note: Abbreviations/terms used in the document

EOI: Expression of Interest
OEM: Original Equipment Manufacturers
BHEL: Bharat Heavy Electricals Limited
EDN: Electronics Division
TCA: Technology Collaboration Agreement
PCB: Printed Circuit Boards
IPR: Intellectual Property Rights
EMI: Electro Magnetic Interference
EMC: Electro Magnetic Compatibility
PMG: Permanent Magnet Generator
DCS: Distributed Control system
GUI: Graphic User interface
HMI: Human Machine Interface
Direct Excitation System: Static Excitation System
Indirect Excitation System: Brushless Excitation System