



Subject: Expression of Interest (Eol) for Technology tie-up for Fuel Cell Stack and System

1) Introduction:

This Expression of Interest (Eol) seeks responses from Original Equipment Manufacturers (OEMs) who are meeting the requirements of this Eol and are willing to be associated with BHEL through a Technology Collaboration Agreement (TCA) on long term basis to enable BHEL to design, engineer, manufacture, assemble, integrate, quality control, test, supply, maintain, operate, repair, service, troubleshoot, fault diagnosis, carryout root cause analysis and sell fuel cell stack and system.

Fuel cell system means Proton Exchange Membrane (PEM) fuel cell stack including Air supply subsystem with its controller and filter, Hydrogen supply subsystem with recirculation unit, Suitable humidifiers and water separation unit if needed, Thermal management system to maintain the temperature of fuel cell stack, Safety and warning system, Control and instrumentation for automatic trouble free operation and Power management system for providing required DC/AC output along with the fuel cell stack for various applications, like road transport, railways, stationary etc.

2) About Bharat Heavy Electricals Limited:

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, industry, defence, renewable and non-conventional energy. The energy sector covers generation, transmission and distribution equipment for hydro, thermal, nuclear and solar photo voltaic based power plants. BHEL has been in this business for more than 55 years and BHEL supplied power equipment account for more than 57% of the total thermal generating capacity in India. BHEL is also listed in stock exchanges of India. The company has 16 manufacturing units, 4 power sector regions, 8 service centers, 1 overseas office and 15 regional offices besides host of project sites spread all over India and abroad. The annual turnover of BHEL for the year 2019-20 was ~ USD 3 Billion. BHEL's highly skilled and committed manpower of approximately 34000 employees, the state-of-art manufacturing facilities and practices together with the latest technologies, has helped BHEL to deliver a consistent track record of performance. To position leading state-owned companies as Global Industrial giant for their exemplary performance, Government of India categorized BHEL as "Maharatna Company" in 2013, empowering the company with enhanced autonomy in decision making. BHEL's major technology tie-ups include agreements with Siemens, Germany (for steam turbines, generators and condensers); MHI, Japan (for Pumps); MPL, Japan (for Flue Gas Desulfurization Systems); Vogt Power International, USA (for HRSG); ISRO (for Space Grade Lithium-Ion Cells), NANO Company Ltd., Korea (for SCR Catalysts), HLB Power Company Ltd., Korea (Gates and Dampers), Kawasaki Heavy Industries, Japan (for Stainless Steel Coaches for Metros) and Babcock Power Environmental Inc., USA (for Selective Catalytic Reduction Systems). More details about the entire range of BHEL's products and operations can be obtained by visiting our website <http://www.bhel.com>.

BHEL has a dedicated research establishment at Hyderabad, wherein research and indigenous development of state-of-the-art technologies, products & systems in varied engineering fields including emerging & futuristic applications are taken up. In the field of fuel cell systems, BHEL is working in the area of Low-Temperature Proton Exchange Membrane Fuel Cell (LTPEMFC) and High-Temperature Proton Exchange Membrane Fuel Cell (HTPEMFC) technologies.



BHEL has a capability and an experience in the design and manufacture of up to 5 kW liquid cooled LT PEM Fuel Cell System. Its production units are equipped with latest and state-of-art manufacturing facilities. The in-house facilities are equipped to integrate and package complete fuel cell system up to 5kW. Also, it has facilities to scale up components for modular 25 kW stack. BHEL has developed capabilities in fuel cell stack components like bipolar plates, cooling plates, current collector, edge seals, tie rods, clamping plates etc. and in fuel cells sub-systems like C&I, Cooling System, Humidifiers etc. BHEL is now focusing on development of high power density fuel cell stack. The modular system is very suitable for different applications like railways, long-range buses and heavy trucks etc.

3) Scope of cooperation:

BHEL intends to shortlist the Original Equipment Manufacturers (OEMs) based on this Eol and to subsequently select a suitable partner for a long term Technology Collaboration Agreement (TCA) for complete Fuel Cell Stack and System as per indicative scope of technology transfer at **Annexure-1**.

BHEL shall receive applications pursuant to this Eol in accordance with the terms set forth 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 Eol for submission of applications.

Upon receipt of responses against this Eol, BHEL will review the responses to ascertain suitability of the offer and shortlist Prospective Collaborators 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 Collaborators. The detailed terms and conditions for such a paid-up license agreement shall be mutually agreed upon. Prospective collaborators shall be responsible for transferring necessary know-how & know-why to BHEL for Fuel Cell Stack and System.

