



REPUBLIC OF THE PHILIPPINES  
**NATIONAL POWER CORPORATION**  
(Pambansang Korporasyon sa Elektrisidad)

## **BID DOCUMENTS**

Name of Project : **A6IC UPGRADING AND INTEGRATION OF UNIT 1  
& 2 SCADA SYSTEM TO DCS**

Project Location : **AGUS 6 HEPP, ILIGAN CITY, LANA DEL NORTE**

PR No. : **MG-A7M23-005**

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SECTION I

**INVITATION TO BID**



# National Power Corporation

## INVITATION TO BID

### PUBLIC BIDDING – BCS 2024-0266

- The NATIONAL POWER CORPORATION (NPC), through its approved Corporate Budget of CY 2024 intends to apply the sum of (Please see schedule below) being the Approved Budget for the Contract (ABC) to payments under the contract. Bids received in excess of the ABC shall be automatically rejected at Bid opening.

PR Nos./PB Ref No. & Description	Similar Contracts	Pre-bid Conference	Bid Submission / Opening	ABC/ Amt. of Bid Docs
MG-A7M23-005 / PB240507-CM00213  A6IC Upgrading and Integration of Unit 1 & 2 SCADA System to DCS	Supply, Delivery, Installation, Test and Commissioning or upgrading of SCADA System / Real-Time Monitoring System for Hydro Electric Power Plant	25 April 2024 9:30 A.M.	07 May 2024 9:30 A.M.	₱ 31,500,000.00 / ₱ 25,000.00
HO-FFW23-010 / PB231003-CM00289 (PB3)  Upgrading of Various Telemetry Systems of FFWSO Project	Supply and Delivery or Upgrading of Telemetry Systems for Flood Forecasting or warning systems	25 April 2024 9:30 A.M.	07 May 2024 9:30 A.M.	₱ 20,000,000.00 / ₱ 25,000.00
<b>Venue: Kañao Function Room, NPC Bldg. Diliman, Quezon City</b>				

- The NPC now invites bids for Items listed above. Delivery of the Goods is required (see table below) specified in the Technical Specifications. Bidders should have completed, within (see table below) from the date of submission and receipt of bids, a contract similar to the Project. The description of an eligible bidder is contained in the Bidding Documents, particularly, in Section II. (Instruction to Bidders).

PR No/s. / PB Ref No/s.	Delivery Period / Contract Duration	Relevant Period of SLCC reckoned from the date of submission & receipt of bids
MG-A7M23-005	Two Hundred Seventy (270) Calendar Days	Fifteen (15) Years
HO-FFW23-010	Two Hundred (200) Calendar Days	Ten (10) Years

- Bidding will be conducted through open competitive bidding procedures using a non-discretionary "pass/fail" criterion as specified in the 2016 revised Implementing Rules and Regulations (IRR) of Republic Act (RA) No. 9184.

Bidding is restricted to Filipino citizens/sole proprietorships, partnerships, or organizations with at least sixty percent (60%) interest or outstanding capital stock belonging to citizens of the Philippines, and to citizens or organizations of a country the laws or regulations of which grant similar rights or privileges to Filipino citizens, pursuant to RA 5183.

- Prospective Bidders may obtain further information from National Power Corporation, Bids and Contracts Services Division and inspect the Bidding Documents at the address given below during office hours (8:00AM to 5:00PM), Monday to Friday.
- A complete set of Bidding Documents may be acquired by interested Bidders from the given address and website(s) and upon payment of the applicable fee for the Bidding Documents, pursuant to the latest

Guidelines issued by the GPPB. *Bidding fee may be refunded in accordance with the guidelines based on the grounds provided under Section 41 of R.A. 9184 and its Revised IRR.*

6. The National Power Corporation will hold Pre-Bid Conference (**see table above**) and/or through video conferencing or webcasting which shall be open to prospective bidders. Only registered bidder/s shall be allowed to participate in the conduct of virtual pre-bid conference. **Unregistered bidders** may attend the Pre-Bid Conference at the Kafiao Room, NPC subject to the following:
  - a. Only a maximum of two (2) representatives from each bidder / company shall be allowed to participate during the virtual pre-bid conference.
  - b. Wearing of Face Masks is recommended but not required in view of Proclamation No. 297 S.2023 lifting the State of Public Health Emergency Throughout the Philippines
  - c. The requirements herein stated including the medium of submission shall be subject to GPPB Resolution No. 09-2020 dated 07 May 2020
  - d. The Guidelines on the Implementation of Early Procurement Activities (EPA) shall be subject to GPPB Circular No. 06-2019 dated 17 July 2019
7. Bids must be duly received by the BAC Secretariat through (i) manual submission at the office address indicated below; (ii) online or electronic submission before the specified time stated in the table above for opening of bids. Late bids shall not be accepted.
8. All Bids must be accompanied by a bid security in any of the acceptable forms and in the amount stated in ITB Clause 14.
9. Bid opening shall be in the Kafiao Function Room, NPC Head Office, Diliman, Quezon City and/or via online platform to be announced by NPC. Bids will be opened in the presence of the bidders' representatives who choose to attend the activity.
10. The National Power Corporation reserves the right to reject any and all bids, declare a failure of bidding, or not award the contract at any time prior to contract award in accordance with Sections 35.6 and 41 of the 2016 revised IRR of R.A. No. 9184, without thereby incurring any liability to the affected bidder or bidders.

11. For further information, please refer to:

**Bids and Contracts Services Division,  
Logistics Department**  
Gabriel Y. Itchon Building  
Senator Miriam P. Defensor-Santiago Ave. (formerly BIR Road)  
Cor. Quezon Ave., Diliman, Quezon City, 1100  
Tel Nos.: Tel Nos.: 8921-3541 local 5564/5713  
Email: [bcسد@napocor.gov.ph](mailto:bcسد@napocor.gov.ph) /

12. You may visit the following websites:

For downloading of Bidding Documents: <https://www.napocor.gov.ph/bcsd/bids.php>



**ATTY. MELCHOR P. RIDULME**  
Vice President, Office of the Legal Counsel and  
Chairman, Bids and Awards Committee

SECTION II

**INSTRUCTIONS TO  
BIDDERS**

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## SECTION II – INSTRUCTIONS TO BIDDERS

### 1. Scope of Bid

The **National Power Corporation (NPC or NAPOCOR)** wishes to receive Bids for the **A6IC UPGRADING AND INTEGRATION OF UNITS 1 & 2 SCADA SYSTEM TO DCS**, with identification number **PR NO. MG-A7M23-005**.

The Procurement Project (referred to herein as "Project") is composed of one (1) lot and will be awarded to one (1) Bidder in one complete contract, the details of which are described in Section VI (Technical Specifications).

### 2. Funding Information

2.1. The GOP through the source of funding as indicated below for CY 2023 in the amount of **₱ 31,500,000.00**.

2.2. The source of funding is the Corporate Operating Budget of the National Power Corporation.

### 3. Bidding Requirements

The Bidding for the Project shall be governed by all the provisions of RA No. 9184 and its 2016 revised IRR, including its Generic Procurement Manuals and associated policies, rules and regulations as the primary source thereof, while the herein clauses shall serve as the secondary source thereof.

Any amendments made to the IRR and other GPPB issuances shall be applicable only to the ongoing posting, advertisement, or **IB** by the BAC through the issuance of a supplemental or bid bulletin.

The Bidder, by the act of submitting its Bid, shall be deemed to have verified and accepted the general requirements of this Project, including other factors that may affect the cost, duration and execution or implementation of the contract, project, or work and examine all instructions, forms, terms, and project requirements in the Bidding Documents.

### 4. Corrupt, Fraudulent, Collusive, and Coercive Practices

The Procuring Entity, as well as the Bidders and Suppliers, shall observe the highest standard of ethics during the procurement and execution of the contract. They or through an agent shall not engage in corrupt, fraudulent, collusive, coercive, and obstructive practices defined under Annex "I" of the 2016 revised IRR of RA No. 9184 or other integrity violations in competing for the Project.

### 5. Eligible Bidders

5.1. Only Bids of Bidders found to be legally, technically, and financially capable will be evaluated.

5.2. Foreign ownership exceeding those allowed under the rules may participate when citizens, corporations, or associations of a country, included in the list issued by

the GPPB, the laws or regulations of which grant reciprocal rights or privileges to citizens, corporations, or associations of the Philippines.

The foreign bidder claiming eligibility by reason of their country's extension of reciprocal rights to Filipinos shall submit a certification from the relevant government office of their country stating that Filipinos are allowed to participate in their government procurement activities for the same item/product. The said certification shall be validated during the post-qualification of bidders.

- 5.3. Pursuant to Section 23.4.1.3 of the 2016 revised IRR of RA No.9184, the Bidder shall have an SLCC that is at least one (1) contract similar to the Project the value of which, adjusted to current prices using the PSA's CPI, must be at least equivalent to at least fifty percent (50%) of the ABC.
- 5.4. The Bidders shall comply with the eligibility criteria under Section 23.4.1 of the 2016 IRR of RA No. 9184.

## **6. Origin of Goods**

There is no restriction on the origin of goods other than those prohibited by a decision of the UN Security Council taken under Chapter VII of the Charter of the UN, subject to Domestic Preference requirements under ITB Clause 18.

## **7. Subcontracts**

- 7.1. The Bidder may subcontract portions of the Project to the extent allowed by the Procuring Entity as stated herein, but in no case more than twenty percent (20%) of the Project.

The portions of Project and the maximum percentage allowed to be subcontracted are indicated in the **BDS**, which shall not exceed twenty percent (20%) of the contracted Goods.

- 7.2. The Supplier may identify its subcontractor during the contract implementation stage. Subcontractors identified during the bidding may be changed during the implementation of this Contract. Subcontractors must submit the documentary requirements under Section 23.1 of the 2016 revised IRR of RA No. 9184 and comply with the eligibility criteria specified in ITB Clause 5 to the implementing or end-user unit.
- 7.3. Subcontracting of any portion of the Project does not relieve the Supplier of any liability or obligation under the Contract. The Supplier will be responsible for the acts, defaults, and negligence of any subcontractor, its agents, servants, or workmen as fully as if these were the Supplier's own acts, defaults, or negligence, or those of its agents, servants, or workmen.

## **8. Pre-Bid Conference**

The Procuring Entity will hold a pre-bid conference for this Project on the specified date and time and either at its physical address and/or through videoconferencing/webcasting as indicated in paragraph 6 of the IB.

## **9. Clarification and Amendment of Bidding Documents**

Prospective bidders may request for clarification on and/or interpretation of any part of the Bidding Documents. Such requests must be in writing and received by the Procuring Entity, either at its given address or through electronic mail indicated in the IB, at least ten (10) calendar days before the deadline set for the submission and receipt of Bids.

## 10. Documents comprising the Bid: Eligibility and Technical Components

- 10.1. The first envelope shall contain the eligibility and technical documents of the Bid as specified in Section VIII (NPCSF-GOODS-01 - Checklist of Technical and Financial Documents).
- 10.2. The Bidder's SLCC as indicated in ITB Clause 5.3 should have been completed within Fifteen (15) Years prior to the deadline for the submission and receipt of bids.
- 10.3. If the eligibility requirements or statements, the bids, and all other documents for submission to the BAC are in foreign language other than English, it must be accompanied by a translation in English, which shall be authenticated by the appropriate Philippine foreign service establishment, post, or the equivalent office having jurisdiction over the foreign bidder's affairs in the Philippines. Similar to the required authentication above, for Contracting Parties to the Apostille Convention, only the translated documents shall be authenticated through an apostille pursuant to GPPB Resolution No. 13-2019 dated 23 May 2019. The English translation shall govern, for purposes of interpretation of the bid.
- 10.4. The Statement of the bidder's Single Largest Completed Contract (SLCC) (NPCSF-GOODS-03) and List of all Ongoing Government & Private Contracts Including Contracts Awarded but not yet Started (NPCSF-GOODS-02) shall comply with the documentary requirements specified in the **BDS**.

## 11. Documents comprising the Bid: Financial Component

- 11.1. The second bid envelope shall contain the financial documents for the Bid as specified in Section VIII (NPCSF-GOODS-01 - Checklist of Technical and Financial Documents).
- 11.2. If the Bidder claims preference as a Domestic Bidder or Domestic Entity, a certification issued by DTI shall be provided by the Bidder in accordance with Section 43.1.3 of the 2016 revised IRR of RA No. 9184.
- 11.3. Any bid exceeding the ABC indicated in paragraph 1 of the IB shall not be accepted.
- 11.4. For Foreign-funded Procurement, a ceiling may be applied to bid prices provided the conditions are met under Section 31.2 of the 2016 revised IRR of RA No. 9184.

## 12. Bid Prices

- 12.1. Prices indicated on the Price Schedule shall be entered separately in the following manner:
  - a. For Goods offered from within the Procuring Entity's country:
    - i. The price of the Goods quoted EXW (ex-works, ex-factory, ex-warehouse, ex-showroom, or off-the-shelf, as applicable);

- ii. The cost of all customs duties and sales and other taxes already paid or payable;
  - iii. The cost of transportation, insurance, and other costs incidental to delivery of the Goods to their final destination; and
  - iv. The price of other (incidental) services, if any, listed in the **BDS**.
- b. For Goods offered from abroad:
- i. Unless otherwise stated in the **BDS**, the price of the Goods shall be quoted delivered duty paid (DDP) with the place of destination in the Philippines as specified in the **BDS**. In quoting the price, the Bidder shall be free to use transportation through carriers registered in any eligible country. Similarly, the Bidder may obtain insurance services from any eligible source country.
  - ii. The price of other (incidental) services, if any, as listed in the **BDS**.

### 13. Bid and Payment Currencies

13.1. For Goods that the Bidder will supply from outside the Philippines, the bid prices may be quoted in the local currency or tradeable currency accepted by the BSP at the discretion of the Bidder. However, for purposes of bid evaluation, Bids denominated in foreign currencies, shall be converted to Philippine currency based on the exchange rate as published in the BSP reference rate bulletin on the day of the bid opening.

13.2. Payment of the contract price shall be made in Philippine Pesos.

### 14. Bid Security

14.1. The Bidder shall submit a Bid Securing Declaration or any form of Bid Security in the amount indicated in the **BDS**, which shall be not less than the percentage of the ABC in accordance with the schedule in the **BDS**.

14.2. The Bid and bid security shall be valid for **One Hundred Twenty (120) calendar** days from the date of opening of bids. Any Bid not accompanied by an acceptable bid security shall be rejected by the Procuring Entity as non-responsive.

### 15. Sealing and Marking of Bids

Each Bidder shall submit Two (2) copies of the first and second components of its Bid, marked **Original** and photocopy. Only the original copy will be read and considered for the bid.

Any misplaced document outside of the **Original** copy will not be considered. The photocopy is **ONLY FOR REFERENCE**.

The Procuring Entity may request additional hard copies and/or electronic copies of the Bid. However, failure of the Bidders to comply with the said request shall not be a ground for disqualification.

If the Procuring Entity allows the submission of bids through online submission to the given website or any other electronic means, the Bidder shall submit an electronic copy of its Bid, which must be digitally signed. An electronic copy that cannot be opened or is corrupted shall be considered non-responsive and, thus, automatically disqualified.

Bidders must also comply with the Disclaimer and Data Privacy Notice specified in the **BDS**.

## 16. Deadline for Submission of Bids

16.1. The Bidders shall submit on the specified date and time and either at its physical address or through online submission as indicated in paragraph 7 of the **IB**.

## 17. Opening and Preliminary Examination of Bids

17.1. The BAC shall open the Bids in public at the time, on the date, and at the place specified in paragraph 9 of the **IB**. The Bidders' representatives who are present shall sign a register evidencing their attendance. In case videoconferencing, webcasting or other similar technologies will be used, attendance of participants shall likewise be recorded by the BAC Secretariat.

In case the Bids cannot be opened as scheduled due to justifiable reasons, the rescheduling requirements under Section 29 of the 2016 revised IRR of RA No. 9184 shall prevail.

17.2. The preliminary examination of bids shall be governed by Section 30 of the 2016 revised IRR of RA No. 9184.

## 18. Domestic Preference

18.1. The Procuring Entity will grant a margin of preference for the purpose of comparison of Bids in accordance with Section 43.1.2 of the 2016 revised IRR of RA No. 9184.

## 19. Detailed Evaluation and Comparison of Bids

19.1. The Procuring Entity's BAC shall immediately conduct a detailed evaluation of all Bids rated "*passed*," using non-discretionary pass/fail criteria. The BAC shall consider the conditions in the evaluation of Bids under Section 32.2 of the 2016 revised IRR of RA No. 9184.

19.2. If the Project allows partial bids, bidders may submit a proposal on any of the lots or items, and evaluation will be undertaken on a per lot or item basis, as the case maybe. In this case, the Bid Security as required by **ITB** Clause 14 shall be submitted for each lot or item separately.

19.3. The descriptions of the lots or items shall be indicated in **Section VI (Technical Specifications)**, although the ABCs of these lots or items are indicated in the **BDS** for purposes of the NFCC computation pursuant to Section 23.4.2.6 of the 2016 revised IRR of RA No. 9184. The NFCC must be sufficient for the total of the ABCs for all the lots or items participated in by the prospective Bidder.

19.4. The Project shall be awarded to one (1) Bidder in one complete contract.

- 19.5. Except for bidders submitting a committed Line of Credit from a Universal or Commercial Bank in lieu of its NFCC computation, all Bids must include the NFCC computation pursuant to Section 23.4.1.4 of the 2016 revised IRR of RA No. 9184, which must be sufficient for the total of the ABCs for all the lots or items participated in by the prospective Bidder. For bidders submitting the committed Line of Credit, it must be at least equal to ten percent (10%) of the ABCs for all the lots or items participated in by the prospective Bidder.

## **20. Post-Qualification**

- 20.1. Within a non-extendible period of five (5) calendar days from receipt by the Bidder of the notice from the BAC that it submitted the Lowest Calculated Bid, the Bidder shall submit its latest income and business tax returns filed and paid through the BIR Electronic Filing and Payment System (eFPS) and other appropriate licenses and permits required by law and stated in the **BDS**.

## **21. Signing of the Contract**

- 21.1. The documents required in Section 37.2 of the 2016 revised IRR of RA No. 9184 shall form part of the Contract. Additional Contract documents are indicated in the **BDS**.

SECTION III

**BID DATA SHEET**

### SECTION III - BID DATA SHEET

ITB Clause	
5.3	<p>For this purpose, similar contracts shall refer to supply, delivery, installation test and commissioning or upgrading of SCADA system/real-time monitoring system for hydro electric power plant.</p> <p>The Single Largest Completed Contract (SLCC) as declared by the bidder shall be verified and validated to ascertain such completed contract. Hence, bidders must ensure access to sites of such projects/equipment to NPC representatives for verification and validation purposes during post-qualification process.</p> <p>It shall be a ground for disqualification, if verification and validation cannot be conducted for reasons attributable to the Bidder.</p>
7.1	<p>Subcontracting may be allowed on transport, local/non-skilled labor under the supervision of the Bidder. The Bidder shall not be relieved from any liability or obligation that may arise from the performance of the Subcontractor.</p>
10.1	<p>The prospective bidder shall submit a valid and updated Certificate of PhilGEPs Registration under Platinum Membership (all pages including the Annex A of the said Certificate). <b>Non-compliance shall be a ground for disqualification.</b></p>
10.4	<p>The list of on-going contracts (Form No. NPCSF-GOODS-02) shall be supported by the following documents for each on-going contract to be submitted during <b>Post-Qualification</b>:</p> <ol style="list-style-type: none"> <li>1. Contract/Purchase Order and/or Notice of Award</li> <li>2. Certification coming from the project owner/client that the performance is satisfactory as of the bidding date</li> </ol> <p>The bidder shall declare in this form all his on-going government and private contracts including contracts where the bidder (either as individual or as a Joint Venture) is a partner in a Joint Venture agreement other than his current joint venture where he is a partner. Non declaration will be a ground for disqualification of bid.</p> <p>The Statement of the bidder's Single Largest Completed Contract (SLCC) similar to the contract to be bid (Form No. NPCSF-GOODS-03) shall be supported by the following documents to be submitted during <b>Bid Opening</b>:</p> <ol style="list-style-type: none"> <li>1. Certificate of Acceptance; or Certificate of Completion; or Official Receipt (O.R); or Sales Invoice</li> </ol> <p>Any single bidder/s who already procured/secured the bidding documents but want to avail the Joint Venture Agreement (JVA) shall inform the BAC in writing prior to the bid opening for records and documentation purposes.</p>

10.5	<p>Bidders shall also submit the following requirements in their first envelope, Eligibility and Technical Component of their bid:</p> <ol style="list-style-type: none"> <li>1. Data and Information to be submitted with the Proposal as specified in Clause TS-15.0 of Section VI - Technical Specifications;</li> <li>2. Complete eligibility documents of the proposed sub-contractor, if any</li> </ol>
12	<p>The price of the Goods shall be quoted DDP Project Site or the applicable International Commercial Terms (INCOTERMS) for this Project.</p>
14.1	<p>The bid security shall be in the form of a Bid Securing Declaration, or any of the following forms and amounts:</p> <ol style="list-style-type: none"> <li>a) The amount of not less two percent (2%) of ABC, if bid security is in cash, cashier's/manager's check, bank draft/guarantee or irrevocable letter of credit; or</li> <li>b) The amount of not less than five percent (5%) of ABC, if bid security is in Surety Bond.</li> </ol>
15.0	<p>All bid submissions and related correspondences are confidential and for viewing only by the intended recipient/s. Any unauthorized access to review, reproduce, or disseminate the information contained therein is strictly prohibited. The National Power Corporation (NAPOCOR) does not guarantee the security of any information electronically transmitted.</p> <p>Bid submissions and related correspondences may contain personal and sensitive personal information, and are subject to the Data Privacy Act of 2012, its implementing rules, regulations and issuances of the National Privacy Commission of the Philippines ("Privacy Laws"). By viewing, using, storing, sharing and disposing (collectively "Processing"), such bids submissions and correspondences, you agree to comply with the Privacy Laws. By responding to correspondence, you consent to the Processing by NAPOCOR of the Personal Data contained in your submission/reply in accordance with NAPOCOR's Personal Data Privacy Policy which you can find at <a href="http://www.napocor.gov.ph">http://www.napocor.gov.ph</a>.</p> <p>To report any privacy issue, contact the Data Privacy Officer at <a href="mailto:dpo@napocor.gov.ph">dpo@napocor.gov.ph</a>.</p> <p>NAPOCOR is not liable for the proper and complete transmission of the information contained in bid submission/correspondences nor for any delay in its receipt.</p>
19.3	<p>The Goods are grouped together in one (1) lot and will be awarded to one (1) Bidder in one complete contract.</p> <p>Partial bid is not allowed. The Goods are grouped in a single lot and the lot shall not be divided into sub-lots for the purpose of bidding, evaluation, and contract award.</p> <p>The Bidders bid offer must be within the ABC of the lot.</p>

	Bid offers that exceed the ABC of the lot or with incomplete price, shall be rejected.
19.5	If the Bidder opted to submit a Committed Line of Credit (CLC), the bidder must submit a granted credit line valid/effective at the date of bidding.
20.1	<p>Additional documents to be submitted during Post-Qualification:</p> <ul style="list-style-type: none"> <li>a. Class A – Eligibility Documents listed on the Annex A of Certificate of PhilGEPs Registration under Platinum Membership pursuant to Section 34.3 of the Revised IRR of R.A. 9184</li> <li>b. Contract/Purchase Order and/or Notice of Award for the contracts stated in the List of all Ongoing Government &amp; Private Contracts Including Contracts Awarded but not yet Started (NPCSF-GOODS-02);</li> <li>c. Certification coming from the project owner/client that the performance is satisfactory as of the bidding date for all ongoing contracts stated in Form NPCSF-GOODS-02;</li> <li>d. Contract/Purchase Order for the contract stated in the Statement of the bidder's Single Largest Completed Contract (SLCC) similar to the contract to be bid (Form No. NPCSF-GOODS-03)</li> <li>e. Documents to be submitted during post-qualification process as specified in TS-15.0 of Section VI-Technical Specifications</li> </ul> <p>Manufacturer's brochures, manuals and other supporting documents of equipment, materials, hardware and tools proposed by the bidders must comply with the technical specifications of such equipment, materials, hardware and tools. It shall be a ground for disqualification if the submitted brochures, manuals and other supporting documents are determined not complying with the specifications during technical evaluation and post-qualification process.</p> <p>Equipment, materials, hardware and tools proposed by the winning bidder to be supplied, which were evaluated to be complying with the technical specifications, shall not be replaced and must be the same items to be delivered/installed/used during the contract implementation. Any proposed changes/replacement of said items may be allowed on meritorious reasons subject to validation and prior approval by NPC.</p>
20.2	The licenses and permits relevant to the Project and the corresponding law requiring it as specified in the Technical Specifications, if any.
21.2	Notice to Proceed.

SECTION IV

**GENERAL CONDITIONS  
OF CONTRACT**

## SECTION IV – GENERAL CONDITIONS OF CONTRACT

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## SECTION IV – GENERAL CONDITIONS OF CONTRACT

### 1. Scope of Contract

This Contract shall include all such items, although not specifically mentioned, that can be reasonably inferred as being required for its completion as if such items were expressly mentioned herein. All the provisions of RA No. 9184 and its 2016 revised IRR, including the Generic Procurement Manual, and associated issuances, constitute the primary source for the terms and conditions of the Contract, and thus, applicable in contract implementation. Herein clauses shall serve as the secondary source for the terms and conditions of the Contract.

This is without prejudice to Sections 74.1 and 74.2 of the 2016 revised IRR of RA No. 9184 allowing the GPPB to amend the IRR, which shall be applied to all procurement activities, the advertisement, posting, or invitation of which were issued after the effectivity of the said amendment.

Additional requirements for the completion of this Contract shall be provided in the **Special Conditions of Contract (SCC)**.

### 2. Advance Payment and Terms of Payment

- 2.1. Advance payment of the contract amount is provided under Annex "D" of the revised 2016 IRR of RA No. 9184.
- 2.2. The Procuring Entity is allowed to determine the terms of payment on the partial or staggered delivery of the Goods procured, provided such partial payment shall correspond to the value of the goods delivered and accepted in accordance with prevailing accounting and auditing rules and regulations. The terms of payment are indicated in the **SCC**.

### 3. Performance Security

- 3.1. Within ten (10) calendar days from receipt of the Notice of Award by the Bidder from the Procuring Entity but in no case later than the signing of the Contract by both parties, the successful Bidder shall furnish the performance security in any of the forms prescribed in Section 39 of the 2016 revised IRR of RA No. 9184.
- 3.2. The performance bond to be posted by the Contractor must also comply with additional requirements specified in the **SCC**.

### 4. Inspection and Tests

The Procuring Entity or its representative shall have the right to inspect and/or to test the Goods to confirm their conformity to the Project specifications at no extra cost to the Procuring Entity in accordance with the Generic Procurement Manual. In addition to tests in the **SCC, Section VI (Technical Specifications)** shall specify what inspections and/or tests the Procuring Entity requires, and where they are to be conducted. The Procuring Entity shall notify the Supplier in writing, in a timely manner, of the identity of any representatives retained for these purposes.

All reasonable facilities and assistance for the inspection and testing of Goods, including access to drawings and production data, shall be provided by the Supplier to the authorized inspectors at no charge to the Procuring Entity.

## **5. Warranty**

- 5.1 In order to assure that manufacturing defects shall be corrected by the Supplier, a warranty shall be required from the Supplier as provided under Section 62.1 of the 2016 revised IRR of RA No. 9184.
- 5.2 The Procuring Entity shall promptly notify the Supplier in writing of any claims arising under this warranty. Upon receipt of such notice, the Supplier shall, repair or replace the defective Goods or parts thereof without cost to the Procuring Entity, pursuant to the Generic Procurement Manual.

## **6. Liability of the Supplier**

The Supplier's liability under this Contract shall be as provided by the laws of the Republic of the Philippines.

If the Supplier is a joint venture, all partners to the joint venture shall be jointly and severally liable to the Procuring Entity.

SECTION V

**SPECIAL CONDITIONS  
OF CONTRACT**

**SECTION V – SPECIAL CONDITIONS OF CONTRACT**

GCC Clause	
1	<p><b>Delivery and Documents –</b></p> <p>The delivery terms applicable to the Contract is DDP delivered to the project site specified in the technical specifications, in accordance with INCOTERMS. Risk and title will pass from the Supplier to the Procuring Entity upon receipt and final acceptance of the Goods at their final destination.</p> <p>Delivery of the Goods shall be made by the Supplier in accordance with the terms specified in Section VI – Technical Specifications. The details of shipping and/or other documents to be furnished by the Supplier are as follows:</p> <p><i>For Goods supplied from within the Philippines</i></p> <p>Upon delivery of the Goods to the Project Site, the Supplier shall notify the Procuring Entity and present the following documents to the Procuring Entity:</p> <ul style="list-style-type: none"> <li>(i) Original and four copies of the Supplier's invoice showing Goods' description, quantity, unit price, and total amount;</li> <li>(ii) Original and four copies of Supplier's factory test/inspection report;</li> <li>(iii) Original and four copies of the certificate of origin (for imported Goods);</li> <li>(iv) Delivery receipt detailing number and description of items received signed by the Procuring Entity's representative at the Project Site;</li> <li>(v) Certificate of Completion/Inspection Report signed by the Procuring Entity's representative at the Project Site;</li> <li>(vi) Original and four copies of the Inspection Receiving Report signed by the Procuring Entity's representative at the Project Site;</li> <li>(vii) Original and four copies of the Manufacturer's and/or Supplier's warranty certificate; and</li> <li>(viii) Documents specified in the Technical Specifications, if any.</li> </ul> <p><i>For Goods supplied from abroad:</i></p> <p>Upon shipment, the Supplier shall notify the Procuring Entity and the insurance company by e-mail the full details of the shipment, including Contract Number, description of the Goods, quantity, vessel, bill of lading number and date, port of loading, date of shipment, port of discharge etc. Upon delivery to the Project Site, the Supplier shall notify the Procuring Entity and present the following documents as applicable with the documentary requirements of any letter of credit issued taking precedence:</p> <ul style="list-style-type: none"> <li>(i) Original and four copies of the Supplier's invoice showing Goods' description, quantity, unit price, and total amount;</li> </ul>

SECTION V – SPECIAL CONDITIONS OF CONTRACT

	<p>(ii) Original and four copies of the negotiable, clean shipped on board bill of lading marked "freight pre-paid" and five copies of the non-negotiable bill of lading ;</p> <p>(iii) Original and four copies of Supplier's factory test/inspection report;</p> <p>(iv) Delivery receipt detailing number and description of items received signed by the Procuring Entity's representative at the Project Site;</p> <p>(v) Certificate of Completion/Inspection Report signed by the Procuring Entity's representative at the Project Site;</p> <p>(vi) Original and four copies of the Inspection Receiving Report signed by the Procuring Entity's representative at the Project Site;</p> <p>(vii) Original and four copies of the certificate of origin (for imported Goods); and</p> <p>(viii) Original and four copies of the Manufacturer's and/or Supplier's warranty certificate including all other documents specified in the Technical Specifications, if any.</p> <p>For purposes of this Clause the Procuring Entity's Representative at the Project Site is VP - Mindanao Generations.</p> <p><b>Incidental Services –</b></p> <p>The Supplier is required to provide all of the following services, including additional services, if any, specified in Section VII - Schedule of Requirements:</p> <p>a. performance or supervision of on-site assembly and/or start-up of the supplied Goods;</p> <p>b. furnishing of tools required for assembly and/or maintenance of the supplied Goods;</p> <p>c. furnishing of a detailed operations and maintenance manual for each appropriate unit of the supplied Goods;</p> <p>d. performance or supervision or maintenance and/or repair of the supplied Goods, for a period of time agreed by the parties, provided that this service shall not relieve the Supplier of any warranty obligations under this Contract; and</p> <p>e. training of the Procuring Entity's personnel, at the Supplier's plant and/or on-site, in assembly, start-up, operation, maintenance, and/or repair of the supplied Goods.</p> <p>f. Additional requirements specified in Section VI – Technical Specifications, if any.</p> <p>The Contract price for the Goods shall include the prices charged by the Supplier for incidental services and shall not exceed the prevailing rates charged to other parties by the Supplier for similar services.</p>
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**Spare Parts –**

The Supplier is required to provide all of the following materials, notifications, and information pertaining to spare parts manufactured or distributed by the Supplier:

1. such spare parts as the Procuring Entity may elect to purchase from the Supplier, provided that this election shall not relieve the Supplier of any warranty obligations under this Contract; and
2. in the event of termination of production of the spare parts:
  - i. advance notification to the Procuring Entity of the pending termination, in sufficient time to permit the Procuring Entity to procure needed requirements; and
  - ii. following such termination, furnishing at no cost to the Procuring Entity, the blueprints, drawings, and specifications of the spare parts, if requested

The spare parts and other components required are listed in **Section VI (Technical Specifications)** and **Section VII (Schedule of Requirements/Bid Price Schedule)** and the costs thereof are included in the contract price.

The Supplier shall carry sufficient inventories to assure ex-stock supply of consumable spare parts or components for the Goods for the period specified in the Technical Specifications.

Spare parts or components shall be supplied as promptly as possible, but in any case, within three (3) months of placing the order.

**Packaging –**

The Supplier shall provide such packaging of the Goods as is required to prevent their damage or deterioration during transit to their final destination, as indicated in this Contract. The packaging shall be sufficient to withstand, without limitation, rough handling during transit and exposure to extreme temperatures, salt and precipitation during transit, and open storage. Packaging case size and weights shall take into consideration, where appropriate, the remoteness of the Goods' final destination and the absence of heavy handling facilities at all points in transit.

The packaging, marking, and documentation within and outside the packages shall comply strictly with such special requirements as shall be expressly provided for in the Contract, including additional requirements, if any, specified below, and in any subsequent instructions ordered by the Procuring Entity.

The outer packaging must be clearly marked on at least four (4) sides as follows:

- Name of the Procuring Entity
- Name of the Supplier
- Contract Description
- Final Destination
- Gross weight

	<p>Any special lifting instructions                  Any special handling instructions                  Any relevant HAZCHEM classifications</p> <p>A packaging list identifying the contents and quantities of the package is to be placed on an accessible point of the outer packaging if practical. If not practical the packaging list is to be placed inside the outer packaging but outside the secondary packaging.</p> <p><b>Transportation –</b></p> <p>Where the Supplier is required under Contract to deliver the Goods CIF, CIP, or DDP, transport of the Goods to the port of destination or such other named place of destination in the Philippines, as shall be specified in this Contract, shall be arranged and paid for by the Supplier, and the cost thereof shall be included in the Contract Price.</p> <p>Where the Supplier is required under this Contract to transport the Goods to a specified place of destination within the Philippines, defined as the Project Site, transport to such place of destination in the Philippines, including insurance and storage, as shall be specified in this Contract, shall be arranged by the Supplier, and related costs shall be included in the contract price.</p> <p>Where the Supplier is required under Contract to deliver the Goods CIF, CIP or DDP, Goods are to be transported on carriers of Philippine registry. In the event that no carrier of Philippine registry is available, Goods may be shipped by a carrier which is not of Philippine registry provided that the Supplier obtains and presents to the Procuring Entity certification to this effect from the nearest Philippine consulate to the port of dispatch. In the event that carriers of Philippine registry are available but their schedule delays the Supplier in its performance of this Contract the period from when the Goods were first ready for shipment and the actual date of shipment the period of delay will be considered force majeure.</p> <p>The Procuring Entity accepts no liability for the damage of Goods during transit other than those prescribed by INCOTERMS for DDP deliveries. In the case of Goods supplied from within the Philippines or supplied by domestic Suppliers risk and title will not be deemed to have passed to the Procuring Entity until their receipt and final acceptance at the final destination.</p> <p><b>Intellectual Property Rights –</b></p> <p>The Supplier shall indemnify the Procuring Entity against all third-party claims of infringement of patent, trademark, or industrial design rights arising from use of the Goods or any part thereof.</p>
<p>2.2</p>	<p>Advance payment not to exceed fifteen percent (15%) of the contract amount shall be allowed and paid within sixty (60) calendar days from effectivity of the contract and upon the submission to and acceptance by the Procuring Entity of an irrevocable letter of credit or bank guarantee issued by a Universal or Commercial Bank. The irrevocable letter of credit or bank guarantee must be for an equivalent amount, shall remain valid until the goods are delivered, and accompanied by a claim for advance payment.</p>

All progress payments shall first be charged against the advance payment until the latter has been fully exhausted.

The terms of payment shall be as follows:

**1) For Supply and Delivery Contracts:**

- (a) On Contract Effectivity: Advance payment of Fifteen percent (15%) of the total Contract Price shall be paid within sixty (60) days from effectivity of the Contract and upon submission of a claim and an irrevocable letter of credit or bank guarantee issued by a Universal or Commercial Bank for the equivalent amount valid until the Goods are delivered and in the form provided in Section VIII- Bidding Forms.
- (b) On Delivery: Eighty percent (80%) of the Contract Price of the **delivered Goods** shall be considered for payment, less the total amount of advance payment, if any and other deductions. If the amount is sufficient to fully recoup the advance payment, the remainder after deductions shall be paid to the Supplier within sixty (60) days after the date of receipt of the Goods and upon submission of the documents (i) through (vi) specified in the SCC provision on Delivery and Documents. Otherwise, the total delivery payment shall be charged against the advance payment and the remaining advance payment will be fully recouped from the succeeding claims.
- (c) On Acceptance: The remaining twenty percent (20%) of the Contract Price of the **delivered Goods** shall be paid to the Supplier within sixty (60) days after the date of submission of the acceptance and inspection certificate for the respective delivery issued by the Procuring Entity's authorized representative. In the event that no acceptance certificate is issued by the Procuring Entity's authorized representative within forty five (45) days after successful test and commissioning, if required, the Supplier shall have the right to claim payment of the remaining twenty percent (20%) subject to the Procuring Entity's own verification of the reason(s) for the failure to issue documents (vii) and (viii) as described in the SCC provision on Delivery and Documents.

**2) For Supply, Delivery, Installation, Test and Commissioning Contracts:**

- (a) On Contract Effectivity: Advance payment of Fifteen percent (15%) of the total Contract Price shall be paid within sixty (60) days from effectivity of the Contract and upon submission of a claim and an irrevocable letter of credit or bank guarantee issued by a Universal or Commercial Bank for the equivalent amount valid until the Goods are delivered and in the form provided in Section VIII- Bidding Forms.
- (b) On Delivery: Eighty percent (80%) of the price of the **delivered Goods**, excluding price for installation, test and commissioning shall be considered for payment, less the total amount of advance payment, if any and other deductions. If the amount is sufficient to fully recoup the advance payment, the remainder after deductions shall be paid to the Supplier within sixty (60) days after the date of receipt of the Goods and upon submission of the documents (i) through (vi) specified in the

SCC provision on Delivery and Documents. Otherwise, the total delivery payment shall be charged against the advance payment and the remaining advance payment will be fully recouped from the succeeding claims.

