

## 1. Project Information and General Scope

The Gulshan 132kV UGSS is the first underground substation to be constructed in Bangladesh and will improve the electricity supply reliability and allow development of the overlying space. The Project comprises the design and construction of the UGSS and its building, a 132kV Bay extension on source substation, 132kV T/Ls and 33kV and 11kV D/Ls including D/L diversions.

The UGSS is the first phase of a larger development referred to herein as the “Gulshan DESCO Development” which comprises a proposed 35 storey mixed-use superstructure overlying two underground substations. The Project includes only the southernmost substation within the development up to seven floored podium structure where the UGSS’s cooling system is installed, as well as the connecting transmission/distribution lines, and associated infrastructure. The Project does not include other aspects of the Gulshan DESCO Development, such as the main superstructure or adjacent substation, but shall be designed to accommodate the future construction of these structures. In particular it shall be noted that the UGSS will form part of the foundation structure for the superstructure and shall be designed accordingly, to fully support the superstructure in all foreseeable conditions.

The UGSS is connected, via the T/L, to PGCB’s 230kV Rampura grid supply substation, which lies around 2km to the southeast of the UGSS in the Chaitantoli area of Dhaka. The T/L runs approximately 3 km, from the eastern wall of the UGSS. From there it runs: north along Road 134; east along Gulshan Badda Link Road, over Gulshan Lake; south along the road which runs along the lake’s eastern edge before crossing over South Badda Road and curving to the southeast where it joins Hatir Jheel Link Road and continues to the east; south-southwest along Bir Uttam Rafiqul Islam Avenue; east-southeast along Jahurul Isam Avenue; and north-northeast along Avenue No. 4 where it joins Rampura substation.

Next to Gushan 132kV UGSS, PGCB and DESCO operates existing semi-indoor substation, and 132kV, 33kV, 11kV lines are installed on Road 134 and Road 135. The underground tunnel for the UGSS is constructed on Road 134 by diverting and protecting these installed cables. During the excavation work including exploration, 33kV/11kV distribution lines buried in the excavation area will have a temporary shutdown, but 132kV transmission lines will remain energized.

The immediate segment of T/L from the UGSS’s boundary lies under the cable tunnel area that runs around the UGSS premises throughout Road 134. Along the rest of the route, the T/L comprises buried cables. To the immediate north and south of a vertical shaft connecting to the UGSS boundary, cable tunnels will be constructed, and the an internal invert level of the tunnels is 3.0m below ground. Power cables are arranged to rise up through the shaft and installed in the cable tunnels. The cable tunnel to the north shall contain multiple 132kV, 33kV, and 11kV cables. The cable tunnel to the south of the shaft shall contain 33kV and 11kV distribution cables.

For the tender purposes only, the footprint for the UGSS and the alignment for both tunnels and buried sections of T/L and design studied in proceeding studies are attached as a part of the Employer’s Drawings.

The Contractor shall be responsible for the equipment design, civil & structural design (where applicable) and construction of the Works in accordance with the requirements stated in the Contract including, but not limited to, the Specifications, the Employer’s Drawings and submissions to relevant government authorities/technical departments for obtaining all necessary clearances/approvals. The preliminary UGSS design attached for

tender reference purpose employs a diaphragm wall system with approximately 28 meter depth, and the UGSS has a footprint of 42.3m long, 26.7m wide, and 27.1m deep. The structure has four basement levels with B1 ~5.1m high, B2 ~7.5m high, B3 ~3.5m high, and B4 ~8.0m high. The cable tunnel connects to the UGSS via a shaft with an internal invert level of 16.1m below ground level, allowing the cables to run into the UGSS at B3 level. The plan view dimensions of the shaft are 25.3 m in length and 6.6m in width

This project may have interfacing works with other contractors, utility agencies and stakeholders. The Contractor shall study, design and construct all necessary interfacing works for the completion of this Contract, which may extend beyond the Contract limits. The Contractor shall reinstate/reconstruct any works affected by the Works.

The Contractor shall refer to the following “6. Scope of Works” for the general breakdown of the scope of works. The provisions in the Conditions of Contract shall always take precedence. All other documents are deemed to be mutually explanatory, unless otherwise stated.