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

4) Prequalification requirements (PQR):

a) The Prospective Collaborator should have at least 3 years of experience of designing manufacturing, assembling, testing & integration and supply of fuel cell stacks and systems, as on the closing date of this Eol. ***(Suitable/relevant documentary evidence to substantiate the fulfilment of this PQR is to be submitted along with Eol)***.

AND

b) Prospective Collaborator should have designed, engineered, manufactured, assembled, integrated and supplied at least one (01) no. fuel cell stack and system in last 3 years for use in either traction or road transportation or stationary application with single stack capacity of 50 kW or more and the system should have been in successful operation for at least 2000 hours in a year as on the closing date of this Eol. ***(Requisite performance certificate from the end client/customer as documentary evidence to substantiate the fulfilment of this PQR is to be submitted along with Eol)***

5) Brief Description of Eol Process:

The response to Eol shall be accompanied with details on company background, technical features/ product catalogue, reference list, satisfactory operation certificates, performance certificates, audited annual financial reports for last 3 (three) years including auditor's report etc.



Bharat Heavy Electricals Limited

Expression of Interest (Eoi) for Technology Tie-up for Fuel Cell Stack and System

A summary of experience and responses is to be provided as per Annexure-2, Annexure-3 and Annexure-4.

In case any amendment/ corrigendum is issued to this Eoi, it shall be notified only at <http://www.bhel.com>

6) Schedule of Eoi & contact details:

6.1 Schedule of Eoi:

The schedule of Eoi shall be as follows -

S. No.	Description	Date
1.	Issue of Eoi document	31.12.2020, Thursday
2.	Last date for submission of Eoi response	22.01.2021, Friday

6.2 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 66337218 / 7323/ 7220
Fax: +91 11 26492974
Email: techeoi@bhel.in

7) Miscellaneous:

7.1 Right to accept or reject any or all Applications:

- 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.
- 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.
- 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.

7.2 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

a)	<p>Licensing & transfer of state-of-the-art technology relating to the design, engineer, manufacture, assemble, integrate, quality control, test, supply, maintain, operate, repair, service, troubleshoot, fault diagnosis, carry out root cause analysis and selling of Fuel Cell system including fuel cell stack and all its sub-systems for fuel supply, thermal management, humidification, control, instrumentation, safety, power electronics. The fuel cell system should be suitable for various applications like road transport, stationary, railways etc.</p> <p>Transfer of know-how for mechanical and electrical integration /interfacing of fuel cell stack & its subsystems with other sub systems/aggregates of Electric Vehicle/Energy Storage System/ Rail etc.</p>
b)	Transfer of applicable computer programs including logics and source code, if any
c)	Transfer of improvements/modifications/developments/up-gradations carried out by the prospective collaborator over the duration of the technology transfer agreement for taking care of new market requirements and obsolescence of components used in the system
d)	Assistance in planning & setting up of the facilities by way of expert advice in terms of identifying, sizing & selection of equipment required for manufacturing and assembly, their layout and foundation etc.
e)	Assistance for establishing manufacturing processes, commissioning of the manufacturing facilities, design of special tools and dies, jigs & fixtures etc. by way of deputation of experts for mutually agreed number of man days as and when required by BHEL.
f)	Transfer of Site feedback and troubleshooting information
g)	Training in the design, engineering, manufacturing, assembly, integration, quality control/ quality assurance, installation, maintenance, operation, repair, service, troubleshoot, fault diagnosis & root cause analysis.
h)	Deputation of prospective collaborator's experts to assist BHEL in absorbing the technology for licensed products.
i)	Support through engineering services from prospective collaborator's design office / manufacturing facilities for licensed products.
j)	Transfer of information to enable BHEL to source/procure those items, which the prospective collaborator sources from outside (as they are not manufactured by the prospective collaborator) for use in the fuel cell systems.

(SIGNATURE)