- (c) On Acceptance: The remaining twenty percent (20%) of the price of the **delivered Goods** plus price for installation, test and commissioning shall be paid to the Supplier within sixty (60) days after the date of submission of the acceptance and inspection certificate for the respective delivery issued by the Procuring Entity's authorized representative. In the event that no acceptance certificate is issued by the Procuring Entity's authorized representative within forty five (45) days after successful test and commissioning, the Supplier shall have the right to claim payment subject to the Procuring Entity's own verification of the reason(s) for the failure to issue documents (vii) and (viii) as described in the SCC provision on Delivery and Documents.

**3) For Supply, Delivery, Installation, Test and Commissioning Contracts where Installation, Test and Commissioning prices are included in the supply price:**

- (a) On Contract Effectivity: Advance payment of Fifteen percent (15%) of the total Contract Price shall be paid within sixty (60) days from effectivity of the Contract and upon submission of a claim and an irrevocable letter of credit or bank guarantee issued by a Universal or Commercial Bank for the equivalent amount valid until the Goods are delivered and in the form provided in Section VIII- Bidding Forms.
- (b) On Delivery: Sixty percent (60%) of the price of the **delivered Goods** shall be considered for payment, less the total amount of advance payment, if any and other deductions. If the amount is sufficient to fully recoup the advance payment, the remainder after deductions shall be paid to the Supplier within sixty (60) days after the date of receipt of the Goods and upon submission of the documents (i) through (vi) specified in the SCC provision on Delivery and Documents. Otherwise, the total delivery payment shall be charged against the advance payment and the remaining advance payment will be fully recouped from the succeeding claims.
- (c) On Acceptance: The remaining forty percent (40%) of the price of the **delivered Goods** shall be paid to the Supplier within sixty (60) days after the date of submission of the acceptance and inspection certificate for the respective delivery issued by the Procuring Entity's authorized representative. In the event that no acceptance certificate is issued by the Procuring Entity's authorized representative within forty five (45) days after successful test and commissioning, the Supplier shall have the right to claim payment subject to the Procuring Entity's own verification of the reason(s) for the failure to issue documents (vii) and (viii) as described in the SCC provision on Delivery and Documents

<p>3.2</p>	<ol style="list-style-type: none"> <li>1. The following must be indicated in the performance bond to be posted by the Contractor:                     <ol style="list-style-type: none"> <li>i. Company Name</li> <li>ii. Correct amount of the Bond</li> <li>iii. Contract/Purchase Order Reference Number</li> <li>iv. Purpose of the Bond:                          "To guarantee the faithful performance of the Principal's obligation to undertake <u>(Contract/Purchase Order Description)</u> in accordance with the terms and conditions of <u>(Contract No. &amp; Schedule/Purchase Order No.)</u> entered into by the parties."</li> </ol> </li> <li>2. The bond shall remain valid and effective until the duration of the contract <u>(should be specific date reckoned from the contract effectivity)</u> plus sixty (60) days after NPC's acceptance of the last delivery/final acceptance of the project.</li> <li>3. In case of surety bond, any extension of the contract duration or delivery period granted to the CONTRACTOR shall be considered as given, and any modification of the contract shall be considered as authorized, as if with the expressed consent of the surety, provided that such extension or modifications falls within the effective period of the said surety bond. However, in the event that the extension of the contract duration or delivery schedule would be beyond the effective period of the surety bond first posted, it shall be the sole obligation of the CONTRACTOR to post an acceptable Performance Security within ten (10) calendar days after the contract duration/delivery period extension has been granted by NPC.</li> <li>4. Other required conditions in addition to the standard policy terms issued by the Bonding Company:                     <ol style="list-style-type: none"> <li>i. The bond is a penal bond, callable on demand and the entire amount thereof shall be forfeited in favor of the Obligee upon default of the Principal without the need to prove or to show grounds or reasons for demand for the sum specified therein;</li> <li>ii. The amount claimed by the Obligee under this bond shall be paid in full and shall never be subject to any adjustment by the Surety;</li> <li>iii. In case of claim, the Surety shall pay such claim within sixty (60) days from receipt by the Surety of the Obligee's notice of claim/demand letter notwithstanding any objection thereto by the Principal.</li> </ol> </li> </ol>
<p>4</p>	<p>The inspections and tests that will be conducted are specified in the Technical Specifications.</p>

## SECTION VI

# TECHNICAL REQUIREMENTS

**SECTION VI – TECHNICAL SPECIFICATIONS**

**PART I – TECHNICAL SPECIFICATIONS**

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# Section VI - Technical Specifications

## PART I – TECHNICAL SPECIFICATIONS

### TS-1.0 GENERAL

This specification covers the features and technical requirements for the **A6IC Upgrading and Integration of Unit 1 & 2 SCADA System to DCS**.

The SCADA upgrade to be provided shall include equipment that is new, unused, and has passed the manufacturer's quality control for ensured reliable and safe operation of Unit Nos. 1 & 2 at Agus 6 HP Plant. These shall fit their intended use and shall comply with all applicable regulations, quality, and standards. The design of this SCADA Upgrade shall take into consideration the specifications of all existing undamaged associated systems/equipment of Unit Nos. 1 & 2 at Agus 6 HP Plant.

The system to be supplied shall provide reliable and timely process data, status monitoring and operation, alarm handling, historical data storage and retrieval, and open communication interface to existing unit 1 and unit 2 controllers, flexibility, and protection of people, equipment, and environment capable to meet the requirements as detailed in this specification. The Supplier must supply all minor items (such as auxiliary relays, terminal blocks, accessories, etc.) which are necessary although not expressly described in the Technical Specifications, to guarantee the trouble-free operation and ease in the maintenance of the supplied equipment (or parts of equipment supplied) with particular reference to the provisions to be taken into consideration to avoid dangerous or wrong operations.

The Supplier shall accept full responsibility for the full conformance to specifications, documentation, quality assurance, project implementation, training, preparation for shipment, warranty provisions, and compliance with the applicable codes and standards and the requirements of this specification.

### TS-2.0 SCOPE OF WORK

The works to be done shall include all hardware equipment including the software necessary for the secure and reliable operation of the plant. The system shall consider provisions for the upgrading of the control and monitoring of the other units in the plant.

The Supplier shall perform all the works required by this technical specification. It should be noted that the contract also includes all and every work and service although not specifically mentioned but is required to complete the works ready for operation as well as the dismantling and hauling works of all equipment to be replaced to the designated location.

It shall cover the furnishing of all hardware equipment, materials, tools, labor, and other necessary incidentals required for the A6IC SCADA Upgrading and Integration of Unit Nos. 1 & 2 at Agus 6 HP Plant which shall generally consist of but not be limited to all hardware equipment, materials, and services enumerated, herein:

1. Conduct site inspection to verify and assess the extent of the related and incidental works needed to implement the project competently and efficiently;
2. Supply, delivery, installation, testing, and commissioning of SCADA application software and other related hardware for a complete SCADA/Control system to be installed at Agus 6 HPP Central Control Room (Station Level). The scope shall consist of but not be limited to the following:
  - a) SCADA Software with the required functionality as defined in this technical specification
  - b) SCADA User Interface
  - c) SCADA Support Services
  - d) Cyber Security
  - e) SCADA Hardware
    - a. Servers
    - b. Desktops
    - c. Switches
    - d. Cabinet, Cable and Panel
  - f) Documentation
  - g) Quality Assurance
  - h) Project Implementation and
  - i) Training
3. Formulate/program the logic circuit and the Human Machine Interface (HMI) station software;
4. Pre-testing, and commissioning of the whole system;
5. Conduct toolbox meetings and safety orientation;
6. Checking of all delivered materials;
7. Supply, delivery, laying, and termination of cables. The process includes but is not limited to the termination of the new cables to the panel. Installation shall be complete with all the requirements firmly and safely connected and interconnected with operating switches, interlocks, signalization, alarms, and metering instruments to the extent required to put the power plant in satisfactory operating conditions.
8. Conduct training of NPC personnel regarding the hardware/software operation, and maintenance of the supplied equipment including system configuration, setting, and parameterization;
9. Overall testing and commissioning of the whole system; and
10. All other works which are not specified on the technical specifications that are necessary for the complete and reliable operation of the system for the project shall be hereby provided by the Supplier.

In addition, the following shall be provided by the Supplier:

1. Removal/dismantling and hauling of all equipment and materials to be placed in designated NPC plant stockyard/warehouse area;

2. Provision of services of highly qualified, and competent engineers for the direct supervision during the test and commissioning of all supplied equipment;
3. Submission of drawings and documents i.e. Equipment Hardware Manufacturer's drawings, Operation and Maintenance Manuals, Calculation, etc.; and,
4. Provision of technical assistance and services during one (1) year warranty period such as periodic assessment of the operating condition. This includes all maintenance services to be rendered upon request in the event of any abnormality occurring within the warranty period.

It shall include all and every work occurring although not specifically detailed herein but is required to fully complete and make ready the safe and reliable operation of the system.

The Supplier shall be responsible for the complete system design, and proper functioning of the system. The equipment to be furnished shall be complete with all parts, and in excellent working condition.

All the system engineering software and online system, materials, and parts including all the various equipment and devices necessary for instrumentation and control requirements which are not specifically mentioned herein but are necessary for the proper construction, assembly, and operation of the equipment shall be furnished at no additional cost to NPC.

Any damage to the existing structures/ facilities incurred during transport, unloading/ mounting, installation, laying of cables, testing, and commissioning shall be the responsibility of the Supplier.

The Supplier shall bear full responsibility that the equipment has been designed and fabricated by all codes, standards, and applicable governmental regulations and performs under the conditions and to the standards specified herein.

Any and/or all expenses that may arise for the proper execution of the project shall be the responsibility of the Supplier and no additional payment thereof shall be made by NPC.

### **TS-3.0 DELIVERY PERIOD AND LOCATION**

The delivery period shall be **TWO HUNDRED SEVENTY (270) CALENDAR DAYS** reckoned from receipt of Notice to Proceed.

The equipment to be supplied shall be delivered to **Agus 6 HPP, Iligan City, Lanao Del Norte.**

The Supplier shall be responsible for taking particular reference to its accessibility, means of transportation, and all other factors that could hamper the smooth execution of the contract.

Any and/or all expenses arising through the lack of knowledge of the supplier regarding the existing conditions of the delivery site shall be his responsibility and no additional payment thereof shall be made by NPC.

**TS-4.0 CODES AND STANDARDS**

The equipment and materials to be furnished shall be designed, manufactured, and tested by, but not limited to, the latest issues of the following codes and standards, including all addenda, in effect at the time of purchase order unless otherwise stated in this specification:

1. American National Standards Institute	ANSI
2. Institute of Electrical & Electronic Engineers	IEEE
3. American Society for Testing and Materials	ASTM
4. National Electrical Manufacturers Association	NEMA
5. Underwriters Laboratories, Inc.	UL
6. International Electro-Technical Commission	IEC
7. International Standards Organization	ISO
8. Japanese Industrial Standards	JIS
9. Japanese Electrical Standards	JES
10. National Electric Code	NEC
11. Philippine Electrical Code	PEC
12. National Electrical Safety Code	NESC
13. Philippine Electronics Code	PEC

These codes and standards set forth the minimum requirements that the Supplier, if, in the Supplier's judgment and with NPC's acceptance, superior or more economical designs or materials are available for the successful and continuous operation of the Supplier's equipment as required by this specification.

In addition to these codes and standards mentioned, the Supplier shall comply with all National and local laws, codes, regulations, statutes, and ordinances.

Equipment or materials meeting other internationally accepted standards, which ensure an equal or higher quality than the standards mentioned, will also be accepted.

In the event of any apparent conflict among codes, and standards or this specification, the Supplier shall refer the conflict to NPC for written resolution before the start of the fabrication. A final decision regarding the acceptance of the final standards is the prerogative of NPC.

No deviation from the accepted standards shall be made after the Contract without the written approval of NPC.

Standards listed in the individual technical specification are used mainly for NPC's references. Other internationally known standards, however, shall also apply, provided such standards are equivalent in all respect to the standard prescribed and to the specific requirements described in the individual equipment specification. Supplier shall submit copies of such standards for NPC's review and approval.

## **TS-5.0 DESIGN REQUIREMENTS**

The new SCADA system to be provided shall include hardware that is new, latest version of SCADA software and third-party support, unused and has passed the manufacturer's quality control for ensuring reliable and safe operation of the SCADA/CS system. These shall fit their intended use and shall comply with their applicable regulations, quality, and standards. The design of the system/equipment shall take into consideration the specifications of all existing associated controllers/equipment present at the Agus 6 HP Plant.

The objective is to create a hardware and software engineering environment where maintaining and upgrading the SCADA will always be more cost-effective than replacing it. To keep up with changing requirements developing additional capabilities during the course of this project and for the entire lifespan of the SCADA.

The design requirements shall have but not be limited to the following:

- a) SCADA Software with the required functionality as defined in this technical specification
- b) SCADA User Interface
- c) SCADA Support Services
- d) Cyber Security
- e) SCADA Hardware
  - a. Servers
  - b. Desktops
  - c. Switches
  - d. Cabinet, Cable and Panel
- f) Documentation
- g) Quality Assurance
- h) Project Implementation and
- i) Training

To minimize the need for spare parts and to facilitate simple maintenance and operation, the structure of the various supply components must be as uniform as possible. Equivalent components must be interchangeable.

## **TS-6.0 SCADA SOFTWARE REQUIREMENTS**

### **TS-6.1 General**

The SCADA system that will be purchased by NPC shall provide safe and reliable monitoring with high degree operational efficiency, powerful configuration tools, well defined and structured graphic interfaces, practically convenient application interfaces, multiple ports that are compliant to international standards and various kinds of conventional and advanced functions for the demands of water conservancy & hydropower users and cascade centralized control & dispatching applications.

The required system shall have the operational speed, computing power, adequate input/output storage capacity, and self-diagnostic/analysis capability to meet the requirements as detailed in this specification.

### TS-6.2 SCADA Design Requirements

#### 1. Network Architecture

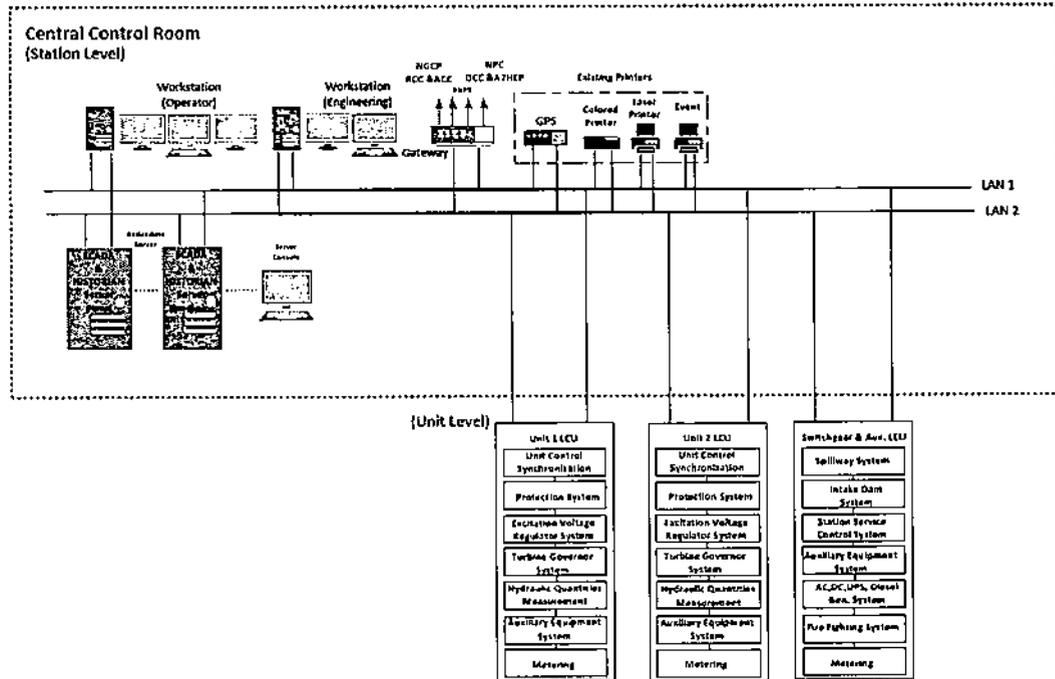


Figure TS-6.2.1: Network Architecture of NPC SCADA

The SCADA upgrade shall be implemented on the station level only. Existing Unit level LTU shall be properly interface with the new SCADA. It shall be the responsibility of the supplier to properly interface, test its connectivity and a point to point testing from station level to unit level controllers using existing protocol.

The SCADA system shall consist of foreground human-machine interaction program and background program. The human-machine interaction program mainly completes the image display, report, brief, curve query and other interactive graphic display and operating functions; the background program is for various kinds of background processing operation, such as communication between computer monitoring system and peripheral equipment, database management and historical database management, etc.

The SCADA system shall be based on distributed object-oriented platform. For the system planning, design and software implementation or the provision of configuration tools to users, all the application interfaces shall be object-oriented and of true cross-platform concept. It shall adopt widely-used software tools compliant with TCP/IP, SQL, ODBC, JDBC, Java RMI and OPC international standards, which enables itself with sufficient openness, extensibility, and adaptability to heterogeneous platform.

Figure TS-6.2 shown above is the Network Architecture of NPC SCADA. This shall be characterized as follows:

- a. Standard features for NPC SCADA system shall include but not limited to the following:

(1) Server Client Configuration

The SCADA architecture shall be fully distributed, open system structure and a redundant LAN. The Server/Host, Operator workstation, engineer training workstation and each communication workstation shall be a Linux Operating Systems (OS) that comply with IEEE and ISO open system international standards. The SCADA system shall be provided with an open interfaces.

- (2) SCADA and Historian Server. The server or host shall be in redundant configuration in a Prime -Hot Standby mode and running on a LINUX Operating System (OS)

- (3) Client – The SCADA system shall support several types of concurrent HMI clients, (operators, maintenance,) depending on the type of application. The main HMI clients are workstation and or desktop running on Linux (OS). The new system shall be able to integrate existing workstations as possible.

- (4) Database - Database shall be event driven. When an event happens, the database shall immediately process the work related to this event, such as judging whether this is an accident or a failure; and whether there is a need to start post disturbance review; pushing out event processing instructions; starting sequential control process, etc.

- (5) Database Editor – A database editor to define and maintain real time data as well as statics data shall be provided in the SCADA. The database editor tool shall include equipment configuration, I/O measuring-point configuration, function configuration, object configuration and AGC/AVC configuration.

- (6) Graphic Data Editor – The Graphics Data Editor shall be provided for creating process pictures and making them dynamic. The SCADA shall be provided with efficient development environment for on-line, off-line, and multi-developer.

Graphic interfaces shall be object-oriented, and shall provide a user-friendly interfaces. Connection to objects shall be supported for picture generation. Thus, enables the pictures can be copied as corresponded to the objects, and that pictures can also be independent of the real-time database for the foreground connection inspection. Pictures can be displayed in animation, which means to use the mouse to click out the equipment object operation menu.

- (7) Widgets and Graphics Library – The SCADA system shall be provided with dozens of built-in graphic library and widget for industries and application and shall allow the development of new

libraries from existing libraries or by creating new symbols and import of any libraries into the engineering or development environment. Intuitive screen editing tools shall be provided.

- (8) Historian - The historian is responsible for storing and logging all of the data that the SCADA system aggregates. It allows operators to look at historical data of the plant. The historian can also have trending and reporting capability. It shall be possible to integrate market relational database such as MySQL, Oracle, etc., when the system expands and larger applications will require the use of these market relational databases.
- (9) Security - Security associated with user types shall be provided that user profiles are created with levels of access to each functionality of the SCADA system and the parameterized application. Users are associated with these profiles allowing the deployment of security levels both during the configuration of the application and during its execution, in real time. In addition, the software allows you to track user access at all levels. Integrated and extensible by both privilege and role-based models
- (10) Sequential Control Editor - Efficient and convenient visual sequential programming tool shall be provide. The programming tool for control and regulation is inputted by means of a process flow. In addition, it also has online debugging, online modification and offline simulation functions, and automatically provides operator interface to reflect the process implementation situation.
- (11) Alarms and Events - Alarm and Events tool shall be provided.
- i. The alarm groups are defined, with all associated behavioral functions, such as the shape of the alarm line, the color according to its state (in alarm waiting for recognition, in acknowledged alarm, etc.), the columns that describe the alarm as time in millisecond, recognition column, descriptive/speech text, variable status/value, etc.
  - ii. The capability of creating alarm areas in which you can allocate the items of alarms. These logical areas are defined at the project level, also supporting subareas, allowing the configuration of hierarchically arranged logical groupings. The facility is for the group treatment of alarms in the same area. You can then get information on how many alarms are active or recognized in an area or subarea. You can enable or disable all alarms in an area (including its subareas) or subareas only.
- (12) Report Generator- Shall be provided to enable the users to develop customized reports based on user needs. Also, basic reports for electrical sector applications are ready. Thus, reports of current alarms, day events, operation log, real-time or historical trend, query to historical events, query to application tags are already ready and

allow the use of several filters. If the user needs to change it, to adjust more properly to his needs, it is easy. Manual or automatic report creation with extensible options. It shall be possible the generate reports thru third party supplied report generator thru ODBC or equivalent standard interface.

- (13) Scripting and Debugging Tools – The SCADA system shall have the capability to implement scripting language (similar to C++) allows unlimited customization of almost every feature including simple display customizations, advanced tag types (with graphics), automated tag creation and complex data-handling functions. The SCADA shall be provided with numerous built in functions and mathematical data calculation.
- (14) Automatic Generation Control (AGC)- The main objective of the AGC is to control the active power of the whole power plant rapidly and economically and to meet requirements in multiple aspects of electric power system under the constraint of meeting various kinds of safe generation operation.
- (15) Automatic Voltage Control (AVC) - The objective of AVC is to follow the different operation modes and operating condition to make a real-time control decisions for the unit in the whole power plant in case various safety constraints for power station and units are met, so as to automatically maintain the bus voltage or the reactive power of the whole plant at a current set values, properly distributed the reactive power of each generating unit in the plant, and finally improve the overall auto operation level of the power plant.
- (16) The SCADA system shall be provided with I/O Drivers or protocol to interface with existing Local Unit Controllers (LCUs'), PLCs, RTU and IEDs.
- i. Modbus (all types), DNP 3.0 (all types), IEC-60870-5-101, IEC-60870-5-104, OPC UA and IEC 61850
  - ii. Proprietary protocol supported by different PLC manufacturers shall be included and supported (e.g., Siemens ProfiNet and ProfiBus etc.,)
- b. A gateway shall be provided with the capability to share real-time data to the following control and command centers:
- (1) Mindanao Regional Control Center thru DNP3 over IP
  - (2) Mindanao Back-Up Regional Control Center thru DNP3 over IP
  - (3) Iligan Area Control Center thru DNP3 over IP
  - (4) Agus 6&7 HPPs Command Center thru DNP3 over IP
  - (5) NPC Command Center thru DNP3 over IP
  - (6) Market Operation Center thru DNP3 over IP
- The gateway has also the capability to retrieve data for the existing RTU of NPC thru DNP3 over IP and Serial
- c. The GPS clock synchronization system is mainly to provide the unified time for dispatching automation system, energy metering system, power generation plant monitoring system, microcomputer protection

unit, fault recording unit, automatic safety device and measurement device. When an accident happens, it grasps the real-time information and then provides unified clock platform for the analysis and judgment on the accident reasons. To achieve this, the Supplier/OEM shall properly interface new SCADA system with the existing GPS clock to synchronize the time of all devices connected of the network.

- d. The SCADA system shall be provided with the capability to send message of latest observed data including accident, actual active/reactive power, water level, flow rate, etc. instantly or regularly to operation staff for real-time monitoring. In some circumstances, users can manually edict and send message through this platform to certain receivers. The hardware requirement will be purchased separately.
- e. The SCADA system shall be provided with the embedded WEB services to provide access to plant data thru intranet. The users can browse graphics, real-time data, report, historical curve, etc. The web services shall adopt J2EE structure and service-oriented idea design and supports heterogeneous environment as follows:
  - (1) support external data interaction through XML technology and SOAP protocol
  - (2) support a variety of international standard data interface such as JDBC, ODBC, TCP/IP etc.,
  - (3) effective control of data flow and balance of dynamic load,
  - (4) multi-level user access permission,
  - (5) unified authentication, and
  - (6) seamless connection between monitoring system and web system.

Hardware requirement and physical isolation device set to safeguard the security of SCADA System will be purchased separately.

- f. The SCADA system support cooperative development, with several users editing the same application in different computers, in parallel, and one user opening two or more applications in parallel, in the same computer.
- g. SCADA is composed of several processes that are executed in parallel. Thus, the SCADA system shall have the capability for distributed processing: for example, the communication server may run on one computer, the application server on another, etc.
- h. The SCADA system shall be provided with the capability to run an application in test mode, not changing the user's historical and alarm files.
- i. The system shall support multi-server architecture and each server or paired servers shall communicates with the field through their protocols. All workstations shall have access to all data read from the servers or paired severs

- j. Existing Printers shall be connected the new SCADA System.

The SCADA hardware and software configuration shall not impose restrictions that prevent the system from growing to meet future NPC needs on a continuous and expanding basis. Each part of the system shall be designed accordingly.

## 2. Expansion Requirement

To maintain SCADA performance in the future, as new functions and data communications are added and the delivered capabilities become limiting, the SCADA shall be designed to enable the convenient addition of processing units, main memory, and bulk memory. The bulk memory capacity of all processing units shall be also expandable.

There shall be no restrictions on the vertical (i.e., upgrade of processors, etc.) or horizontal expansion (i.e., adding processors, workstation's, peripherals, or connections to other LANs or WAN, etc.) of the proposed configuration.

NPC's personnel shall be able to make all databases and SCADA changes to support the anticipated system growth, through interactive procedures supplied in the initial SCADA, and without the assistance of the Supplier/OEM. The Supplier/OEM shall provide all related documentation and training.

It shall be possible to meet the indicated expansion requirements with only the field addition of PUs, main memory, bulk storage, peripherals, and/or necessary communication interface equipment. The Supplier/OEM shall adequately demonstrate that the SCADA can meet NPC's hardware expansion requirements as specified. It shall be possible to add any quantity of user interface devices (of the types listed in Table 2-1) via simple, interactive procedures and without removing the SCADA from service. The quantity of devices to be supported by the SCADA shall be limited only by the software licenses and the capacity of the processing units and the communications networks.

## 3. Expansion Characteristics

The SCADA expansion requirements are based on the most probable growth rates, the potential for new applications, and the desire to balance delivered SCADA costs against capabilities. In addition, NPC wishes to extend the life of the delivered SCADA with minimal disruption to system operations. Accordingly, the following expansion characteristics shall be provided:

- a. Processing Units - A growth path shall be provided that allows the upgrading of computational power and main memory by means of field expansion and/or change out of a PU. Such upgrades shall be possible by simply "changing out" the PU and/or adding PUs while retaining software and hardware compatibility. This capability shall be provided with the delivered SCADA.

- b. Computer Peripheral Equipment - All peripheral equipment shall be standard products with standard interfaces capable of being replaced with more powerful and/or newer models without requiring additional hardware or software changes.
- c. Communication Equipment - All data communication equipment shall be selected and integrated in such a way that NPC may take advantage of new and improved data communication equipment as it becomes available. Standard equipment and protocols shall be used, and no modifications to standard hardware or software shall be allowed.
- d. User Interface - The design of the user interface shall be such that NPC may take advantage of new and improved user interface technology as it becomes available. Standard interfaces and equipment shall be used, and no modifications to standard hardware or software shall be allowed.
- e. Local and Wide Area Networks - Standard LANs, WANs, and associated protocols shall be provided within each subsystem of the SCADA to allow interconnection of PUs and system support equipment. The LANs and WANs shall provide for several important growth features including: incremental expansion, addition of new computers, resource sharing, parallel operation of functions, and backup of functions.
- f. Data Exchange - All data links shall conform to data communication standards. All communications shall be supported by the software protocol access interfaces such that the physical connections and details of the link procedures are transparent to the application programs. The design of the SCADA shall provide the hardware and software for the interface and use of a WAN that uses both TCP/IP and OSI.
- g. Operating System Software - Operating system software shall be based on widely used operating system. No application program shall use a proprietary feature of an operating system. NPC shall be able to upgrade to higher levels (revisions) of operating system as they are made available without making modifications to the hardware, application software, support software, or the system executive

- services (except as provided for by the operating system Supplier/OEMs).
- h. Applications Software - In developing applications programs, NPC shall be able to utilize structured techniques and all standard high-level languages supported by the computer manufacturer. Interface libraries shall be provided to allow access to database elements, display services, and operating system services. NPC
  - i. Software Tools and Documentation- The software development tools and documentation supplied shall be sufficient to allow NPC to maintain the SCADA and design and integrate new capabilities into the SCADA without requiring additional design information or licensing. The use of proprietary designs for which design information will not be made available is absolutely prohibited.

#### 4. Performance Requirement

##### a. SCADA Fail Safe Capability

For both Normal and High Activity Levels, the SCADA shall at all times maintain the specified level of performance. These activity levels shall not cause the SCADA to fail or produce erroneous results.

The SCADA shall incorporate failsafe capabilities to handle system activity levels that exceed the High Activity Level. Under these conditions, the SCADA shall continue to process or maintain coherency of inputs obtained from remote inputs, local inputs, and user interface processes. Acceptable failsafe methods include sharing reserve PU resources or the graceful degradation of certain applications other than data acquisition, data exchange, and the associated data processing to allow sufficient resources for power system monitoring and alarm handling. Entering a failsafe state shall always be alarmed and logged.

##### b. Failure and Recovery Requirement

The SCADA shall be capable of recovering from the various software and hardware failures within the required failure recovery times as shown in Table 7-3 to Table 7-4.

##### c. SCADA Performance Index

A performance test shall be conducted during the Site Acceptance Test (SAT) after delivery and commissioning of the SCADA. The following performance requirements shall be met by the SCADA during the Site Acceptance Test.

**SCADA Performance Index**

Project index		Parameter	Remarks	
Capacity requirement	Number of plants and stations which can be directly connected	≥10	The number shall meet demand of system construction scale	
	Number of dispatching structures which can be connected at the same time	≥2		
	Total memory capacity	≥5 years	Event record with 5 years; report and curve data within 5 years	
	Spare capacity of server disk	≥30%	Send out alarm information when the disk capacity is less than 15%	
Real-time	Response time of system	Picture calling-out time	≤1 second	
		Response time of data searching	≤5 seconds	
		Refresh time of real-time data on the picture: counted after the refresh of database	≤1second	
		The time from when the alarming or event happens to the picture characters are displayed and make a sound	≤1second	
		The time from when the operator sends the	≤1second	

		executive command to when the local control unit displays the reply		
	Transmission time of data	Transmission time of action message	≤3 seconds	From query of substation system to data refreshing, refreshing of system database of main station
		Transmission time of analogue measured value	≤4 seconds	
	Large-scale fault of system: direct connection with plant and station, duration for transmission of all information		≤3 minutes	
	Large-scale fault of system: no direct connection with plant and station, duration for transmission of all information		≤5 minutes	
	Execution time for command issuing		≤8 seconds	The duration from command carried out by operator of main-station system to execution feedback through command of substation system
<b>Response Time of Control Functions</b>	(1) Processing cycle for active power joint control function		3s 1min adjustable	
	(2) Processing cycle for reactive power joint control function		35-3min adjustable;	
	(3) Processing cycle for automatic economic operation function		5-30min adjustable;	
	(4) Response time of implementing automatic control command of station control level - from		≤ 1.5 seconds	

	sending out control command to arriving at local control point to implement this control command		
	(5) Response time of all transferred information change	≤2 seconds	
<b>Responsiveness of local unit control level</b>	(1) Data acquisition time: a) Acquisition cycle for digital quantity inputs (DI) b) Acquisition cycle of analog quantity inputs: i. electricity quantity, ii. non-electricity quantity and iii. RTD quantity is from c) Resolution of sequence of event (SOE) recording point	< 1second  ≤250ms  < 1s 1 to 5 s	
	(2) Time for local control unit from receiving commands to start executing commands	< 1ms	
	(3) AGC/AVC Calculation cycle	≤ 1s	
	(4) Double-unit changeover time	0s	
<b>Communication System</b>	(1) main station system and substation system	Meet demand of data network, 2M special line and satellite channel means	
	(2) inside main station system	100M/1000 M	
	(3) communication method inside main station system	TCP/IP protocol is used as the basic network communic	

			ation protocol	
	(4) communication protocol		Support various kinds of communication protocols for main station and substation. Data interaction between substation systems manufactured by different factories can be realized. Besides, channel monitoring and data flow monitoring can be realized at the same time.	
	Channel type	64K/2M special line	√	
		10M/100M	√	
		2M special line	√	
		Dispatching data network	√	
		ATM network	√	
		Satellite network	√	As backup channel
<b>System resource and technology requirement</b>	Under normal condition	Server CPU (interval of 5min)	≤25%	
		Human-machine work station (interval of 5min)	≤35%	

	When lots of data shall be handled	Server CPU (interval of 5min)	≤40%	
		Human-machine work station (interval of 5min)	≤50%	
	Network load	Average load rate under normal condition (within any 5min)	≤5%	
		Average load rate when system accident occurs (within any 5min)	≤10%	

Double-unit changeover time: double units as hot standby to assure no disturbance, no loss of real-time data and no interruption of real-time tasks during changeover.

**5. Availability Requirements**

The total accumulative downtime of all critical functions on an annual basis shall not exceed four (4) hours and twenty-three (23) minutes (representing an availability of 99.95%), and not more than a total of forty (40) incidents of downtime for any one or more critical function shall occur in any one (1) year period or proportionally during the required SCADA availability test. The bidder's proposal shall provide the calculations that justify how the required availability shall be guaranteed.

The SCADA shall exhibit an availability of 99.95% calculated. Over a 1-year period (8760 consecutive hours of operation), the SCADA shall be available (as defined in this Clause) for no less than 8755 hours and 37 minutes. In addition, there shall be no more than 40 incidents of unavailability over the same period. The bidder's proposal shall provide the calculations that justify how the required availability shall be guaranteed.

The availability of the SCADA shall be tested as described in this tender. The SCADA shall satisfy the 99.95% availability criteria and shall experience no more than 40 incidents of unavailability over the test period.

For the system to be available, user interface workstations must be stable. Restarts to clear workstation faults must be absolutely minimized. Each such restart shall be considered one of the forty allowable incidents described in the previous paragraph.

**6. Maintainability Requirements**

a. Hardware

The SCADA shall be designed so that a two (2) hour Mean-Time-To-Repair (MTTR) shall be achieved, measured from the time a qualified technician arrives on-site. All equipment shall be modular in construction and shall be supported with comprehensive diagnostic software routines including complete documentation for all equipment and software routines including and software.

b. Software

The SCADA shall be designed to allow on-line software module integration and on-line modification of database parameters with no effect or downtime on real-time system operation. Changes in database definition (including, but not limited to, addition of power system equipment, modification of equipment characteristics, and modification or addition of calculations) shall be possible without regeneration of the entire database.

The elapsed time required to modify a software module and to make a change to the database are specified in Table 7-4.

**7. Sizing and Response Requirement**

The Supplier shall design SCADA System to include sizing and response requirement as shown in the following tables:

Table 7-1 User Interface Equipment Sizing

Description	Main Power House Control Room
Agus 6 HPP Control Center	
3x27"-LCD Monitors for Operations Workstation	1
2x27"- LCD Monitors for Maintenance/Operator Desktop	1
Color Laser Printer	1

Note : Existing Workstations shall be integrated in the new SCADA System

Table 7-2: Data Storage Sizing Requirements

Data Type	Quantity	Periodicity	Retention Period	On-line Archiving
Analog Points	100	2 seconds	45 days	5 years
Analog Points	100	4 seconds	45 days	5 years
Analog Points	200	10 seconds	45 days	5 years
Analog Points	200	5 minutes	45 days	5 years
Analog Points	100	15 minutes	45 days	5 years
Status Points	3,000	by exception	45 days	5 years
Accumulator	132	15 minutes	45 days	5 years
System Snapshot	DPF save case	5 minutes	45 days	5 years
Alarm & Event	2000/hour	As required	45 days	5 years

File(s)				
Disturbance Data	10/day	As required	45 days	5 years

Table 7-3 Real Time SCADA Recovery Requirements

Function	Time
Detection of hardware or software failure	Within 15 seconds
Restart of individual application software subsystems	Within 30 seconds
Total system hot restart	Within 1 minute
Total system cold restart	Within 30 minutes
Workstation hot restart	Within 30 seconds
Workstation cold restart	Within 5 minutes
Detection and switching of failed communications channel	Within 10 seconds
LAN failure recovery	Within 30 seconds

Table 7-4 Software Maintenance Requirements

Activity	Maximum Elapsed Time
Complete database regeneration	<15 minutes
Complete system build	<15 minutes
Single display link and integrate onto all workstations	<1 minute
Link and integrate all display	< 15 minutes
Compile and link all source system software and rebuild Real-Time SCADA	<15 minutes
Compile and link all source system software and rebuild Real-Time SCADA	<15 minutes
Compile, link and integrate into the on-line system a system software module	<15 minutes
Perform an on-line update of an operational Database parameter, and propagate the changes to The source (or defining) data	<1 minute
Suppression of a function to permit integration of an on line database parameter change	<30 seconds
Add a new equipment to the database on-line (exclusive of data entry time)	< 5 minutes

Table 7-4 LCU/PLC/RTU/Controller/IED Channels

Communication Channel	Quantity
IP	Max. of 10
Serial	None

Table 7-5 Tags Sizing

Summary of Points/Tags					
Item No.	Device Name	I/O Type			Accumulator
		AI	DI	DO	
1	LCU Unit No.1	OEM shall use Existing Tags			

2	LCU Unit No.2.	OEM shall use Existing Tags			
3	LCU Switchyard and Auxiliary (Unit 1 and Unit 2)	OEM shall use Existing Tags			
4	LCU Unit 3 (Future)	Same Tags as above			
5	LCU Unit 4 (Future)	Same Tags as above			
6	LCU Unit 5 (Future)	Same Tags as above			
7	LCU Switchyard and Auxiliary (Unit 3,Unit 4 and Unit 5)	Same Tags as above			

*Note: LCU unit 1, LCU unit 2 and LCU for Switchyard and Auxiliary are existing controllers the rest are future installation*

**TS-6.3 SCADA Application Functionality Requirement**

All requirements of this section shall apply equally to all data acquisition, supervisory control, data exchange, and processing, regardless of the data source or the communications protocol used between the SCADA and the data source.

