EXPRESSION OF INTEREST

FOR

Partnering with BHEL

ON

Design, Engineering, Configuration, Supply & Development, Programming, and Testing Commissioning of Flexible Operation Solutions for Fossil fired thermal power plant

Issued by:

Bharat Heavy Electricals Limited- Electronics Division or BHEL-EDN

(Hereinafter referred to as 'BHEL')

P.B.No.2606, Mysore Road, Bangalore having

Its head office at

BHEL House, Siri Fort NEW DELHI-110 049

INDIA

DISCLAIMER

All information contained in this EOI provided / clarified are in good interest and faith. The information contained in this Expression of Interest document or subsequently provided to Applicant(s), whether verbally or in documentary or any other form, by or on behalf of BHEL, is provided on the terms and conditions set out in this EOI and such other terms and conditions subject to which such information is provided.

The purpose of this EOI is to provide interested parties with information that may be useful to them in the formulation of their application for qualification and subsequent selection pursuant to this EOI. This EOI is not an offer by BHEL to the prospective Applicant(s) or any other person. This EOI is neither intended nor shall it be construed as creating or requiring any ongoing or continuing relationship or commitment with any party or person. This is not an offer or invitation to enter into an agreement of any kind with any party.

Though adequate care has been taken in the preparation of this EOI document, the interested firms shall satisfy itself that the document is complete in all respects. The information is not intended to be exhaustive. Interested Agencies are required to make their own enquiries and assumptions wherever required. Intimation of discrepancy, if any, should be given to the specified office immediately. If no intimation is received by this office by the date mentioned in the document, it shall be deemed that the EOI document is complete in all respects and firms submitting their interest are satisfied with the EOI Document in all respects. However, BHEL reserves the rights to make changes to the requirements while publishing the RFP without specifying any reason.

The issue of this EOI does not imply that BHEL is bound to select and shortlist Applicant(s) for next stage or to enter into any agreement(s) with any Applicant(s). BHEL reserves all right to reject any applications submitted in response to this EOI document at any stage without assigning any reasons thereof. BHEL also reserves the right to withhold or withdraw the process at any stage. Neither BHEL nor its employees and associates will have any liability any loss, expense or damage which may arise from or be incurred or suffered in connection with anything contained in this EOI document or any matter deemed to form part of this EOI document, the information and any other information supplied by or on behalf of BHEL. BHEL accepts no liability of any nature whether resulting from negligence or otherwise howsoever caused arising from reliance/use of any statements/information contained in this EOI by the Applicant. BHEL is not making any representation or warranty, express or implied, as to the accuracy or completeness of any information/statements made in this EOI.

The Applicant shall bear all its costs associated with or relating to the preparation and submission of its Application including but not limited to preparation, copying, postage, delivery fees, expenses associated with any demonstrations or presentations which may be required by BHEL or any other costs incurred in connection with or relating to its Application. All such costs and expenses will remain with the Applicant and BHEL shall not be liable in any manner whatsoever for the same or for any other costs or other expenses incurred by an Applicant in preparation or submission of the Application, regardless of the conduct or outcome of the EOI.

I. INTRODUCTION

This Expression of Interest (EoI) seeks response from Agencies / Companies who are involved in designing/developing or have past experience in providing Self Tuning AI Model based/ Artificial Neural Network/Fuzzy Logic based Flexible operation Solutions for Fossil fired power plants.

II. ABOUT BHEL

Bharat Heavy Electricals Limited (BHEL) is a Central Public Sector Enterprise, wherein Government of India is holding 63.06% of its equity. It is an integrated power plant equipment manufacturer and one of the largest engineering and manufacturing companies of its kind in India having a turnover of about USD 5 billion. The company is engaged in the design, engineering, manufacture, construction, testing, commissioning and servicing of a wide range of products and services for the core sectors of the economy, viz. Power, Transmission, Industry, Transportation, Renewable Energy, Oil & Gas and Defence with over 180 product offerings to meet the needs of these sectors.

Since its inception in 1964, BHEL has been the solid bedrock of evolution of India's Heavy Electrical Equipment industry. BHEL has a mammoth 20,000 MW per annum capability for manufacturing of power generation equipment. A widespread network of 17 manufacturing units, 2 repair units, 4 regional offices, 8 service centres, 1 subsidiary, 4 overseas offices, 6 joint ventures, 15 regional marketing centres and current project execution at more than 150 project sites across India and abroad corroborates the humongous scale and size of its operations.