Details required from Prospective Collaborator

S. No.	Requirement	Prospective Collaborator's response (YES/NO) and remarks if any
1.	Whether the Prospective Collaborator is an Original Equipment Manufacturer (OEM) of fuel cell stack and system	
2.	For how many years, Prospective Collaborator is in business of fuel cells	
3.	Whether the prospective collaborator has capability of engineering and product development of fuel cell stack and system	
4.	Whether the Company background and its product profile/catalogues along with technical details of fuel cell stack and system, which is being offered to BHEL under this EoI, enclosed	
5.	Whether product data sheet has been enclosed	
6.	Whether information on competitors/market share has been enclosed	
7.	Whether Prospective Collaborator's detailed reference list (including performance certificates, satisfactory operation certificates etc.) as per Annexure-4 have been enclosed	
8.	Whether Prospective Collaborator's annual audited financial reports including auditor's report for last 3 years have been enclosed	
9.	Whether the Prospective Collaborator owns the Intellectual Property Rights for the technology being proposed for transfer under the Technology Collaboration Agreement (TCA) or has 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.	
10.	Whether the Prospective Collaborator has any experience in establishing new manufacturing, testing and assembly facilities, if so please specify.	
11.	Whether Prospective Collaborator has offered technology license to any other company in the world for supply of Fuel Sells. If so, please specify.	
12.	<i>The Prospective Collaborator should have at least 3 years of experience of designing, manufacturing, assembling, testing & integration and supply of fuel cell stacks and systems, as on</i>	



Bharat Heavy Electricals Limited

Expression of Interest (Eoi) for Technology Tie-up for Fuel Cell Stack and System

	<p><i>closing date of this Eoi.</i></p> <p>Whether Prospective Collaborator meets above PQR and suitable/relevant documentary evidence to substantiate the fulfilment of above PQR has been submitted.</p>	
13.	<p><i>Prospective Collaborator should have designed, engineered, manufactured, assembled, integrated and supplied at least one (01) no. fuel cell stack and system in last 3 years for use in either traction or road transportation or stationary application with single stack capacity of 50 kW or more and the system should have been in successful operation for at least 2000 hours in a year as on the closing date of this Eoi.</i></p> <p>Whether Prospective Collaborator meets above PQR and requisite performance certificate from the end client/customer as documentary evidence to substantiate the fulfilment of above PQR has been submitted.</p>	
14.	<p>Whether the fuel cell stacks and systems being proposed for technology transfer to BHEL is approved for all necessary certifications for use in traction, road transportation and stationary applications (<i>to be substantiated with necessary certificates</i>)</p>	
15.	<p>Details about the total Strength of Engineering/ Technical Personnel</p>	
16.	<p>Whether the Prospective Collaborator has any presence in India. If so, please specify.</p>	

Relevant documentary evidence to substantiate the fulfilment of above requirements to be furnished along with suitable response.

(SIGNATURE)



Information on Various Parameters of Fuel Cell Stack & System

S. No.	Specifications / Parameters	Prospective Collaborator's response (YES/NO) and remarks if any
1.	Whether the Membrane Electrode Assemblies (MEAs) are manufactured in-house or bought out	
2.	If MEAs are manufactured in-house, then specify details about procurement of raw materials like catalyst, electrolyte membrane and porous conducting electrode, backing layer etc.	
3.	If MEAs are bought out, then details about the process for procurement of the raw materials by BHEL	
4.	Whether the Bipolar plates and cooling plates are manufactured in-house or bought-out	
5.	If plates are manufactured in-house, then details about procurement of raw materials like carbon powder, binder etc.	
6.	If plates are bought out, then details about the process for procurement of raw materials by BHEL	
7.	Whether the Prospective Collaborator has in-house capability for all sub-components (current collectors, end plates and Insulation sheet, tie-rods etc.) of stack	
8.	Whether the Prospective Collaborator has in-house capability for all other sub-systems (Anode and cathode humidifiers, thermal management system, control and safety system, reactant supply system etc.)	
9.	Whether any agreement / technology tie-up with a third party is required for any item/material used in manufacturing of fuel cell system. If yes, please specify.	
10.	Manufacturing capacity of MEAs/Stack/System	
11.	Stack and system rating (Range)	
12.	Current density: Amp/cm ²	
13.	Voltage/cell at rated current density	
14.	Operating pressure at anode and cathode	
15.	Power density of stack: kW/lit and kW/kg	



Bharat Heavy Electricals Limited

Expression of Interest (Eoi) for Technology Tie-up for Fuel Cell Stack and System

16.	Life of fuel cell stack in hours for automobile applications and for stationary applications	
17.	Degradation rate mV/1000hours	
18.	Whether the Prospective Collaborator has the capability of making fuel cell stack and system of 50 kW rating or more	
19.	Whether the Prospective Collaborator has supplied fuel cell stack and systems of at least 25 KW rating for E-Bus or e-truck application	
20.	Volume of fuel cell stacks and system supplied (numbers with capacity) in last three years	
21.	Cumulative Operational hours/kms of fuel cell systems supplied by the Prospective Collaborator in last three years	
22.	Minimum operational durability of fuel cell stacks and systems with degradation rate	
23.	Auxiliary power consumption for various sub-systems in fuel cell system.	
24.	Operating temperature range of fuel cell system including extreme weather conditions	

(SIGNATURE)