Performance and capacity requirements for these functions are presented in Section TS-6.2

**1. DATA TYPES**

The SCADA shall store in the real-time database the most recently acquired and processed value of the following data types:

- a. Analogue data – a representation of a continuously variable (real) value.
- b. Status data – a representation of a discrete or state value.
- c. Accumulator data – a representation of the integral over time of a continuously variable (real) value. Also referred to as a “count” value.

This data may be acquired from telemetry (refer to Sub-Section 2) or may be generated by other means (refer to Sub-Section 3).

**2. DATA ACQUISITION**

Telemetered data shall be collected from the following existing data sources:

- a. Local Controller Unit (LCU), Programmable Logic Controllers (PLC) and Remote Terminal Unit (RTU) located in the power house and other facilities throughout the NPC Plant.

- b. Electronic Intelligent Devices (IED). These devices include power meters, protection relay, as well as Generator and turbine controllers, etc. It can be polled by the SCADA master or PLC or RTU.
- c. NPC shall determine the mapping of the location name to the data source.
- d. The identity of all data presented to the users of the SCADA shall include the location name rather than the data source name, and, where applicable, data presentation shall be organized by location name rather than by data source name.

#### **a. Data Acquisition Protocols**

The SCADA shall support all features of all specified protocols unless specifically stated otherwise.

Functional requirements for capabilities not supported by the communications protocol used by a data source need not be supported by the SCADA, but only for those sources using the protocol.

The SCADA shall support industrial standard protocols as specified in this technical specification.

#### **b. Scan Groups**

A "scan group", as used in this specification, shall be defined as an addressable unit of data to be retrieved from a data source. A scan group may include one or more items of data, as defined by the protocol used by the data source and its configuration.

- a. Each item of data available from each data source shall be assigned by NPC to one or more scan groups, in accord with the capabilities of the source and the protocol used by the source.
- b. Each data source may include any number of scan groups and each scan group may contain any number of points, up to the limits of the protocol.
- c. No scan group will be defined to span more than one data source.

The SCADA shall support all data addressing capabilities of each data source and shall specifically not be limited to retrieving only all data or all data of a specific type (status, analogue, or accumulator) in a single scan.

#### **c. Data Acquisition**

The SCADA shall acquire data by periodic polling (master/slave relationship between the SCADA and the data source), by spontaneous reporting (peer-to-peer), and on demand.

The SCADA shall accept and process data transmitted as a full report and by exception.

### **(1) Periodic Data Acquisition via Polling**

The SCADA shall acquire periodic polled data by periodically transmitting a scan request to each scan group.

NPC shall assign a scan periodicity, a start time or offset from the top of the hour, and a timeout to each scan group.

- i. The scan periodicity shall be set between 1 second and 3600 seconds to a resolution of one second.
- ii. The scan start-time shall establish the time after the start of an hour that the first scan of the scan group is to occur. Start time shall be specified to a resolution of one second.
- iii. The timeout shall be set between 1 and 60 seconds to a resolution of 1 second and shall be used to identify telemetry failure.

The SCADA shall support parallel (concurrent) scanning of sources on multiple communications channels and over networks where the protocol supports concurrent exchanges (such as over TCP/IP networks).

### **(2) Periodic Data Acquisition via Polling – Freeze and Read**

Prior to the transmittal of a scan request for selected scan groups, typically those containing accumulator values, the SCADA shall issue a "freeze" command to one or more data sources at the defined time of the collection.

The freeze command may be of any of the following types:

- i. A 'broadcast' freeze command addressing multiple (typically all) data sources on a given communications channel. The data sources will not reply to the freeze command.
- ii. A 'broadcast' freeze command addressing multiple (typically all) data sources on a given communications channel. The data sources will present an indication of the successful receipt of this freeze command in the reply to the next scan request.
- iii. A freeze command addressed to a single data source or scan group. The data source will not reply to the freeze command.
- iv. A freeze command addressed to a single data source or scan group. The data source will present an indication of the successful receipt of this freeze command in the reply to the next scan request.

For those data sources that present a success indication, the scan request shall not be issued to the data source until that data source reports success of the freeze command.

- i. If a 'broadcast' freeze command has been issued to multiple data sources on a channel, all data sources reporting success shall be scanned.
- ii. The failure of any data source on a channel shall not delay the scanning of data sources reporting success.

Failed freeze commands, if detectable, shall be handled as telemetry failures, including retrying the failed freeze command if defined.

### **(3) Spontaneous Reporting**

Unsolicited data acquisition may be spontaneously initiated by data sources, typically when changes in input data (to the source) are detected or when processes within the data source determine that data must be reported (for example, periodically).

The SCADA shall accept data transmitted from the spontaneously reporting data sources at any time, and shall acknowledge the receipt of the data as required by the protocol.

Some spontaneously reporting data sources may include capabilities for the SCADA to invoke a demand scan.

### **(4) Demand, Programmatic and Integrity Scans**

In addition to periodic and spontaneous data acquisition, the SCADA shall acquire data from sources under the following conditions:

- i. When requested by a user. (A user shall be able to define on any display a cursor target that will initiate this "demand" scan.)
- ii. When initiated by an application. The SCADA shall include calls to the data acquisition function such that software written by NPC can initiate "programmatic" scans.
- iii. Periodically for all scan groups where the data is acquired by report by exception or by spontaneous reporting. This is referred to as an "integrity scan".
- iv. The periodicity of the integrity scan shall be user-defined for each scan group.
- v. The integrity scan shall command a full report of data.

Each initiation of a demand, programmatic, or integrity scan shall include parameters to specify the data source and scan group to be scanned.

### **(5) Full Report and Report by Exception**

The SCADA shall accept data reported in full and by exception.

- i. Data reported in full is transmitted as the current value of every item in the scan group requested (polling) or transmitted (spontaneous reporting), even where the value has not changed since it was last reported.
- ii. Data reported by exception is transmitted by the source when the value of the data has fulfilled some condition at the source, typically when it has changed. (Some data, typically analogue data, is reported only when the magnitude of the change exceeds a threshold value – its "dead band".)

If supported by the protocol and for those data sources so configured by NPC, the SCADA shall store a dead band value for each value reported by exception.

- i. This dead band shall be adjustable by NPC's authorized programmer/engineer.

The dead band shall be downloaded to the data source upon change of the dead band and whenever the data source is brought on-line.

#### **d. Enabling and Suspending Data Acquisition**

The SCADA shall suspend acquisition of ("remove from scan") any individual point, scan group, or entire data source when directed by a user.

- i. Suspended points acquired by polling may continue to be polled from the data source, but shall not be processed nor stored in the database.
- ii. Suspended data sources acquired by polling shall not be polled.
- iii. Suspended points, scan groups, and data sources reporting spontaneously shall not be processed nor stored in the database.

The value of the point stored in the database at the time of suspension shall be retained until acquisition is enabled or the value is manually substituted.

The SCADA shall set an "acquisition suspended" quality code for all suspended points and shall make an entry for the points on the off-scan summary.

- i. The acquisition suspended quality code shall be distinct from the "telemetry failure" quality code.

The SCADA shall enable acquisition of a point, scan group, or data source when directed by a user.

- i. Enabled points shall be acquired, processed, and stored in the database.
- ii. The acquisition suspended quality code shall be removed from the affected points, and the affected points shall be removed from the off-scan summary.
- iii. Points marked as manually substituted when acquisition is enabled shall not be processed or stored in the database, until the user removes the manual substitution.

#### **e. Telemetry Failure**

"Telemetry failure" is defined as any of the following conditions:

- i. Failure of the SCADA to complete a scan group data collection within a timeout defined for the scan group.
- ii. Failure of the SCADA to complete a scan group data collection prior to the next scan request addressed to the same scan group.
- iii. Failure of the SCADA to complete a scan group data collection due to errors in the communications with the data source.

The SCADA shall maintain a "retry count" for each scan group.

- i. The count shall be incremented for each failed scan of a polled scan group.
- ii. The count shall be incremented for each erroneous transmission from a spontaneously reporting scan group.
- iii. The retry count shall be reset whenever a successful acquisition is completed.

Scans of failed, polled scan groups with a scan periodicity longer than a threshold (initially 10 seconds) shall be immediately retried (without waiting for the next periodic scan time).

Scans of failed, polled scan groups with scan periodicities less than or equal to the threshold shall not be retried, but the retry count shall be incremented. (The scan will be effectively "retried" at the next periodic scan time for these scan groups.)

A telemetry failure shall be declared for a telemetered value when:

- i. The retry count exceeds a retry limit set for a scan group.
- ii. If a spontaneously reporting data source reports data at a rate faster than the SCADA can process the data ("data overrun"), the SCADA shall declare a telemetry failure for the source.

Upon declaring telemetry failure:

- i. The SCADA shall set a "telemetry failure" quality code for all affected points and shall make an entry for the points on the off-scan summary.
- ii. The SCADA shall generate an alarm. The alarm shall describe the data source or scan group failing; the individual points of the scan group or data source shall not be listed.
- iii. The last good value of a point in telemetry failure (that value stored in the database immediately prior to the detection of the telemetry failure) shall be retained in the database.
- iv. For selected accumulator points, Long Value Accumulator Quality Code, the SCADA shall automatically substitute another value for accumulator points experiencing telemetry failure.

Scans of polled scan groups subsequent to a telemetry failure shall occur at a user-defined multiple of the normal periodicity (initially one).

The SCADA shall reset the telemetry failure condition:

- i. After a user-specified number of consecutive successful polls have occurred.
- ii. After a time specified for all spontaneously reporting sources (initially 30 minutes).
- iii. When directed by user action.

When the telemetry failure condition is reset

- i. The SCADA shall generate an alarm describing the data source or scan group restored to scan.

- ii. The retry count shall be reset.
- iii. The SCADA shall resume polling the data and updating the database with the data (unless the data is also marked as manually substituted).
- iv. The telemetry failure quality code shall be removed from the affected points.
- v. The affected points shall be removed from the off-scan summary.

The user shall be able to inhibit this failure restoration procedure (for all sources, not individually).

#### **f. Manual Substitution**

The SCADA shall support one of the following methods for manual substitution.

- i. The SCADA shall support user entry of a substitute value for any point.
  - a) The SCADA shall set a "manual substitution" quality code for a manually substituted point, but shall not suspend data acquisition for the point.
  - b) When the point is next successfully (without error) acquired and processed, the value shall be overwritten and the manually substituted quality code shall be reset.
- ii. The SCADA shall support user entry of a substitute value for any point experiencing telemetry failure or for which scanning has been suspended or while a telemetry failure condition is present.
  - a) The SCADA shall set a "manual substitution" quality code for a manually substituted point.
  - b) When data acquisition is enabled or the telemetry failure condition is reset and the point is next successfully (without error) acquired and processed, the value shall be overwritten and the manually substituted quality code shall be reset.

#### **g. Data Acquisition Security**

Selected data acquisition communications errors shall be reported to NPC's central security logging system. These errors include but are not limited to:

- i. Unexpected replies, including incorrect replies to commands from the SCADA, spontaneous reports from sources not configured as spontaneously reporting, and spontaneous reports from spontaneously reporting sources that have been inhibited
- ii. Detection of control commands, scan requests, or other central-system-initiated commands not initiated from authorized systems.
- iii. Replies of incorrect length. The SCADA shall reject over-length replies. This feature shall be specifically demonstrated during factory testing.
- iv. Communication errors, such as invalid checksum or protocol violations.

The data acquisition front-end processors shall serve as “firewalls” protecting the SCADA local network from unauthorized and inappropriate communication attempts from the field devices.

- i. This protection shall be implemented for both traditional serial protocols as well as modern routable protocol transports (i.e., TCP/IP).

Provision shall be given to record all communication traffic, selectable on a communication channel basis, for the purpose of detecting unauthorized activity, unusual activity, and attempts to defeat the security capabilities of the SCADA or its electronic security perimeter.

The Supplier/OEM shall discuss any security enhancements, such as encryption or additional authentication that are available to enhance the integrity of the telemetered data.

### **3. DATA ACQUISITION – NON TELEMETERED DATA**

Non-telemetered data shall be generated by the following means:

- a. User entry.
- b. Calculated by the data processing function.
- c. Calculated by applications.

Unless explicitly stated otherwise, all requirements in this and other sections pertaining to telemetered data, such as enabling and suspending data acquisition, manual substitution, limit monitoring, state change detection, enabling and inhibiting alarms, and quality codes, shall also apply to non-telemetered data.

### **4. DATA PROCESSING**

Data to be stored in the real-time database of the SCADA shall be subject to the following processing:

- a. Data quality.
- b. Analogue data.
- c. Status data.
- d. Accumulator data.
- e. Non-telemetered data.
- f. Calculated data.
- g. Redundant data.
- h. Network status processor.
- i. Initial scan processing.

All data stored in the real-time database, regardless if it is acquired from telemetry, non-telemetered, or generated by application programs, shall be subjected to the same processing.

#### **a. Data Quality**

Quality codes are attributes of database points that identify conditions affecting a database point.

- (1) All quality codes that apply to a point shall be maintained in the database for that point and shall be accessible for display, inclusion in reports, and use by SCADA functions.
- (2) Typically, only the most severe code will be presented on a display or report. However, it shall be possible to access and present the most severe code and all codes individually. (Severity is defined later in this section.)

Quality codes telemetered along with data from data sources using standard protocols such as Modbus (all variant), DNP3 (all variant), IEC 60870-5-101 and 104.

Quality codes shall be accessible from the database, as another data item.

Quality codes shall be available for use in calculated values as Boolean (true/false) values. For example, a calculated point may be defined for which the value of the result is dependent on the presence of selected quality codes using the conditional execution operators (if-then-else) of the generalized calculations.

The SCADA shall include tools for NPC to modify the quality code mapping and severity order.

Each quality code shall be set or reset independently of all other codes. Thus, the number of possible combinations of quality codes for a given point shall be  $2^n$ , where  $n$  is the number of codes (attributes).

The following quality codes, when applied to a point, shall be interpreted as invalid or "bad" data:

- (1) Acquisition suspended.
- (2) Calculation suspended.
- (3) Telemetry or calculation failure
- (4) ADC inaccuracy
- (5) Reasonability violation.
- (6) Inconsistent result.
- (7) Long value (for the first accumulator reading after telemetry failure).
- (8) Not commissioned.

Values with a manually substituted quality shall be considered valid or "good".

The not-commissioned quality code shall be set and removed by a user to indicate equipment that has not been placed into service.

- (1) The user may set and remove the not-commissioned quality code for:
  - i. Individual data points.
  - ii. Data sources.

All data points in the data source shall be marked as not-commissioned.

## b. Analogue Data

Prior to storage in the SCADA database, analogue data shall be processed as follows:

- (1) ADC accuracy monitoring.
- (2) Conversion to engineering units
- (3) Reasonability checking
- (4) Limit checking.
- (5) Rate-of-change checking

### (1) ADC Accuracy Monitoring

Selected data sources will report one or two reference points for each analogue-to-digital (ADC) converter in the source.

These reference points shall be scanned as part of the normal data acquisition process and compared against high and low limits. These limits shall be the same limits used for the limit checking function, Operating Limit Checking.

- i. When the value of any reference exceeds its high or low limit, an ADC inaccuracy condition shall be declared.

All analogue points converted by that ADC shall be marked with an 'ADC inaccuracy' quality code, the analogue points shall be processed as for a telemetry failure, and an alarm shall be generated for the ADC (not for the individual analogue points).

When the ADC reference returns to within its limits, the quality codes shall be removed, the analogue points shall be returned to normal processing, and a return-to-normal alarm shall be generated for the ADC.

### (2) Conversion to Engineering Units

Analogue points shall be converted to engineering units by assuming a linear characteristic of the form:

$$\text{Converted\_value} = (a * \text{Telemetered\_value}) + b$$

- i. Where a and b are signed coefficients defining the scaling and offset of the conversion.
- ii. The coefficients may be of either sign.
- iii. The coefficients shall be individually defined for each analogue point and stored in the definition of that point.

It shall be possible to "smooth" the converted value by the application of a geometric smoothing filter to the converted value.

- i. Each analogue **point's** database definition shall include the ability to define the smoothing constant to be applied during the conversion from raw telemetered data to engineering units.

The following algorithm shall be used to convert selected analogue points that use 'expanded scale' transducers (this conversion form is also referred to as "clamp to zero"):

*if (Telemetered\_value  $\geq$  z)*

*Converted\_value = (a\*Telemetered\_value) + b*

*else*

*Converted\_value = 0*

- i. Where a and b are as above.
- ii. Where z is a positive coefficient defining the lower limit of the transducer.
- iii. The coefficients shall be individually defined for each analogue point and stored in the definition of that point.

Selected analogue points shall be rounded to the nearest integer after conversion.

- i. These points may be used to represent integer values such as transformer tap positions.

### **(3) Reasonability Checking**

All analogue points shall be compared against high and low reasonability limits each time they are processed. The reasonability limits shall represent the extremes of valid measurements for the point's value.

An alarm shall be generated when a reasonability limit violation is detected, the value shall be marked with a 'reasonability violation' quality code, and the value shall be processed as for a telemetry failure.

When the data returns to a reasonable value, the new value shall be accepted, the 'reasonability violation' quality code shall be removed, and a return-to-normal alarm shall be generated.

### **(4) Operating Limit Checking**

All analogue points shall be compared against operating limits that define various operating ranges for the point.

- i. Pairs of high and low limits shall be supported for each point
- ii. The initial value of each limit shall be stored in the definition of that point.

- iii. The SCADA shall ensure that the limit values obey the following relationship for every analogue point:

*Low\_Reasonability*

$$\_lim\ it \leq \dots \leq Low\_lim\ it_n \leq low\_lim\ it_1 \leq high\_lim\ it_1 \leq \dots$$

$$\leq high\_lim\ it_n \leq high\_reasonability\_lim\ it$$

Users shall change the limit value(s) by overriding the current value.

- i. Overridden limits shall be marked with a "limit override" quality code and shall be used in place of the initial limit value.
- ii. When the user removes the override, the limit shall revert to its initial value (as defined above).
- iii. All overridden limits shall be presented on the alarm inhibit and override summary and the manual replace summary.

User may mark any limit as inactive.

- i. Inactive limits shall not be checked.
- ii. Marking a limit as inactive is not equivalent to inhibiting an alarm.

The "normal range" of an analogue point is defined as the set of values between the innermost low and high limits.

Whenever an analogue value crosses a limit in a direction away from its normal range, a limit violation alarm shall be generated.

- i. The analogue value shall be marked as being in the "off-normal" condition and shall be included in the off-normal summary display.
- ii. Analogue limit violations that are the direct result of supervisory control actions shall be reported as events rather than as alarms.

Whenever a monitored point crosses a limit in a direction towards its normal range, a return-to-normal alarm shall be generated.

Whenever an analogue point crosses more than one limit, either away from or towards its normal range, each limit crossing shall be alarmed.

A dead band shall be applied to each of the limits to derive the return-to-normal level, so that repeated alarming does not occur when the value of a point repeatedly crosses a limit.

- i. A unique dead band shall be specified for each analogue point and shall be stored in the definition of that point.

**(5) Rate-of-Change Checking**

Selected analogue points shall be checked against rate-of-change limits.

- i. A rate-of-change limit shall be defined for every analogue point subject to rate-of-change limit checking.
- ii. The initial value of each limit shall be stored in the definition of that point.
- iii. An alarm shall be generated when the change in the value of the analogue point between two successive scans exceeds the point's rate-of-change limit.
- iv. The check against the limit may be either against the absolute value of the change (where a violation is declared if the value is increasing or decreasing) or against signed value (where a violation is declared only when the change in value is in the same direction as the sign of the limit) as selected for each point.
- v. The alarm limit may be specified as one of:
  - a) Absolute value, signed or unsigned
  - b) Percentage of the range of the Engineering Value, signed or unsigned
  - c) Percentage of the point value in the previous recorded scan as selected for each point.

Filtering shall be applied to the change.

- i. Filter constants shall be defined for each point subject to rate-of-change limit checking.
- ii. Filter constants shall be stored in the definition of that point.

Rate-of-change alarming shall be inhibited for analogue changes caused by supervisory control operations.

Users shall override the rate-of-change limit values.

- i. Overridden limit values shall be marked with a "limit override" quality code.
- ii. When the user removes the override, the limit shall revert to its initial value (as defined above).

A user shall mark the rate-of-change limit as inactive.

- i. An inactive limit shall not be checked.

Whenever a rate-of-change alarm has been declared for an analogue point, the point shall be marked as being in the "off-normal" condition.

- i. All analogue points that are "off-normal" shall be included in the off-normal summary display.

When the rate-of-change of the analogue value is less than the rate-of-change limit, a return-to-normal alarm shall be generated and the point shall be removed from the off-normal summary display.

## **(6) Operating Limits**

Operating limit sets are collections of operating limits that shall, upon user direction, replace the operating limits currently in use.

Each operating limit set shall include an entry for each operating limit in the database.

Upon user command, the current operating limits for an individual point or for all points in the SCADA shall be changed to the corresponding entry from the selected operating limit set.

- (1) The SCADA shall not change a limit that is marked as manually overridden.
  - i. Instead, the point and limit with the conflict shall be listed on a limit conflict display.
  - ii. This display shall identify the point and limit, along with the value of the initial (non-overridden) limit, the value of the override limit, and the value of the limit from the operating limit set.

### c. Status Data

Prior to storage in the SCADA database, status data shall be processed as follows:

- (1) State conversion.
- (2) Normal state processing.
- (3) State change detection.

#### (1) State Conversion

Each status point telemetered from a data source shall be converted to a meaningful state as follows (where supported by the data source and the protocol used to communicate with the data source):

- i. Two-State Points. Two state points are typically reported as a single status bit representing one of two possible states of a power system device or other equipment or process.
  - a) Any value of the input shall be converted to any defined state for the point.
  - b) State definitions shall be as in the currently operational system.
  - c) The assignment of the value conversion and state definition shall be made on a per-point basis and shall be stored in the definition of that point.
  - d) The SCADA shall support at least the number of two-state definitions, including open/closed, trip/close, on/off, alarm/normal, auto/manual, and remote/local.
- ii. Three-State Points. Three-state points are typically reported as two status bits, which represent one of three possible states of a power system device or other equipment or process:
  - a) Any value of the input shall be converted to any defined state for the point.
  - b) The "fourth state" shall be designated as "invalid" or "indeterminate".

- c) State definitions shall be as in the currently operational system.
  - d) The assignment of the value conversion, state definition, and fourth-state designation shall be made on a per-point basis and shall be stored in the definition of that point.
  - e) The SCADA shall support at least the number of three-state point definitions, including open/closed/in-transit and remote/local/automatic.
- iii. Momentary Change Detection (*MCD*) – two-state points that may incur multiple operations between scans: Typically, such points are identified with circuit breakers with high-speed reclosers.
- a) All state definitions for two-state points shall be supported.
  - b) Based on the state of the point from the previous scan, the state of the point from the current scan, and the state of the change indication from the current scan, the following operations shall be detected:
    - c) Initially closed:
      - Trip (open).
      - Trip, close.
      - Trip, close, trip.
    - d) Initially open:
      - Close.
      - Close, trip.
      - Close, trip, close.
  - e) Some protocols may report multiple operations of any device as a series of operations of the same device all transmitted in the same message.
  - f) The SCADA shall process all reported changes of any device within a message.
  - g) The logic for processing MCD points shall function such that multiple changes of state can be identified by calculations and other logic that may execute as a result of a change of state.
  - h) That is, functions that would execute upon a change in state of a status point from closed to open shall likewise execute as a result of a trip-close momentary operation.

## (2) Normal State Processing

One of the states of each status point shall be designated as its "normal" state.

- i. It shall be possible to define a point as having no normal state.
- ii. The designation shall be made individually for each point and shall be stored in the definition of the point.

Users shall be able to override the normal state definition and to remove the override.

- i. Overriding the normal state designation shall establish a normal state override quality code on the point.

- ii. Removal of the normal state override shall remove the normal state override quality code.

All points with an overridden normal state shall be listed on the off-normal summary display.

### **(3) State Change Detection**

Each time a status value is acquired, its state shall be compared to the state currently resident in the database and any change of state shall be reported.

- i. Changes in state that are the direct result of a supervisory control action initiated within the SCADA shall be reported as events.
- ii. Spontaneous changes in state (changes not the direct result of a supervisory control action) shall be reported as alarms.

All status points that have a normal state designated and whose state is not the normal state after a state change shall be included in the off-normal summary display.

The reporting of changes of state of three-state values into the third state or fourth state shall be monitored for an adjustable time to allow for completion of the action of slow-moving devices such as motor-operated switches.

- i. The point's state shall be the third state or fourth state even if the delay time has not expired.
- ii. Reporting of changes into the fourth state shall also be processed as a telemetry failure.

#### **d. Accumulator Data**

Prior to storage in the SCADA database, accumulator data shall be processed as follows:

- (1) Conversion to engineering units.
- (2) Reasonability checking.
- (3) Limit checking.
- (4) Accumulator substitution.

#### **(1) Conversion to Engineering Units**

Data sources will report accumulator points in two forms, as a continuous count value and as a resetting count value.

1. Accumulator values collected from data sources that have been processed by the data source shall be processed as a form of resetting count values.
  - a) That is, even though the value may have been converted to engineering units and checked for limit violations prior to

transmission to the SCADA, the SCADA shall process the value as if it had not been previously processed. This will, for example, enable the SCADA to convert kWh values to MWh values, and to check the value against different limits.

Data reported in raw count form shall be converted to engineering units using the following linear conversion algorithm:

IF  $Raw\_value_n \geq Raw\_value_{n-1}$

THEN

$Converted\_value = a*(Raw\_value_n - Raw\_value_{n-1})$

ELSE

$Converted\_value = a*(Raw\_value_n - Raw\_value_{n-1} + Max\_value - Min\_value)$

Where:

1.  $a$  is a signed coefficient defining the scaling of the conversion,
2.  $Raw\_value_n$  is the current telemetered value,
3.  $Raw\_value_{n-1}$  is the previous telemetered value.
4.  $Max\_value$  is the maximum count value.
  - a) When the accumulator reaches its maximum count value (at the data source), the next count will produce the minimum count value. This is referred to as accumulator "rollover".
  - b)  $Min\_value$  is the minimum count value.
5. The coefficients and rollover count values shall be individually defined for each accumulator point and stored in the definition of that point.

Data reported in resetting count form shall be converted using the following linear conversion algorithm:

$Converted\_value = a*(Raw\_value_n)$

Where:

1.  $a$  and  $Raw\_value_n$  are as defined above.
2.  $Raw\_value_n$  will be reset to zero (at the data source) after it has been successfully read from the data source.
3. The coefficients shall be individually defined for each accumulator point and stored in the definition of that point.

Each component of the accumulator value, including the current and previous (if applicable) raw values and the converted value, shall be stored in the SCADA database.

1. Raw value(s) shall be stored in count form.
2. Converted values shall be stored as analogue values.

**(2) Reasonability Checking**

All accumulator points shall be compared against high and low reasonability limits each time they are processed. The reasonability limits shall represent the extremes of valid measurements for the point's value.

An alarm shall be generated when a reasonability limit violation is detected, the value shall be marked with a "reasonability violation" quality code, and the value shall be processed as for a telemetry failure.

When the data returns to a reasonable value, the new value shall be accepted, the 'reasonability violation' quality code shall be removed, and a return-to-normal alarm shall be generated.

The SCADA shall provide the ability for NPC to change the high and low reasonability limits, which shall be unique for each point.

**(3) Operating Limit Checking**

All accumulator points shall be compared against operating limits that define various operating ranges for the point.

- i. Pairs of high and low limits shall be supported for each point (refer to Table 2-6: Application Capacity).
- ii. The initial value of each limit shall be stored in the definition of that point.
- iii. The SCADA shall ensure that the limit values obey the following relationship for every analogue point:

$$Low\_reasonability\_lim\ it\ \leq\ \dots\ \leq\ Low\_lim\ it_n\ \leq\ low\_lim\ it_1\ \leq\ high\_lim\ it_1\ \leq\ \dots$$

$$\leq\ high\_lim\ it_n\ \leq\ high\_reasonability\_lim\ it$$

- iv. Users shall change the limit value(s) by overriding the current value.
  - a) Overridden limits shall be marked with a "limit override" quality code and shall be used in place of the initial limit value.
  - b) When the user removes the override, the limit shall revert to its initial value (as defined in above).
  - c) All overridden limits shall be presented on the alarm inhibit and override summary and the manual replace summary.
- v. User may mark any limit as inactive.
  - a) Inactive limits shall not be checked.
  - b) Marking a limit as inactive is not equivalent to inhibiting an alarm. Alarm inhibiting shall apply only to active alarms.

The “normal range” of an accumulator point is defined as the set of values between the innermost low and high limits.

Whenever an accumulator value crosses a limit in a direction away from its normal range, a limit violation alarm shall be generated.

- i. The accumulator value shall be marked as being in the “off-normal” condition and shall be included in the off-normal summary display.
- ii. Accumulator limit violations that are the result of supervisory control actions shall be reported as events rather than as alarms.

Whenever a monitored point crosses a limit in a direction towards its normal range, a return-to-normal alarm shall be generated.

Whenever an accumulator point crosses more than one limit, either away from or towards its normal range, each limit crossing shall be alarmed.

A dead band shall be applied to each of the limits to derive the return-to-normal level, so that repeated alarming does not occur when the value of a point repeatedly crosses a limit.

- i. A dead band shall be specified for each accumulator point and shall be stored in the definition of that point.

#### **(4) Accumulator Substitution**

When an accumulator value cannot be determined, a substitute value shall be stored in the database.

- i. Accumulator substitution shall occur in lieu of retaining the last good value as defined for telemetry failure.

Accumulator substitution shall be initiated by the following conditions:

- i. Telemetry failure of an accumulator point.
- ii. An accumulator points with a long value quality code.
- iii. When the difference between the accumulator value and another analogue or accumulator value (typically a calculated analogue value) exceeds a predefined value (a “meter error”).
  - a) The association between the accumulator value and the other value and the maximum difference value shall be individually defined for each analogue point and stored in the definition of that point.

An accumulator value that has been manually entered by a user shall be considered a valid value.

Accumulator values may be the result of redundant data processing.

- i. To ensure that the redundant data processing completes prior to the accumulator substitution processing, accumulator substitution processing shall be delayed by 15 seconds from the completion of the accumulator value conversion and storage of the converted value in the database.

The value to be substituted for the failed accumulator value shall be one of the following:

- i. A calculated or telemetered accumulator value.
- ii. A calculated or telemetered analogue value.
- iii. A value of zero (0).
  - a) The value to be substituted shall be individually defined for each accumulator point and stored in the definition of that point.
- iv. Only a single substitution value will be selected for any point.
- v. That substitution value shall be used only if it is not marked as bad.
  - a) Values outside alarm limits shall be deemed valid.
  - b) If the substitution value is not current or not valid, a value of zero shall be substituted.

Substituted values shall be marked with a substituted quality code, in addition to a telemetry failure code and distinguishable from the redundant data processing quality code.

#### **e. Non-Telemetered Data**

Certain data in the database will not be updated from data sources or SCADA functions, but will be manually entered by users.

- (1) These data points shall include analogue, accumulator, and status points.

An event message shall be generated for each change made to a non-telemetered value.

Non-telemetered points shall be marked with a 'non-telemetered' quality code, but not with a 'telemetry failure' quality code or a 'manual entry' quality code.

- (1) Non-telemetered points shall be otherwise indistinguishable from telemetered or calculated points.

#### **f. Calculated Data**

Calculated points/tag shall be generated using the following arguments:

- (1) Database values.
- (2) Database value attributes, including limit values.
- (3) Quality flags of database values (as status values).

Calculations shall include:

- (1) NPC-defined algorithms (generalized calculations).
- (2) Algorithms supplied with the SCADA (such as MVA calculations and analogue value integration).

Calculated points shall produce resultant values of analogue, status, and accumulator types.

- (1) Analogue and accumulator resultant values shall be stored as either analogue (including limit values for another point) or accumulator values, depending on the calculation definition.

Calculations shall be performed periodically.

- (1) The periodicity of each calculation shall be assigned on a per-point basis and shall be stored with the definition of the calculation.
  - a) An implementation where a calculation is triggered whenever any of the arguments of the calculation change is also acceptable.
  - b) If executed "on change", the execution periodicity shall be interpreted as the maximum allowable time from the change of the argument until the calculation is completed and the result is stored in the database.
- (2) Any database value shall be acceptable as input to a calculation, assuming that the value type, analogue, status, or accumulator, is appropriate for the use.
  - a) Analogue and accumulator values shall be used interchangeably as arguments.
  - b) Values generated as calculated points and values produced by SCADA functions
  - c) shall be used as arguments interchangeably with telemetered and non-telemetered points.
  - d) The SCADA shall support drag and drop (or cut and paste) of points from displays or the database into calculation definitions.

The calculation function shall detect arithmetic exceptions such as division by zero and over-range results.

- (1) Such conditions shall be placed a "calculation failure" quality code on the resultant calculated point. (This may also be represented by a "telemetry failure" quality code.)

The SCADA shall support user entry of a substitute value for the results of any calculation.

The resulting value shall have a manual substitution quality code.

#### **(1) Calculation Suspension and Quality Codes**

The SCADA shall suspend calculation of any individual point when directed by a user.

The value of the point stored in the database at the time of suspension shall be retained until the calculation is enabled or the value is manually substituted.

The SCADA shall set an "calculation suspended" quality code for all suspended points and shall make an entry for the points on the off-scan summary.

- i. The calculation suspended quality code shall be distinct from the telemetry failure and acquisition failure quality codes.

The SCADA shall enable calculation of a point when directed by a user.

- i. Enabled points shall be calculated and stored in the database.
- ii. The calculated suspended quality code shall be removed from the affected points, and the affected points shall be removed from the off-scan summary.
- iii. Points marked as manually substituted when calculated is enabled shall not be processed or stored in the database.

The presence of a quality code on any of its arguments shall not disrupt the calculation using that value.

The quality code of the calculated value shall be the most severe quality code of the arguments.

- i. Results of calculations that are manually overridden shall be denoted with a quality code that can be differentiated from the propagation of a manual substitution quality code from one its arguments.
- ii. Results of calculations that are suspended shall be denoted with a quality code that can be differentiated from the propagation of calculation suspended quality code from any its arguments.

When any of the following data quality conditions are set or reset for the result of a calculation, the SCADA shall act as defined for the corresponding condition for a telemetered point:

- i. Calculation suspended (like acquisition suspended).
- ii. Manually substituted.
- iii. Calculation failure.
- iv. Reasonability violation.
- v. Limit override.
- vi. Normal state override.
- vii. State estimator bad data.

## (2) Generalized Calculations

Generalized calculations shall be defined from the following operators, functions, and rules:

- i. *Mathematical operators* – addition, subtraction, multiplication, division, absolute value, square root extraction, exponentiation, and logarithmic functions.

- ii. *Trigonometric functions* – including sin, cos, tan, and inverse functions.
- iii. *Summation function* – summation of “n” different variables.
- iv. *Daily totals function* – the daily total of hourly values for a single variable.
- v. *Average function* – average of the values for a single variable over predefined intervals, such one hour.
- vi. *Filter function* – digital filter in the form  $\alpha * x + (1 - \alpha) *$  (previous filtered value).
- vii. *Min/max functions* – selection of the minimum and maximum value from a set of arguments.
- viii. *Peak function* – determination of the maximum values for a single variable over predefined intervals, such as the instantaneous values over one hour and hourly maximums over one day. Peak determinations shall also save the date/time of occurrence.
- ix. *Logical operators* – including AND, OR, NOT, and XOR
- x. *Comparative operators* – including greater and less than, equal to, and combinations thereof
- xi. *Value limiting functions* – zero cutoff, high limiter, and low limiter
- xii. *Conditional execution rules* – including if-then-else statements.
- xiii. *Execution sequence rules* – equivalent to multi-level parenthesis.
- xiv. Each calculation may consist of up to ten arguments.

**(3) MVA Calculation**

MVA shall be calculated using any of the formulae specified below. The formula to be used shall be selected for each MVA calculation.

$$MVA = \sqrt{MW^2 + MVAR^2} - \text{sign always positive}$$

$$MVA = \sqrt{MW^2 + MVAR^2} - \text{sign the same as the sign of the MW}$$

$$MVA = \frac{kV * A * \sqrt{3}}{1000} - \text{sign always positive}$$

$$MVA = \frac{kV * A * \sqrt{3}}{1000} - \text{sign the same as the sign of the MW}$$

$$\text{power factor } pf = \frac{MW}{MVA}$$

**(4) Integration**

The integration calculation will typically be used to produce MWh and Mvarh values from MW and Mvar inputs respectively.

The integration period shall be defined for each point and stored with the point’s definition.

The result for the current period shall be stored and a new integration started at the end of each period.

- i. Two resultant values shall be maintained in the database as analogue values for each integration point:
- ii. The value for the current (in-progress) period.
  - a) The current value shall be recomputed each time the argument is scanned and the argument is judged to be valid (refer to Section 3.4.1, Data Quality). (That is, the current value shall be recomputed to reflect the integrated value at the time of the sample.)
- iii. The result for the previous (completed) period.

A count of valid samples for each integration point shall be maintained through the integration period.

- i. The count shall be compared against a NPC-entered minimum count for each point at the end of the integration period.
- ii. If the count of valid samples for a period is below the minimum value, a calculation failure shall be considered to exist and the (calculated) current value shall be stored with the "calculation failure" quality code.
- iii. The count shall be reset at the expiration of each period.

#### **(5) Processing of Calculated Data**

After a data item is calculated, it shall be processed as follows:

1. Analogue value:
  - a) Reasonability limit checking
  - b) Operating limit checking
  - c) Rate-of-change checking
2. Status value:
  - a) Normal state checking
  - b) State change checking
3. Accumulator value:
  - a) Reasonability limit checking
  - b) Operating limit checking

#### **g. Redundant Data Processing**

Selected values in the SCADA database may be available from more than one source. Typically, the "best available" source of the value is chosen for use in displays, reports, and other functions. The function of choosing the best available source is called "redundant data processing."