With key focus on project execution, the worldwide installed base of power generating equipment supplied by BHEL has exceeded 178 GW. BHEL's equipment that account for about 60% of the country's total generation from thermal utility sets (coal based), stand a testimony to its valuable contribution towards nation building. BHEL's global competitiveness has established its footprint in all the inhabited continents with references in 82 countries.

In Current Power generation Scenario, there is a significant Increase in Share of Feed in from Fluctuating renewable source mainly from Solar. This large scale integration of Energy generated from Renewable sources requires a new operating regime of Existing coal fired power plants. Flexible operation of Conventional fossil powered power generation plants is the need of the hour to ensure adequate power system stability.

Flexible power plant operation mainly focusses on these areas: Low minimum load Operation, short and efficient start-ups and shut-down, and high ramp rates...

BHEL shall be executing flexible operation solutions using Self tuning AI model based /Artificial Neural Network/Fuzzy Logic based solutions for different variants/ratings of sub-critical and super-critical thermal power plants in India. These aim to provide a complete flexible operations solution for thermal power plants.

The technology partner's role is to supply software, license along with any other associated hardware (if required) to enable BHEL in designing, Engineering, configuring, system integration, simulation testing and site deployment. Technology partner to train BHEL and /or than 250 their customer engineers for using the system so as to make them self-sufficient in developing, debugging and troubleshooting the implemented control logic. Independently.

Through this tender, BHEL-EDN seeks to select a Technology partner qualifying techno-commercially and on the basis of meeting the Pre-Qualification requirement and technical details mentioned in this specification.

Technology partner is expected to handhold BHEL engineers in getting them familiarized on the system features and equip them to engineer/design using Technology partners' system detailed in the later part of this specification. Logistics/schedule for conducting such hands-on training shall be discussed during execution stage.

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

III. PURPOSE

This specification covers the scope of Design, Engineering, Configuration, Supply & Manufacture, Programming, Inspection, testing, Factory Acceptance Testing (FAT), documentation, shipping, installation supervision & commissioning, Site Acceptance Testing (SAT).

Scope of this EOI is to engage technology partner for providing flexible operation solution using Self tuning Adaptive AI model /Artificial Neural Network/Fuzzy Logic based solutions for various fossil fired Power plants as below:

a) **First project will be jointly executed by technology partner and BHEL. Technology partner will have major role/responsibility in achieving the desired results and demonstration. During this period, Technology partner will train BHEL Engineers in all aspects to independently implement, troubleshoot Self tuning Adaptive AI model /Artificial Neural Network/Fuzzy Logic based system which will be referred as APC (Advanced Process Control) further in this document.**
b) **Subsequent projects will be executed by BHEL Engineers. However, support from technology partner is restricted to remote support/guidance so that entire solution is implemented and demonstrated to the desired requirement. BHEL will source only the license to use the Self tuning Adaptive AI model /Artificial Neural Network/Fuzzy Logic based solutions for these projects.**
c) **In case if BHEL Engineer could not achieve desired result with Remote support, Changes required in Core APC Software (If Required) to be developed & enabled by technology partner free of cost.**

Technology Partner shall be responsible for ensuring that the installed APC software is error-free/bug-free and meets the requirement of Flexible operation requirement of Thermal power plant.

Any activity specifically not listed in this document, does not absolve the technology partner of their responsibility to include such activities in their scope of work & supply, which otherwise is necessary, to complete successful functioning of APC system as per scope for the Flexible operation requirement of Thermal power plant. All such type of activities shall be carried out by the Technology partner without any time/ cost implication.

The APC system shall be designed to meet the total functional requirement, specifications and plant operational requirement as per Process scheme, process description and any other requirement as defined in this bid package.

If at any point of time of execution of the job, the APC or any other system supplied is found inadequate to meet the above requirements, In that case any addition/ modification required in software shall be carried out by the technology partner without any cost implication and within the delivery schedule committed

Mechanical modifications in existing Plant shall not be envisaged as part of Flexible operation solutions.