## **2. Scope of Works**

The works covered by the Bid are: design, engineering, manufacture, construction, assembly/preassembly, tests at manufacturer’s works, insulation work, shop painting, delivery properly packed for transport, supply, complete erection, final check-up, testing at site, successful commissioning, conducting of performance and acceptance tests at the Employer’s site of underground substation building along with underground tunnel facility; 132kV gas insulated switchgear (GIS); 132/33 kV (120MVA) & 33/11kV (50MVA) gas insulated power transformers; indoor 33 kV and 11KV switchgears, control, protection and all relevant functions required for the substation operation, and civil works at 132/33/11 kV Gulshan underground substation and bay extensions of the Rampura Substation inclusive of supply of all labour; supervision, tools, implements and supplies. The works also cover the diversion, re-connection, and new installation of 132kV transmission lines, and 33kV & 11kV distribution lines from the UGSS and neighbouring semi-indoor substation prior to the commission of construction work and posterior to the commissioning of the underground substation.

The details of the requirements for the Plant are given in Section IV [Schedule of Guarantee] and corresponding specifications in this tender document. The scope also includes imparting training to DESCO Engineers on the plant offered.

The Contractor is responsible for ensuring that all and any items of work required for the safe, efficient and satisfactory completion and functioning of the works are included in the bid price, whether they will be described in the specification or not.

The substation configuration shall be based on the Single Line Diagram and relevant drawings attached in Chapter 4. The reference for the underground substation facility layout is also attached in Chapter 4.

The detailed scope of work for the UGSS main equipment, but not limited to; comprises the following:

## **2.1. Civil and Building work for the construction of the underground substation building, underground tunnel around the UGSS, and underground transmission line facility along the road<sup>1</sup>**

Summary of the Design and Construction of the UGSS Building and Underground tunnel facilities are given below. The detailed specifications are as listed in the technical particulars and guarantee schedules in Chapter 3 to Chapter 5 (of the Bidding Documents, Volume 2).

- (a) Design and construct underground substation (UGSS), including ventilation shafts, drainage, plumbing, sanitary and other systems. The construction of UGSS includes necessary civil works including piling, ERSS, excavations, and construction of UGSS underground building structure, firefighting system, and M&E facilities.
- (b) Design and construct podium superstructure overlying UGSS, including ventilation shafts, drainage, plumbing, sanitary and other systems.
- (c) Design and construct cable tunnel and cable entrance shaft to allow transmission line (T/L) and distribution line (D/L) to connect into level B3 of the UGSS and reconstruct all other surface roads within the Contract boundary as shown on the Employer's Drawings.
- (d) Design and construct T/L & D/L trenches and all civil works associated with the installation of the T/L & D/L and reconstruct all other surface roads within the Contract boundary as shown on the Employer's Drawings.
- (e) Design and construct transmission line trench and all civil works associated with the installation of the T/L.
- (f) Design and construct temporary and permanent retaining structures and any earthworks required for the UGSS and T/L & D/L.
- (g) Divert and/or support and reinstate all services and utilities crossing into the Contract Boundary, or otherwise affected by the works.
- (h) Reinstate properties affected by the Works as shown on the Employer's Drawings and all affected properties identified by the Contractor during the building damage assessment and utilities' damage assessment.
- (i) Provide temporary entrances and exits for the affected adjacent developments/properties during construction and restoration of the entrances and exits and other facilities after the completion of construction.
- (j) Ascertain, determine and verify the locations of all services in the vicinity of the Works, and co-ordinate with Utility Agencies and Dhaka North City Corporation (DNCC) for the diversion and support of the affected services and the laying of new services.
- (k) Propose and implement measures to minimize the impact on utilities and services due to construction.
- (l) Co-ordinate with Dhaka Water Supply Authority (DWASA) and DNCC and carry out the diversion and reinstatement of drainage infrastructure affected by the Works.
- (m) Conduct pre-construction and post-construction condition surveys of all affected properties and utilities and produce the associated visual inspection reports.
- (n) Carry out impact assessment and settlement analysis of the adjacent structures and utilities based on the Contractor's detailed construction method and Temporary Works design for the Works.
- (o) Assess the structural adequacy of adjacent buildings and structures within the influence zone of the Works with respect to the historical, on-going and predicted

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<sup>1</sup> The work scope for the civil and building portion described here is not the exhaustive lists of Civil and Building construction work defined in Chapter 3.1 of Volume 2.

settlements and to estimate the extent of ground movement that can be tolerated by each structure. Carry out underpinning, protection, risk assessment, settlement control and monitoring of existing building and structures where required.