The redundant data processing inputs are called "arguments," and the chosen source is called the "resultant best value."

Arguments shall include telemetered values, calculated values, and values generated by SCADA functions.

1. Arguments and the resultant best value shall be the same database type, analogue, status, or accumulator.
2. It shall be possible to use both analogue and accumulator values as arguments for an accumulator resultant.
3. When defining a redundant point, the user will rank the arguments in a priority order.

The highest-ranking argument with a valid value shall be stored in the database as the resultant best value.

1. If none of the arguments have a valid value, the highest-ranking item with the least severe quality shall be stored as the result.

a) The severity of quality codes shall be as defined in this section.

Users shall be able to override automatic selection and manually select any argument.

1. Restoration of automatic redundant data processing shall require manual action by a user.

Automatic and manual changes of the selected argument shall be reported as an event.

## 5. TAGGING

Tags are conditions applied to database values in order to call the users' attention to exception conditions for field devices and to inhibit supervisory control actions.

### a. Tag types and Supervisory Control Inhibit

The SCADA shall support the number of tag types and the number of tags to be set on an individual point per.

Each tag type shall be ordered by the Purchase to indicate its relative priority to other types.

The tag types shall be defined by NPC to correspond with its standard field device tagging scheme.

- (1) The definition shall include the tag type name (such as, clearance, warning, caution, hot line, and do not operate) and its supervisory control inhibit properties.
- (2) The control inhibit properties shall be selected by NPC for each tag type from the following:
- (3) All control allowed
- (4) Control inhibited in one direction, such as close
- (5) Control inhibited in the other direction, such as trip
- (6) All control inhibited.

- (7) The supervisory control function shall check for the presence of a control inhibit tag as part of the control permissive scheme defined in this Section.

#### **b. Tag Application**

It shall be possible to apply a tag to any database item.

A user shall place tags by selecting the database item to which the tag is to be applied and by then selecting a tag menu command.

The user shall be required to enter, for each tag, the following information:

1. Date and time of tag placement.
2. Tag type.
3. Substation and point identification (supplied by the SCADA).
4. A tag comments.
5. As part of the tag placement process, the SCADA shall prompt the user to enter alphanumeric comment information to be stored with the tag.
6. The comment field shall be at least sixty characters in length.
7. The user ID of the user applying the tag.
8. The user identification shall occur automatically by attaching the user login name.

Each tag shall be presented on a tag summary display.

1. The display shall normally order the tags by plants; however, the generic sorting and filtering capabilities.
2. A user shall be able to edit and delete tags from this display.
3. The user ID field shall be protected from editing.

Tag application, editing, and removal shall be recorded as events.

Each database item presented on a display shall have an associated attribute to indicate the highest-priority tag applied to the item.

1. An indication shall be provided that multiple tags are associated with the device.
2. Selection of the device tag indication shall bring up that page of the tag summary display presenting the tag selected.
3. If multiple tags are present for the item, that page of the tag summary display presenting the most recently entered or edited tag shall be presented.

### **6. Supervisory Control**

The SCADA shall issue supervisory control commands to field devices when directed by a user or an application program.

- a. While this Specification states that commands are sent to a "field device", the SCADA typically communicates with some intermediary device such as an RTU that operates the field devices or passes on the commands to the field device. Therefore, for the purposes of this section, the term "field device" shall be interpreted to mean the data source or other device communicating with the SCADA.

Control actions requested by a user shall include a confirmation step after selection of the field device to be controlled and the control action to be commanded.

- a. After the user confirms the control action, the supervisory control message exchange process shall be initiated.
- b. The message exchange with the field device shall use a select-checkback-execute command sequence if available in the protocol.
- c. The execute command shall be issued only if select and checkback messages are exchanged without error and if the checkback message indicates that the correct field device and control action have been selected.
- d. Any errors in the control command exchange shall be reported as alarms to the user and the command shall be cancelled.
- e. The select and execute messages shall not be retried.
- f. The control action shall be cancelled (the execute message shall not be sent), if, after selecting a field devices and control action:
- g. The user does not execute the control action within 20 seconds (a programmable interval).
- h. The user performs any workstation action other than executing the control action.

The supervisory control function shall perform a permissive check immediately after the user has selected the device and control action.

- a. If the permissive check fails, the control action shall be cancelled and a message shall appear.

Once a supervisory control action has been commanded, an indication that a control action is in progress shall be made in the database for that device.

- a. The indication shall be reset when the control completion check declares the action successful or unsuccessful.

The user shall not be prevented from requesting other displays, performing a different supervisory control action, or performing any other operation while the SCADA waits for a report-back on previously executed control actions.

SCADA functions shall not be suspended or delayed:

- a. While the user commands a supervisory control action.

- b. While messages are exchanged between the SCADA and the field device.
- c. After the command messages have been exchanged but before the control completion check has completed.
- d. Between the times that repeated incremental control execute commands are issued.
- e. However, supervisory control messages sent to field devices shall be given priority over data acquisition commands.
- f. Data acquisition commands delayed due to supervisory control commands shall be issued to data sources immediately after the supervisory control message exchange has been completed.

The following supervisory controls shall be supported in the SCADA.

**a. Single State Control (Relay Reset)**

The SCADA shall support the supervisory control of devices, such as under frequency reset relays, that can only be commanded to one state.

It shall not be possible to select a command into the second state for these devices.

**b. Two- and Three-State Control (Switching Devices)**

The SCADA shall support the supervisory control of devices, such as switches, that can be commanded to either of two states.

- (1) It shall not be possible to select a command to a third or fourth state for three-state points.

**c. Two- and Three-State Control – Delayed Close (Capacitor and Reactor Switching)**

Selected two- and three-state switching devices shall be designated as "delayed close" points.

The procedure for controlling these devices shall be the same as that of a switching device except that subsequent supervisory control actions for the same device shall be inhibited for a specified interval after the switch has been opened.

- (1) Commands subsequent to a close command shall be allowed immediately (without waiting for the delay).
- (2) If a user attempts to operate the device prior to expiration of the time interval, the error shall be managed as a permissive check failure.
- (3) The initial value of the delay shall be determined by NPC individually for every device subject to delayed close and shall be stored in the database with the definition of the control command.

**d. Incremental Control (Tap-Changing Transformers)**

The SCADA shall support the supervisory control of devices that can be incrementally moved ("jogged") to one of multiple states, such as the tap position of Load Tap Changing (LTC) transformers and the control settings of voltage regulators and static var compensators.

The initial selection and control of the device for an incremental operation shall follow the same sequence as for two- and three-state device control: select-checkback-execute.

However, it shall not be necessary for the user to reselect the device for additional incremental operations.

- (1) The user shall only have to repeat the desired number of incremental execute commands, which shall be performed immediately.

The user shall be able to cancel the operation at any time.

- (1) When cancelled, the selection of the device shall be reset.
- (2) The SCADA shall cancel the operation 20 seconds after a control execute has been issued or if the user performs any workstation action other than the control execute command.
- (3) The timer shall be reset with each subsequent control execute command.

Control actions that would result in movement of the device beyond its defined operating range shall be rejected (assuming that a position feedback value is telemetered).

- (1) The operating range shall be defined by NPC individually for each device and shall be stored with the definition of the device.

#### **e. Setpoint Control**

The SCADA shall support the supervisory control of devices, such as voltage regulators and var compensators, where the supervisory control command specifies the desired operating point as a continuous (not discrete) value.

The user command sequence shall allow the user to enter the desired operating point, typically in engineering units.

Control actions that would result in movement of the device beyond its defined operating range shall be rejected.

- (1) The operating range shall be defined by NPC individually for each device and shall be stored with the definition of the device.

#### **f. Automatic Supervisory Control**

The Automatic Supervisory Control (ASC) function shall permit multiple supervisory control commands to be programmed for automatic execution in a predefined sequence.

ASC commands to be supported shall include:

- (1) All supervisory control commands.
  - i. Wait for completion (with timeout).
    - a) If the control completion check is not received or does not have the expected value, the SCADA shall terminate the execution of the ASC sequence and shall declare an alarm.
  - ii. Proceed without completion.
- (2) Pause execution of the sequence for a given time delay.
- (3) Pause the sequence until a user commanded continue action.
- (4) Pause and wait for a condition (with timeout).
  - i. If the condition is not received or does not have the expected value, the SCADA shall terminate the execution of the ASC sequence and shall declare an alarm.
- (5) Conditional jump (pass control to another ASC sequence or continue with the current sequence).
  - a) Conditional jumps shall "nest".
- (6) Manual entry.
- (7) Stop (exit).

Execution of any sequence shall be based on AOR.

The SCADA shall not introduce any artificial delays in the execution of an ASC command sequence other than the pause and wait commands described above.

No limit shall be placed on the number of ASC command sequences that may execute in parallel at any time.

The following manipulation of ASC sequences shall be possible:

- (1) Display a catalog of the sequences.
- (2) Display, build, copy, edit, and delete a sequence.
- (3) Name the sequence and enter a description.
- (4) Store the sequence.
- (5) Select the sequence for execution.
- (6) Execute the sequence.

At any time during the execution of a sequence, the user shall be able to stop further execution via an ASC cancel feature.

Initiation of an ASC sequence shall be recorded as an event.

- (1) "Stop", "continue", or "cancel" commands shall also be recorded as events.

All control commands attempted to be initiated by the sequence or via programmatic initiation and whether the control was successful or not shall be recorded as events.

### **g. Control Completion Check**

The response to all control actions shall be verified by monitoring a feedback variable designated individually for selected devices.

- (1) If a feedback point is not defined for a device, the control completion check shall be deemed successful as long as the control command is successfully transmitted to the field device.

A report-back timer, independently defined for each device, shall be started when the execute command is issued.

- (1) The timeout value shall be adjustable from two seconds to at least ten minutes to a one second resolution.

During the report-back time, the user shall not be prohibited or blocked from other actions including display call-up, tagging, other supervisory controls, etc.

The user shall be provided with an indication that a control action is in progress, and a report of the result of the control action.

A control action shall be deemed successful if the appropriate success indication described below is recognized prior to expiration of the report-back timer:

- (1) For single-state, two-state, and three-state devices (including delayed close devices) – a status feedback point changes to the desired state.
  - i. The control action shall be reported as successful even if the change to the desired state is momentary.
  - ii. The data acquisition and processing functions shall then report the subsequent change away from the desired end state as an alarm.
- (2) For incremental control devices – an analogue feedback point changes to the desired value, within a tolerance, individually specifiable for every device.
- (3) For setpoint outputs – an analogue feedback point changes to the desired value, within a tolerance, individually specifiable for every device.

Successful controls shall be recorded as events.

Unsuccessful controls shall be annunciated as alarms.

- (1) The alarm shall differentiate between failures due to communications problems and failures of the device to achieve the desired end state.

For supervisory control commands issued as part of a group control or load shedding operation, the successful completion of each control actions shall be reported.

- (1) If any operation is unsuccessful, the user shall be informed of those devices in the group that failed to operate by individual alarms.

Where a supervisory control action is initiated by an application, the interface shall include features to report the success or failure of the control action to the application.

#### **h. Control Permissive**

Execution of selected supervisory control commands shall be dependent on passing a control permissive check.

The presence of any, all, or none of the following conditions for the selected device shall be deemed as a failure of the check:

- (1) The feedback point for the device is in the state to be realized by the control command.
- (2) A tag with a supervisory control inhibits property is set.
- (3) A status value from the SCADA database, designated for the device, evaluates as true.

Only selected devices will be specified with the permissive status value.

- (1) The permissive designation shall be specified by the user and stored in the definition of the device.

If the permissive check fails:

- (1) The user shall be informed of the failure by a message that clearly indicates the permissive failure and that differentiates among the check types.
- (2) The user shall be presented with the options of canceling the control action and of overriding the permissive.
- (3) If the user elects to override the permissive check, the message presented for the execute step and all records of the control action shall clearly indicate that the user has overridden the permissive check.

If the permissive check passes, the control sequence shall continue.

Where a supervisory control action is initiated by a Supplier/OEM- or NPC-supplied application, the interface shall include features to report the presence of a control inhibit tag and to accept override commands from the application.

#### **TS-6.4 Database Editor**

A database editor to define and maintain real time data as well as statics data shall be provided in the SCADA. The database editor tool shall include equipment configuration, I/O measuring-point configuration, function configuration, object configuration and AGC/AVC configuration.

The database editor shall be provided with a title bar, menu bar, tool bar, configuration switch area, status display area, project catalogue area, equipment configuration area, protection configuration area and object configuration area.

When it is under database configuration status, "database editing" window it shall include title bar, menu bar, tool bar, configuration switch area, status display area, project catalogue area, measuring-point area and measuring-point property area.

#### 1. Menu Bar and Tool Bar

A tool bar shall be provided with main menu for the database editing operation. The file menu shall include a process to "create object ( e.g. power plant", "save object including its branches ", "load object", "Compile object", and synchronize object with other nodes or simply copy an object with the other object" then "Exit" process

#### 2. Status Display Area

A status display area shall be provided on the right side of "database editing" window. Databases of different types in basic database display independently, and these databases mainly display all related information in database in form of list.

#### 3. Project Catalogue Area, Measuring-Point List Area and Measuring-Point Property Area

Project catalogue area shall cover project tree editing menu and project tree. There shall be an inverted tree structure diagram of project catalogue, which is called project tree. Project tree shall consist of "branches" and "leaves" of different level. There shall be "project root" on top of project tree. "Branches" and "leaves" are on the lower part of project tree. We can choose, edit, inquire or modify branch databases conveniently through project tree. Measuring-point area and measuring-point property area only appear after clicking "leaves" of project tree.

### **TS-6.5 Graphics Display Editor**

Tools to define and maintain displays shall be provided with the SCADA. The display "editor" shall support the definition of all of the displays in the SCADA and shall be that same tool used by the Supplier/OEM to develop displays provided by the Supplier/OEM.

#### 1. Display Style

All displays provided by the Supplier/OEM shall have a consistent layout and consistent rules of operation (also known as a consistent "look and feel").

- a. Each display shall be consistent in its use of graphics, commands, menus, colors, poke procedures, and data entry such that data similar in appearance shall have a consistent meaning throughout the SCADA.
- b. The previous requirement shall apply to displays provided from the Supplier/OEM's standard offering and displays developed specifically for NPC as part of this contract.

The Supplier/OEM shall submit to NPC a display style guide.

- a. All displays produced by the Supplier/OEM as part of their standard product shall comply with this display style guide.

NPC will develop a style guide for displays.

- a. At NPC's option, any displays produced by the Supplier/OEM for this project, excluding displays to be incorporated into the Supplier/OEM's standard product, shall be produced in compliance with this style guide.

## 2. Display Generation and Editing

An interactive display generation and editing tool shall be provided for creating the operational displays and interfaces associated with each application.

- a. The user shall use this tool to draw (rather than code) the contents of application windows, define dynamic linkages to any SCADA data, and sensitize display elements to respond to user input actions (such sensitized elements are typically referred to as cursor targets and function keys).
- b. The ability to link to any SCADA data, not only real-time data, shall allow interactive graphic displays to be constructed for all applications in the SCADA via the display building tool.

The display editor shall be used to construct new displays and modify existing displays.

The editor shall support displays constructed as world coordinate spaces and displays constructed as fixed spaces (displays built to a fixed coordinate space, which can be translated but not scaled).

The display editor shall be fully compatible with the database generation and editing function.

The display editor shall be fully interactive and shall provide "What You See Is What You Get" (WYSIWYG) capabilities. The display editor shall maintain a complete audit trail of edit activity as part of software configuration management. New displays shall be constructed beginning from a blank display, from an existing display definition, or from display templates within a library.

The editor shall support the creation of libraries of standard and custom symbols or components to be created, modified, and used to facilitate the editing process. Symbols can be modified after which all instances with that symbol show the modified symbol.

Each instance of a symbol can be rotated and scaled, without modifying the symbol itself. The editor shall be designed such that any future display requirements may be readily added to its functional display definition capabilities.

The display editor shall support the listing, dumping, reloading, and validating of display definitions.

- a. The list function shall provide for partial and full summaries (directories) of displays cross-referenced to their use in applications.
- b. The list function shall also produce detailed documentation of the contents of any display showing all elements.
- c. The list function shall also provide tools to find on which displays a given piece of data is referenced.
- d. Dumping and reloading of displays shall be provided for individual displays, display libraries, individual applications, or an entire application system.
- e. The display editor shall produce displays compatible with every workstation of the SCADA.
- f. NPC shall not have to develop multiple versions of displays for each type of workstation or for different GUI products included with the SCADA.
- g. The display editor shall support, as a minimum, the following construction features:
  - (1) Editing features to copy, move, delete and modify selected individual items and groups of information and to undo/redo the previous actions.
  - (2) Building a display at any scale (zoom) level.
  - (3) Visible and invisible snap-grids at specifiable increments with (selectable) snap-to placement of objects on the grid.
  - (4) Various font types and sizes, line types, and line thickness.
  - (5) Bold-face fonts shall be possible in displays, and may not disappear at data imports.
  - (6) Linking of any defined graphics symbol to any database point.
  - (7) Pop-up menus for selection of points for linkages by default.
  - (8) The user, however, shall be able to request a menu list of all available points.
  - (9) Ability to establish different symbol or display conventions for the same database point on the same or on different displays.
  - (10) Definition of dynamic display linkages to any SCADA database variable on any SCADA display.
  - (11) Building and modification of display icons and store them in an easily accessible library.
  - (12) Protection of any data field on any display against user entry based on log-on identifiers
  - (13) Activation of displays within any application system or across all application systems by a simple procedure that causes no noticeable interruption of on-line SCADA activity.
- h. A scripting tool to facilitate the modification of displays to incorporate NPC changes on top of any Supplier/OEM product upgrades and to port existing NPC displays and third party products into the Supplier/OEM's system.
- i. Using AutoCAD drawing files in .dxf format as input. Such files shall be directed to specific layers of a world coordinate display where they shall become static display elements.

If a display definition is stored in multiple locations (for example, a copy in each workstation), a validation function shall be provided to ensure that all

definitions over all workstations in all component systems are consistent and up-to-date.

### 3. Display Elements

Displays shall be composed of the following display elements:

- a. Text.
- b. Drawing primitives (polylines, polygons, arcs, circles, ellipses, etc.).
- c. Bit-mapped images including TIFF, JPG, PNG, GIF etc.
- d. Formatted data items
- e. Display macros
- f. Display layers
- g. User interaction features
- h. Extensive Graphic Library - Includes plentiful industry-specific images, symbols, polygons, and data-driven animations. Import BMP, JPG, WMF, and EMF formats by dragging them from your desktop.
- i. Photo Realistic Background Tiles - Create a consistent look and divide pages into areas of interest. Drag on and resize at least 100 patterns.
- j. Lighting Overlay Tiles - Add depth and help direct the focus of operators
- k. True Color SCADA - To help create vibrant looking displays and reports, shall supports 24-bit/32-bit 'true color'. Use the color selector to pick from more than 16 million colors. Script functions shall also support true color graphics.

Drawing primitives and text shall refer to common graphic attribute definitions for color, line width, fill pattern, et al. Text shall also refer to fonts.

### 4. Data Presentation

The user, during the interactive display definition process, shall logically identify individual dynamic data fields and data arrays in defined displays.

- a. All linkages to the database necessary for ensuring the proper retrieval and output of the dynamic data or data arrays during actual use of the display shall be automatically established according to this identification.
- b. The linkages between the displays and the database shall be by logical identification (for example, point name or point identifier) and shall be designed such that any database modifications (even those resulting in insertions into tables/files and changes in table/file sizes) do not require redefinition of existing displays.

Data fields shall reference all supported formats.

- a. These formats shall include programming language-equivalent data-to-ASCII conversions, plus all general GUI style elements (for example, radio boxes, menus, and sliders) and a special set of formats appropriate to the SCADA context.
- b. Formats shall be conveniently definable and modifiable.

It shall be possible to present any item in the database on any display.

- a. Database items shall be displayable anywhere on the screen, excluding dedicated screen areas such as the display heading.

- b. There shall be no limitation on the number of data items presented on any display, up to the physical limitations of the window or screen.
- c. Screen locations for cursor targets shall be unrestricted.

Database items shall be presented in the following formats as appropriate:

- a. Numerical text that presents analog and accumulator values. The format definition of the text shall include the number of characters, number of decimal places, and the use of sign or flow direction arrows.
- b. Symbols, including alphanumeric text strings for a single item, based upon the item's state for all defined states.
- c. Symbols, including alphanumeric text strings for multi-state items, based on flag fields where each flag represents a condition or a state and where multiple states may be true at any time (for example, data quality flag fields for both telemetry failure and alarm inhibit may be simultaneously set for an item).
- d. X-Y and X-t point relationships with vectors connecting the points; for example, trending and Kiviat plots.
- e. Filled polygons (x or y axis inside the polygon showing the percent of full scale of the variable); for example, bar charts.
- f. Filled arcs; for example, pie charts or simulations of meter movements.
- g. Colors, textures, and blink conditions based upon state or value changes or a change of data quality; for example, alarm limits.

Combinations of the actions listed above; for example, change a bar chart color when the data value exceeds the limit.

## 5. Quality Code and Tag Presentations

The quality code reflects the condition of the data on the display.

- a. When more than one condition applies to the data, the highest priority condition, as determined by NPC defined priority sequence shall be displayed.
- b. NPC shall determine the presentation of each quality code.
- c. Color, appended symbols, and other display features may be used.
- d. It shall be possible to construct multiple representations for a data item and its quality codes such that the presentation of data may be optimized for a particular display.

A separate indicator shall be used to reflect the tag status of a database point.

- a. Tags are defined in subsection Tagging.
- b. When more than one tag applies to a point, the highest priority tag, as determined by a NPC defined priority sequence, shall be displayed.
- c. NPC shall determine the presentation of each tag.
- d. Color, appended symbols, and other display features may be used.
- e. It shall be possible to construct multiple representations for a data item and its tags such that the presentation of data may be optimized for a particular display.

## 6. Display Layers

World coordinate displays shall be constructed in layers.

1. Each layer shall be a self-contained world co-ordinate space onto which display elements, including data, shall be placed.
2. Layers shall be displayed in a defined order, with higher-order layers overlaying lower order layers.

3. Where displayable elements of a multiple layers occupy the same space, the higher-order layer elements shall be displayed. Otherwise, the elements of the lower-order layers shall be visible.

The selective presentation of layers – “decluttering” – shall be controlled by the scale (zoom) level and by user selection.

- a. Each layer shall be visible over a range of scale level set defined as the display is built.
- b. As the user scales the display, layers shall be presented or removed from presentation.
- c. It shall also be possible for the user to override the automatic selection of layers and to select those layers presented at any time.

## 7. User Implementation

Cursor targets shall send a message to an application or issue a command when events (such as a user action) occur.

The SCADA shall support the following commands via user interaction:

- a. Call a display (in the window of the calling command or in a new window as defined for the command).
  - (1) Page forward and backward commands shall be considered special cases of display call interaction, where the sequence of displays shall be part of the display definition.
- b. Initiate a program. (Programs may be a SCADA application, operating system, utility, or third-party program.)

Such commands shall convey both fixed and contextual data.

- a. As a minimum, supported contextual information shall include:
  - (1) Record identities linked to the cursor target.
  - (2) Cursor position on the screen and within the display.
  - (3) Database, application, and application system associated with the display.
  - (4) List position (for lists).
  - (5) Workstation and user identification and any associated parameters.

Conditional attribute values shall be attached to any display element, primitive, or macro.

- a. Conditional attributes shall be able to make a particular display item valid or invalid depending on whether the referenced data or display context is in a specified state.
- b. Multiple cases shall be supported so that, for example, a data item may appear in one color if it is in range, another color if it is below range, and a third color if it is above range. Other examples of some of the attributes of power system entities that can be color-coded are states (in service/out of service/manually overridden, etc.) and values (real time, state estimated, unavailable, good, bad, manually overridden, etc.).

The SCADA shall support “pop-up” and “pull-down” menus for user interaction.

- a. Those menus supplied with the SCADA shall be extensible by NPC to incorporate new features and applications developed by NPC.

- b. The capability to add additional items to existing menus, to define entirely new menus, and to link the call-up of new menus to specific user actions shall be provided.
- c. The menu items, when selected, shall pass messages to applications including fixed and contextual data as described above.

### **TS-6.6 Report Generator**

A report generator shall be supplied for report creation and modifications. This utility shall support the creation of reports from all databases and files of the SCADA. The following describes the minimum capabilities of the report compiler utility:

1. Report addition
2. Report modification
3. Report deletion
4. Scheduling periodic output
5. Output device assignment
6. Report headings
7. Enable/disable printout of data quality flags.

The format of each report shall be defined via the report generator. Some reports, however, may be dynamically generated. A special printout for each report shall be available for output with all associated interfaces to the database identified in a readable format.

Reports for a specified period of time shall be complete for the period (e.g., a daily report shall be all inclusive of data between the hours of 00:00 through 23:59). The report output function may execute at a reasonable period (approximately 5 minutes) after the hour mark or other designated run-times.

The report generator shall support laser printer outputs, including the use of all supplied or future acquired fonts.

Reports shall be drafted in two ways. On one hand process representations can be specially drafted to be used as a report. The structuring is just as for regular process representations however these report process representations can also be automatically printed in the background without being displayed on the operator's workstation.

Beyond this, an add-on to Microsoft Excel is implemented allowing tabular and graphical reports drafted directly from the archived data and online data. Excel is thereby used both as the report drafting tool for report templates and as an output tool for the reports. All mathematical and statistical functions as well as the complete Excel range of possible graphical outputs/charts and diagrams should be available.

Reports can be generated manually, value-triggered or time-controlled. In addition to displaying and printing reports, an HTML report can also be automatically generated which is then be published on the internet or the intranet. It is also possible to have a generated report automatically sent by email after it has been created.

The scripting tool as define in section 3.8 shall be able to create and generate customized report base on customers requirement.

The SCADA shall be provided with a variety of pre-defined report types designed to analyze the performance of the equipment comprising the physical system of the power house . Most can be used across a wide variety of industries while others are intended specifically for power plant. Any number of additional custom reports can be defined and saved.

1. Analog Summary Report - The average, minimum, maximum, and total values for selected analog tags within a configured period.
2. Daily Snapshot Report - A "snapshot" of each included tag's value, at a specified time and date.
3. Daily Total Report - The sum of values accumulated for each selected set of tags in a specified period.
4. Detail Report - Shows the values recorded for each selected tag, within the given time period.
5. Driver Communication Error Detail Report - Driver error activity, recorded over a specified period.
6. Driver Communication Summary Report - A history of driver activity for a specified time period.
7. Hourly Snapshot Report - A "snapshot" of selected tag's value, every 60 minutes in a specified time.
8. Hourly Total Report - The sum of the values accumulated hourly for selected tags in a specified time.
9. Standard Report - Shows all the values logged for a tag over a chosen time span.

The SCADA shall be designed keep the process history safe accessible. That includes making this data available to third-party business systems and reporting packages to facilitate more complex needs, such as state-specific compliance reports. The SCADA shall support the following standards:

1. ODBC Server
2. Excel Add-In

The SCADA shall have the capability to interface third party industrial reporting solutions like XLReporter® and Dream Report® etc.

### **TS-6.7 Historian**

A data historian database shall be provided to efficiently collect and store process data from a SCADA system. These stored data can then be used to display trends of process data on charts, create reports, and perform data analysis.

The Data historian shall be characterized as follows:

1. Historian shall be an integrated component of SCADA database management.
2. The historical data shall be efficiently stored in a data format packs that more data into every megabyte of hard drive space for long-term data storage and no more archiving required if possible.

3. Historian Status Monitoring Widget shall provide instant status of write and storage rates. When write rates exceed storage rates, data is automatically buffered and written in burst mode when the historian connection is available.
4. The historian shall be able to logged data into a variety of user interfaces while operators can create their own ad-hoc trends and reports.
5. It is possible that data shall be stored directly to the historian at the time of trigger occurrence.
6. The SCADA shall have the capability log on change, on related event (can be used for disable/enable), on time/sample period, or on operator actions (e.g., manual data entry, setpoint change, or control action).
7. Upon request, the Historian analyzes raw tag data and provides time-series summary data, based on a user-definable duration divided into time slices.
  - a) Time-weighted average (analog)
  - b) Minimum (analog)
  - c) Maximum (analog)
  - d) Change in value (analog)
  - e) Value at start (analog)
  - f) Time of Minimum (analog)
  - g) Time of Maximum (analog)
  - h) Totalizer (analog)
  - i) Interpolated (analog)
  - j) Diff between start and end (analog)
  - k) Zero to non-zero transitions (digital)
  - l) Non-zero time (digital)
8. The SCADA system shall support any number of historians for a single application. Each one can be configured to store data for a different geographical and functional area. Each tag may store data to one Historian. The SCADA shall allow to configure redundant third party relational databases such as Microsoft SQL, Oracle, and MySQL to share data from the historian.
9. Redundant Historians shall use the same schema. SCADA shall use timestamps to ensure that each data-point is identical down to the millisecond. Should the primary database server fail, associated workstations and Thin Clients seamlessly switch to the next designated database. When restored, historical data automatically synchronizes across a local or wide area network.
10. Real-time synchronization shall be provided to ensure history shall safely distributed across all redundant servers
11. The SCADA system shall be able to easily shares data with third-party business platforms. It shall have the capability to import the history from an old legacy system.
12. The SCADA System shall provide a method to detect tampering or corruption of the database. Logging in to a redundant third-party database shall need strict security control as provide by the manufacturer's instructions.
13. SCADA system shall make it easy to share real-time and/or historical data with third-party software platforms via these industry standard protocols and methods.
  - a) ODBC Server - Allows to use popular software like XLReporter®, Dream Report®, Crystal Reports®, Access®, or Excel® to extract SCADA system data. SCADA acts as a database where each logged

tag represents a table of timestamps and values that reporting software can query to retrieve logged values.

- b) Third-Party Reporting - Third-party reporting products, such as e.RIS®, XLReporter®, and Dream Report®

### **TS-6.8 Scripting Language**

A scripting language shall be provided and shall be integrated into the system to realize complex operational sequences, dialogues, data manipulations, etc.; this language shall both available on the user interface and as an independent autonomous process module.

The scripting language shall support multi-threading (quasi parallel execution of code sections on common data and objects within a single program). Moreover, adjusted data types for manipulation of process data points are provided. Through execution as a fast interpreter, it is no longer necessary to have several compilation runs hence allowing changes on a running system. Compiling is only needed in a few scenarios regarding UI presentation.

The language shall be easy to handle by provided tools like autocompletion of known and defined commands and modules. Furthermore, a debugger tool shall be provided that should be implemented to find step by step development support and be able to define break-out points to scripts stopping them at a certain line. The debugger tool can help finding bugs in manager communication as well as in existing scripts.

The scripting tool shall have the ability to create code layers. This allows you to develop an extensive set of customized objects (including graphics, functions, displays and reports) and reuse them in any application. This saves considerable development time by allowing you to create multiple applications all based on a template of error-free objects. If you make changes to a code layer, you can easily update applications built upon that layer.

The scripting tool shall be able to perform data calculation as define in subsection of SCADA functionality.

### **TS-6.9 Sequential Control Editor and Debugging Tool**

In the control of hydropower plants, the mode of control operation as sequential control is commonly applied. Thus, the SCADA shall be provided with this kind to tool to provide safe and reliable operation of hydro units. This, the sequential control flows, or equipment operation locking conditions provided shall be presented in the form of flow charts. This flow chart is a kind of presentation widely used for describing a particular control flow. It describes a sequential control process with specified graphs. This approach is direct, convenient, and easy to be accepted by users. A flow chart provides a simple and graphical process description. For sequential control, it is the most natural language. So long as the flow chart has configured the complete process of a control, the corresponding control program is completed. This system provides a direct and interactive approach of generating the sequential control program for hydropower plant

operation. By applying this programming method in engineering application, the realized sequential control will be more convenient.

### **TS-6.10 Automatic Generation Control**

The SCADA system shall be provided with the Automatic Generation Control Capability. The main objective of the AGC is to control the active power of the whole power plant rapidly and economically and to meet requirements in multiple aspects of electric power system under the constraint of meeting various kinds of safe generation operation. The Automatic Generation Control (AGC) for power plants shall be provided with different control mode as follows:

1. Control by Load Curve
2. Control by Frequency Modulation
3. Control by Given Load

### **TS-6.11 Automatic Voltage Control**

The SCADA system shall be provided with Automatic Voltage Control (AVC) capability. The objective of AVC is to follow the different operation modes and operating condition to make a real-time control decisions for the unit in the whole power plant in case various safety constraints for power station and units are met, so as to automatically maintain the bus voltage or the reactive power of the whole plant at a current set values, properly distributed the reactive power of each generating unit in the plant, and finally improve the overall auto operation level of the power plant.

The Automatic Voltage Control (AVC) for power plants shall be provided with different control mode as follows:

1. Constants Value
  - a. Control the Distribution of reactive load in the whole plant by total reactive power for the whole plant given by the central dispatch/locally
  - b. Distribute the whole reactive in accordance with the bus voltage given by the central dispatch/locally so that the bus voltage of the power plant will be kept at the given level.
  - c. Distribute the whole reactive in accordance with the bus voltage increment given by the central dispatch/locally so that the bus voltage of the power plant will be kept at the given level.
2. Curve
  - a. Distribute the reactive power of the whole plant by the current value of voltage curve given by the central dispatch/locally so that the bus voltage will be kept at the curve set value level.

## **TS-7.0 USER INTERFACE REQUIREMENTS**

The principal interface between users and the SCADA shall be the workstations or a desktop. Printing devices and a video wall screens system will also be part of the interface between the users and the SCADA.

The following definitions shall apply:

1. Workstation/Desktop – A workstation/desktop is an operating console consisting of one or more monitors and user interaction devices.
2. Screen – A screen is the full physical display area of a monitor.
3. Window – A window is that area of a screen where a display is presented.
4. Display – A display is the image selected by the user for view on a screen or within a window. A display may be part of a world coordinate space.
5. Cursor Targets – A pushbutton-like area on displays that the user "operates" (typically, by pushing a mouse button) to interact with the SCADA.
  - a. The response of the SCADA to operation of a cursor target may vary depending on the user action used to operate the target (different mouse buttons may produce different responses).
  - b. These shall include the ability to define "hypertext" or URL-addressable links. These links may be inserted directly on the display (similar to present "poke-point" linkages to other SCADA displays) as well as being able to be included as menu items for various functions. The URL may link to anywhere in NPC's SCADA network.
  - c. Cursor targets are interchangeable with function keys – physical pushbuttons on a keyboard or mouse that initiate actions when operated by a user. The terms are used interchangeably in this document.

### **TS-7.1 Thin Client User Interface**

The primary User Interface (UI) for the SCADA shall maximize use of "thin client" (server-based computing) technologies so as to permit automatic centralized maintenance and administration.

This shall be accessible from any secure location on NPC's secure SCADA communication network.

Users external to NPC's secure SCADA communication network shall use a similar interface through a specially configured environment that includes the capability for NPC to define additional functional restrictions (e.g., "view-only").

This fully functional UI shall meet the following design guidelines:

1. Pages shall load quickly, i.e., the display response requirements of as defined in this Technical Specification.

2. Displays shall have a consistent look and style. Use of colors and fonts shall be applied consistently. Control buttons, navigation aids, message windows and any other window functions shall have a consistent appearance, function, and location.
3. Navigation aids shall be provided to enable users to easily determine which display is being viewed and to facilitate movement around the current display and to other displays
  - a. Users shall be provided with positive, visual feedback when they make a selection, which remains visible until the request is completed or until they make a new selection
  - b. Dynamic and real-time information on the displays shall refresh at a rate configurable by an authorized programmer/engineer, from 2 seconds to 1 minute.
  - c. Audible alarm annunciation shall be provided

Location independence is a key requirement of this primary user interface. Access to displays, data, reports, applications, etc. shall be governed by SCADA Access Security and not by where the user is physically located.

All third-party software used to provide this functionality shall be identified and the implementation shall not be dependent on the use of a specific browser.

## **TS-7.2 User's Interface General Interface**

The graphics system supplied with the SCADA shall execute on all workstations/desktop provided by the Supplier/OEM and on NPC-supplied personal computers running a Microsoft Windows or other vendor preferred operating system using commercially available GUI software products.

NPC shall build a display only once, after which it shall operate on any workstation.

NPC shall not have to develop multiple versions of displays for each type of workstation or for different GUI products included with the SCADA.

The following features shall be included in the SCADA user interface; however, alternatives may be offered, but must be functionally equivalent to the features specified.

### **1. Common UI Features**

The user interface shall include the following common elements on each workstation and other portable device, screen, or display (as required):

- a. Time and date shall be presented on each workstation, not necessarily on each screen or display, and shall be always visible.
- b. When replaying historical data in one or more windows, the windows' border color shall change and the date/time of the data being presented shall be displayed in the window frame.

- c. User login and an indication of the user's assigned areas of responsibility shall be displayed in the window frame.
- d. An alarm window, shall be presented on each workstation and any portable device.
- e. An indication that audible annunciation of alarms has been suppressed
- f. A heading at the top of each user-defined window consisting of the unabbreviated name of the display, the abbreviated display call-up name, and, on multipage displays, a page number in the form Page N of M.
  - (1) The source of the data and application shall be clearly indicated on the window heading or frame and the window border color shall be changed.
  - (2) A navigation aid for each display that is larger than the window in which it is presented.
    - i. The navigation aid shall be a condensed map of the full display.
    - ii. It shall be located in the lower right hand corner of the screen and pertain to the display in the active window.
    - iii. Highlighting within the condensed display shall indicate the portion of the display that is currently presented.
    - iv. The user shall be able to move, resize, and close the navigation aid.
  - (3) A means for the user to enter and edit free-format text notes or memo related to any display shall be provided.
    - i. The notes or an indication of the presence of notes for each display shall be presented each time the display is called.
    - ii. If an indication is present, the notes shall be called via a single user action
  - (4) An area for the presentation of user guidance messages and an area for the presentation of user help.

The different system statuses shall be very visible in the displays, using e.g. border colors and texts.

It must be clear to a user that after a button was clicked the process is started by showing an indication (e.g. hourglass or message).

## 2. Windows

"User-defined" windows shall be those windows under the control of a user. (Within this specification, the term "window" refers to a user-defined window unless otherwise indicated.)

- a. User-defined windows shall be in addition to those that may be required for the common display features.
- b. Each thin client shall support the simultaneous presentation.
- c. The combined screens of a thin client shall be managed as a single screen or "desktop".