1.0 INSTRUCTION TO APPLICANTS:

1.1 Reputed business entities may submit their application as per ***Annexure -1 & Annexure – 2*** (along with supporting documents for PQR) by Post / e-mail so as to reach us on or before **2020** at the following address:

Mr. Shakti Prakash / Ms. Brindha. M,
NEB 4th Floor,
BHEL EDN,
P.B. No. 2606, Mysore road,
Bangalore-560026,
India.
Email: shaktiprakash@bhel.in / brindha@bhel.in
Phone: +91 9449869933 / 08026989503

1.2 The details submitted by the Applicant(s) shall be complete in all respects and BHEL may seek clarifications/additional information as considered necessary. Such clarifications/additional information must be provided within 5 days of BHEL request.

1.3 The EOI process involves seeking willingness of interested parties and selecting one or more party (ies) amongst all who make an application in response to this EOI.

1.4 Any request for further information or clarification on the EOI document may be submitted to the above mentioned official within 07 days from date of issue of EOI.

1.5 Responses to EOI are to be submitted in English only. Supporting documents, as required, should also be in English language. In case of some documents being available in languages other than English, the Applicant shall necessarily provide duly authenticated translated version of the same in English.

1.6 Duly authorized representative of the Applicant(s) shall sign on each page of the document. Response to EOI should be prepared in such a way so as to provide a straight forward, concise description of Applicant's capabilities.

1.7 Notwithstanding anything contained in this EOI, BHEL reserves the right to accept or reject any Application and to annul the EOI Process in whole or part, at any time without any liability or any obligation for such acceptance, rejection or annulment, and without assigning any reasons thereof.

1.8 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.

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

1.10 All costs incurred for participation in the EOI shall be borne by the Applicant(s).

2.0 Pre-Qualifying Requirements (PQR):

PQR responses to be submitted as per Annexure-2. It is desired that the prospective partner/ respondent meet the following pre-qualification requirement supported with relevant documents/ credentials/ certificates for further consideration:

2.1 Be a Designer / Developer for APC Software Solutions

2.2 The system (with all its sub-systems) as being offered/supplied should have been installed and operating satisfactorily in a thermal power plant for at least 1 Year (as corroborated by user certificate).

2.3 Has sufficient engineering/design capabilities for design, development, testing and commissioning of proposed scope of work.

2.4 No previous contract has been terminated or part terminated due to Technology partner's failure.

2.5 Has not suffered insolvency / bankruptcy.

2.6 Respondent must have positive net worth as of last financial year.

NOTE: Applicants with deviations to the above mentioned PQR are also encouraged to apply and submit their proposal, although decision of BHEL regarding the suitability of applicant shall be final and binding.

3.0 SUMMARY

3.1 Objective

The main objective is to provide Self tuning Adaptive AI model /Artificial Neural Network/Fuzzy Logic based Software solutions for Flexible operation, Combustion optimization and Soot blowing Optimization. This will enable achieving tighter controls especially during disturbances and reducing minimum stable unit load, through the use of advanced control algorithms.

The solution to include as a minimum following solutions. Further, any other advanced process control software solution required to meet the functional requirements of specification (specified elsewhere) are also to be provided

a) **Combustion Optimization** –Combustion optimization of boiler while maintaining flame stability, CO limits and rated parameters of SH steam temperature, RH steam temperature and avoiding metal temperature excursions.

b) **Soot Blowing Optimization** – Optimization of operation of Soot blowers in closed loop.

c) **Faster load Ramp up/Ramp Down** – To achieve faster ramp rates, through the development of advanced models of the Boiler response characteristics, while maintaining the rated parameters of MS pressure, SH steam temperature and RH steam temperature. APC for main steam pressure control loop for achieving tighter throttle pressure and temperature control during load changes.

d) **SH/RH Temperature Excursion Reduction** - Temperature variations during load change and unit disturbances shall be regulated through the development of advanced models of the steam temperature processes while maintaining limits on SH & RH metal temperatures. Software solutions for Flexible operation for SH/RH spray control loop for achieving tighter steam temperature controls during unit disturbances.

e) **Min stable load** – Improve control loop performance to allow stable unit operation till technical minimum load, with all control loops in auto at lower loads without oil support while maintaining flame stability.
   - Response of unit at control load (50% TMCR load).
   - Feasibility of new minimum stable load in range of 20 – 40% TMCR load.

Technology partner to furnish the Guaranteed or Expected Results/Parameters for above mentioned Functional requirement.

The APC software should be capable of gathering data from Plant and build model for simulation. The simulation model shall be used for Controller testing/adjustment need be done in simulation before actual deployment at site.