- (p) Carry out site investigation to locate and confirm nature and condition of neighbouring structure foundations.
- (q) Carry out site investigation to confirm geotechnical and hydrogeological conditions at and around the Site, to ensure detailed design accounts for actual ground conditions and allow safe construction.
- (r) Carry out a detailed assessment and evaluation of the ground conditions and prepare a Ground Investigation Report.
- (s) Carry out instrumentation and monitoring works based on the minimum requirements as shown on the Employer's Drawings. The Contractor shall review these minimum requirements and include/propose any additional instrumentation or monitoring works to the acceptance of the Engineer. The Contractor shall check the instrumentation readings regularly and confirm that the Temporary Works are behaving in accordance with the design. The Contractor and his Design Engineer shall attend the Weekly Instrumentation Meeting (IM) as requested by the Engineer.
- (t) Plan, interpret and analyse instrumentation, monitor readings, and implement necessary preventive, rectification, strengthening and protective measures to safeguard the existing structures in the vicinity of the Works.
- (u) Design and implement all Temporary Traffic Management (TTM) diversion schemes based on the Contractor's proposed construction methods, including associated Traffic Impact Assessments (TIA) studies where necessary.
- (v) Co-ordinate with Interfacing Contractors, land owners, property developers, utility agencies, other authorities and stakeholders.
- (w) Relocate existing facilities affected by the Works and reinstate them upon completion of the Works.
- (x) Reinstate all existing works disturbed by the Works.
- (y) Carry out earthworks and site clearances required by the Works.
- (z) Design and construct temporary and permanent escape staircases and other necessary escape routes from underground works.
- (aa) Supply and apply protective coating on UGSS, shaft and tunnel walls and roof.
- (bb) Design, supply and install waterproofing system for the underground structures.
- (cc) Design and construct the at-grade drainage system.
- (dd) Design and construct the UGSS, shaft and tunnel drainage, storm water and waste water drainage system.
- (ee) Design, construct and maintain an access road to the site offices as shown on the Employer's Drawings.
- (ff) Carry out all other ancillary or related works and services required/necessary for the full completion of the Works.

The brief description of the Works included in this Contract given above is for the guidance of the Contractor only. The Contractor shall be solely and fully responsible for investigating and ensuring that the actual extent and nature of the Works in this Contract are understood prior to the submission of its Bid.

Any doubt or ambiguity as to the actual extent or nature of the Works should be clarified with the Employer in writing before the Bid is submitted. No claims arising out of a lack of clarity of, or ambiguity in, the Employer's Bidding/Contract documents will be entertained. The Contractor shall make allowances for any and all contingencies on account of this provision in its Bid.

## **2.2. Underground Substation Main Components**

### **2.2.1. SCADA, telecommunication system, and LV supply system**

- (a) Design, supply, installation and commissioning of substation automation system along with HMI.
- (b) Design, supply, installation, testing and commissioning of two sets of indoor type Fibre Optic Multiplexer Equipment shall be installed for SCADA, protection & communication.
- (c) Design, supply, installation, testing and commissioning of one set of new digital type telephone exchanges shall be installed (24 subscribers and 3 trunks), and a paging system in the UGSS.
- (d) Design, supply, installation, testing and commissioning of complete new sets of DC and LVAC systems, with all necessary materials required for the plant being installed with sufficient spares for the final substation form's energy consumption, including 110V DC battery components & battery chargers, 48V DC battery & battery charger systems, DC distribution boards, and LVAC distribution boards.
- (e) Design, supply, installation and commissioning of CCTV with 6 cameras at 6 strategic locations in the GIS building and substation area.
- (f) Design, supply, installation, testing & commissioning of two (2) 10,000kVA 33/0.4 kV auxiliary Transformers, HV switchgear board, and LV supply boards with automatic switchover function. All required HV cables with connections to the 33 kV LV side of 132/33kV GITs at cable termination boxes shall be side bushing type with enclosures directly connected to the bushings.
- (g) Design, supply, installation, testing and commissioning of UGSS earthing system along with the UGSS building earthing, and earthing cage and mesh underneath the UGSS building.