- d. The capability to have windows open at any position within the desktop and moved continuously from screen to screen across the full desktop shall be provided.
- e. When a window is "maximized" it shall only fill the monitor where the window is currently opened.
- f. If a "pop-up" dialog box is presented on the thin client, it shall be placed on the same monitor where the request was issued.
- g. When a "pop-up" or other dialog box is presented on the screen it shall not cover the location on the screen where the operation was executed.
- h. The window for a function output shall be different than the window for the function execution.
- i. The presentation of any display in any window shall be allowed.
- j. Window position and dimensions shall be independently adjustable to a resolution of four pixels or less.
- k. The capability to minimize windows, reduced to an icon representing the display, "restored" to the size and position immediately prior to minimization, and "maximized", expanded to the full area of a screen or desktop, by simple user actions shall be provided.
- l. The capability to close windows as long as one window remains open on every screen shall be provided.
- m. Efficient techniques for opening, closing, and switching between windows on a screen or desktop shall be provided.

The system allows snapshots of the windows to be made and stored, including editing and updating the snapshot and adding notes to the snapshot.

### 3. Display Selection

Rapid, convenient, and reliable selection of displays shall be provided using the following methods:

- a. Selection from a menu display.
- b. Cursor target operation on any menu, graphic, or tabular display.
- c. Selection of an alarm on an alarm summary or the alarm window followed by a display request command.
- d. Selection of an indicator in the alarm window.
- e. Entry of a display name in a display select field.
- f. Forward and reverse paging through a series of displays.
  - (1) Paging forward from the last page of a series shall present the series' first page.
  - (2) Paging backward from the first page of a series shall present the series' last page.
- g. Operating a display recall cursor target in a window.
  - (1) This shall cause the display that was on view immediately prior to the current display to be recalled.

- (2) The most recent displays called within the window shall be stored in a circular recall list and that successive recall actions recall progressively “older” displays.

The user shall be provided with window selection techniques to independently direct a display to any window at the workstation.

#### **4. List Display**

Certain displays shall present data in a text “list” format. That is, a tabular format consisting largely of rows of similar entries. Reports presenting time-sequenced data, alarm summary displays, and application program results are examples of list displays.

The SCADA shall support the following techniques for moving through the data presented on list displays:

- a. Scrolling via slider bars.
- b. Paging up and down (not to be confused with forward and reverse paging)
- c. Entry of a page number.

Paged displays (as opposed to scrolling displays) shall include a “page M of N” message on each page of the display. Empty pages – pages with no entries – shall be removed from the page sequence.

Generalized filter (search) and sort commands shall be available on list displays.

#### **5. Scaling and Translation**

The user shall be able to scale (zoom) the image of a world coordinate space or other display in a smooth fashion.

- a. The scale factors shall allow the presentation of an entire world coordinate space or other display on the full screen or a window.
- b. Static and dynamic data shall be displayed and updated during a scaling operation, and display text shall be scaled to be consistent with the scaled image.
- c. In case texts and symbols have different zoom patterns, this may not cause texts or symbols to overlap other texts or symbols.
- d. At defined scale factors, levels of declutter shall be invoked.

The user shall be able to select an area of a world coordinate display by cursor manipulation (“rubber-banding”) and cause the display to be redrawn with the selected area centered in the display and with the selected area magnified to best fit the full window. The window dimensions shall not be changed by such an action.

The user shall be able to translate (pan) the display image to permit the observation of other portions of a display within a selected window. Static and dynamic data shall be displayed and updated during a translation operation.

## 6. Supervisory Control Initiation

Supervisory control actions shall be initiated through dialog that present commands dependent on the type of element to be controlled.

- a. As the final step of the supervisory control process, the user shall be presented with a clear description of the device to be controlled and the specific command to be issued and shall be required to confirm the command ("execute") or terminate the command ("cancel").
- b. The SCADA shall issue the command to the end device only after the user confirms the operation.

The supervisory control procedure shall support the control permissive check and other control interlock requirements.

## 7. Data Entry

User entry of data shall be facilitated by simple procedures to select the point or points to be entered, enter the value or values, validate the changes, and to confirm or cancel the entry.

Data entry may use full window or single point techniques as appropriate.

- a. The full window entry mode shall be initiated by user action and shall simultaneously affect all points on the display within the window for which data entry is possible.
  - (1)The SCADA shall respond by suspending the updating of the display and highlighting all points on the display that may be entered.
  - (2)The user shall then enter the new values and request entry of the values.
  - (3)The value appearing in the entry field shall be the value processed for entry into the database.
  - (4)The SCADA shall perform any validity checks appropriate to the affected points.
  - (5)If there are no invalid entries, the new values shall be written to the database.
  - (6)If there are invalid entries, the invalid entries shall be highlighted and the user presented with the option of correcting the entries or accepting only the valid entries.
- b. Single-point data entry shall be initiated by selecting the point to be entered and commanding the data entry mode.
  - (1)Only the selected point shall be placed in the data entry mode.
  - (2)The remainder of the entry procedure shall be as for full-screen entry.

All entered data, particularly free-format text fields, shall be checked to ensure that they contain only valid characters, do not contain embedded program codes, are of the proper format, and are within the expected length of the entered field.

While entering a value for a variable that can be selected from a list, the SCADA will automatically complete this value with the first value from this list.

## 8. User Action Recording

All user actions that change SCADA data or operating conditions shall be recorded as events, except for the following:

- a. Actions that request displays or modify their presentation, such as scaling, translation, paging, scrolling, relocating windows, and resizing windows.

Each event record shall include:

- a. The login identity of the user.
- b. The time and date of the action.
- c. A complete identification of the database point affected.
- d. A clear (non-coded) description of the action.
- e. The value, state, or condition of the item changed before and after the action.

## 9. Interlocks

Although the same display may appear concurrently in multiple windows at multiple workstations, data entry for that display shall be restricted so that multiple users will not produce conflicting actions on a given value.

If a display is in the full-window data entry mode in one window, an attempt to initiate the data entry function for that display in another window on the same or another workstation shall result in rejection of the second attempt to enter the data entry mode and the second user shall be informed of the conflict.

Control of a power system device, management of a single point (such as suspending data acquisition for a point), and single-point data entry shall only be allowed from one window at one workstation at a time.

Concurrent user action on different areas of a world coordinate map or other display and concurrent supervisory control, data management, and single-point data entry of different points on the same display shall be allowed.

## 10. Memos

Users shall be able to define and attach memos that contain free-form text and graphics to displays.

- a. After definition of the memo contents, the user shall attach the memo to any location within a display.
- b. A unique icon or indicator shall be provided that will visually highlight to the user that a memo is assigned to the display.
- c. The memo icon shall be visible at all declutter levels.
- d. The ability to copy a memo and paste it to another display shall be provided.

Text and graphics entered as memos shall be checked to ensure they contain only valid characters and codes, that they do not contain embedded program codes or instructions that will be inadvertently executed when the memos are displayed, and are within the expected length of the entered field.

## 11. Inactivity Timeout

The progress of all user operations shall be monitored.

- a. If a user does not complete to a step within a multi-step operation within a pre-defined time, the process shall reset, and the user shall be informed of the reset.
- b. A partially completed action shall be reset if the user begins another non-related sequence.

A second inactivity timeout, constrained to be no shorter than the above timeout, shall blank the screen (i.e., "screen saver") upon timeout.

- a. This "screen saver" function may be turned off by the individual user.
- b. The "screen saver" shall not disable the audible alarm capability of the workstation.
- c. Any user activity, including keyboard or mouse actions, or occurrence of an alarm shall bring the display on view immediately prior to the timeout back to view.

## 12. User Guidance

The SCADA shall respond to all user actions indicating whether the action was accepted, was not accepted, or is pending. For multi-step procedures, the SCADA shall provide feedback at each step.

Indications such as text messages, color changes, and blinking shall provide this feedback.

## 13. User Help

General and specific context-sensitive on-line help shall be available to the SCADA user.

Access to user help shall be available by:

- a. A Help command on the window menu bar.
- b. A Help button in a dialog box.
- c. Topics from a Help menu.

The Help menu shall present a list of topics available for reference.

- a. The topics shall refer to the SCADA user documents.
- b. The ability to scroll through the topic's explanatory text shall be supported.

The Help button in a dialog box shall present the text of the SCADA user documents where use of the dialog box is explained.

- a. The user shall be able to scroll through this text.
- b. Exit from the help facility shall return the user to the same point in the sequence for which help was requested.

Context-sensitive help facilities shall be provided for each application software package and the database fields.

- a. The capability to easily edit or add additional help facilities in the future shall be provided.

All help files and other documents used by operators and support staff shall be locally contained on the delivered system(s).

- a. No external network access shall be required to access any necessary help or support documentation.
- b. HTML versions of the Help documents supplied shall be free of any embedded virus or other mal-ware codes.

These shall be available to the user at any work position within the SCADA.

#### **14. User Layout**

Each user shall be able to save a set of user layouts.

- a. A layout shall include what windows assigned to which screens and what displays are assigned to the windows.
- b. Window size and location shall also be saved, as shall any user selectable characteristic of the display in effect (e.g., filters, sort order, visible columns, etc.).
- c. Up to twenty sets of layouts per user shall be saved.

#### **15. User Login and Account Management**

Requirements to user login and to account management are shall be provided.

#### **16. Areas of Responsibility**

Once logged on, access to the SCADA capabilities shall be managed by assigning a set of areas of responsibility (AORs) to individual users. There shall be no restrictions on the assignment of multiple AORs to a user or the assignment of an AOR to multiple users. Each AOR assignment shall be further defined as either read-only or read/write.

- a. Read-only access shall preclude user interaction with the display other than to request another display.
- b. Read/write access shall allow full interaction with the display, subject to function, database, and supervisory control AOR.

The access security validation procedure shall follow a hierarchy of AORs:

- a. Displays – Each display shall be assigned to a single AOR.
  - (1) The presentation of each display shall be limited to user's assigned to that AOR, even though access to the functions, data items, or supervisory control devices presented on the display may be allowed.
- b. Functions – Each function shall be assigned to a single AOR.
  - (1) Access to the facilities of any function shall be limited to selected users even though access may be permitted to a display from which such facilities could be exercised.

- (2) The means by which displays, reports, and databases are defined and modified shall be considered functions, as well as functions that manage the software configuration of the SCADA.
  - (3) These functions shall be subject to the same access security validation as other functions.
  - (4) Management of AORs shall be a function itself subject to validation.
- c. Database Items – Each database item shall be assigned to a single AOR.
- (1) Attempts to manage any database item shall be denied if the item's AOR does not match the user's AORs.
  - (2) Database item management regulated by the operating AOR scheme shall include:
    - i. Enabling and suspending acquisition, calculation, and processing.
    - ii. Inhibiting and enabling alarm processing.
    - iii. Manually substituting a value.
    - iv. Overriding a limit.
    - v. Managing alarms, including alarm acknowledgement and deletion.
- d. Supervisory Control Devices – Each database item for which supervisory control has been defined shall be assigned to an AOR (for the supervisory control action, separate from item management assignment).
- (1) Similar to database item access controls, attempts to initiate supervisory control actions shall be denied if the supervisory control database item's AOR does not match the user's assigned AORs.
  - (2) Access to supervisory control facilities shall encompass not only the control, but also access to the control inhibit (tagging) feature for the database item.
  - (3) Control of the SCADA hardware configuration shall be considered a supervisory control procedure.

The access security function shall insure that each AOR is at all times assigned to at least one user.

- a. If an AOR is not assigned for more than a configurable amount of time (initially, 5 minutes) suitable alarms shall be generated.

### **TS-7.3 Alarm and Event Processing**

Alarms shall be conditions that are annunciated to users when detected and that require user action.

Alarms may be generated by any SCADA function, including the processor and device failure detection functions.

- 1. Alarms, when initially detected, shall be marked as "unacknowledged".

2. Users shall indicate that they have taken action on the alarm by acknowledging the alarm.

Events are conditions that shall be recorded by the SCADA, but that do not require annunciation or action, including acknowledgement, by users.

1. Events may be generated by the same functions as alarms.
2. For the purposes of this discussion, events shall be considered as a special case of alarms, where the event is intended only to record information.

Alarms shall be subjected to a series of alarm processing actions and user interactions.

1. Those actions to be executed shall be determined by the AOR assigned to that database item that is exhibiting the alarm condition and by the alarm class also assigned to the database item.

Each database item may be associated with several alarms. For example, a telemetered analog point will include operating limit alarms, reasonability limit alarms, and telemetry failure alarms.

Each alarm of each point shall be individually assigned to an AOR and to an alarm class.

An alarm shall appear for elements (e.g., feeder breakers) that change state more times than is defined in e.g., a given dead band.

### **1. Alarm Class and Presentation**

Each alarm shall be assigned to a single alarm class that determines how the following alarm presentation and management characteristics are to be employed:

- a. Audible annunciation – no audible alarm, single stroke or repeating, and which tone is to be sounded.
- b. Display presentation:
  - (1) For one-line diagrams – symbol change, color change, or no change, and flash/no flash for both unacknowledged and acknowledged alarms.
  - (2) For message displays (such as an alarm summary) – message color and flash/no flash.
- c. Inclusion on or exclusion from the alarm window.
- d. Inclusion on or exclusion from the alarm summary (note that all alarms and events shall be included on the event summary).
- e. Alarm management (acknowledge and delete):
  - (1) None required (for events).
  - (2) Acknowledgement is required before deletion.
  - (3) Manual deletion (user action) is required.
  - (4) The alarms are deleted when the return-to-normal alarm for the point is acknowledged.
  - (5) The alarms are deleted when the alarm is acknowledged.

- (6) Acknowledgement is not required before deletion. Unacknowledged alarms may be deleted.
- (7) Manual deletion (user action) is required.
- (8) The alarms are deleted when the return-to-normal alarm for the point is acknowledged.
- (9) The alarms are deleted when the alarm is acknowledged.

## 2. Alarm Messages

Alarm messages shall be a single line of text describing the alarm that has occurred.

Each alarm message shall include:

- a. The time and date of the alarm. (Alarms from previous days shall be clearly identified).
- b. A complete identification of the database point.
- c. A clear (non-coded) description of the alarm.
- d. The value, state, or condition of the item changed before and after the alarm.

The alarm message shall be unabbreviated English text and shall not require the use of a reference document for interpretation.

NPC shall be able to modify alarm message formats and define new formats.

## 3. Alarm Window

The alarm window shall provide a visual indication of alarm conditions in every AOR assigned to the user.

The alarm window shall contain an indicator for each data source (for example, a generator) and SCADA function.

- a. Indicators for data sources and functions with no alarm conditions present shall not be visible.
- b. When an unacknowledged alarm is present in any data source or function, the indicator shall be displayed and flashing, color, or other highlighting shall be used to draw the user's attention to the indicator.
- c. Acknowledgement of the alarm shall modify the attributes of the indicator to indicate the presence of only unacknowledged alarms.
- d. Cursor selection of the indicator for a data source or application shall call to the screen an alarm list filtered for that data source or application.

If the number of indicators exceeds the capacity of the alarm window, the user shall be notified of the overflow condition.

#### 4. Alarm Acknowledgement

Alarms for any database item or application function condition shall be acknowledged by user action on any display presenting the alarm and programmatically.

- a. When an alarm is acknowledged, the unacknowledged condition shall be reset in the database and all display attributes for the point shall be reset to their acknowledged state.

Alarms shall be acknowledged both individually and multiply.

- a. Individual alarm acknowledgement shall require selection of a specific alarm before the acknowledgement is commanded.
- b. If an individual point in alarm is selected on the alarm summary display, the acknowledge action shall affect only that message.
- c. If an individual point in alarm is selected on any other display, the acknowledge action shall affect all alarms for that point.
- d. Multiple alarm acknowledgements shall function as individual alarm acknowledgement, except that the UI shall include features to select multiple alarm message for acknowledgement.
- e. The SCADA shall operate successively on each message selected for multiple acknowledgements.

Page acknowledgement shall be supported only on the alarm summary display and shall affect only those alarms visible within the window at the time the acknowledge action is commanded.

- a. It shall not be possible to acknowledge alarms that are not in the view of the user at the time of the acknowledge action.
- b. The SCADA shall operate successively on each message selected for page acknowledgement.

#### 5. Alarm Detection

Alarms for any database item or application function condition shall be deleted by user action on any display presenting the alarm and programmatically.

- a. When an alarm is deleted, the unacknowledged condition shall be reset in the database and the alarm message(s) shall be removed from the alarm summary display.
- b. All other alarm attributes shall remain as before the delete action and the alarm conditions shall continue to be shown on displays other than the alarm summary.

Alarms shall be deleted both individually and multiply. Individual alarm deletion shall require selection of a specific alarm before the deletion is commanded.

- a. If an individual point in alarm is selected on the alarm summary display, the deletion action shall affect only that message.
- b. If an individual point in alarm is selected on any other display, the deletion action shall affect all alarms for that point.

- c. Multiple alarm deletion shall function as individual alarm deletion, except that the UI shall include features to select multiple alarm messages for deletion.
- d. The SCADA shall operate successively on each message selected for multiple deletions.

Page deletion shall be supported only on the alarm summary display and shall affect only those alarms visible within the window at the time the deletion action is commanded.

- a. It shall not be possible to delete alarms that are not in the view of the user at the time of the deletion action.
- b. The SCADA shall operate successively on each message selected for page deletion.

## 6. Alarm Inhibit and Disable

Alarm annunciation for any point shall be inhibited and enabled by user command. Alarm inhibit and enable operations shall be reported as events. When inhibited, alarms for the point shall be detected and processed and the database attributes for the alarm condition shall be set.

- a. The point in alarm shall be marked as unacknowledged and any alarms detected shall not be annunciated nor presented on the alarm summary.
- b. Alarm conditions and messages existing at the time of an inhibit action shall remain as before the action.
- c. Alarms detected subsequent to an inhibit action shall not be annunciated when alarming is enabled.

## 7. Alarm Audible Silencing and Suppression

Audible alarm annunciation shall be silenced, suppressed, and enabled by user command.

Alarm audible silencing and enable operations shall be reported as events. Audible alarm silencing shall stop ongoing audible annunciation at the workstation issuing the silence command.

- a. New alarms shall again sound the audible alarm.

Audible alarm suppression silences audible annunciation and suppresses audible annunciation for new alarms at the workstation issuing the silence command until audible annunciation is enabled.

- a. An indication of the suppression shall be presented as a common feature on the workstation so that the user is clearly informed of the condition.

## 8. Enhanced Alarm Management

As an option, additional features for alarm management shall be provided. The enhanced alarm management function shall include:

- a. Minimization of nuisance alarm messages (for example, repetitive alarms for the same alarm condition).
- b. Combining of related alarm messages.
- c. Prioritization of alarm messages.
- d. Highlighting of the most urgent messages.
- e. Suppression of alarms based on related alarm conditions.
- f. Evaluation of related alarm conditions to determine the true alarm condition.
- g. Filtering and sorting capability

#### **TS-7.4 Trending**

The SCADA shall include facilities to generate plots of database values against time - "trends" or "trend displays".

1. Trends shall be constructed as a set of "plot points" connected into a "curve" of the scaled value of selected database items on the vertical axis versus time on the horizontal axis.
2. The trend shall include a minimum of 1000 "x-t" plot points for each database value presented on the display.

Data presented on each trend display shall include historical values, values acquired previous in time to the current time and stored in the data historian function, and real-time values, the latest value acquired for the point.

To initiate a trend, a user shall select a start time and date for the trend, the database values to be displayed (up to the maximum number of curves on the display), and the update rate for the trend.

1. The display shall initially display the plot points for the selected database value(s) from the start time and date (using data historian data if the start time and date is earlier than the current time and date) up to the current value in the real-time database (if the time scale extends to the current time and date), plotting the value at the time intervals of the update rate.
2. If the curves do not fill the time axis, each curve shall be extended by a single plot point at the update rate by adding the real-time value of the point to the end of the curve.
3. When the curves fill the time axis, the oldest plot point shall be removed from the display and the curve and the time axis shall be shifted to accommodate a new plot point.

The trend presentation shall include features to scroll through time. When a trend display shows only historical values, the trend display shall not update.

The trend display shall also present the following information:

1. The name of each value trended.
2. Curve values at any point in time selected by the user.
3. The quality codes for the data at any point in time selected by the user.

4. A scale for the value axis of the trend.
5. The time scales.

Users shall be able to configure the trend display by adjusting the following parameters:

1. Range – the intercept and maximum (full range) values for each curve in engineering values. The default range shall be set by the reasonability limits for the value.
2. Trend update rate.
3. Trend start time.
4. Color, symbol, and line type for each curve.

Violations of alarm limits shall be highlighted.

### **TS-7.5 Display Hard Copy**

The SCADA shall print a copy of a window on any thin clients when commanded by a user.

1. The output shall be directed to a printer of the user's choice.
2. Color displays shall be translated to gray scale for black and white printers using a mapping table (or other, similar technique) that can be changed by the user.

The display hardcopy function shall not inhibit the thin client from normal operation after a copy is requested, even when multiple users issue simultaneous hardcopy requests.

The hardcopy devices shall correctly print all fonts supplied with the User Interface.

A facility to copy screens and/or a selected window and save in a format for inclusion in Microsoft® Office products shall also be provided.

### **TS-7.6 Supplier/OEM Provided Display**

The Supplier/OEM shall provide the displays described below. All Supplier/OEM - provided displays shall present data using data names defined by NPC.

#### **1. Access Control Displays**

This display shall allow a designated authority to control user access to the SCADA. The display shall enable the designated authority to enter, modify, and delete user IDs and passwords and to assign AORs and operating modes.

#### **2. Menu Directory Displays**

This display shall list all menu displays in alphabetical order. Each entry in the list shall have a cursor target for menu selection.

### 3. SCADA Directory Display

This display shall list all SCADA displays in alphabetical order. Each entry in the list shall have a cursor target for display selection.

### 4. SCADA Configuration and Control

These displays shall allow the user to monitor and control the SCADA configuration. The displays shall:

1. Present all equipment and communication link status and associated alarms.
2. Provide menus or cursor targets for performing actions such as failover, switching local and remote devices (such as workstations, servers, and PLC/RTUs), switching communication channels, controlling the SCADA resource monitoring function.
3. Present processor and communication channel loading and error statistics.

These displays shall graphically show the interconnected elements of the SCADA including communication paths and Supplier/OEM-provided channel interface equipment such as modems, transceivers, and multiplexors.

The data sources communicating over each path shall be shown.

### 5. Summary Displays

Summary displays shall be list displays presenting power plant system and SCADA conditions to the users. Unless indicated otherwise in the following specific requirements for individual summary displays, user interaction with the displays shall be limited to filtering and sorting of the data presented in the displays.

The SCADA shall support filtering by:

- a. AOR (Areas of Responsibility)
- b. Location (e.g., turbine or generator)
- c. Point name
- d. Alarm class/Priority
- e. Date and time.

The SCADA shall support "wildcard" filters. The SCADA shall support sorting in both increasing and decreasing alphanumeric and date and time direction. At least three concurrent filters, each with sorting, shall be supported. It shall be possible to define default filters and sorting for each summary, to be applied when the display is called to view:

- a. Alarm and Event summaries – sorted by date and time, with the most recent entries in view when the display is called.

(1) The summaries shall be filtered to present only those entries of those AORs assigned to the calling user.

- b. All other summaries – sorted location (alphanumeric) and then by date and time.
  - (1) No filter shall be applied.
  - (2) The summaries shall be filtered to present only those entries of those AORs assigned to the calling user.

All summary displays shall have the option of being temporarily “frozen”, i.e., the user can stop the display from updating so that alarms or events that are being viewed do not rapidly move or scroll off the screen.

- a. The summary shall remain frozen until the user “unfreezes” the summary.

The frozen state of the summary shall be clearly indicated to the user on the display and evident on any hard/soft copies produced by the system

#### a. Alarm Summary

A single user action shall be used to call an alarm summary that presents only those alarms for the AORs assigned to the user.

- (1) All alarms in all classes shall be presented.
- (2) The SCADA shall also include facilities to call a general alarm summary, with a single user action, that will present all alarms in all AORs authorized for the user to view.

Alarm summaries shall show power system and SCADA alarms.

- (1) The user shall be able to acknowledge and delete messages on the display.
- (2) Flashing shall identify unacknowledged alarms. (To facilitate reading unacknowledged messages, only the time field shall flash).
- (3) The alarm class shall determine the response of the SCADA to acknowledge or delete actions and to annunciation of return-to-normal alarms.

NPC prefers an implementation where the alarm summaries expand to display any quantity of alarms.

- (1) If the capacity of the alarm summary is limited, the capacity of the alarm summary.
- (2) If the capacity of the alarm summaries is limited and an alarm summary display becomes full, the oldest messages shall be automatically deleted and the newest messages shall be added.
  - i. All alarm messages shall be saved in the Historian.
- (3) It shall be possible to perform any alarm interaction from the alarm summary displays.

**b. Event Summary**

The event summary shall be similar to the alarm summary with the exception that all alarms and events (such as supervisory control commands, tag placement, and data management actions) shall be listed.

Events shall be removed from the event summary only when the capacity of the display is exceeded.

The oldest events shall be removed as new events are listed. All events shall be saved.

**c. Off-Normal Summary**

This display shall list devices and values that are not in their normal state.

Telemetered, calculated, and manually entered status, analog, and accumulator data points shall be included.

The displays shall show the off-normal data points in the following groups:

- (1) Status points for which the present telemetered state is different from the normal state stored in the database
- (2) Analog and accumulator points that present values exceeding alarm limits.

**d. Off-Scan Summary**

This display shall list all points that have been suspended from acquisition.

**e. Alarm Inhibit and Override Summary**

This display shall list devices and data values for which the user has inhibited alarm processing and for devices and data values for which the user has overridden limits.

- (1) The entries for overridden limits shall show the database (non-overridden) value of the limit as well as the overriding value.
- (2) Controls to enable sorting by substation and by date and time of the entry of the alarm inhibit or override shall be included on the display.

**f. Tag Summary**

This display shall list and describe all active tags for all devices. The user shall be able to place and remove tags from this summary. Information on this display shall list each device tagged and shall include: date and time of tag placement, user who placed the tag, tag level, station identifier, device identifier, and comment field.

**g. Manual Replace Summary**

This display shall list and describe all active tags for all devices. The user shall be able to place and remove tags from this summary. Information on this

display shall list each device tagged and shall include: date and time of tag placement, user who placed the tag, tag level, station identifier, device identifier, and comment field.

#### **h. Memo Summary**

A Memo Summary display shall be provided. Each memo shall have an entry in the summary that includes:

1. The name of the display on which it is present,
2. The name of the user that created or last changed the memo
3. The date/time it was created or changed
4. The first 80 characters of text
5. A selection target that shall take the user to the display showing the selected memo.

### **6. Communication Maintenance Display**

Communications with data sources and other computer systems shall be managed via these displays. Communications management displays shall show the current status of the communication channels. Communication error counts and tabulations of all types of errors shall also be displayed.

### **7. Application Program Displays**

The Supplier/OEM shall provide all displays associated with all specified application programs and functions. Displays that allow the user to interact with SCADA application programs shall use a common look and-feel approach. The information provided shall help expedite the user's interactions.

### **8. Other Displays**

Specific display requirements for other SCADA functions are described throughout this Specification. The Supplier/OEM shall be responsible for the supply of all displays necessary to support the specified functions, in addition to any other SCADA displays required to control and monitor the SCADA itself.

## **TS-7.7 User Graphical Visualization**

This section describes the requirements for a user interface graphical visualization features that is integrated with the SCADA.

The intended visualization tool shall allow operators to view power plant system quantities described below in an efficient graphical format. The application should be able to enhance operators' capabilities to comprehend different network quantities in real-time for "situational awareness".

The SCADA shall have the capability to provide wide area situational awareness.

A capability to represent large amounts of data by means of advanced graphical visualization methods is intended to facilitate fast evaluation of the data by

operators, to enable them to quickly analyze power system conditions (voltage, flows, load density and outage area, etc.) and discern potential problems.

The following functional subsystem shall be provided as part of situation awareness.

1. Provide the functionality for visualizing the power plant system on large wallboard displays with advanced graphical features such as multi-layers, smart zooming, custom dashboards, contours, Heat Map, color gradient, moving arrow, thermal limit violation (Pie Chart) and animation.
2. Provides the functionality for monitoring the current reliability status.

The user interface graphical visualization shall be design based on the following characteristics:

1. The system shall be easily integrated with the SCADA technology using high-performance interfaces;
2. The system shall reuse the existing SCADA as the main source of data and models; all displays shall be model driven and automatically generated.
3. The system shall be designed for mission-critical real-time applications with no single point of failure and a redundant scheme to meet 99.95 percent availability criteria.
4. The system shall be considered secured similar to the SCADA with controlled access (authentication)

The presentation of the information should be meant to support a specific decision process, such as detecting voltage problems, frequency deviation, high vibration, high temperature, high pressure etc.

This visualization shall present a consistent view of the network on large wallboard display in the control room. The same view shall be accessible on operator workstations and other thin clients with all capability to analyze situation either on the workstation or at the wallboard. The graphical visualization shall include graphical aids for immediate detection and better understanding of a particular situation.

The visualization tool shall support building custom dashboards by capturing part of different displays (overview, single diagrams, etc.) on the fly without additional configuration and place, drag move them between logical tabs. The captured displays shall update as per real-time and it shall be possible to store the dashboard and recall whenever required.

It shall present overall assessment of system reliability with constant monitoring of situations.

## **TS-8.0 SUPPORTING SOFTWARE REQUIREMENTS**

NPC's goal is to acquire a hardware and software engineering environment in which it will always remain much more economical to maintain and upgrade the SCADA than to replace it. NPC expects to develop additional functionality

concurrently with this project and throughout the lifetime of the SCADA in order to keep pace with changing requirements.

### **TS-8.1 Conformance to Standards**

NPC requires that the SCADA conform to mainstream computing standards, emerging standards, and de facto standards wherever those standards are appropriate in the context of a SCADA design.

### **TS-8.2 Use of Supplier/OEM Standard Support Software**

NPC considers it impractical to ask the Supplier/OEM to make substantial changes in its software support tools and practices for the SCADA.

Therefore, although a specific set of software support requirements are presented in this clause, a major intent of the clause is to elicit a clear statement from the Supplier/OEM as to the nature of the proposed software support environment. In any case, NPC will require the Supplier/OEM to supply what is proposed, and will verify this during testing.

### **TS-8.3 Distributed Computing Environment**

The Supplier/OEM shall supply a distributed computing environment that assures adequate flexibility for the evolution of the SCADA. Use of any of the associated services described in this clause shall be restricted to users with proper authorization.

#### **1. General Requirements**

Application and communication SCADA are logical groupings of functionality serving a consistent purpose and managed as a group. System management is the activity of administering an application or communication system running in a computing network. This includes installing the application or communication system within the computing network and assigning appropriate network resources.

The computing network shall be viewed as a set of processing units (with computing and peripheral resources) connected by communications services (e.g., LANs and WANs). The computing network shall include the set of processing units supplied by the Supplier/OEM and expanded by NPC over time. Network management shall refer to the general administration of these computing resources.

The term "product", as used in this clause, refers to established, recognized commercial offerings with a significant installed base and associated user community.

## **2. Computer Operating SCADA**

NPC prefers that all processing units of the SCADA use the same operating system so that training-costs and maintenance difficulties are minimized. The operating system shall in all cases be a standard product and shall not be modified by the Supplier/OEM. The Supplier/OEM may use value-added utilities or subroutines that utilize the operating system services, provided they are fully supported

The SCADA shall be designed such that upgrades to operating system products may be implemented without significant interruption of the SCADA (i.e., without violating availability requirements) and without changes to SCADA application functions.

## **3. Computing Network Communications**

Communications within and among the computing networks supplied by the Supplier/OEM shall conform to OSI standards, TCP/IP. The distributed computing environment shall be able to use both local area networks (LANs) and wide area networks (WANs) transparently, such that there shall be no restriction (other than capacity limitations) on the geographic dispersal of applications among the processing units of the application SCADA within the SCADA.

## **4. Configuration, Control and Monitoring of Computing Networks**

Services shall be provided for the configuration, control, and monitoring of computing network resources. Network configuration and control products shall be accessible from any node in the computing network and shall be capable of managing resources anywhere in the network. Network configuration and control products shall allow any computing network element (processor, peripheral, or communications link) to be started, shut-down, reconfigured, or tuned without affecting the availability of the computing network as a whole.

Any computing network configuration and control operation that affects the availability of resources to an application system shall issue messages to that system notifying it of the loss or restoration of the resource.

A network monitoring and administration tool shall be provided. The interface of this tool shall show the SCADA hardware configuration in form of a map or equivalent. The network-monitoring tool, shall automatically discover the equipment to construct the map/diagram. It shall support management of multi-vendor network hardware, printers, servers, and workstations.

It shall support remote administration of network devices, management of thresholds for monitoring performance and generation of alarm and event notifications. It shall be possible to send these notifications to maintenance personnel through e-mail

The Network management system shall manage the interfaces to the SCADA servers, workstations, devices, and all SCADA connected devices.

The network management software shall be based on the Simple Network Management Protocol over TCP/IP.

## **TS-8.4 Network Services**

Network services shall provide facilities available to the application systems that run in the computing network. The requirements associated with these facilities are described in the following sub-clauses.

### **1. Network Security**

A network security management facility shall be supplied as an integral part of the computing network. This facility shall supply security access and protection to all network resources, and shall be an integral part of the network management product.

### **2. Network Time Synchronization**

Network time shall be maintained for all elements of the computing network. Synchronization among the different network processors shall be made through the use of Distributed Time Services or equivalent use by the Supplier/OEM. Each processor and workstation in the network shall synchronize to the time server periodically at a rate, initially set to one minute, but which shall be changeable by NPC. Synchronization shall also occur upon System Controller demand.

Network processor clocks shall be automatically synchronized to within 1 msec of the synchronized time standard. In the event that the time standard inputs are not available, automatic resynchronization shall be terminated until the inputs are re-established. The user shall have the capability to manually suspend the automatic time re-synchronization service and manually update the processor clock through the user interface. If the internal clock and the time standard differ by more than a programmable amount, the synchronization shall be suspended, and an alarm shall be generated.

### **3. Network File Service**

Services shall be provided to give users of the computing network access to files from anywhere in the network. The file system shall provide a reliable, consistent interface that offers the same performance and ease of access for both network and locally resident files.

The network file service shall be easy to administer, and it shall take advantage of the global naming service. The network file service shall allow transparent information access to applications and utilities and shall support functions such as remote copy, backup, and restore across network nodes. It shall be possible to allocate or de-allocate devices to the network file system as well as allocate or de-allocate logical files and their backups to physical devices via a convenient maintenance procedure. The network file service shall be easily extensible as the computing network is expanded.

### **4. Backup, Restore and Archiving**

The Supplier/OEM shall provide a set of utility services capable of backing up, archiving, and restoring all devices in the SCADA configuration without requiring manual intervention by support personnel or users. The backup and archiving

services shall automatically back up all information needed to recover from failures or data corruption, regardless of where the information is located.

The SCADA shall include services to backup, archive and restore all SCADA software and data independently of its location on the SCADA networks.

- a. The backup information shall include the SCADA and network configuration information, such as database table and queue sizing, router tables and firewall access rules.
- b. The distributed backup process shall include all procedures and methods including required initial installation media for completely restoring the systems from an uninitialized state to a fully functioning state, for example, following a hardware disaster. It shall be possible to perform a bare metal back-up and restore
- c. A process must be supplied to test backup media periodically to ensure that the information contained on it is recoverable if needed.

## 5. Print Service

Hard copy output resources in the computing network, shall be capable of being assigned as network (rather than local) resources, and shall be available for use from any node in the network.

A System Administrator shall be able to control which printers can be accessed by which users. The System Administrator shall be able to remove a printer from the network print services and reserve it as a dedicated printer for special requests. The printers shall be assigned global names in the global directory.

The network print services shall transparently route the print job to the specified printer, whether local to the user or remote. Users shall be kept informed of the status of their print jobs (e.g., spooled/printed/completed). Users shall be assigned a default printer and shall be able to override the default for access to other printers in the computing network.

The network print services shall support print jobs based on any valid print file format generated by any processor in the network, including as a minimum:

1. Historical reports
2. Real-time reports
3. Word processor text/documents
4. Graphs, etc.
5. Displays

## 6. Watchdog Service

Failure monitoring logic within the SCADA computing network shall detect all failures that affect the availability of network resources or services.

All failures shall be logged as part of performance monitoring. Loss of network resources or services shall be immediately reported to any and all users that have requested the resource or service. It is preferred that each functional unit providing a resource or service be self-configuring in a fault situation, notifying its direct users of any events that have taken place.

## 7. Diagnostic

Both on-line and off-line diagnostics shall be provided for all SCADA equipment. On-line diagnostics shall operate in conjunction with the real-time operation of the device being tested. This may be accomplished with self-check capabilities incorporated in the equipment handlers and/or monitor software. Any detected errors shall be logged in clear and distinct English. The online help facility shall be used to describe the error and corrective action.

A second class of diagnostics shall be provided that operates concurrently with the SCADA functioning on-line, but may require the equipment being tested to be off-line. Using the configuration control displays, it shall be possible to declare equipment off-line and unavailable and to perform the appropriate diagnostics under interactive control.

A stand-alone diagnostic monitor shall also be provided for each processing unit (PU) in the SCADA network. The stand-alone monitor shall be used after the PU has been isolated from the SCADA and shall provide the capability to run off-line diagnostics to troubleshoot failures on that PU and its associated peripheral equipment.

Authorized users shall be able to remotely logon to the SCADA in order to execute diagnostics. The SCADA shall include security mechanisms that prohibit unauthorized users from accessing the SCADA.

### TS-8.5 Application and Communication System

Access to system administration services and facilities shall be possible from any node in the SCADA computing network, provided that proper authorization exists.

#### 1. Application Software System Configuration and Control

Each of the supplied application software systems shall be capable of being reconfigured to use different network resources without requiring source code changes. Application software systems may similarly be configured to share network resources without restriction other than the capacity limitations of the resources.

Application software system configuration and control services shall provide for the assignment of processes within a system to processors, and for the orderly start-up, operation, and shutdown of those processes. Assuming that backup processes are necessary to provide high availability for the application systems, configuration and control shall be able to incorporate both the primary and backup processes within the computing network, such that the backup processes are maintained in a "standby" condition, ready to assume primary status within the specified availability and performance requirements.

Application system configuration and control shall respond to the loss of any computing network resource by moving to backup processes or backup resources, as necessary. System configuration and control shall also respond to the restoration of any network resource, including restoration of backup processes and redistribution of processes to their primary configuration.