Advanced Process Control (APC) shall mean the set of techniques which use a multiple input multiple output predictive model for improving the performance of the control loops w.r.t the desired objective (i.e. efficiency improvement or emissions reduction etc.). The model can be Self tuning Adaptive AI model /Artificial Neural Network/Fuzzy Logic based Software solutions.

By using multi-variable advanced automation strategies, the Application should run the plant closer to actual process limits/constraints, allowing an increase in overall efficiency, a reduction in emissions and an improvement in unit ramp rate and load demand response.

3.2 General Requirements

a) The requirements for Software solutions for Flexible operation are indicated on functional basis in the specification. BHEL shall carry out engineering, selection and connection of all components and subsystems to form a complete system whose performance is in accordance with functional, hardware and other requirements of these specifications. However, Technology partner to provide all the required design / best practices to implement the solution to meet flexible operation requirement.

b) The offered software solution should utilize latest hardware and software versions. All software including modelling, optimization software etc. as required are to be provided.

c) Hardware requirement such as controller, IO modules etc., for the offered system shall be manufactured, sourced by BHEL EDN in consultation with Technology partner. All necessary input shall be provided in detail to BHEL. Additional support, if any shall also be provided on as required basis.

d) Commissioning of Self tuning Adaptive AI model /Artificial Neural Network/Fuzzy Logic based Software solutions for Flexible operation shall be a BHEL activity with remote Technology Partner's support but in the first project where it shall be joint activity by Technology Partner and BHEL. Technology Partner shall depute experienced personnel for the commissioning of the Software solutions for Flexible operation in the first project.

3.3 Functional Requirements

a) Suitable interfacing with DDCMIS to be provided for collecting data and sending commands back to DCS for changing the bias/set points/controller outputs of the closed loop controls in the DDCMIS. In case the software solution for Flexible operation is not

integral to DDCMIS, the Technology partner shall be responsible for designing cyber security architecture for connecting to DCS and inform the same to Purchaser in details as Hardware shall be BHEL make and supplied by BHEL.

b) Typical outputs from the APC shall include Aux. air damper bias, over fire air damper bias, burner tilt bias, Feeder bias, FG O2 SP bias, Fuel Master SP bias, CMC Load SP to TG bias etc. For SH/RH steam temperature, the outputs shall be either spray demand bias or direct output switchover. Exact details shall be finalized with the Employer during engineering stage. Please Note that the above list is tentative and not exhaustive. Technology partner must consider all variables required to meet the requirements mentioned somewhere else in this document and not limited to above.

c) The Technology partner shall take into account all regimes of the operation of the units during the design of software solution for Flexible operation system, further, all constraints of the units shall be taken into consideration during the Self tuning Adaptive AI model /Artificial Neural Network/Fuzzy Logic based software design.

d) The software should have adaptive control features i.e. it should take into account actual unit conditions and constraints for giving the bias/set-points/control outputs. The Software solution should be self- tuning to automatically adjust on real time to actual unit conditions and constraints. It would be preferred to use a controller different than fixed parameter PID controllers in order to avoid their stability constraints.

e) Fail safe design: The Self tuning Adaptive AI model /Artificial Neural Network/Fuzzy Logic based software implementation should ensure fail safe design with 'start/stop' functionality, tracking functionality and bump less transfer to DDCMIS and alarm to operator in case of any malfunction. Suitable set point and bias tracking functions also to be implemented. APC ON/OFF should be available to DCS / OW S/LVS

f) GUI for the APC: The APC should be capable of handling on line changes in control objectives (constraint limit changes/ priority changes/ set point or range target changes) without switching off the APC. Status of Optimizer, its KPI, Trends for process values, APC parameters etc., alarm page for showing alarms generated by APC software.

g) Historization of APC inputs, calculated values and outputs i.e. all CVs, MVs and DVs (CVs – Controlled variables, MVs – Manipulated variables and DVs – Disturbance Variables)….

h) Snapshot of best achievable performance (i.e. Heat rate) in a given set of conditions to be available in the APC software. The overall implementation should not result in deterioration of the unit HR.

i) KPIs of APC being generated in APC software shall also to be transferred to DCS over the interface link for further transfer to Station LAN and PI, as required. In case the KPI for optimization are made available , the same should be additionally used for the deriving of the final solution

j) User level security: The software shall support advanced security methods to provide protection against unauthorized access, disclosure, modification, and use.
Remote connectivity: The Technology partner shall provide the necessary support required for connecting the APC system to their remote service centre, through which the diagnostics & fault analysis of the APC system can be carried out.