## 2. Console Management

Consoles (i.e., Workstation/PC's with accompanying monitor, keyboard, and cursor-positioning device) shall be treated as computing network resources that potentially may be used to access the real-time SCADA, its historian function. Console management shall be able to control whether and how consoles may access any function in the system.

System definitions within the SCADA shall include any number of consoles as user positions. These system definitions shall be able to overlap, so that one console may be claimed by more than one system. Console queues, status, permissions, activity logs, etc. shall be maintained separately for each system to which the console is assigned.

## 3. Shutdown and Startup Service

A shutdown procedure shall be provided for an orderly shutdown of each processor and network in the SCADA.

Start-up procedures shall exist for the following conditions:

- a. Hot Restart. For this condition, the most recent version of the main memory data shall be used for continued operation.
- b. Warm Start. For this condition, a previously saved, version of the database shall be used to initialize all real-time data values.
- c. Cold Start. For this condition, default values shall be used for the entire database.

## 4. Time Service

Application system time shall be distinct from network time. Application system time shall be shared by a group of applications within a system. Application system time shall maintain time and date as understood by the users (i.e., account for holidays, daylight savings time changeovers, etc.). Application system time may be driven either by network time (the default) or by an application.

As a minimum, application system time shall provide the following features:

- a. Process the daylight-saving time switchovers automatically and assure that all functions and programs are updated appropriately. Capability to enable/disable or change the scheduled date/time of automatic switchover of the daylight-saving time shall also be provided via graphical, user interface.
- b. All logs and reports shall accommodate daylight saving time switchover such that the extra hour is processed appropriately without manual intervention
- c. A uniform internal representation to facilitate normal date and time, relative date and time, arithmetic date, and time operations, etc.
- d. A date maintenance facility (day in week, date, week number, week in month, day in year, day in month).

- e. Support for leap years, unlimited holidays per year, and change of century.

## 5. Other Utility Functions

A complete set of programming utility functions shall be provided by the Supplier/OEM. These utilities shall be executable upon demand or may be scheduled periodically and must be available in any of the SCADA computer systems. As a minimum, the set of utilities shall include:

- a. Main memory and bulk memory analyzer
- b. Media conversion, including all directions that are feasible with the media supplied (e.g., printer, permanent storage medium unit, disk unit)
- c. Binary load and dump to/from the disk or permanent storage medium and the main memory or bulk memory
- d. Record comparison of the contents of main memory or bulk memory to permanent storage medium contents
- e. Disk de-fragmentation utility (automatic de-fragmentation is desired).

Information from periodic programming utility executions shall be accumulated in a file.

## 6. Communication Maintenance

The SCADA communications interface shall be prepared using tools supplied by the Supplier/OEM. Subsequent changes to these tools by the Supplier/OEM shall not require any rework by NPC. The Supplier/OEM shall be responsible for all required modifications.

### a. Diagnostics

The diagnostics for the communications interface shall provide at least the following capabilities:

- (1) Select any communications channel for test
- (2) Select a request message for transmission to another computer
- (3) Select single or cyclic message transmissions to another computer for test purposes
- (4) Monitor displays of information received from another computer.

### b. PLC/RTU Communication Maintenance

Software with an interactive user interface shall be provided to maintain and monitor all communications with the LCU/PLC/RTUs. Features that this software shall contain as a minimum are as follows:

- (1) Provide interactive access to all LCU/PLC/RTU database parameters
- (2) Facilitate the addition and modification of LCU/PLC/RTU elements
- (3) Provide error detection and recovery procedures
- (4) Monitor and display data communication device status
- (5) Provide local input/output communication statistics including the number of errors, retries, bytes transferred, etc.

## TS-8.6 SCADA Resource Monitoring

The resources of the processors, servers, and communication processors in the SCADA shall be monitored by measuring, calculating, and displaying, as a minimum, such resource utilization parameters as the following:

1. Time utilization (percent CPU utilization) of each function per processor
2. Time utilization (percent disk utilization) of each function per disk
3. Disk data transfers per disk
4. Network performance.

The above parameters represent the significant ones for most computer systems. Depending on the design of the particular proposed computer system hardware and software, other parameters shall also be monitored. Statistical sampling techniques or other accumulation techniques shall be used to collect these parameters over a user-selected time period.

This SCADA resource monitoring function, which shall include the sampled-data collection and computation functions, shall be a software function activated only upon demand by the user. The user shall be able to specify the study period over which samples are collected and the sampling frequency. Typical study periods shall be ten (10) seconds to sixty (60) minutes, and typical sampling frequencies shall be once per two (2) milliseconds to once per fifty (50) milliseconds.

## TS-8.7 Error Detection and Failure Determination

All servers, devices and functions shall be monitored for fatal and recoverable errors. All detected errors and failures shall be recorded centrally for maintenance purposes. These records shall include the dates and times of the failures, the reason for the failure and of the subsequent automatic or manual return to service.

### 1. Server and Device Errors

All servers, devices and functions shall be monitored for fatal and recoverable errors. All detected errors and failures shall be recorded centrally for maintenance purposes. These records shall include the dates and times of the failures, the reason for the failure and of the subsequent automatic or manual return to service.

### 2. Software Errors

Execution errors in functions that are not resolved by program logic internal to the function shall be considered fatal software errors. Examples of errors that may be resolved by internal program logic include failure of a function to achieve a solution due to violation of an iteration limit or arithmetic errors (such as division by zero).

These errors shall produce an alarm informing the user of the error but shall not be considered fatal software errors.

Fatal software errors shall result in either termination of the function or shall be handled as a fatal server error.

1. The action to be performed shall be defined for each function.

2. If the function is to be terminated, future executions of the function shall also be inhibited until the function is again initiated.

### 3. Reasonability of Data

All data shall be checked for reasonability.

- a. All input data and parameters, whether collected automatically or entered by a user, shall be checked for reasonability, and rejected if they are unreasonable.
- b. All intermediate and final results shall be checked to prevent unreasonable data from being propagated or displayed to the user.

When unreasonable input data or results are detected, diagnostic messages, clearly describing the problem, shall be generated. All programs and the system shall continue to operate in the presence of unreasonable data. All calculations using the unreasonable data shall be temporarily suspended or continue to use the last reasonable data.

### TS-8.8 On-Line Help

The Supplier/OEM shall provide an on-line help system and associated software tools that can be used by NPC to build additional on-line help facilities. As a minimum, the on-line help system shall include on-line help for:

1. Database
2. Documentation management
3. System operation
4. Diagnostics.

The software tools for building the on-line help facilities shall use hypertext facilities and MS Word for Windows.

## TS-9.0 SCADA HARDWARE REQUIREMENTS

### TS-9.1 Server (SCADA and Historian)

The Processing Unit (PU) of each SCADA computer system consists of:

1. Processing Unit
2. Main Memory
3. Disk Memory
4. Computer Terminals
5. Processor Interconnection

The Processing Units (PUs) shall be current computer processor models properly selected to ensure efficient operation of the SCADA and Historian Server. NPC shall be able to replace or upgrade the PUs with future PU offerings to obtain increased SCADA performance with no required SCADA software changes. Redundant configurations of PUs can be provided to meet the availability requirements.

### **TS-9.2 Rackmount Console Kit**

It shall be rack mounted in a (panel) provided with a 1 rack unit (RU) Rackmount Console with at least a 19-inch LCD color monitor, keyboard and touchpad using a KVM switch.

The computer terminal shall provide extensive PU control and display functions. As minimum, these functions shall include the ability to:

1. Max. of eight (8) KVM Switch port
2. Display the contents of any actual or virtual memory location
3. Display the content of any register.
4. Clear selected and/or all registers.
5. Set the content of a selected register.
6. Halt/run PU processes.
7. Single step (execute on instruction per step).
8. Automatic fill (auto load) from a selected device.
9. Run low level diagnostics.

All computer terminal screen activity shall be saved in a file for subsequent review, and printing if desired.

### **TS-9.3 Local Area Network/Industrial Switch**

The Local Area Networks (LANs) that support the distributed SCADA architecture shall be based on 10/100/1000BaseT technology using intelligent hubs conforming to ISO 802.3 standards.

### **TS-9.4 Gateway**

The gateway shall bridge the gap between plants and automation systems/control centers.

### **TS-9.5 User Interface Equipment**

The UI equipment includes:

1. Workstation
2. KVM Extender

### **TS-9.6 Cabinet**

The Cabinet shall include accessories complements the cabinet and can be used to adapt the cabinet to various applications. The mounting depth of the enclosure

shall accommodate servers, computer terminal, storage devices, communication and other network equipment from all major manufacturers.

### **TS-9.7 UTP Cables, Connectors, Faceplate and Raceway Molding**

The supplier shall provide necessary UTP cables, RJ45 connectors, Faceplates and molding needed for installation, configuration, commissioning and maintenance of the SCADA system and all its functionalities.

They shall comply with the following minimum requirements:

1. UTP Cables, Category 6 [Guaranteed to meet all purposed draft beyond 100MHz up to 350MHz; Supports 10BASE-T, 100BASE-TX, Fast Ethernet, Gigabit Ethernet, Voice, Voice, Telephony, Multimedia, 155Mb/s ATM; Flame Rating : Plenum; Construction : 24 AWG, bare copper wire insulated with FEP(Plenum)]
2. RJ45 connector for Category 6 UTP.
3. Rubber boots for RJ45, assorted colors
4. Modular Faceplates: the faceplate offers pressure-release designation label covers which eliminate the need for a probe-pic or screwdriver when installing faceplate labels. They are designed to be used with the angled or flat MAX modules.
5. Single Gang Faceplates for 3 modules
6. Modular jack for Category 6 and 6/8 position USOC: provides maximum bandwidth for all LAN, multimedia and VoIP application; with Stuffer Cap for secure strain relief and acts as a termination base;
7. Factory terminated patch chord, UTP Cat 6, stranded type.
8. Non-metallic surface Raceway, fittings and boxes

### **TS-9.8 Patch Panel/Wire Management**

Patch Panel/Wire Management shall be Category 6 patch panels feature uniquely engineered PCB adapters designed to exceed Category 6 ANSI/TIA/EIA 568-B.2-1 component specifications, provide higher bandwidth to support data in excess of 250MHz, and allow an error-free transmission path for the cabling system. Additionally, these are "center balanced" to Cat 6 patch cords minimizing common mode emissions while providing greater noise immunity, for 10/100/1000BASE-T Ethernet application.

The Supplier shall comply with the following minimum requirements:

1. Category 6 Patch Panel:
2. Two (2) sets of Patch Panel Wire/cable Management Bar:
3. Eight (8) sets Front and Rear Duct Panels (Conceals patch cords): 7-rings; 6 pass-through holes; hinged front cover;
4. Five (5) Vertical Rings are mounts to front of 2U and 3U panels
5. Five (5) Transition Spool which maintains T568 compliant bending radius.

## TS-10.0 CYBER SECURITY REQUIREMENTS

All security functions required by this specification must be implemented in a non-interfering manner, such that authorized and legitimate use of the SCADA is not hampered, nor is the ability to perform required functions impeded by the security features. All updates and corrections in cyber and information security protection is covered under Quality Assurance and Testing Requirement

### TS-10.1 Applicability of Cyber Security

The SCADA software shall be audited immediately during SAT to ensure that the initiatives in the following subsection for cyber and information security are satisfied.

#### 1. Removal of Unused Services

All applications, utilities, system services, scripts, configuration files, databases, user accounts and all other software not required for operation of the SCADA shall be removed.

The SCADA to be removed shall specifically include, but not be limited to:

- a. Non-operational application functions
- b. Games.
- c. Device drivers for devices not delivered.
- d. Servers and clients for unused Internet services.
- e. All software compilers except for the PDS.
- f. Software compilers for languages that are not used in the SCADA.
- g. All unused protocol suites.
- h. Unused administrative utilities, diagnostics, network management, and system management functions.
- i. Backups of files, databases, and programs, used during system development.
- j. Databases, configuration files, and other files used for development and testing.
- k. Programs and scripts used for development and testing, including sample programs and scripts.
- l. Help systems not directly supporting SCADA applications.
- m. Disable open Ports; Ports that are not used in the New SCADA System.

Additional "hardening", particularly following established methods and guidelines, including, but not limited to those developed by the original software vendor, shall be performed by the Supplier/OEM as part of the software installation and configuration activities.

The Supplier/OEM shall document and submit documentation that the foregoing has been completed.

The Supplier/OEM shall use the best possible means to scrub, or otherwise destroy beyond recovery all electronic Confidential Information in its possession, certifying such destruction in writing to NPC's Procurement Agent, and providing NPC's security team a written explanation of the method(s) used for data disposal/destruction, along with a written certification that such method meets or exceeds NPC's data handling standards and industry best practices for the disposal/destruction of sensitive data.

## **2. Software updates and Antivirus and Anti Malware Scan**

All updates to the operating system and application software addressing cyber and information security shall be installed as specified in this tender.

The software shall be scanned for viruses, worms, Trojan horses, and other software contaminants during the Site Acceptance Test (SAT) and at the start of site testing. Later NPC shall have the possibility to repeat such tests any time.

## **3. Free of "Electronic Self-Help" Enabled Software**

The SCADA software shall not contain embedded faults or back-door mechanisms that allow the software provider or any other party to remotely disable some or all of the functions of the software, to affect their performance, or in any way to degrade its operation (so-called "electronic self-help" in the terms of the Uniform Computer Information Transactions Act).

The software shall not contain any mechanism that automatically disables some or all of its functions or degrades their operation on a certain date or upon the occurrence of a specific event.

## **4. Security Monitoring**

The SCADA shall maintain log for all access attempts at both the application and electronic security perimeter.

The SCADA shall maintain logs of system events related to security in sufficient detail to create historical audit trails and enable a root-cause analysis for a period of at least 90 calendar days.

Provision shall be given to copy the system event data to an alternate storage medium for storage longer than 90 days, if required as part of a longer -term investigation.

- a. The logs shall capture the following for both human users and application requests:
- b. All attempts to log on, both successful and unsuccessful.
- c. Any privilege change requests, both successful and unsuccessful.
- d. All user actions affecting security, such as changing passwords.
- e. All attempts to access files for which the user has no access privileges.
- f. Attempts to perform an action not authorized by the security scheme.

- g. Detecting unauthorized access (intrusions), and attempts at unauthorized access at the access points to the electronic security perimeter(s) twenty-four hours a day, seven days a week. For the purposes of the above requirements, the term “user” shall refer both to human users and to applications requesting such actions.

Shall generate an alarm when access activity may be indicative of attempts to obtain unauthorized access to system services or data.

- a. A simple method shall be provided for the user to view and to change the rules for generating alarms.
- b. Initially, an alarm shall be generated when the system detects the any of following activities:
- (1) Repeated attempts from a specific workstation or external port to log in.
  - (2) Repeated failed attempts at file access.
  - (3) Port scans (attempts to access closed ports or services).
  - (4) Unusual levels of traffic on the local area network.

## 5. Generic and Default Accounts

The Contractor shall disable or remove, as technically feasible, all generic accounts, guest accounts, development accounts, maintenance accounts, and default accounts provided by hardware, operating system, database, application program, and other providers.

- a. Where specific accounts cannot be removed, they shall be renamed or disabled to prevent unauthorized access.
- b. Where technically feasible, all actions to be performed by shared or elevated privilege accounts shall be initiated using a specifically named individual user account, followed by a “switch-user” function to the shared or generic account to perform a necessary or required function. This action provides both authentication of a specifically named, valid user, as well as an audit trail of any elevated privilege actions performed.
- c. This action provides both authentication of a specifically named, valid user, as well as an audit trail of any elevated privilege actions performed.

If not technical feasible to do so, the Supplier/OEM shall provide written notification to NPC for reasons why specified mitigation measures.

## 6. User Authentication

A mechanism for defining and controlling user access to the operating system environment of the SCADA shall be provided.

The SCADA must support account management methods to enforce access authentication and accountability of user activity, and to minimize the risk of unauthorized access.

The SCADA and the underlying operating system must support the requirement that users have individual accounts, without compromising the functionality and operating restrictions.

For implementations where individual computer nodes maintain their own unique internal user identification codes, the same named user shall use the same internal user identification code for all nodes within the SCADA.

The SCADA system shall have the capability to implement a 'Rules' and 'Roles' user access based.

- a. RULES - A combination of tags, privileges, and locations that allows to finely tune what users can do and from where. Grant different users' access to different areas without creating new privileges.
- b. ROLES - Combinations of Rules and other Roles that match the duties of specific jobs (e.g., Plant 1 Operator).

## **7. Appropriate Use Banner**

Users accessing the SCADA through web-scada or maintenance access shall be presented with an "Appropriate Use Banner", the contents of which will be provided by the Purchaser.

## **8. Secure Maintenance Access**

Secure maintenance access to the operating environment shall be provided for both remote and local users.

1. The access shall provide authentication of valid users without transmitting plain-text passwords on the network.
2. An encrypted access mechanism such as ssh shall be used
3. Secure file copy features included in ssh shall be used to manually transmit files between nodes when using the network.

## **9. Authorization Process**

The Supplier/OEM shall maintain lists of all authorized personnel with access to the SCADA while on site at the Supplier/OEM's development site, including their specific electronic and physical rights to the systems, servers, or databases, and a date for which access will be terminated.

## **10. Authentication Methods and Password Construction**

The SCADA system shall have the capability to be configured to use OS log-in account.

The SCADA system shall have the capability to implement a hashed user password. Login credentials are never held in a form that anyone can decrypt and recover.

Passwords for maintenance access shall comply with NPC security policy, to be provided to the Supplier/OEM.

The minimum password length shall be configurable by NPC, and initially set to 8 characters with a maximum of 16 characters allowed that are a combination of letters, numbers, and symbols (@, #, \$, %, etc.). Passwords shall case-sensitive that contains letters in both uppercase and lowercase.

All accounts providing interactive or network access shall have passwords. There shall be a limit of a configurable number of attempts allowed until the user is locked out.

Accounts that exist strictly for identification and ownership purposes shall be disabled from all interactive, networks, or other access.

The Supplier/OEM shall provide a mechanism to temporarily disable access and security authentication policies for individual users during emergency system recovery or other abnormal operations, where system availability would be negatively impacted by normal security procedures.

NPC shall have review and approval rights for these "bypass" procedures. This rollback operation shall be logged in the system for reference purposes.

## **11. Installation of Third-Party Security Patches**

Whenever the SCADA Supplier/OEM and suppliers of software to the SCADA Supplier/OEM, release a software change ("upgrade", "update", "modification", "release", or "patch") to correct a security related error in the code or to close a vulnerability, the Supplier/OEM shall take immediate steps to test, confirm, and deliver to NPC a patch to install the software change on the SCADA.

The Supplier/OEM shall review security patches daily after release by the third-party Supplier/OEM.

The Supplier/OEM shall provide to NPC, in a secure manner, a report that states the impact of the patches on the Supplier/OEM's baseline software.

The Supplier/OEM shall complete testing of the applicable security patches within 30 days.

The initial testing for NPC's SCADA software configuration shall be done in an environment that is operationally similar to that of the SCADA.

Testing shall have the goal of confirming that the patch indeed does not introduce any new errors and does not interfere with the Supplier/OEM-supplied software.

The security patch shall be tested and install to NPC by the Supplier/OEM in a secure fashion within the 30-day period.

The implementation and testing of all security patches shall follow the established configuration management and change control processes.

This includes the execution of test procedures where the change is deemed "significant".

If during testing at NPC, a patch is found to interfere with the operation of the SCADA software, NPC will notify the Supplier/OEM and the Supplier/OEM shall initiate the resolution process with the third-party Supplier/OEM.

## **12. Obligation for Notification of Security Vulnerability in Supplier/OEM Provided Software**

The Supplier/OEM shall inform NPC in a secure manner the discovery of an error in or a property of any software resident on the SCADA that makes the SCADA vulnerable to cyber-intrusion.

Supplier/OEM shall have a patch management and update process.

Supplier/OEM shall provide details on their patch management and update process during project implementation shortly after Contract award.

Responsibility for installation and update of patches shall be the responsibility of the Supplier/OEM.

Supplier/OEM shall provide notification of known vulnerabilities affecting Supplier/OEM-supplied or required OS, application, and third-party software within the reasonable period agreed upon by the Supplier/OEM and NPC after public disclosure.

Supplier/OEM shall provide notification of patch(s) affecting security as identified in the patch management process.

Supplier/OEM shall apply, test, and validate the appropriate updates and/or workarounds on a baseline reference system before distribution.

Supplier/OEM shall provide within a negotiated period (pending the severity and risk of the vulnerability) appropriate software and service updates and/or workarounds to mitigate all vulnerabilities associated with the product and to maintain the established level of system security.

The Supplier/OEM shall diligently work to correct the error or modify the property to close the vulnerability, and shall make the correction fully tested and available to NPC at no cost and must be corrected to NPC's satisfaction.

This obligation for notification and the closure of security-related vulnerabilities shall remain during warranty and as long as a Service Agreement is in place.

After warranty, but without a Service Agreement, Supplier/OEM shall notify NPC of security related vulnerabilities.

Closure of security-related vulnerabilities in the absence of a Service Agreement will be handled on an individual contract basis.

The Supplier/OEM shall provide NPC with a process to submit problem reports to be included in the system security process.

Submitted reports shall be reviewed and an initial action plan generated within 48 hours of submittal.

Supplier/OEM shall protect problem reports of a security nature from public disclosure and when notifying other customers shall not release any information to indicate that NPC identified the problem.

Supplier/OEM shall verify and provide documentation that all services are patched to current status.

### **TS-10.2 Disposition of Sensitive Information**

Any documentation or other material replaced during maintenance shall be disposed in such a manner as to protect sensitive information.

This includes maintenance actions performed on the SCADA, as well as the Supplier/OEM's remote diagnostic system.

### **TS-10.3 General Security Consideration**

The following sections describe the non-technical security requirements required of the Supplier/OEM.

These security requirements are in addition to the technical security requirements described elsewhere in this specification.

#### **1. Security Management Controls and Audits**

The Supplier/OEM shall review and accept the applicable sections of the policy and procedure. Supplier/OEM staff shall follow all applicable requirements of NPC's Security Policy while on site at an NPC location.

Supplier/OEM will submit the cyber security standard conformance certificates which are specified in the technical specification. During the final acceptance or guarantee period, NPC will reserve its right to carry out Cyber Security Audits to third parties. If a non-compliance is detected with certificates NPC will allocate a certain time to Supplier/OEM to solve the problem.

The Supplier/OEM shall establish and comply with a policy that identifies access limitations to sensitive information related to the SCADA, as well as information about NPC's electrical system.

As a minimum, this document must address access to procedures, critical asset inventories, maps, one-line diagrams, floor plans, equipment lists and layouts, configurations, databases, and application software.

The document shall identify measures that provide both electronic and physical protection for the sensitive information.

When the Supplier/OEM no longer needs the information, all copies shall be returned to NPC, or destroyed as specified by NPC.

NPC and Supplier/OEM shall protect all data transmitted between the Supplier/OEM's site and NPC's site, and shall jointly determine the methods required to securely transmit any data required for this project.

Encryption programs with email integration, such as PGP shall be sufficient. The Supplier/OEM shall provide NPC a documented procedure for accessing NPC's system while located at the Supplier/OEM's site.

This process shall include an approval and review process to ensure that only authorized personnel (i.e., Supplier/OEM staff, sub-Contractors, Contractors, and Contractors) have access to the system and NPC information.

NPC may request a review of the procedure and the list of authorized personnel at any reasonable time during the project.

Logical or electronic access to the systems by Supplier/OEM staff shall be limited to that required for the staff to perform their job duties, based on appropriate roles and responsibilities documented as part of the access approval.

The Supplier/OEM shall maintain a list of personnel who are responsible for authorizing access to the SCADA, identifying each by name, title, business telephone and the list of systems or application functions for which they are responsible to authorize access.

## **TS-11.0 ENVIRONMENTAL REQUIREMENTS/OPERATING CONDITIONS**

All equipment shall conform to the environmental requirements and conditions applying to the location where it is to be used. Additional heating by equipment inside buildings must be considered.

All equipment and materials to be furnished shall meet the performance and rating requirements of this specification and all Supplier's guarantees shall be based on operation within the prevailing environmental conditions. This also applies during storage and if susceptible to moisture absorption or fungus attack, the equipment and materials shall be treated with fungicidal varnish and otherwise be adequately tropicalized as far as necessary by national and international environmental and health and safety regulations.

Special measures shall be taken such as the use of chemically treated insert parts and proper surface preparation and paint application by this Specification for equipment installed at Site(s) with a corrosive atmosphere, to protect exposed metal parts and other materials susceptible to a chemical reaction.

Materials susceptible to deterioration from climatic conditions or subject to the formation of fungus or any other form of parasitic life shall preferably not be used, but if used and cannot be avoided, these must be permanently protected.

For all outdoor equipment, the operation of the equipment must not be influenced by dew, fog, rain, wind, sun radiation, quick changes of temperature, dust, smoke, salts, aggressive gases, and steams. Outdoor installations shall be protected against solar radiation using adequate covers, where required, with non-deteriorating material to be provided by the Supplier.

## **TS-12.0 TRAINING REQUIREMENTS**

### **TS-12.1 Training of NPC Personnel**

The Supplier shall provide local training courses for NPC's personnel in English. All necessary training materials shall be provided by the Supplier/OEM and each trainee shall receive individual copies of the technical training manuals and or pertinent documents.

Class materials, including documents sent before the training classes and class handouts, shall become the property of NPC.

Training shall be geared towards the technical engineers and maintenance personnel of NPC through the transfer of technical knowledge.

Training selected from among NPC maintenance staff will be qualified electrical and/or electronic personnel. Their experience will be of a broad and general technical nature, including general familiarity with electronic systems and testing facilities.

The cost of performing the training course shall be included in the Contract Price for the equipment.

#### Training Objectives

The training courses shall be designed to:

- a) Enable maintenance staff to perform maintenance of the equipment by teaching principles of the operation troubleshooting methods and procedures leading to the identification and replacement of a faulty piece of equipment, modules, units, and components, with the objective that NPC's personnel will become capable of carrying out repair and maintenance without outside assistance.

- b) Enable maintenance staff to perform routine maintenance of the equipment by way of electrical and mechanical adjustments, lubrication, and/or replacement of parts subject to wear or with a limited life.
- c) Enable the plant operation personnel to run and operate the SCADA to properly monitor and control the equipment for efficient and effective plant operation and response accordingly any unavoidable situations or disturbances in the power plant.
- d) Provide an understanding of the software and a working knowledge of the database for additions, modifications, and deletions and the practical use of diagnostic programs.

#### Course Documentation

The Supplier shall submit a daily schedule for the entire training period and a syllabus for each course with a listing of course documentation, no later than thirty (30) days before the start of training.

Documentation shall be provided covering each course to a level of detail so that the text is self-explanatory and enough as a future reference.

Before the start of a course, each trainee shall receive at least one (1) set of documentation covering that course. The Supplier shall submit to NPC one (1) set of course documentation per trainee no later than fifteen (15) days before to start of each course.

#### Course Content

NPC considers the training to be as important a project deliverable as any other element of the SCADA. Therefore, the Supplier/OEM shall budget, plan, develop, deliver, and manage the required training program with the same commitment as for other deliverables

The Supplier/OEM shall coordinate the preparation of the overall training program with NPC, and shall provide a comprehensive training schedule as part of the detailed project schedule. The training schedule shall maintain synchronism with the project, so that training is provided at the correct stage, and is not scheduled too early or too late.

The training course shall consist of formal courses including classroom training, instruction, and explanation during shop tests, and practical work sessions with the Supplier's/Manufacturer's specialists during the implementation of requirements of the Contract. Training shall be on the same hardware and software supplied under the contract.

The number of NPC personnel that shall attend each of the formal SCADA training courses is listed in Table 12.1.

**Table 12.1. ATTENDEES PER TRAINING COURSE**

COURSE	Number of Participants per Training	Number of Trainings	Min. No of days per Training	Venue
SCADA Overview	4/8	2	Half Day	NPC
SCADA Concepts and Its Implementation	8	1	2	NPC
SCADA Application and Database/Display Build-up/Configuration/SCADA Admin	8	1	15	NPC
SQL Training	8	1	3	NPC/Supplier Site (Local)
Admin Training 1. OS 2. SCADA and Communication Interface	4 8	1 1	3 2	NPC/Supplier Site (Local)
Hardware Maintenance 1. Server 2. Workstation 3. Switch	4	1	3	NPC/Supplier Site (Local)
Operators Training/ Users Training	5/5	2	2	NPC/Supplier Site (Local)

**TS-12.2 Training Course Requirement**

**1. SCADA Overview Course**

The SCADA Overview course shall be the first course in the training sequence. It shall be planned to serve two purposes:

- a. It shall constitute an introductory class for NPC’s personnel who are designated to attend additional training later. It shall also provide each trainee with a general understanding of SCADA including those aspects of the SCADA for which the trainee will not receive additional training.
- b. It shall familiarize NPC’s management, who will not attend additional training with the capabilities, configuration, operation, and maintenance of the SCADA.

This class shall be scheduled for duration of half day and shall provide ample opportunity for free interchange between Supplier/OEM and NPC personnel. This class shall begin with a management seminar lasting for half a day and providing a high-level overview; this shall be followed by a more technical seminar covering hardware and software components and their inter-relationships.

## 2. SCADA Training

This class is schedule for two (2) days training. With the following topics:

- a. Understanding SCADA:
  - (1) Start by explaining the basic concept of SCADA, its purpose, and its role in industrial automation.
  - (2) Discuss the components of a SCADA system, including the Human-Machine Interface (HMI), Remote Terminal Units (RTUs), Programmable Logic Controllers (PLCs), communication infrastructure, and databases.
  - (3) Highlight the key features and benefits of SCADA systems, such as real-time monitoring, data acquisition, alarm management, and control capabilities.
- b. SCADA Architecture:
  - (1) Explain the typical layered architecture of a SCADA system, which includes field devices, RTUs or PLCs, communication networks, the SCADA server, and the client interface.
  - (2) Describe each layer in detail, discussing their functions, protocols used for communication, and data flow between layers.
  - (3) Discuss redundancy and fault tolerance mechanisms to ensure the reliability and availability of the SCADA system.
- c. SCADA Communication:
  - (1) Explain the various communication protocols used in SCADA systems, such as Modbus, DNP3, OPC, and IEC 60870-5.
  - (2) Discuss the advantages and considerations for selecting the appropriate communication protocol based on the specific application requirements.
  - (3) Explain how SCADA systems communicate with field devices, RTUs, and PLCs over different communication mediums like Ethernet, serial communication, and wireless networks.
- d. SCADA Data Acquisition:
  - (1) Describe the process of data acquisition in SCADA systems, including analog and digital data acquisition from sensors, transducers, and other field devices.
  - (2) Explain the role of RTUs and PLCs in collecting and processing data from remote locations and transmitting it to the SCADA server.
  - (3) Discuss the types of data collected, such as process variables, alarms, events, and historical data, and their importance in system monitoring and decision-making.
- e. SCADA Security:
  - (1) Highlight the importance of security in SCADA systems, given the potential impact of cyber threats and attacks.
  - (2) Discuss security measures and best practices, such as network segmentation, access controls, authentication, encryption, and intrusion detection systems.
  - (3) Explain the importance of regular software updates, patch management, and employee training to mitigate security risks.

f. **SCADA Trends and Future Developments:**

- (1) Provide an overview of the latest trends and advancements in SCADA systems, such as cloud-based SCADA, edge computing, and the integration of IoT technologies.
- (2) Discuss the potential benefits and challenges associated with these advancements and their impact on industrial automation.
- (3) Highlight emerging technologies

### **3. Database/Display/Editor Building Course/Configuration**

This course shall be designed to train NPC personnel in the use of the facilities that will be used to develop the database and the displays and to do limited software development and programming work as well as some configuration need to interface the different network devices.

Included among the goals of these courses shall be training in:

- a. How to set up a SCADA database and display building environment.
- b. How to identify database fields, entries, records, tables and contexts.
- c. How to structure field device (e.g., PLC, RTU, etc.) table definitions interfacing and communication configuration using Modbus Serial and IP, DNP 3 Serial and IP.
- d. How to build tables and arrays.
- e. How to build displays.
- f. How to perform database maintenance.
- g. How to generate the database from source materials.
- h. How to perform maintenance of symbol libraries, display color groups, and display string lists.
- i. Create Tags
- j. Scripting and Programing
- k. Create Real Time Trending and Historical Trending
- l. Report Generation
- m. Interfacing with different Client like android devices
- n. Etc.
- o. Hands-On Exercise

### **4. Basic Structured Query Language (SQL) Training**

This course is intended for individuals with basic computer skills, familiar with concepts related to database structure and terminology, and who want to use SQL to query databases in the SQL historian. This course, Basic SQL shall teach NPC personnel to use SQL as a tool to retrieve the information you need from SCADA/Historian databases.

Included among the goals of this course shall be training in:

- a. Execution a Simply Query
  - (1) Connect to the SQL Database
  - (2) Query a Database
  - (3) Save a Query
  - (4) Modify and Execute a Saved Query
- b. Performing A Conditional Search
  - (1) Search Using One or More Conditions
  - (2) Search for a Range of Values and NULL Values
  - (3) Search Data Based on Patterns
- c. Working with Functions
  - (1) Perform Date Calculations
  - (2) Calculate Data Using Aggregate Functions
  - (3) Manipulate String Values
- d. Organizing Data
  - (1) Sort Data
  - (2) Rank Data
  - (3) Group Data
  - (4) Filter Grouped Data
  - (5) Summarize Grouped Data
  - (6) Use PIVOT and UNPIVOT Operators
- e. Retrieving Data from Multiple Tables
  - (1) Combine the Results of Two Queries
  - (2) Compare the Results of Two Queries
  - (3) Retrieve Data by Joining Tables
- f. Exporting Query Results
  - (1) Generate a Text File
  - (2) Generate an XML File
- g. Project Exercise/Hand-On Exercise

## 5. System Administration or ADMIN Training

### a. SCADA Admin

The Operating System Administration Certification/Training courses shall be designed to train NPC personnel in managing and maintaining the system at the operating system level both for the Server as well as the workstation.

At the end of these courses, participants shall be able to:

- (1) Manage and maintain System Administration Database and Files.
- (2) Administer networks.

- (3) Shut-down and Boot-up the system from different media-like disk, tape, CD-ROM, and network.
- (4) Back-up and restore file system.
- (5) Administer Security.
- (6) Administer workstation.
- (7) Reconfigure the operating system kernel.
- (8) Maintain disk.
- (9) Add hardware and other computer peripherals.
- (10) Add users to the system.
- (11) Add operating system software.
- (12) Maintain network services, mail, and other communication services.
- (13) Project Exercise/Hand-On Exercise

#### **b. SCADA Communication Software**

The Supplier/OEM shall provide training on the SCADA, PLC and RTU communications, communications software used for the SCADA LANs and WANs, and on the interfaces and communications links with the external subsystems and networks. This training shall provide an explanation of the theory, implementation, and maintenance of LAN, WAN, and bridging network software.

At the end of this course, participants shall be able to:

- (1) Introduction of SCADA
- (2) Different Application of SCADA and its corresponding Benefits
- (3) Brief History of Industrial Protocol
- (4) Understand the basic communications theory and industrial protocol used in this project.
- (5) Understand the communications design and implementation in the SCADA.
- (6) Type of Communication Interface
- (7) Different Industrial Protocol and its equivalent interfaces
- (8) Understand the protocol implementation like
  - i. MODBUS Serial and IP and
  - ii. DNP Serial and IP
  - iii. Etc.

#### **6. Hardware Maintenance Training Courses**

This training shall qualify NPC personnel to maintain and troubleshoot to the level of boards or replaceable modules for all SCADA equipment that is not covered by a maintenance contract. It shall include practical training on preventive and corrective maintenance of all equipment, including use

of special tools and instruments. The training shall be provided on SCADA equipment or on similarly configured systems.

NPC selects to perform its own maintenance on the SCADA computer system; the Supplier/OEM's more advance training courses may be selected. These courses shall teach participants to install, configure, diagnose, and verify the proper operation of processors, desktop workstations, communication interfaces, and all SCADA peripheral equipment. Participants shall troubleshoot malfunctions introduced into the system using all available diagnostic tools. The majority of time shall be spent in labs to maximize hands-on exposure to all SCADA hardware. These courses shall enable participants to perform basic, intermediate, and some advanced system fault isolation and repair. The courses shall include software, hardware, and SCADA configuration issues that can masquerade as one another.

At the end of the course, participants shall be able to:

- a. Determine the major functions power-on self-tests.
- b. Understand the general features and the characteristics of the computer system server and workstation and switch.
- c. Understand the general concept of virtualization for server
- d. Understand and configure the Time and Frequency subsystem
- e. Understand and configure the hardware and processors.
- f. Understand and configure switches.
- g. Understand and configure the RAID disk for server.
- h. Project Exercise/Hand-On Training

## **7. Operators Training**

An operators training course shall be provided. The objective of this course is to train NPC personnel on how to use the SCADA from System Controller's perspective. The training materials shall include the SCADA user's manual, and the course shall focus on hands-on training on the SCADA such that participants perform typical power house operations (e.g., switching and "what if" studies, etc.,).

The operators training course shall include but not limited to the following:

- a. A system overview that presents NPC's SCADA configuration, application, capability, and performance concepts.
- b. General operating procedures that cover basic user interface features, display and report capabilities, log-on steps, areas of jurisdiction, user access.
- c. Use of SCADA real-time and study applications under a full range of typical operating conditions, including purpose, theory of

- operation, and the user interface features that support each application.
- d. Equipment handling such as minor SCADA maintenance activities that do not require a technician.
  - e. Verification that the information in the SCADA user's manual is valid.
  - f. Navigation of different display, Data Trending from real time as well as Historical Data.
  - g. Alarm and Event Display filtering and priority display
  - h. Creation and Report Generation
  - i. Project Exercise/Hand-On Exercise

At the end of this course, the participants shall be capable of operating the NPC SCADA System.

## **TS-13.0 QUALITY ASSURANCE AND TESTING REQUIREMENTS**

To ensure that a well-engineered and contractually compliant system is produced by the Supplier/OEM, a quality assurance program approved by the NPC shall be followed and the following formal tests shall be performed:

1. Factory Acceptance Test (FAT)
2. Site Commissioning
3. Site Acceptance Test (SAT)
4. SCADA Availability Test (AT)

### **TS-13.1 Quality Assurance Program**

The Supplier/OEM shall adhere to a Quality Assurance (QA) program for the preparation of all Contract deliverables, including documentation, hardware, firmware, and software. The program shall provide for early detection of actual or potential deficiencies, timely and effective corrective action, and a method of traceability of all such deficiencies.