3.4 Exclusivity

Subject to the provisions of the AGREEMENT, BHEL will have exclusive rights to offer the APC solution in Indian market for flexible operation requirement.
Further Technology partner will not promote in TERRITORY (Projects in India) either directly or indirectly the offered APC solution competing with BHEL.

4. TRAINING

a) Developer/ Administrator level training: The Technology partner shall provide detailed training to Minimum eight (8) BHEL engineers at the works of the APC technology provider to cover all aspects of Implementing & Troubleshooting APC Software Independently. Accordingly the training module to be proposed by APC Partner. At the end of this training, the participants shall be able to tune the settings of the APC software in order to account for plant/equipment characteristics change or modification in the objectives of the APC solution. For the first project, training to be unlimited (complete and hand holding) to ensure that the technology is absorbed by BHEL engineers.

b) User level training: The Contractor shall provide user level training for site operations. The training shall be held in two batches. This training needs to be conducted before the commissioning activity of the APC of the respective stage. Accordingly the training module to be proposed by APC Partner.

c) Online knowledge base for troubleshooting: An online portal with unlimited access to BHEL engineers for troubleshooting related to APC needs to be provided. This shall be updated on timely basis and kept upto date.

Training Material shall be provided to each of the participants of the above courses.

5.0 SCOPE OF SUPPLY

5.1 Engineering Services

Activities to be performed at BHEL premises (Jointly for the first project and by BHEL for subsequent project with remote support from Technology partner as required)

- Development of the application;
- Development of the process model required (as a minimum) for application FAT;
- Application FAT;

- Engineering training to BHEL Engineers.

Activities to be performed at the Power Plant site:

- Site survey;
- Preliminary verification;
- Design inputs tests (as required);
- Installation and final tuning of the controller;
- Performance testing and evaluation of the result;
- Operator training to customer.

5.2 Hardware

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a) All hardware related to controllers, IO modules etc. if any, shall be manufactured, and sourced by BHEL EDN in consultation with Technology partner. All necessary input shall be provided in detail to BHEL by Technology partner. Additional support, if any shall also be provided on as required basis.

5.3 Software

The software licenses (APC HMI with Engineering tool) for the implementation of the proposed solution is envisaged. All licenses required for the complete implementation of flexible operations must be provided as an integrated license and to be considered in the offer. These licenses shall have perpetual warranty, however, limited to platform change due to hardware up gradation/obsolescence/R&M. Technology partner shall establish a mechanism to notify BHEL on new release of patches/upgrades as and when there are releases and include BHEL in their mailing list or any other mechanism for notifying on regular interval
The Software/License requirements for the complete implementation of APC software solutions shall be informed to BHEL in detail by Technology partner E.g.: Microsoft Windows Operating System, Office and Anti-virus licenses etc. necessary for Machine, hosted on the Server/workstation
The software should have the capability to add or remove process constraints during operations by the customer. The offered APC Software Components should not have any recurring cost.

6.0 TECHNICAL DETAILS

a) Anything contradictory to the specifications with any of technical details, observed shall be brought to BHEL's notice in advance for clarification.

b) ONE set of license of all software used in APC programming/graphic building to be given to customer along with system.

APC software should have all the diagnostics and alarms information pertaining to APC software and provision shall be available to transfer the same to announce in DCS for operator notification/attention.

c) Site support till SAT (site Acceptance test) shall be provided without any obligation on number of visits. This shall be as and when required and desired by BHEL at site during installation-supervision & commissioning for the first project and for the

subsequent projects remote support if necessary shall be provided by Technology partner.

h) The Technology partner to also upgrade/update the APC solution at the time of DDCMIS Upgrade/update

6.1 COMMUNICATION/ FOREIGN DEVICE INTERFACE

a) The APC software shall communicate with DCS, using Industry standard protocol.

b) APC software Technology partner shall have provision for redundant communication. In addition, shall indicate/include all hardware and software required at APC end for the establishment of communication. All the communication links and interfaces shall be dual redundant, configured in the hot standby mode. **(Both modules working in parallel with dynamic data equalization, one primary and the other secondary, which shall take over automatically on failure of primary Module).**

c) Technology partner shall give reference of any such communication established between APC system and **DCS system and various other systems**.

d) Technology partner shall give all engineering assistance to BHEL for establishment of communication between the two systems.