### **TS-13.2 Variance Reporting and Process**

A computerized variance recording, and tracking system shall be placed in service no later than the scheduled beginning of the SAT. This system shall be designed to record and track variances for documentation deficiencies, functional deficiencies, performance deficiencies, procedural deficiencies (as when deviations from contractually required QA procedures are observed), and test deficiencies (as when the system cannot satisfactorily pass a step within a test procedure) through final acceptance of the SCADA.

Variances may be initiated by both Supplier/OEM and NPC personnel and shall be classified as follows:

1. Open (recorded but solution not formulated by the Supplier/OEM)

2. Assigned (denoting solution formulated by the Supplier/OEM)
3. Pending (denoting fixed by the Supplier/OEM and awaiting retest or verification)
4. Resolved (denoting NPC acceptance or verification).

The variance recording and tracking system shall allow full printouts of all variance information, condensed printouts of abbreviations of the variance information (one line per variance), and shall produce subsets of the variances based on searches of the variance parameters singly or in combination. For example, it shall be possible to produce a printout of all the variances (and only those variances) that were at a specified priority level, concerned a specific named subsystem, had open or assigned status, and were initiated within a named period.

### **TS-13.3 Factory Acceptance Test**

For this project Factory Acceptance Test is not part of suppliers/OEM deliverables.

### **TS-13.4 System Commissioning**

#### **1. Shipment**

The Supplier/OEM shall perform series of testing of the SCADA system prior for shipment base on the standard of OEM. A set of test procedure results shall be provided to NPC after the test.

An official notice of intent to ship shall be submitted by the Supplier/OEM. The Supplier/OEM shall indicate the contents, names of all carries, estimated shipping weight, size shipment, insurance provisions, date schedule to leave the factory, and estimated date/time of arrival of the system shipped.

#### **2. Inspection**

Upon the arrival of equipment/component and/or materials at the site, NPC and the Supplier or their authorized representatives, shall jointly verify the delivered equipment/component and/or materials following the steps below:

- a. Inspection and verification of the packing list;
- b. Visual inspection of the condition of the packing and its surfaces; and
- c. Partial opening of the crates and plastic sheet protection to verify the content and its physical condition and to check the pilferage or damage during shipment and storage.

A record shall be prepared carefully noting all eventual shortages, defects, or damages, signed by the Supplier, and concurred by NPC. All shortages and damages noted shall be immediately replaced by the Supplier at his own cost. Supplier shall also ensure the timely delivery of such replacement without affecting the agreed overall contract implementation schedule.

### 3. System Installation

The Supplier/OEM shall place the equipment on site, interconnect the Supplier/OEM-furnished equipment using Supplier/OEM-supplied cables, and install all necessary cables external to the system, such as wiring to the communications equipment and the electrical power supply.

### 4. System Start-up

The Supplier/OEM shall be responsible for the start-up of the SCADA after its installation. The Supplier/OEM shall:

1. Inspect the system for proper installation.
2. Power up the system and run diagnostics to verify the proper operation of all system hardware.
3. Load the software of the system and boot the system. All executables shall be recompiled from the source to guarantee that the source and source listing are up to date.
4. In cooperation with NPC, activate communication with field devices and other system that interface with the system.
5. Check the on-site operation of the system.
6. Tune or initialize any application software as needed.

### 5. Pre-Commissioning

Pre-commissioning shall be performed after the SCADA has been installed and configured, all initial software has been loaded and system start-up has been completely successfully. Pre-commissioning activities shall include, but shall not be limited to checking that the on-site operation of the completed SCADA computer system, including its communications interfaces to all relevant field devices and external systems are ready for the Site Acceptance Test (SAT).

#### TS-13.5 Site Acceptance Test (SAT)

The SAT shall start after the Supplier/OEM procedures have been approved by NPC. During the SAT, all relevant documentation for the pre-tested system, including its design and maintenance documents, user manuals, test plan and procedures, shall be made available and kept on the test floor for general access. All such documentation shall be complete, up to date, and accurate.

A complete system software generation shall be performed just prior to the SAT to ensure full compatibility with up-to-date, formally controlled, system sources. The test configuration shall include no software patches. Computer-produced system generation records shall be provided for inspection by NPC and included in the official records of the SAT. NPC shall receive early notice for the system generation and have the option to attend it.

During the SAT, the presence of major discrepancies such as frequent processor failover, excessive delay in system response, major or non-recoverable database errors (where wrong values are accessed or stored), incorrect operation of major functions, vulnerability severity index with Critical and High score base on CVSS, etc., may, at the discretion of NPC's Project In-Charge or a designated representative, suspend the entire Site Acceptance Test pending correction of the problem. After correction of a major discrepancy, the entire Site Acceptance Test shall be restarted. Minor discrepancies may, at the option of NPC, be corrected and retested without suspending the entire Site Acceptance Test. NPC shall have the right to request the other hardware and software modules, which it believes may be affected by the correction, also be retested. It is the intent of NPC to have all discrepancies resolved to its satisfaction before each SCADA computer system is shipped.

Software variances must be corrected through fully documented code updates. Software patches shall not be allowed. System documentation must also be updated to reflect variance corrections.

## 1. Equipment Test

### a. Visual Test

These tests shall verify that the SCADA includes all required equipment and is properly configured.

Visual inspection for proper workmanship and labelling, including cables and connectors shall be performed. Initial sizing shall be verified visually where practical. The assembly drawings and configuration drawings will also be verified at this time.

### b. Verification of Upgrade, Vulnerabilities and Expansion Capabilities

These tests shall include inspection and verification that the required SCADA upgrade, expansion capabilities and security patches have been furnished correctly and SCADA system already hardened. This should be accomplished visually where practical; where not practical, review of appropriate OEM data sheets will suffice.

### c. Hardware Diagnostics Test and Vulnerability Assessment

#### (1) Hardware Diagnostic Test

The Hardware Diagnostic Test shall consist of individual tests of all hardware comprising the SCADA computer system. These tests shall consist of running all OEM hardware diagnostic programs to be supplied with the system and, when OEM diagnostic programs are not available, special diagnostic programs devised by the Supplier/OEM.

The diagnostic tests shall be also used to verify memory and bulk memory sizing.

## (2) Vulnerability Assessment

This test shall be conducted to all SCADA network devices like server, workstation, SCADA Application, etc. to determine the network device vulnerabilities and open ports. The Supplier/OEM have the option to use any of the following VA software or any equivalent software.

1. RAPID 7 Metasploit
2. Tenable Nessus
3. Qualys
4. Supplier/OEM standard VA software

## 2. System Functional Tests

These tests shall rigorously exercise all functions and devices, both individually and collectively, and shall verify the correct functional operation of all hardware and software. These tests shall, as a minimum, include the following, as may be applicable to the system under test:

- a. Verification of all required operational functionality of the system, such as SCADA applications, interfaces, etc. supplied in the project
- b. Verification that all software has been correctly sized; this may be accomplished by review of computer configuration tables.
- c. Verification of proper acquisition, processing, and storage of data from local input, and verification of protocol and data exchanges with all external subsystems that will interface with the system. Where necessary, the Supplier/OEM shall provide appropriate simulations of the external systems; such simulations must themselves be verified before being used.
- d. Verification of all user interface functions.
- e. Verification of the proper operation of Servers, Workstations, LAN switches, PLCs, IED's connection thru MODBUS serial and IP, GPS, printers and the computer network as a whole by monitoring of LAN traffic by the LAN Analyzer to be provided with the SCADA, diagnostic procedures, and reconfiguration tests.
- f. Verification of the application and system development capabilities including, software configuration management, source code development, documentation management, user interface development, real-time data set development, RDBMS development, database generation and maintenance, report generation and modification, alarm and event message definition, test environments, and other utility functions.
- g. Verification of communications maintenance capabilities including diagnostics, communications maintenance (PLC, RTU, IED, data links, etc.) and local input/output maintenance.

- h. Verification of all hardware maintenance capabilities.
- i. Verification of the proper response of the system to at least the following abnormal situations:
  - (1) Loss/restoration of hardcopy devices
  - (2) Loss/restoration of System Controller consoles
  - (3) Loss/restoration of bulk-storage devices
  - (4) Loss/restoration of processors/servers
  - (5) Loss/restoration of external subsystems
  - (6) Loss/restoration of input power (UPS failure)
  - (7) Loss/restoration of communication network processors
  - (8) Excessively large bursts of alarms
  - (9) Loss/restoration of time/frequency equipment
  - (10) Loss/restoration of LANs
  - (11) Communication errors (simulated by Supplier/OEM)
- j. Verification of the cyber and information security control like SCADA access and authentication etc., as well as monitoring unauthorized access.
- k. Verification on SCADA data transfer to data historian and Web Services.
- l. Verification of visualization capabilities.
- m. Verification of Back-Up and Disaster recovery functions as require on this tender
- n. Verification that changes of system time will not prevent the system from operating properly and that the system can correctly handle the beginning of a new day, month, and year; leap years and the change in century; and changes to and from Daylight Savings Time.
- o. Verification that the required open system standards and design guidelines have been met. Where applicable and acceptable to the NPC, certification may be substituted for testing.
- p. Point to point testing of all telemetry points from station level to unit level LCU/Unit sensor as all defined in the database.
- q. Verification of communication between Station Level to Unit Level LCU
- r. Verification of LCU data with respect to respective PLC and unit sensors
- s. Generate Report
- t. Verify/creation of displays as well as its functionality
- u. Verification/creation of addition telemetry points in the real time database and corresponding functionalities.
- v. Verification/Functionality of the data historian
- w. Testing of control command trip/close and raise/lower
- x. Verification/functionality of AGV and AVC
- y. Verification/Functionality of sequential control editor and debugging tool
- z. Other structured test that NPC will request.

Completion of the system functionalities shall require successfully performing and passing all of the functional tests outlined above and resolution, to NPC's satisfaction, of all variances discovered during the tests.

The test schedule shall allow time throughout the functional testing for unstructured testing by NPC. Time for unstructured testing shall be reserved at the rate of at least two hours of unstructured testing for each eight hours of structured testing, but no less than four days total. Unstructured testing opportunities shall be made available to NPC on request. This time will be used by NPC to perform additional tests, the need for which may be recovered during the formal testing, and to investigate any potential problems detected. The unstructured tests will be performed during the System Functional Test period and/or during the 120-Hour Test at the discretion of NPC.

### 3. Performance Tests

These tests shall verify that the specified performance requirements are met for the SCADA. Simulation shall be provided by the Supplier/OEM, where necessary, to create the conditions for the specified operating scenarios (see TS-6.2.4 Clause of these Technical Specifications). This simulation shall include additional processor executions, disk input/output and main and bulk memory usage (allocations) to be imposed on the system through the use of simulation software or hardware. The specified spare memory and resources shall be removed or otherwise made unavailable prior to system performance testing.

The following general conditions shall apply to all performance testing:

1. The simulations shall be tested first to verify that the desired simulated activity is indeed being accomplished.
2. All support software needed to efficiently perform the performance tests for the defined system activity levels shall be included in the performance requirements. This means that performance requirements shall not be relaxed because of the execution of the support software or for any other reason.
3. Execution of the performance tests shall be automated as much as possible to the extent that test runs can be reproduced. It shall be the Supplier/OEM's responsibility, with help where appropriate from NPC personnel, to execute, monitor, and measure the test runs and to provide readable test reports to prove that performance requirements were met.
4. The Supplier/OEM shall perform no software modification or development activities other than those required by the SAT Procedures.

The Supplier/OEM shall allow NPC to perform stress tests in which the system will be loaded to very high activity states in order to determine at which point performance is degraded and to identify which parts of the system are most likely to be affected first. The Supplier/OEM shall assist NPC in the planning and performance of the stress tests.

Completion of the system performance tests shall require successfully performing all of the test procedures and resolution, to NPC's satisfaction, of all variances discovered during the tests.

## **TS-13.6 SCADA Availability Testing (AVT)**

### **1. Test Requirements**

A 120-hour SCADA Availability Test (AT) will be conducted for the fully integrated SCADA following installation, start-up, pre-commissioning, and completion of the Site Acceptance Test for all SCADA computer systems.

The AT shall commence at a time mutually agreed upon by the Supplier/OEM and NPC. The Test will be performed under actual operating conditions. This test will be considered the final test of the SCADA. The Supplier/OEM shall always have his qualified representatives on call during the 120-hour SCADA. The purpose of the AT is to verify the reliability of the hardware and software of the SCADA.

### **2. Condition During the Test**

During the AT test period:

- a. The Supplier/OEM shall bear the responsibility for all corrective maintenance on the SCADA. NPC, however, may correct problems under direction from the Supplier/OEM.

NPC will be responsible for the SCADA restarts notification to the Supplier/OEM of service requirements, and preventive maintenance.

### **3. Availability Calculation**

During the SCADA Availability Test, downtime and operational time shall be recorded and accumulated. The SCADA must archive the availability that is specified in Clause of these Technical Specification. The availability of the SCADA shall be computed using the following formula:

$$\% \text{ Availability} = (\text{Total Elapsed Time} - \text{Total Downtime}) \times 100 / \text{Total Elapsed Time}$$

The SCADA shall be considered down, and downtime shall be recorded, upon occurrence of any of the following:

1. The Supplier/OEM or NPC representative determines that a critical function has become unusable at the SCADA power plant control center. "Unusable" shall be construed as continuously inoperable, intermittently non-functional, or slow to responds to events or operators request to a degree that corrective action must be taken.

2. A critical function is interrupted by the removal of the SCADA equipment for corrective maintenance or preventive maintenance at the SCADA power house control center. "Corrective maintenance" is defined as unscheduled events to perform required repairs to equipment that has degraded in performance or failed.
3. The simultaneous partial or total loss of any workstation.

SCADA downtime accumulation shall be stopped upon occurrence of any the following:

1. All critical function(s) become usable and restored to full operational service.
2. The Supplier/OEM and NPC representatives agree that the SCADA is usable to a level that it should be in service.
3. NPC selects to restore the equipment to temporary or interim on-line service during repair procedures, if the repairs could otherwise have been continued. Under these conditions, the time that the equipment is back in service and the time necessary for repeated maintenance caused by the temporary or interim service period shall not be assessed against the function(s) downtime.

If the SCADA is down because of failures of equipment or communications provided by NPC, the availability test shall be suspended until the failed equipment provided by NPC becomes available. Downtime and operational time shall not be accrued or included in the computation of availability.

Non-critical functions shall be available as specified in of these technical Specifications. The availability of the non-critical functions shall be measured as described above for the availability of the critical functions.

#### **4. Duration and Criteria for Passing**

The SCADA Availability Test shall be run for 120 hours, this being the required total of runtime plus downtime. Should the guaranteed availability not be demonstrated at the end of 120 hours, the test may be continued by moving the starting time of the test forward and continuing the test until 120 consecutive hours have been accumulated and the guaranteed availability has been demonstrated. The entire 120-hour test must be rerun whenever any hardware or software design or configuration changes are made to the SCADA to correct problems with the Supplier/OEM-provided software, hardware, or firmware, except that database changes will be allowed without invalidating an on-going test. The SCADA shall be deemed to have failed the SCADA Availability Test if more than three (3) re-definition of starting time are required to demonstrate the guaranteed availability, or if the test is not completed within sixty (60) days from the original starting date.

If the SCADA Availability Test fails, the Supplier/OEM shall make all necessary hardware and software corrections that will make the SCADA conform to the NPC's SCADA availability requirements. This effort shall be given a high priority

by the Supplier/OEM, and a weekly progress report shall be sent to NPC's Project In-Charge or designated representative by email. The report shall identify the Supplier/OEM personnel working on the problems and the progress made. The SCADA Availability Test shall then be rerun. This process of making corrections to the SCADA and rerunning the SCADA Availability Test shall be repeated until the SCADA successfully passes the test. All Supplier/OEM costs for such corrections and test reruns shall be borne by the Supplier/OEM. A provisional acceptance will be issued by NPC after the 120 hours SCADA availability successfully passes the test.

#### **TS-14.0 ACCEPTANCE**

Acceptance certificate shall be issued only after all the required inspections and verification are satisfactorily conducted and performed.

If any of the equipment delivered failed to pass inspection and evaluation, NPC may at its judgment, direct the Supplier to make necessary replacements of equipment/spare parts as may be deemed appropriate.

#### **TS-15.0 DOCUMENTS AND DRAWINGS TO BE SUBMITTED**

1. To be submitted with the bid/proposal for evaluation:
  - a. Completely filled-in Sections 1.0 and 2.0 of the Technical Data Sheets (TDS);
  - b. Original Copy of Manufacturer/Distributor Authorization to Bid, directly addressed to the BAC-NPC, indicating therein the PR/Reference number for the following equipment:
    - (1) SCADA Software
    - (2) Support Software
    - (3) SCADA Hardware

In case of authorized Distributor issues the authority to bid, it shall be accompanied by a Certificate of Authorized Distributorship from the Manufacturer.

Note: Authorization to bid and Certificate of Distributorship from the Manufacturer shall be current and valid for at least Six (6) months from the date of bid opening as advertised.

2. To be submitted during post-qualification:
  - a. Completely filled-in Sections 3.0 to 6.0 of the Technical Data Sheets (TDS);

- b. Letter of Confirmation from the Manufacturer that a local agent or representative is available to provide "After Sales Service" to the supplied components/parts/accessories during and after the warranty period. Name, address, and contact number shall be provided;
  - c. Manufacturer's Brochures/Catalogues/Drawings which contain information/data to support the Supplier's submitted and filled-out Technical Data Sheet;
  - d. Certificate from their customer (end-user) duly addressed to the Bidder that the supplied equipment is/are like the items subject for bidding and has performed satisfactorily in service. The certification must indicate in the PR/Reference Number and date of issuance.
3. To be submitted before or upon delivery:
- a. "Certificate of Origin" from the Manufacturer.
  - b. "Warranty Certificate" for one (1) year against factory defects/workmanship.
  - c. Quality Assurance or Quality Inspection Certificate from the Manufacturer.
  - d. Type Tests Certificate with Test Reports in Five (5) copies.
  - e. Routine and Quality Conformance Certificate with Test Reports in Five (5) copies.
  - f. Certified Test and Inspection Reports duly signed and witnessed by NPC representative; and
  - g. Certificate to show that the item to be delivered is brand new.
  - h. Documentation related to project management includes:
    - (1) Documentation Plan
    - (2) Project Management Documents
    - (3) Training Documents
    - (4) Installation and Wiring Instructions
    - (5) Testing Documents Factory Test (FT), SAT and AV
  - i. Documentation related to the SCADA includes:
    - (1) System Overview
    - (2) Hardware Documents
      - i. Operating Details.
      - ii. Preventive Maintenance Instructions
      - iii. Corrective Maintenance Instructions.
      - iv. Adjustment or Replacement Explanations.
      - v. Parts Information
    - (3) Software Documents
      - i. Software Requirements Specification
      - ii. Interface Requirements Document

- iii. Database Specifications
- iv. Software Coding and Scripting Standards
- v. User Documentation General Requirements
- vi. Standard Software Maintenance Manuals
- vii. Application Software Maintenance Manuals
  - a) System Operation and Maintenance Manual.
  - b) System Network Maintenance Manual.
  - c) System Programmer's Manual.
- (4) Network Documents
- (5) Display Style Guide
- (6) Operating Manual
- (7) Maintenance Documents
- (8) System Re-installation Instructions
- (9) As-built Documents
  - i. As-Built Design Documentation
  - ii. As-Built Software Listing
  - iii. As-Built Machine-Readable Documentation

NOTE: All documents and drawings shall be submitted to the Plant Manager – **Manager, Agus 6 HEP Complex**, for evaluation and approval before the issuance of the Acceptance Certificate.

## **TS-16.0 GUARANTEE REQUIREMENTS**

### **TS-16.1 Warranty Support Period**

The Supplier shall guarantee to complete the repair of equipment/device /materials/applications, and/or replacement/upgrade within thirty (30) calendar days upon notice, of the supplied equipment/device/material at his own expense against defect in design, workmanship, and materials for a period of one (1) year after issuance of Acceptance Certificate by NPC. The Supplier shall guarantee that the unit will perform in the manner as outlined in the equipment's manual and the Contract.

The Supplier shall submit a Warranty Certificate (at least 1 year) effective from the date of acceptance by NPC.

After the lapse of the warranty period, if there are no defects found, NPC shall release the warranty security/certificate.

### **TS-16.2 Maintenance Program**

This section specifies the requirements for hardware and software maintenance for the SCADA during the Warranty period.

## 1. SCADA Maintenance Responsibilities

This sub-clause defines the hardware and software maintenance responsibilities for the project.

During the Warranty period both preventive and remedial maintenance of hardware and software are the Supplier/OEM's on-site responsibility including replacement of defective parts.

### a. Hardware Maintenance Responsibilities

The Supplier/OEM shall assume responsibility for hardware maintenance including updates, patches, etc., for the delivered equipment during the Warranty Period. The Supplier/OEM shall be responsible for all timely associated hardware maintenance, including parts and labor, required to meet system availability.

After completion of the Warranty Period, Supplier/OEM shall offer NPC a Hardware Maintenance service contract that shall contain terms that are similar to those contained in the sub-clauses.

### b. Software Maintenance Responsibilities

The Supplier/OEM shall assume responsibility for all software maintenance and upgrade during the Warranty Period. After completion of the Warranty Period, Supplier/OEM shall offer NPC a Software Maintenance and Upgrade service contract that shall contain terms that are similar to those contained in the sub-clauses.

Upon acceptance of the SCADA, the Supplier/OEM shall transfer to NPC all associated software sublicenses and applicable subscriptions to service, including:

- (1) Upgrade kit and media
- (2) Updated documentation
- (3) Online Update and service
- (4) Full Service (Installation included)
- (5) Rights to copy and install the software on any delivered equipment subject to the licensing provision.

The software maintenance and upgrade responsibility of the Supplier/OEM during Warranty shall include, but not be limited to, the following general types of activities.

- (1) Corrections, such as the design, implementation, and testing of modifications and correction to any SCADA, including Operating System & other Third-Party software that does not meet contractual requirements.
- (2) Coordination of software development activities occurring at the Supplier/OEM and NPC sites. Supplier/OEM will not be responsible for the development activities directed by NPC that are in excess of the contractual requirements.
- (3) Testing of patches prior to the installation in the real-time operation.

Changes, such as modification to the size or contents of databases, changes to application programs or displays, addition of new application or displays, and

system configuration changes shall be the responsibility of the Supplier/OEM when needed to meet the contractual requirements.

**c. Warranty Support**

NPC may make changes to databases and displays needed to meet NPC's operational needs during this period. However, the Supplier/OEM will not be responsible for these modification activities directed by NPC which are in excess of the contractual requirements.

**d. Maintenance Tools and Test Equipment**

The Supplier/OEM shall help NPC purchase the special tools and test equipment that the Supplier/OEM use and which are applicable for NPC's maintenance.

**e. Equipment Modification Notices and Revision Levels**

The Supplier/OEM shall provide a subscription to the equipment modification notices issued by all manufacturers of each type of equipment in the SCADA, until the expiration of the warranty period.

These notices, commonly called Equipment Change Orders (ECOs) or Field Change Orders (FCOs), shall advise NPC of any changes or modifications to the equipment that are necessary or suggested for compatibility, operational, maintenance, or safety reasons.

Any modifications to any of the SCADA equipment that are advised by these ECOs and FCOs during the project, shall be managed and implemented by the Supplier/OEM free of charge to NPC, until the expiration of the Warranty. The record shall be updated each time a feature or engineering change is installed or removed from NPC's equipment.

This accurate up-to-date record shall ensure that correct level diagnostic and documentation are available. Also, future feature changes and engineering changes shall be properly configured for NPC equipment prior to shipment and arrive with the correct prerequisites for installation. In addition, should a disaster occur (i.e., fire or flood), this updated record shall provide the information needed to enable NPC to replace the equipment that was destroyed.

**f. Hardware Maintenance Services**

Supplier/OEM hardware maintenance responsibilities shall include the following:

- (1) Provide technical guidance towards the resolution of all hardware problems with supplied system equipment; respond to request for technical support, either via on-site or remote diagnostic access via dial-up technical assistance to resolve the problems.
- (2) Provide support (preventive maintenance, remedial maintenance, engineering changes, spares inventory, problem resolution, etc.
- (3) Provide materials and instruction for appropriate engineering changes

The Supplier/OEM's technical support staff shall work with NPC's technical staff to establish a strategy to efficiently understand and resolve each identified problem; this may involve remotely signing on to the system to execute software analysis tools or the remote exercising of diagnostics by Supplier/OEM technicians. During the evaluation of the problem, the NPC/Supplier/OEM team shall determine what, if any, additional support may be required to resolve the problem; this may involve calling in Supplier/OEM staff member with additional specific expertise, requesting the support of additional NPC expertise, or it may involve dispatching local OEM support, to resolve specific hardware problems.

If at any time, NPC feels that the Supplier/OEM's remote technical support is not effectively resolving a problem, NPC may request that the Supplier/OEM's staff be dispatched to NPC's facility. Within 72 hours, personnel from the Supplier/OEM technical team shall be at NPC's facility to provide hands-on support towards the problem resolution. NPC will not be responsible for any expenses connected to the technical support, including travel expenses.

All these provisions shall be also applicable to software maintenance services.

## **2. Software Maintenance**

The term software shall include the licensed (Supplier/OEM standard software, third-party software, and OEM software) and developed function code, as well as the associated installation kits, release media, documentation, support media such as on-line help facilities and maintenance tools. The Supplier/OEM's maintenance responsibility shall apply to all of these components of the delivered software.

### **a. Extend of Software Maintenance Types of Software**

#### **(1) Types of Software to be Maintained**

The types software that shall be maintained by the Supplier/OEM shall include but not be limited to:

- i. Operating system, services, and utilities.
- ii. Database management
- iii. Communication networks management products.
- iv. Graphical interface and presentation products (for example, X Windows graphical user interface, widget library, and tool kits).
- v. Communication interface products.
- vi. Software development, test, and maintenance tools.
- vii. Code and documentation management tools and diagnostics.
- viii. SCADA applications.
- ix. Cyber and Information security related application

The software will be composed of Supplier/OEM, and third-party elements and the Supplier/OEM's maintenance responsibility shall apply to all of these elements.

#### **(2) Software Maintenance Responsibilities**

The software maintenance responsibilities shall, as a minimum, include the following activities:

- i. Provide technical guidance towards the resolution of all software-related problems with supplied system.
- ii. Correcting all “bugs” and “vulnerabilities” found in the delivered software; in the case of third-party software and OEM software, obtaining a later release of the product that fixes the “bug”
- iii. Performing upgrades, installing new releases, patches and integrating revisions or corrections to all standard and special SCADA software, OEM and third-party software included, that is, integrating corrections to all standard and special software.
- iv. Performing changes or the typical periodic software maintenance tasks, such as:
  - a) Changes to application programs
  - b) Integration of new applications and displays
  - c) System configuration changes
  - d) Performance evaluation and tuning
  - e) Testing of all changes.
- v. Coordinating software development and periodic synchronization of software for the Supplier/OEM and NPC sites during the project.
- vi. Providing same day technical assistance, if notified by NPC; either via on-site visit or remote diagnostic access via dial-up technical assistance to resolve the problems.
- vii. Providing 100 hours of assistance/consulting support per year for free disposal of NPC.
- viii. Providing assistance and investigation to any Cyber-attacks on the SCADA System

The SCADA software will likely be composed of Supplier/OEM's standard system elements, customized or specially developed elements, and several third-party and/or OEM products. In order to facilitate the efficient maintenance of the SCADA software, the Supplier/OEM shall follow the general principle that software that is specific to NPC shall be implemented in specific libraries that are properly identified. This principle shall ensure that changes and upgrades to the Supplier/OEM's standard system software, applications, or third-party products can be implemented without affecting or interfering with the specific NPC software.

### **(3) Periodic Notices of Software Upgrades**

In order to support performance of the software maintenance tasks, the Supplier/OEM shall provide, or cause to be provided, services bulletins and periodic notices of the availability of corrections, modifications, upgrades, revisions, and new releases for all software elements of the SCADA. These bulletins and notices shall be provided during the period from the start of integration of the SCADA at the Supplier/OEM's facility, until the expiration of the warranty period.

These bulletins and notices shall describe, as a minimum, previous products or software levels the upgrade is applicable to and can be integrated with:

- i. Prerequisites for the upgrades.
- ii. Problem(s) the upgrade corrects.
- iii. New features available with the upgrade.

#### **(4) Software Upgrades and New Releases through Warranty**

All of the SCADA software (including third-party and OEM software) updates, revision, and new releases shall be provided and integrated into NPC's SCADA by the Supplier/OEM at no additional charge to NPC, until the expiration of the Warranty of the SCADA. The upgrading work shall be carried out by Supplier/OEM with NPC assistance. The Upgrading work will be planned by Supplier/OEM and NPC. If the software upgrading implies upgrading of hardware not covered by the hardware maintenance Warranty, Supplier/OEM shall provide the hardware upgrade at no additional cost to NPC.

The Supplier/OEM shall upgrade all SCADA software, including OEM and third-party software, to the latest revision level of the Supplier/OEM's baseline product (commensurate with the hardware to be delivered) available at the commencement of the Site Acceptance Test. The Supplier/OEM shall coordinate the timing and effort required for said update as to minimize the impact of project costs and schedule. The Plant Terminals-are specifically excluded from this requirement unless the upgrade is necessary for operation with the upgraded SCADA. For the period between SCADA acceptance and expiration of the Warranty, the Supplier/OEM shall continue to provide both the notices and the actual software updates and new releases for all of the SCADA software.

Supplier/OEM shall perform all installation of updated software and new releases. Installation includes conversion of database and display information provided by NPC to a format compatible with the newest release, reintegration of applicable customs, and configuration of software around Purchasers hardware platform; testing, verification and installation at site.

NPC will participate in the upgrade by performing additional data entry if new functionality is introduced in the SCADA system by the update or upgrade.

After the Site Acceptance Testing and through expiration of the Warranty Period, the Supplier/OEM shall supply software upgrades and new releases of the baseline SCADA. Upgrades and new releases of all software, including OEM and third-party software shall be included. The material supplied shall be in distribution form with complete instruction for installation. Source code shall be supplied for software modified by the Supplier/OEM in order to meet the requirements of this specification. Supplier will install the software, including re-installation of modifications to standard software made specifically for this contract. NPC will also test the updated software.

**TS-17.0 MEASUREMENT OF PAYMENT**

Payment will be made at the contract lot price of the item(s) delivered in the Bid Price Schedule. Payment thereof shall constitute the full compensation for the supply, delivery, installation, test, and commissioning of the equipment/components.

Name of Bidder: \_\_\_\_\_

Signature(s) of Bidder: \_\_\_\_\_

**SECTION VI – TECHNICAL SPECIFICATIONS**  
**PART II – TECHNICAL DATA SHEETS**

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**SECTION VI – TECHNICAL SPECIFICATIONS**

**PART II – TECHNICAL DATA SHEETS**

**UPGRADING AND INTEGRATION OF UNIT 1 & 2 SCADA SYSTEM TO DCS**

- a. The Bidder shall complete this technical data sheet and submit the filled-up form with the technical proposal. The Bidder shall use continuation sheets as necessary for any other additional information keeping to the format shown herein or by reproducing the same.
- b. NPC reserves the right to reject Bids without proper and/or specific data and information as required herein.
- c. The data required are technical features and characteristics of the Equipment/component/material to be provided by the bidder. Bidder's proposal shall at least be equal or superior to the requirements specified by NPC.

**1.0 SCADA HARDWARE SPECIFICATIONS**

Item	Description	NPC Required Specifications	Supplier's Data and Statement of Compliance
1	<b>Server (SCADA and Historian)</b>		
	Quantity	2	
	Type	Rack Type Server	
	Processor	HPE DL380Gen10 2 x Gold5215 (2.5GHz/10C), 64bit	
	Main Memory	At least 64 GB	
	Operating System	Linux	
	Internal Storage	At least 5 x 960G SSD	
	RAID Controller	SSD RAID 5	
	Networking	Dual 1G (on-board) 4x100/1000M Dual 10G SFP+	
	Disk Drive	DVD ROM	
	Power Supply	Redundant Power Supply and Fan Redundant	
	Database	My SQL	
	Inclusions	Power Cord (North America/Philippines C 13/14) Rail Kit Set	
2	<b>Rackmount Console Kit</b>		
	Chassis	1 rack unit (RU) Rackmount Console	
	Monitor size	with at least a 19-inch LCD color monitor	
	Device inputs	Maximum of 8 KVM	

Item	Description	NPC Required Specifications	Supplier's Data and Statement of Compliance
	Features:		
	Display the contents of any actual or virtual memory location	Required	
	Display the content of any register	Required	
	Clear selected and/or all registers	Required	
	Set the content of a selected register	Required	
	Halt/run PU processes	Required	
	Single step (execute on instruction per step)	Required	
	Automatic fill (auto load) from a selected device	Required	
	Run low level diagnostics	Required	
3	<b>LAN Switch</b>		
	Quantity	2 sets	
	Port type and quantity	Gigabit Ethernet ports in total: 8; 2.5 Gigabit Ethernet ports: 4	
	Interfaces	2 x plug-in terminal block, 4-pin 1 x RJ45 socket 1 x SD card slot to connect the auto configuration adapter ACA31 1 x USB to connect auto-configuration adapter ACA21-USB	
	Power Requirements:		
	Operating Voltage	24 VDC (18-32 ) VDC	
	Power Consumption	17 W	
	Power output in BTU (IT)/h	58	
	Ambient conditions:		
	Operating temperature	0 to 60 °C	
	Storage/transport temp.	-40 to 70 °C	
	Relative humidity (non-condensing)	5 to 95 %	
	MTBF (Telecordia SR-332 Issue 3) @ 25°C	1 710 527 h	
	Mechanical construction:		
	Dimensions (WxHxD)	237 x 148 x 142 mm	
	Weight	2.1 kg	
	Mounting	DIN rail	
	Protection class	IP20	
	Mechanical stability:		
	IEC 60068-2-6 vibration	5 Hz - 8.4 Hz with 3.5 mm amplitude; 8.4 Hz-150 Hz with 1 g	
	IEC 60068-2-27 shock	15 g, 11 ms duration, 18 shocks	
	EMC interference immunity		
	EN 61000-4-2 electrostatic discharge (ESD)	± 4 kV contact discharge; ± 8 kV air discharge	
	EN 61000-4-3 electromagnetic field	10 V/m (80 MHz-3000 MHz)	

Item	Description	NPC Required Specifications	Supplier's Data and Statement of Compliance
	EN 61000-4-4 fast transients (burst)	± 2 kV power line; ± 4 kV data line	
	EN 61000-4-5 surge voltage	power line: ± 2 kV (line/earth), ± 1 kV (line/line); data line: ± 1 kV (line/earth)	
	EN 61000-4-6 Conducted Immunity	10 V (150 kHz-80 MHz)	
	EMC emitted immunity:		
	EN 55022	EN 55032 Class A	
	FCC CFR47 Part 15	FCC 47CFR Part 15, Class A	
	Approvals:		
	Basis Standard	CE, FCC, EN61131	
	Safety of industrial control equipment	EN 60950	
	Transportation	NEMA TS2	
	Software:		
	Switching	Independent VLAN Learning, Fast Aging, Static Unicast/Multicast Address Entries, QoS / Port Prioritization (802.1D/p), TOS/DSCP Prioritization, Interface Trust Mode, CoS Queue Management, IP Ingress DiffServ Classification and Policing, IP Egress DiffServ Classification and Policing, Queue-Shaping / Max. Queue Bandwidth, Flow Control (802.3X), Egress Interface Shaping, Ingress Storm Protection, Jumbo Frames, VLAN (802.1Q), Protocol-based VLAN, VLAN Unaware Mode, GARP VLAN Registration Protocol (GVRP), Voice VLAN, MAC-based VLAN, IP subnet-based VLAN, GARP Multicast Registration Protocol (GMRP), IGMP Snooping/Querier per VLAN (v1/v2/v3), Unknown Multicast Filtering, Multiple VLAN Registration Protocol (MVRP), Multiple MAC Registration Protocol (MMRP), Multiple Registration Protocol (MRP) Layer 2 Loop Protection	
	Redundancy	HIPER-Ring (Ring Switch), HIPER-Ring over Link Aggregation, Link Aggregation with LACP, Link Backup, Media Redundancy Protocol (MRP) (IEC62439-2), MRP over Link Aggregation, Redundant Network Coupling, Sub Ring Manager, RSTP 802.1D-2004 (IEC62439-1), MSTP (802.1Q), RSTP Guards	

Item	Description	NPC Required Specifications	Supplier's Data and Statement of Compliance
	Management	DNS Client, Dual Software Image Support, TFTP, SFTP, SCP, LLDP (802.1AB), LLDP-MED, SSHv2, V.24, HTTP, HTTPS, Traps, SNMP v1/v2/v3, Telnet OPC-UA Server	
	Diagnostics	Management Address Conflict Detection, MAC Notification, Signal Contact, Device Status Indication, TCPDump, LEDs, Syslog, Persistent Logging on ACA, Email Notification, Port Monitoring with Auto-Disable, Link Flap Detection, Overload Detection, Duplex Mismatch Detection, Link Speed and Duplex Monitoring, RMON (1,2,3,9), Port Mirroring 1:1, Port Mirroring 8:1, Port Mirroring N:1, RSPAN, SFLOW, VLAN Mirroring, Port Mirroring N:2, System Information, Self-Tests on Cold Start, Copper Cable Test, SFP Management, Configuration Check Dialog, Switch Dump, Snapshot Configuration Feature	
	Configuration	Automatic Configuration Undo (rollback), Configuration Fingerprint, Text-based Configuration File (XML), Backup config on a remote server when saving, Clear config but keep IP settings, BOOTP/DHCP Client with Auto-Configuration, DHCP Server: per Port, DHCP Server: Pools per VLAN, Auto Configuration Adapter ACA31 (SD card), Auto Configuration Adapter ACA21/22 (USB), HiDiscovery, DHCP Relay with Option 82, Command Line Interface (CLI), CLI Scripting, CLI script handling over ENVN at boot, Full-featured MIB Support, Web-based Management, Context-sensitive Help, HTML5 based Management	
	Security	MAC-based Port Security, Port-based Access Control with 802.1X, Guest/unauthenticated VLAN, Integrated Authentication Server (IAS), RADIUS VLAN Assignment, RADIUS Policy Assignment, Multi-Client Authentication per Port, MAC Authentication Bypass, Format options for MAC authentication bypass, DHCP Snooping, IP Source Guard,	