7.0 SPARE PHILOSOPHY

Loading for the controller shall not exceed 60% with installed & future spare inputs & outputs. The system memory shall have sufficient spare capacity for 30% additional application programming & configuration in future.

8.0 WARRANTY

Comprehensive warranty of complete APC system (software) from the completion of the SAT shall be provided in line with the terms & conditions of warranty of DDCMIS. This shall also include services every quarter for tuning of the APC software including the models, if necessary. Real time self-tuning capabilities that avoid manual tuning of the system on regular basis would be very valuable.

9.0 INSPECTION & TESTING

All APC oriented items shall undergo factory testing and inspection by Customers' authorized representatives, unless specified otherwise. The inspection and testing shall be carried out as per related specifications, international codes and practices/ standards approved documents and / or any other document attached along with.

No system or system oriented item shall be dispatched without factory testing witnessed by representatives of Customer / purchaser/ Owner. The testing procedures shall be detailed out by Technology partner based on testing requirements indicated in individual system specifications, and shall be reviewed by BHEL. BHEL & Technology partner the first project must certify that the system is actually ready before calling for FAT. Also all the necessary approved documents and literatures are to be submitted 2 weeks before calling for FAT.

9.1 FAT will be conducted for complete APC system at BHEL Electronics Division works. Detailed Software and hardware check will be done.

9.2 Demonstration of Integrated Testing of APC with DCS at site under the witness of BHEL/ Customer.

9.3 SAT - An integrated SAT will be conducted for complete DCS, APC and associated / allied systems at site after commissioning of the system. After conduction of SAT the system will be taken over by customer.

9.4 Technology partner is liable to update the platform and fixes the defective SW items identified during that period.

9.5 During the period of FAT, any change in system design shall be carried out by the Technology partner without cost implication.

9.6 SAT (Site Acceptance Test) for Performance Testing

Site acceptance test shall be conducted for evaluating the performance of the APC software.

- Site Acceptance Testing Setup: The SAT shall be done after completion of commissioning of the software (including interface testing, checking of fail-safe implementation etc.). SAT would be conducted by comparing performance between APC Off and APC On scenarios. Details of the test shall be approved by BHEL/Customer during details engineering.
- Technology partner to also demonstrate the Combustion optimization APC software capability of reducing NOx. However, it will revert back to heat rate objective after demonstration. It would be valued if the APC is capable of extending the stable operating area where a better heat rate (not best) and lower NOx emissions (not lowest) may coexist.
- Suitable precautions to be taken to ensure that there is no equipment/unit outage due to the conductance of the SAT.
- Suitable measures to be taken during the testing period to ensure similar operating conditions between APC ON duration and APC OFF duration like coal quality, mill combination, ambient conditions etc., as finalized during detailed engineering.

APC Solution	Condition	Monitored Parameter (S) (On versus Off)	Guaranteed/ Expected Results, Parameters
SH/RH Temperature Excursion Reduction	At different steady loads with different coal conditions during mill changeover, Soot blowing etc.	Improvement in Parameter excursion of SH, RH Temp between On versus Off. Std Deviation of temperature against Set point On versus Off	
Faster Ramp up /Ramp Down	At different loads with different ramps and different coal conditions	Improvement in Parameter excursion of Throttle pressure, SH, RH Temp between On versus Off. Improvement in Ramping ratios between On versus Off	
Combustion Optimization & Soot blowing Optimization	At different steady loads with different coal conditions.	Improvement in Heat Rate using delta heat rate method	
Min. Stable Load	At steady Technical Min. load with different coal conditions	All major control loops, are functioning in auto without oil support while maintaining flame stability, keeping other parameters in limits.	

10.0 DOCUMENTATION

10.1 Documentation along with technical BID to be provided by Technology partner. Followings Documents to be submitted as part of the technical offer (without any price implication):

a) Offered system write-up, technical catalogue/data sheets of APC and its modules.
b) APC and sub system architecture.
c) PTR (Proven Track Record) and reference list.
d) Bill of material - Envisaged for running the APC software as per proposed configuration.
e) Unpriced list of each module / item of APC & its subsystem.
f) APC system configuration.
g) Project execution schedule.

10.2 During detailed engineering (After Placement of order) - All engineering documents listed in Point no. 13.1 with revised/ updated documents during technical scrutiny shall be submitted in sets of 2 for approval.

10.3 Along with dispatch of APC - All final drawings/ documents/ O&M manuals shall be submitted to site in sets of 2 (hard copies) and two sets of soft copies preferably in DVD's.

10.4 Technology Partner to handover Engineering/Application/Simulation software for APC system after commissioning

DOCUMENTS FOR REVIEW/RECORDS

Sl .NO	**Description**	**For Owner's Consideration**		**Remarks**
		Review	Records	
1.	Documents and drawings list and schedule including various systems like APC.	✓		
2.	Functional schematics including complex loops	✓		
3.	Logistic support certificates for various systems viz. APC,	✓		
4.	Serial link and interface details for various systems viz. APC.		✓	
5.	Point data base		✓	
6.	Catalogs including technical information and programming manuals, Installation, operation and maintenance manuals		✓	
7.	As-built drawings/ documents		✓	
8.	Graphic display drawings including overview graphics group views, assignments etc.	✓		
9.	Log and MIS reports, Trend Groups	✓		
10	Special test equipment/ tool requirement for maintenance		✓	

Note-1: For the first project, Technology partner shall prepare & submit the as built drawings / documents after commissioning. All the drawings/documents listed shall be converted into "As Built" after commissioning of Project. "As Built" shall include documents generated by Technology partner.

11.0 INSTALLATION SUPERVISION AND COMMISSIONING

11.1 Erection & Commissioning:

Technology partner shall consider in its scope site visits during the complete Commissioning of the APC package, which is a joint activity by BHEL and Technology partner. Technology partner to quote as lump sum charge, per man-day rate will not be accepted. Readiness of site shall be informed by BHEL to Technology partner.

11.2 Entire package may require implementing in various phases, which can be summarized as follows:

- Integration with plant DCS.
- System commissioning for plant operation.
- Site Acceptance test.

11.3 Above phases are indicative only, actual implementation may depend on site front availability.

For the first project -

11.3.1 Technology partner shall assess correctly the duration of the total period of installation supervision and Commissioning of this nature of plant.

11.3.2 Technology partner may consider sufficient period of site stay and site visits of their Engineers. No additional or extra payment will be made for site services other than price indicated in its price offer.

11.3.3 Technology partner shall quote for lump-sum price for Installation, supervision and Commissioning, without any specified time duration. Technology partner shall list out the front requirement for commissioning at various stages.

Technology partner shall consider 50% software modifications at site and other related changes, including changes in the related drawings and documents (after code-1 approval) without any cost implication for the first project

Annexure-1

Information to be submitted by Applicant

1. Name of the Company:
2. Legal status of the Company:
3. Brief description of the Company including details of its business groups/subsidiaries/ affiliates:
4. Date of Incorporation:
5. Date of Commencement of Business:
6. Full address including Telephone nos. / Fax nos.:

   Registered Office:

   Head Office:

   Address for communication:

   Contact Details:

   Office Address in India, if any:
7. Documents to be enclosed:
   a) Technical Credentials – Relevant Product/System catalogues, Experience /Reference List, Copies of Customer Certificates, Engineering strengths, quality accreditations, etc.
   b) Financial Credentials – Copies of Audited Financial statements (Annual Reports) for last 3 years, Credit Rating, Market share (Domestic/International), Segmental Revenue in the applied category(ies).
   c) Other documents considered relevant to meet PQR and support evaluation criteria.

(Sign & Company Seal)

Authorized signatory

Annexure-2

Pre-Qualification Requirements

S.N.	Requirement	Applicant's Response	Supporting document
1	Be a Designer / Developer for APC Software Solutions		
2	The system (with all its sub-systems) as being offered/supplied should have been installed and operating satisfactorily in a thermal power plant for at least 1 Year (as corroborated by user certificate)		
3	Has sufficient engineering/design capabilities for design, development, testing and commissioning of proposed scope of work.		
4	Has not been blacklisted / banned business dealings for Ministry of Railways or any Government Department of India.		
5	No previous contract has been terminated or part terminated due to Technology partner's failure.		
6	Has not suffered insolvency / bankruptcy.		
7	Respondent must have positive net worth as of last financial year.		

(Sign & Company Seal)

Authorized signatory