Item	Description	NPC Required Specifications	Supplier's Data and Statement of Compliance
		Dynamic ARP Inspection, Denial-of-Service Prevention, LDAP, Ingress MAC-based ACL, Egress MAC-based ACL, Ingress IPv4-based ACL, Egress IPv4-based ACL, Time-based ACL, VLAN-based ACL, Ingress VLAN-based ACL, Egress VLAN-based ACL, ACL Flow-based Limiting, Access to Management restricted by VLAN, Device Security Indication, Audit Trail, CLI Logging, HTTPS Certificate Management, Restricted Management Access, Appropriate Use Banner, Configurable Password Policy, Configurable Number of Login Attempts, SNMP Logging, Multiple Privilege Levels, Local User Management, Remote Authentication via RADIUS, User Account Locking, Password change on first login	
	Time synchronization	PTPv2 Transparent Clock two-step, PTPv2 Boundary Clock, Buffered Real Time Clock, SNTP Client, SNTP Server BC with Up to 8 Sync / s	
	Industrial Profiles	EtherNet/IP Protocol, IEC61850 Protocol (MMS Server, Switch Model), Modbus TCP, PROFINET Protocol	
	Miscellaneous	Digital IO Management, Manual Cable Crossing, Port Power Down	
	Hardware configuration of the LAN-Media Module:		
	Interfaces	Port 1: 100BASE-FX, MM-ST; Port 2: 100BASE-FX, MM-ST; Port 3: 10/100BASE-TX, RJ45; Port 4: 10/100BASE-TX, RJ45	
	Network size - length of cable		
	Twisted pair (TP)	Port 3: 0-100 m Port 4: 0-100 m	
	Multimode fiber (MM) 50/125 μm	Port 1: 0-5000 m, 8 dB Link Budget at 1300 nm, A=1 dB/km, 3 dB Reserve, B = 800 MHz x km Port 2: 0-5000 m, 8 dB Link Budget at 1300 nm, A=1 dB/km, 3 dB Reserve, B = 800 MHz x km	
	Multimode fiber (MM) 62.5/125 μm	Port 1: 0 - 4000 m, 11 dB Link Budget at 1300 nm, A = 1 dB/km, 3 dB Reserve, B = 500 MHz x km Port 2: 0 - 4000 m, 11 dB Link Budget at 1300 nm, A = 1 dB/km, 3 dB Reserve, B = 500 MHz x km	
	Power requirements:		

Item	Description	NPC Required Specifications	Supplier's Data and Statement of Compliance
	Operating Voltage	Power supply via the backplane of the MSP switch	
	Power consumption	4 W	
	Power output in BTU (IT)/h	14	
	Software:		
	Diagnostics	LEDs (power, mode, link/data)	
	Ambient conditions:		
	Operating temperature	0-+60 °C	
	Storage/transport temperature	-40-+85 °C	
	Relative humidity (non-condensing)	5-95 %	
	Mechanical construction:		
	Dimensions (WxHxD)	38 mm × 133 mm × 118 mm	
	Weight	201 g	
	Mounting	Backplane	
	Protection class	IP20	
	Mechanical stability		
	IEC 60068-2-6 vibration	5 Hz - 8.4 Hz with 3.5 mm amplitude; 8.4 Hz-150 Hz with 1 g	
	IEC 60068-2-27 shock	15 g, 11 ms duration	
	EMC interference immunity:		
	EN 61000-4-2 electrostatic discharge (ESD)	± 4 kV contact discharge; ± 8 kV air discharge	
	EN 61000-4-3 electromagnetic field	10 V/m (80 MHz-3000 MHz)	
	EN 61000-4-4 fast transients (burst)	± 2 kV power line; ± 4 kV data line	
	EN 61000-4-5 surge voltage	power line: ± 2 kV (line/earth), ± 1 kV (line/line); data line: ± 1 kV (line/earth)	
	EN 61000-4-6 Conducted Immunity	10 V (150 kHz-80 MHz)	
	EMC emitted immunity:		
	EN 55022	EN 55032 Class A	
	FCC CFR47 Part 15	FCC 47CFR Part 15, Class A	
	Approvals:		
	Basis Standard	C-Tick EN61131	
	Safety of industrial control equipment	EN 60950	
	Transportation	NEMA TS2	
4	<b>Gateway</b>		
	Processor	INTEL 2.0HGz	
	Memory	16G DDR4	
	Storage	1TSSD (TLC) hard disk	
	Ports	6 x 1000 Ethernet; 2 x RS232/RS485/RS422 (Isolation); 10 x RS485 (Isolation)	
	Operating System	Linux	
	Double Power	100-240VAC/VDC	

Item	Description	NPC Required Specifications	Supplier's Data and Statement of Compliance
	Operating Temperature	-25°C ~ 55°C, Fan-less Design	
	Mounting	Rack Type	
	Protocol Supported	DNP 3 (All Types) Modbus All (Types) Other protocol supported in the NARI existing controllers	
5	<b>User Interface Equipment</b>		
	Workstations:		
	Processor	HP Z4 G4 Intel® Xeon® W-2223 3.6 2666Mhz 8.25 4C	
	Memory	16GB DDR4	
	Storage	960G SSD+2T SAS 7.2K	
	Graphics	NVIDIA T400 3mDP GFX	
	Ports	WLAN: 2x100/1000M	
	Power Supply	220 VAC	
	Inclusions	Engineering Console: Two (2) 27- Inches LED Monitors 1920x1080 resolution Operator Console: Three (3) 27- Inches LED Monitors 1920x1080 resolution	
		Keyboard and Mouse	
		DVD-RW Drive	
		Linux OS latest version	
	KVM Extender:		
	Quantity	3 sets	
	Computer Connections TX	DVI-D x 2, Audio 3.5mm in, Audio 3.5mm out, USB type B, RS232 9 pin D-Type, SFP slot	
	Computer Connections RX	Video: DVI-D x 2, Audio 3.5mm in, Audio 3.5mm out, USB type A x 4, RS232 9 pin D-Type, SFP slot	
	Approvals	CE, FCC	
	Resolution	1920x1200 @60Hz [Single Link]; 2560x1600 @60Hz [Dual Link]	
	Power	2.5mm DC jack (power adapter included), 100-240VAC 50/60Hz, 0.4A, input to power adapter, 5VDC 12.5W output from power adapter	
	Operating Temperature	0 to 40°C/ 32 to 104°C	
	Inclusion	3 x DVI-D Cables per Set	
		Rack Mount Kit for 19" Rack Cabinet	

Item	Description	NPC Required Specifications	Supplier's Data and Statement of Compliance
6	<b>Cabinet enclosure</b>		
	Features:		
	Size	23.5"W x 79.5"(42U) H x 35"D	
	Material construction	Aluminum, lightweight	
	Vented for optimum air flow		
	Convenient cable access via bottom cable pass-through ports	Required	
	Vented window door and rear door with superior engineered cooling which accommodates front to rear and top to bottom cooling schemes	Required	
	Caster base	Required	
	Pre-assembled casters	4 swivels, non-locking	
	Adjustable feet (4 in forward outermost position)	Required	
	Vented top cover	Required	
	With side covers	Required	
	Anti-tip angles	Required	
	Diameter cable entry holes	Two 4" diameter in top and bottom plus large open bottom provides ample cable entry/egress facilities	
	Front and rear door handles and lock bars for improved security	Required	
	Color	Black	
	Accessories:		
	Stationary Shelves	Five (5) sets	
	Telescopic Shelf	One (1) set	
	Cooling Fan	4 Fans, 10 feet cord terminated NEMA5-15P and mounting hardware	
	Universal Horizontal and Vertical Cable Manager	Required	
	Power Strip	Three (3) sets 19", Eight (8) 3-prong, 15 A, 125 Vac outlets with transformed spaced, Circuit breaker and 10 feet cord; Wall rack mountable; Inclusive of bracket and installation hardware; and Surge protection meets UL 1368/UL 1449 requirements	
	Cabinet Thermostat with adhesive-backed mounting brackets and wiring harness	Required	
	Cable management kit contains	10 D Rings, 10 Cable Clips, 1 Cable Router (1U) and 1 Cable Router (2U)	
	Light kit will be mount in top rear for improved visibility	Required	

Item	Description	NPC Required Specifications	Supplier's Data and Statement of Compliance
	inside the rack: 14W florescent bulb, lamp base (motion detector switch), power cord, assembly kit with mounting bracket		
	Universal Locking Shelf kit	Required	
	Grounding Strap	500A ground strap between straight lengths to maintain electrical connection	
7	UTP Cables, connectors, faceplate, raceway molding	As per supplier's design	

Name of Bidder: \_\_\_\_\_

Signature(s) of Bidder: \_\_\_\_\_

## SECTION VII

# SCHEDULE OF REQUIREMENTS

**SECTION VII - SCHEDULE OF REQUIREMENTS**  
**A6IC UPGRADING & INTEGRATION OF UNIT 1 & 2 SCADA SYSTEM TO DCS**  
**PR. NO. MA-A7C23-005**

ITEM NO.	DESCRIPTION	QTY.- UNIT	* C O D E	UNIT PRICE FOR GOODS AND RELATED SERVICES TO BE SUPPLIED AND DELIVERED						TOTAL PRICE
				Unit Price of Goods Delivered up to Philippine Port +(Phil. Peso)	Import Duties & other Levies Imposed by Phil. Govt. (Phil. Peso)	Value Added Tax and other Taxes Imposed by Phil. Govt. (Phil. Peso)	Local Transport from Port to Delivery Site <(Phil. Peso)	Labor (Installation, Testing and Commissioning) >(Phil. Peso)	Total Unit Price (E+F+G+H+I)	Local Currency (Phil. Peso) (K = J x C)
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)
1.0	A6IC Upgrading & Integration of Unit 1 & 2 SCADA System to DCS including all other works and services as specified in the Technical Specifications.	1 Lot								
	— Nothing Follows —									

- \* Bidders shall enter a code representing the Country of Origin of all imported Equipment, Materials and Accessories
- + Cost of equipment, freight, insurance, etc. up to Phil. port of entry
- < Unit Price for Local Transportation, Insurance and other local costs incidental to delivery of the goods from the Phil port of entry to final delivery site
- > Unit Price for Local Transportation, insurance and other local costs incidental to delivery of the goods from local source to final delivery site

Code	Country of Origin

Name of Bidder: \_\_\_\_\_

Signature of Bidder: \_\_\_\_\_

Note: Final delivery site of the equipment shall be at:  
 Agus 6 HEP Plant, Iligan, Lanao Del Norte

SECTION VIII

**BIDDING FORMS**

## SECTION VIII – BIDDING FORMS

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Sample Form	- Certification from DTI as Domestic Bidder

Standard Form No: NPCSF-GOODS-01

**Checklist of Technical & Financial Envelope Requirements for Bidders**

**A. THE 1<sup>ST</sup> ENVELOPE (TECHNICAL COMPONENT) SHALL CONTAIN THE FOLLOWING:**

**1. ELIGIBILITY DOCUMENTS**

**a. (CLASS A)**

- PhilGEPs Certificate of Registration and Membership under Platinum Category (all pages) in accordance with Section 8.5.2 of the Revised IRR of RA. 9184;

**Note:** The failure by the prospective bidder to update its Certificate with the current and updated Class "A" eligibility documents shall result in the automatic suspension of the validity of its Certificate until such time that all of the expired Class "A" eligibility documents has been updated

- Statement of all its ongoing government and private contracts if any, whether similar or not similar in nature and complexity to the contract to be bid (NPCSF-GOODS-02)

- The Statement of the bidder's Single Largest Completed Contract (SLCC) similar to the contract to be bid, and whose value, adjusted to current prices using the Philippine Statistics Authority (PSA) consumer price index, must be at least 50% of the ABC (NPCSF-GOODS-03) complete with the following supporting documents:

1. Certificate of Acceptance; or Certificate of Completion; or Official Receipt (O.R); or Sales Invoice

*(The Single Largest Completed Contract (SLCC) as declared by the bidder shall be verified and validated to ascertain such completed contract. Hence, bidders must ensure access to sites of such projects/equipment to NPC representatives for verification and validation purposes during post-qualification process.*

*It shall be a ground for disqualification, if verification and validation cannot be conducted for reasons attributable to the Bidder.)*

- Duly signed computation of its Net Financial Contracting Capacity (NFCC) at least equal to the ABC (NPCSF-GOODS-04) or a Committed Line of Credit (CLC) at least equal to ten percent (10%) of the ABC, issued by a Universal or Commercial Bank; If the Bidder opted to submit a Committed Line of Credit (CLC), the bidder must submit a granted credit line valid/effective at the date of bidding.

**b. (CLASS B)**

- For Joint Venture (if applicable), any of the following:

- Valid Joint Venture Agreement (NPCSF-GOODS-05)

**OR**

- Notarized statements from all the potential joint venture partners stating that they will enter into and abide by the provisions of the JVA, if awarded the contract

- Certification from the relevant government office of their country stating that Filipinos are allowed to participate in their government procurement activities for the same item/product (For foreign bidders claiming eligibility by reason of their country's extension of reciprocal rights to Filipinos)

Standard Form No: NPCSF-GOODS-01

## 2. Technical Documents

- Bid Security, any one of the following:
  - Bid Securing Declaration (NPCSF-GOODS-06c)  
**OR**
  - Cash or Cashier's/Manager's check issued by a Universal or Commercial Bank – 2% of ABC;  
**OR**
  - Bank draft/guarantee or irrevocable letter of credit issued by a Universal or Commercial Bank: (NPCSF-GOODS-06a) - 2% of ABC;  
**OR**
  - Surety Bond callable upon demand issued by a reputable surety or insurance company (NPCSF-GOODS-06b) - 5% of ABC, with
    - Certification from the Insurance Commission as authorized company to issue surety
- Duly signed, completely filled-out and notarized Omnibus Sworn statement (Revised) (NPCSF-GOODS-07), complete with the following attachments:
  - For Sole Proprietorship:
    - Special Power of Attorney
  - For Partnership/Corporation/Cooperative/Joint Venture:
    - Document showing proof of authorization (e.g., duly notarized Secretary's Certificate, Board/Partnership Resolution, or Special Power of Attorney, whichever is applicable)
- Documents to be submitted with the Proposal as specified in Clause TS-10.0(a) of Section VI - Technical Specifications;
- Complete eligibility documents of the proposed subcontractor, if any

### **B. THE 2<sup>ND</sup> ENVELOPE (FINANCIAL COMPONENT) SHALL CONTAIN THE FOLLOWING:**

- Duly signed Bid Letter indicating the total bid amount in accordance with the prescribed form (NPCSF-GOODS-08)
- Duly signed and completely filled-out Schedule of Requirement (Section VII) indicating the unit and total prices per item and the total amount in the prescribed Price Schedule form.
- For Domestic Bidder claiming for domestic preference:
  - Letter address to the BAC claiming for preference
  - Certification from DTI as Domestic Bidder in accordance with the prescribed forms provided

Standard Form No: NPCSF-GOODS-01

**CONDITIONS:**

1. *Each Bidder shall submit Two (2) copies of the first and second components of its Bid, marked Original and photocopy. Only the original copy will be read and considered for the bid. Any misplaced document outside of the Original copy will not be considered. The photocopy is ONLY FOR REFERENCE. NPC may request additional hard copies and/or electronic copies of the Bid. However, failure of the Bidders to comply with the said request shall not be a ground for disqualification.*
  
2. *In the case of foreign bidders, the eligibility requirements under Class "A" Documents (except for Tax Clearance) may be substituted by the appropriate equivalent documents, if any, issued by the country of the foreign bidder concerned. The eligibility requirements or statements, the bids, and all other documents to be submitted to the BAC must be in English. If the eligibility requirements or statements, the bids, and all other documents submitted to the BAC are in foreign language other than English, it must be accompanied by a translation of the documents in English. The documents shall be translated by the relevant foreign government agency, the foreign government agency authorized to translate documents, or a registered translator in the foreign bidder's country; and shall be authenticated by the appropriate Philippine foreign service establishment/post or the equivalent office having jurisdiction over the foreign bidder's affairs in the Philippines.*  
*These documents shall be accompanied by a Sworn Statement in a form prescribed by the GPPB stating that the documents submitted are complete and authentic copies of the original, and all statements and information provided therein are true and correct. Upon receipt of the said documents, the PhilGEPS shall process the same in accordance with the guidelines on the Government of the Philippines – Official Merchants Registry (GoP-OMR).*
  
3. *A Bidder not submitting bid for reason that his cost estimate is higher than the ABC, is required to submit his letter of non-participation/regret supported by corresponding detailed estimates. Failure to submit the two (2) documents shall be understood as acts that tend to defeat the purpose of public bidding without valid reason as stated under Section 69.1.(i) of the revised IRR of R.A. 9184.*

Standard Form Number: NPCSF-GOODS-02

**List of All Ongoing Government and Private Contracts Including Contract Awarded But Not Yet Started**

Business Name : \_\_\_\_\_  
Business Address : \_\_\_\_\_

Name of Contract/ Project Cost	a. Owner's Name b. Address c. Telephone Nos.	Nature of Work	Bidder's Role		a. Date Awarded b. Date Started c. Date of Completion or Contract Duration/ Date of Delivery	Value of Outstanding Works / Undelivered Portion
			Description	%		
<b>Government</b>						
<b>Private</b>						
<b>Total Cost</b>						

The bidder shall declare in this form all his on-going government and private contracts including contracts where the bidder (either as individual or as a Joint Venture) is a partner in a Joint Venture agreement other than his current joint venture where he is a partner. Non declaration will be a ground for disqualification of bid.

Note : This statement shall be supported with the following documents for all the contract(s) stated above which shall be submitted during Post-qualification:  
 1. Contract/Purchase Order and/or Notice of Award  
 2. Certification coming from the project owner/client that the performance is satisfactory as of the bidding date.

Submitted by : \_\_\_\_\_  
 (Printed Name & Signature)  
 Designation : \_\_\_\_\_  
 Date : \_\_\_\_\_

Standard Form Number: NPCSF-GOODS-03

**The Statement of the bidder's Single Largest Completed Contract (SLCC) similar to the contract to be bid**

Business Name : \_\_\_\_\_  
Business Address : \_\_\_\_\_

Name of Contract	a. Owner's Name b. Address c. Telephone Nos.	Nature of Work	Contractor's Role		a. Amount at Award b. Amount at Completion c. Duration	a. Date Awarded b. Contract Effectivity c. Date Completed
			Description	%		

- Notes: 1. The bidder must state only one (1) Single Largest Completed Contract (SLCC) similar to the contract to be bid.  
2. Supporting documents such any of the following: Certificate of Acceptance; or Certificate of Completion; or Official Receipt (O.R); or Sales Invoice for the contract stated above shall be submitted during Bid Opening.

Submitted by : \_\_\_\_\_  
(Printed Name & Signature)  
Designation : \_\_\_\_\_  
Date : \_\_\_\_\_

Standard Form Number: NPCSF-GOODS-04

### NET FINANCIAL CONTRACTING CAPACITY (NFCC)

- A. Summary of the Supplier's/Distributor's/Manufacturer's assets and liabilities on the basis of the income tax return and audited financial statement for the immediately preceding calendar year are:

		Year 20__
1.	Total Assets	
2.	Current Assets	
3.	Total Liabilities	
4.	Current Liabilities	
5.	Net Worth (1-3)	
6.	Net Working Capital (2-4)	

- B. The Net Financial Contracting Capacity (NFCC) based on the above data is computed as follows:

NFCC = [(Current assets minus current liabilities) x 15] minus the value of all outstanding or uncompleted portions of the projects under ongoing contracts, including awarded contracts yet to be started coinciding with the contract for this Project.

NFCC = P \_\_\_\_\_

Herewith attached is certified true copy of the audited financial statement, stamped "RECEIVED" by the BIR or BIR authorized collecting agent for the immediately preceding calendar year.

Submitted by:

\_\_\_\_\_  
Name of Supplier / Distributor / Manufacturer

\_\_\_\_\_  
Signature of Authorized Representative

Date : \_\_\_\_\_

Standard Form Number: NPCSF-GOODS-05

### JOINT VENTURE AGREEMENT

#### KNOW ALL MEN BY THESE PRESENTS:

That this JOINT VENTURE AGREEMENT is entered into by and between:  
\_\_\_\_\_, of legal age, *(civil status)* \_\_\_\_\_, authorized representative of  
\_\_\_\_\_ and a resident of \_\_\_\_\_.

- and -

\_\_\_\_\_, of legal age, *(civil status)* \_\_\_\_\_, authorized representative of  
\_\_\_\_\_ a resident of \_\_\_\_\_.

That both parties agree to join together their capital, manpower, equipment, and other resources and efforts to enable the Joint Venture to participate in the Bidding and Undertaking of the hereunder stated Contract of the **National Power Corporation**.

#### NAME OF PROJECT

#### CONTRACT AMOUNT

\_\_\_\_\_

That the capital contribution of each member firm:

NAME OF FIRM	CAPITAL CONTRIBUTION
1.	P
2.	P

That both parties agree to be jointly and severally liable for their participation in the Bidding and Undertaking of the said contract.

That both parties agree that \_\_\_\_\_ and/or \_\_\_\_\_ shall be the Official Representative/s of the Joint Venture, and are granted full power and authority to do, execute and perform any and all acts necessary and/or to represent the Joint Venture in the Bidding and Undertaking of the said contract, as fully and effectively and the Joint Venture may do and if personally present with full power of substitution and revocation.

That this Joint Venture Agreement shall remain in effect only for the above stated Contract until terminated by both parties.

\_\_\_\_\_  
*Name & Signature of Authorized Representative*

\_\_\_\_\_  
*Official Designation*

\_\_\_\_\_  
*Name of Firm*

\_\_\_\_\_  
*Name & Signature of Authorized Representative*

\_\_\_\_\_  
*Official Designation*

\_\_\_\_\_  
*Name of Firm*

#### Witnesses

1. \_\_\_\_\_ 2. \_\_\_\_\_

#### **[Jurat]**

*[Format shall be based on the latest Rules on Notarial Practice]*

Standard Form Number: NPCSF-GOODS-06a

### FORM OF BID SECURITY (BANK GUARANTEE)

WHEREAS, (Name of Bidder) (hereinafter called "the Bidder") has submitted his bid dated (Date) for the [name of project] (hereinafter called "the Bid").

KNOW ALL MEN by these presents that We (Name of Bank) of (Name of Country) having our registered office at \_\_\_\_\_ (hereinafter called "the Bank" are bound unto National Power Corporation (hereinafter called "the Entity") in the sum of [amount in words & figures as prescribed in the bidding documents] for which payment well and truly to be made to the said Entity the Bank binds himself, his successors and assigns by these presents.

SEALED with the Common Seal of the said Bank this \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_.

THE CONDITIONS of this obligation are that:

- 1) if the Bidder withdraws his Bid during the period of bid validity specified in the Bidding Documents; or
- 2) if the Bidder does not accept the correction of arithmetical errors of his bid price in accordance with the Instructions to Bidder; or
- 3) if the Bidder, having determined as the LCB, fails or refuses to submit the required tax clearance, latest income and business tax returns and PhilGEPs registration certificate within the prescribed period; or
- 4) if the Bidder having been notified of the acceptance of his bid and award of contract to him by the Entity during the period of bid validity:
  - a) fails or refuses to execute the Contract; or
  - b) fails or refuses to submit the required valid JVA, if applicable; or
  - c) fails or refuses to furnish the Performance Security in accordance with the Instructions to Bidders;

we undertake to pay to the Entity up to the above amount upon receipt of his first written demand, without the Entity having to substantiate its demand, provided that in his demand the Entity will note that the amount claimed by it is due to the occurrence of any one or combination of the four (4) conditions stated above.

The Guarantee will remain in force up to 120 days after the opening of bids or as it may be extended by the Entity, notice of which extension(s) to the Bank is hereby waived. Any demand in respect of this Guarantee should reach the Bank not later than the above date.

DATE \_\_\_\_\_ SIGNATURE OF THE BANK \_\_\_\_\_

WITNESS \_\_\_\_\_ SEAL \_\_\_\_\_

\_\_\_\_\_  
(Signature, Name and Address)

Standard Form Number: NPCSF-GOODS-06b

### FORM OF BID SECURITY (SURETY BOND)

BOND NO.: \_\_\_\_\_ DATE BOND EXECUTED: \_\_\_\_\_

By this bond, We (Name of Bidder) \_\_\_\_\_ (hereinafter called "the Principal") and (Name of Surety) \_\_\_\_\_ of (Name of Country of Surety) \_\_\_\_\_, authorized to transact business in the Philippines (hereinafter called "the Surety") are held and firmly bound unto National Power Corporation (hereinafter called "the Employer") as Obligee, in the sum of (amount in words & figures as prescribed in the bidding documents), callable on demand, for the payment of which sum, well and truly to be made, we, the said Principal and Surety bind ourselves, our successors and assigns, jointly and severally, firmly by these presents.

SEALED with our seals and dated this \_\_\_\_\_ day of \_\_\_\_\_ 20 \_\_\_\_\_

WHEREAS, the Principal has submitted a written Bid to the Employer dated the \_\_\_\_\_ day of \_\_\_\_\_ 20 \_\_\_\_\_, for the \_\_\_\_\_ (hereinafter called "the Bid").

NOW, THEREFORE, the conditions of this obligation are:

- 1) if the Bidder withdraws his Bid during the period of bid validity specified in the Bidding Documents; or
- 2) if the Bidder does not accept the correction of arithmetical errors of his bid price in accordance with the Instructions to Bidder; or
- 3) if the Bidder, having determined as the LCB, fails or refuses to submit the required tax clearance, latest income and business tax returns and PhilGEPs registration certificate within the prescribed period; or
- 4) if the Bidder having been notified of the acceptance of his bid and award of contract to him by the Entity during the period of bid validity:
  - d) fails or refuses to execute the Contract; or
  - e) fails or refuses to submit the required valid JVA, if applicable; or
  - f) fails or refuses to furnish the Performance Security in accordance with the Instructions to Bidders;

then this obligation shall remain in full force and effect, otherwise it shall be null and void.

PROVIDED HOWEVER, that the Surety shall not be:

- a) liable for a greater sum than the specified penalty of this bond, nor
- b) liable for a greater sum than the difference between the amount of the said Principal's Bid and the amount of the Bid that is accepted by the Employer.

*Standard Form Number: NPCSF-GOODS-06b*  
*Page 2 of 2*

This Surety executing this instrument hereby agrees that its obligation shall be valid for 120 calendar days after the deadline for submission of Bids as such deadline is stated in the Instructions to Bidders or as it may be extended by the Employer, notice of which extension(s) to the Surety is hereby waived.

PRINCIPAL \_\_\_\_\_ SURETY \_\_\_\_\_

SIGNATURE(S) \_\_\_\_\_ SIGNATURES(S) \_\_\_\_\_

NAME(S) AND TITLE(S) \_\_\_\_\_ NAME(S) \_\_\_\_\_

SEAL \_\_\_\_\_ SEAL \_\_\_\_\_

Standard Form No: NPCSF-GOODS-06c

REPUBLIC OF THE PHILIPPINES )  
CITY OF \_\_\_\_\_ ) S.S.

**BID-SECURING DECLARATION**  
**A61C UPGRADING AND INTEGRATION OF UNITS 1 & 2 SCADA SYSTEM TO DCS (PR**  
**NO. PR NO. MG-A7M23-005)**

To: **National Power Corporation**  
BIR Road cor. Quezon Ave.  
Diliman, Quezon City

I/We<sup>1</sup>, the undersigned, declare that:

1. I/We understand that, according to your conditions, bids must be supported by a Bid Security, which may be in the form of a Bid-Securing Declaration.
2. I/We accept that: (a) I/we will be automatically disqualified from bidding for any contract with any procuring entity for a period of two (2) years upon receipt of your Blacklisting Order; and, (b) I/we will pay the applicable fine provided under Section 6 of the Guidelines on the Use of Bid Securing Declaration, within fifteen (15) days from receipt of the written demand by the Procuring Entity for the commission of acts resulting to the enforcement of the Bid Securing Declaration under Sections 23.1 (b), 34.2, 40.1 and 69.1, except 69.1 (f) of the IRR of R.A. 9184; without prejudice to other legal action the government may undertake.
3. I/We understand that this Bid-Securing Declaration shall cease to be valid on the following circumstances:
  - (a) Upon expiration of the bid validity period, or any extension thereof pursuant to your request;
  - (b) I am/we are declared ineligible or post-disqualified upon receipt of your notice to such effect, and (i) I/we failed to timely file a request for reconsideration or (ii) I/we filed a waiver to avail of said right;
  - (c) I am/we are declared as the bidder with the Lowest Calculated and Responsive Bid, and I/we have furnished the performance security and signed the Contract.

IN WITNESS WHEREOF, I/we have hereunto set my hand this \_\_\_\_ day of \_\_\_\_  
20\_\_\_\_ at \_\_\_\_\_, Philippines.

\_\_\_\_\_  
[Name and Signature of Bidder's Representative/  
Authorized Signatory]  
[Signatory's legal capacity]  
Affiant

**[Jurati]**

[Format shall be based on the latest Rules on Notarial Practice]

<sup>1</sup> Select one and delete the other. Adopt same instruction for similar terms throughout the document.

Standard Form No: NPCSF-GOODS-07

### Omnibus Sworn Statement (Revised)

REPUBLIC OF THE PHILIPPINES )  
CITY/MUNICIPALITY OF \_\_\_\_\_ ) S.S.

#### AFFIDAVIT

I, [Name of Affiant], of legal age, [Civil Status], [Nationality], and residing at [Address of Affiant], after having been duly sworn in accordance with law, do hereby depose and state that:

1. *[Select one, delete the other:]*

*[If a sole proprietorship:]* I am the sole proprietor or authorized representative of [Name of Bidder] with office address at [address of Bidder];

*[If a partnership, corporation, cooperative, or joint venture:]* I am the duly authorized and designated representative of [Name of Bidder] with office address at [address of Bidder];

2. *[Select one, delete the other:]*

*[If a sole proprietorship:]* As the owner and sole proprietor, or authorized representative of [Name of Bidder], I have full power and authority to do, execute and perform any and all acts necessary to participate, submit the bid, and to sign and execute the ensuing contract for [Name of the Project] of the [Name of the Procuring Entity], as shown in the attached duly notarized Special Power of Attorney;

*[If a partnership, corporation, cooperative, or joint venture:]* I am granted full power and authority to do, execute and perform any and all acts necessary to participate, submit the bid, and to sign and execute the ensuing contract for [Name of the Project] of the [Name of the Procuring Entity], as shown in the attached [state title of attached document showing proof of authorization (e.g., duly notarized Secretary's Certificate, Board/Partnership Resolution, or Special Power of Attorney, whichever is applicable)];

3. [Name of Bidder] is not "blacklisted" or barred from bidding by the Government of the Philippines or any of its agencies, offices, corporations, or Local Government Units, foreign government/foreign or international financing institution whose blacklisting rules have been recognized by the Government Procurement Policy Board, by itself or by relation, membership, association, affiliation, or controlling interest with another blacklisted person or entity as defined and provided for in the Uniform Guidelines on Blacklisting;

4. Each of the documents submitted in satisfaction of the bidding requirements is an authentic copy of the original, complete, and all statements and information provided therein are true and correct;

5. [Name of Bidder] is authorizing the Head of the Procuring Entity or its duly authorized representative(s) to verify all the documents submitted;

6. *[Select one, delete the rest:]*

*[If a sole proprietorship:]* The owner or sole proprietor is not related to the Head of the Procuring Entity, members of the Bids and Awards Committee (BAC), the Technical Working Group, and the BAC Secretariat, the head of the Project Management Office or the end-user unit, and the project consultants by consanguinity or affinity up to the third civil degree;

*[If a partnership or cooperative:]* None of the officers and members of [Name of Bidder] is related to the Head of the Procuring Entity, members of the Bids and Awards Committee (BAC), the Technical Working Group, and the BAC Secretariat, the head of the Project

Management Office or the end-user unit, and the project consultants by consanguinity or affinity up to the third civil degree;

*[If a corporation or joint venture:]* None of the officers, directors, and controlling stockholders of *[Name of Bidder]* is related to the Head of the Procuring Entity, members of the Bids and Awards Committee (BAC), the Technical Working Group, and the BAC Secretariat, the head of the Project Management Office or the end-user unit, and the project consultants by consanguinity or affinity up to the third civil degree;

7. *[Name of Bidder]* complies with existing labor laws and standards; and
8. *[Name of Bidder]* is aware of and has undertaken the responsibilities as a Bidder in compliance with the Philippine Bidding Documents, which includes:
  - a. Carefully examining all of the Bidding Documents;
  - b. Acknowledging all conditions, local or otherwise, affecting the implementation of the Contract;
  - c. Making an estimate of the facilities available and needed for the contract to be bid, if any; and
  - d. Inquiring or securing Supplemental/Bid Bulletin(s) issued for the *[Name of the Project]*.
9. *[Name of Bidder]* did not give or pay directly or indirectly, any commission, amount, fee, or any form of consideration, pecuniary or otherwise, to any person or official, personnel or representative of the government in relation to any procurement project or activity.
10. In case advance payment was made or given, failure to perform or deliver any of the obligations and undertakings in the contract shall be sufficient grounds to constitute criminal liability for Swindling (Estafa) or the commission of fraud with unfaithfulness or abuse of confidence through misappropriating or converting any payment received by a person or entity under an obligation involving the duty to deliver certain goods or services, to the prejudice of the public and the government of the Philippines pursuant to Article 315 of Act No. 3815 s. 1930, as amended, or the Revised Penal Code.

**IN WITNESS WHEREOF**, I have hereunto set my hand this \_\_\_ day of \_\_\_, 20\_\_\_ at \_\_\_\_\_, Philippines.

*[Insert NAME OF BIDDER OR ITS AUTHORIZED REPRESENTATIVE]*

*[Insert signatory's legal capacity]*

Affiant

**[Jurat]**

*[Format shall be based on the latest Rules on Notarial Practice]*

Standard Form No: NPCSF-GOODS-08

### BID LETTER

Date: \_\_\_\_\_

To: **THE PRESIDENT**  
National Power Corporation  
BIR Road cor. Quezon Ave.  
Diliman, Quezon City

Gentlemen:

Having examined the Bidding Documents including Bid Bulletin Numbers *[insert numbers]*\_\_\_\_\_, the receipt of which is hereby duly acknowledged, we, the undersigned, offer to perform **A61C UPGRADING AND INTEGRATION OF UNITS 1 & 2 SCADA SYSTEM TO DCS (PR NO. MG-A7M23-005)** in conformity with the said Bidding Documents for the sum of *[total Bid amount in words and figures]*\_\_\_\_\_ or such other sums as may be ascertained in accordance with the Schedule of Prices attached herewith and made part of this Bid.

We undertake, if our Bid is accepted, to supply and deliver the goods and perform other services, if required within the contract duration and in accordance with the scope of the contract specified in the Schedule of Requirements and Technical Specifications.

If our Bid is accepted, we undertake to provide a performance security in the form, amounts, and within the times specified in the Bidding Documents.

We agree to abide by this Bid for the Bid Validity Period specified in Bid Documents and it shall remain binding upon us and may be accepted at any time before the expiration of that period.

Until a formal Contract is prepared and executed, this Bid, together with your written acceptance thereof and your Notice of Award, shall be binding upon us.

We understand that you are not bound to accept the Lowest Calculated Bid or any Bid you may receive.

We certify/confirm that we comply with the eligibility requirements pursuant to the Bidding Documents.

We likewise certify/confirm that the undersigned, *[for sole proprietorships, insert: as the owner and sole proprietor or authorized representative of [Name of Bidder]*\_\_\_\_\_ has the full power and authority to participate, submit the bid, and to sign and execute the ensuing contract, on the latter's behalf for the *[Name of Project]*\_\_\_\_\_ of the National Power Corporation *[for partnerships, corporations, cooperatives, or joint ventures, insert: is granted full power and authority by the [Name of Bidder]*\_\_\_\_\_ to participate, submit the bid, and to sign and execute the ensuing contract on the latter's behalf for *[Name of Project]*\_\_\_\_\_ of the National Power Corporation.

We acknowledge that failure to sign each and every page of this Bid Letter, including the attached Schedule of Requirements (Bid Price Schedule), shall be a ground for the rejection of our bid.

\_\_\_\_\_  
*[name and signature of authorized signatory]*

\_\_\_\_\_  
*[in the capacity of]*

Duly authorized to sign Bid for and on behalf of \_\_\_\_\_  
*[name of bidder]*

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**Bank Guarantee Form for Advance Payment**

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To: **THE PRESIDENT**  
National Power Corporation  
BIR Road cor. Quezon Ave.  
Diliman, Quezon City

*[name of Contract]*

Gentlemen and/or Ladies:

In accordance with the Advance Payment Provision, of the General Conditions of Contract, *[name and address of Supplier]* (hereinafter called the "Supplier") shall deposit with the PROCURING ENTITY a bank guarantee to guarantee its proper and faithful performance under the said Clause of the Contract in an amount of *[amount of guarantee in figures and words]*.

We, the *[name of the universal/commercial bank]*, as instructed by the Supplier, agree unconditionally and irrevocably to guarantee as primary obligator and not as surety merely, the payment to the PROCURING ENTITY on its first demand without whatsoever right of objection on our part and without its first claim to the Supplier, in the amount not exceeding *[amount of guarantee in figures and words]*.

We further agree that no change or addition to or other modification of the terms of the Contract to be performed thereunder or of any of the Contract documents which may be made between the PROCURING ENTITY and the Supplier, shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition, or modification.

This guarantee shall remain valid and in full effect from the date the advance payment is received by the Supplier under the Contract and until the Goods are accepted by the PROCURING ENTITY.

Yours truly,

Signature and seal of the Guarantors

\_\_\_\_\_  
*[name of bank or financial institution]*

\_\_\_\_\_  
*[address]*

\_\_\_\_\_  
*[date]*

### CERTIFICATION AS A DOMESTIC BIDDER

This is to certify that based on the records of this office, (Name of Bidder) is  
duly registered with the DTI on \_\_\_\_\_.

This further certifies that the articles forming part of the product of (Name of Bidder)  
which are/is (Specify) \_\_\_\_\_ are substantially composed of  
articles, materials, or supplies grown, produced or manufactured in the Philippines. (Please  
encircle the applicable description/s).

This certification is issued upon the request of (Name of Person/Entity) in  
connection with his intention to participate in the bidding for the (Name of Project)  
of the National Power Corporation (NPC).

Given this \_\_\_ day of \_\_\_\_\_ 20\_\_ at \_\_\_\_\_, Philippines

\_\_\_\_\_  
Name

\_\_\_\_\_  
Position

\_\_\_\_\_  
Department of Trade & Industry