### **2.2.2. 132kV Component**

- (a) Design, supply, delivery, installation, testing and commissioning of a new indoor type 132kV GIS system for six (6) new supply line bays, and three transformer feeders with double busbar and a bus coupler. Three (3) of the six (6) supply lines shall be designed and installed for future supply system extension.
- (b) Design, supply, delivery, installation, testing & commissioning of three (3) units of 132/33 kV, 120 MVA three phase gas insulated power transformers.
- (c) Design, supply, delivery, installation, testing & commissioning of direct dry cooling towers with a closed water circulation system for 132/33kV transformers and 33/11kV transformers, including cooling towers, water piping and its supports, pumps, valves and vanes, along with water cooling system including control & monitoring panels.
- (d) Design, supply, installation, testing & commissioning of associated local control panels, metering panels, protection system for 132 kV side of new 132/33kV power transformers, line bays & bus-coupler bays, as above.
- (e) Design, supply, installation and commissioning of one (01) new 132kV bus bar protection equipment and synchronizing schemes for Gulshan substation.
- (f) Design, supply, installation, testing & commissioning of associated local control, metering panel, protection equipment and substation automation system for 132 kV line bays & bus coupler bays, 132/33kV power transformers.

### **2.2.3. 33kV component**

- (a) Design, supply, delivery, installation, testing & commissioning of three 33/11 kV, 50 MVA three phase gas insulated power transformers.
- (b) Design, supply, delivery, installation, testing & commissioning of three 33kV C-GIS type switchgears for eight (8) outgoing feeders, three (3) 132/33kV transformer feeders and three (3) 33/11kV transformer feeders with double busbar and a bus coupler.
- (c) Design, supply, installation, testing & commissioning of associated local control, metering panel, protection equipment and substation automation system for 33kV line bays & bus coupler bays, 33kV side of new 132/33kV power transformers.

### **2.2.4. 11kV component**

- (a) Design, supply, delivery, installation, testing & commissioning of 11kV Switchgears for eighteen (18) outgoing feeders and three (3) 33/11kV transformer feeders with single busbar and two (2) bus couplers.
- (b) Design, supply, installation, testing & commissioning of associated local control, metering panel, protection equipment and substation automation system for 11kV line bays & intertie bays, 11kV side of new 33/11kV power transformers.

### **2.3. 132kV Transmission/Interconnection Lines, 33kV & 11kV Distribution/ Interconnection Lines**

- (a) Design, supply, delivery, installation, testing & commissioning of 132kV XLPE cables containing copper conductor with joints/terminations including an optical fibre cable, as one (1) new transmission line to be connected from new Gulshan underground substation to Rampura substation. Both ends of the installing cables shall be protected by sealing ends from the factory until being jointed. Apply MCT watertight sealing system for each pipe/conduit.
- (b) Design, supply, delivery, installation, testing & commissioning of 132kV XLPE cables containing copper conductor with joints/terminations for reusing two (2) transmission lines to be connected from new Gulshan underground substation to existing power cables connected to Rampura substation. Both ends of the installing cables shall be protected by sealing ends from the factory until being jointed. Apply MCT watertight sealing system for each pipes/conduits.
- (c) Design, supply, installation, testing & commissioning of 132 kV XLPE cable with copper conductors and cable terminations for three new power transformers at both GIS and transformer ends in the substation. Both ends of the installing cables shall be protected by sealing ends from the factory until being jointed.
- (d) Design, supply, delivery, installation, testing & commissioning of 33kV XLPE cables containing copper conductor with joints/terminations as seven (7) distribution lines connected from new Gulshan underground substation to designated first joints/terminations. Both ends of the installing cables shall be protected by sealing ends from the factory until being jointed. Apply MCT watertight sealing system for each pipe/conduit.
- (e) Design, supply, delivery, installation, testing & commissioning of 33kV XLPE cables containing copper conductors with joints/terminations as connecting lines among equipment in new Gulshan underground substation. The interconnection includes connection among three (3) units of 132/33kV transformers and three (3) units of 33/11kV transformers to corresponding 33 kV GIS feeders; and the connection from two 33kV GISs to HV switching board for two (2) units of 33kV/400V auxiliary

transformers. Both ends of the installing cables shall be protected by sealing ends from the factory until being jointed.

- (f) Design, supply, delivery, installation, testing & commissioning of 11kV XLPE cables containing copper conductor with joints/terminations as eighteen (18) distribution lines connected from new Gulshan underground substation to designated first joints/terminations. Both ends of the installing cables shall be protected by sealing ends from the factory until being jointed. Apply MCT watertight sealing system for each pipe/conduit.
- (g) Design, supply, delivery, installation, testing & commissioning of 11kV XLPE cables containing copper conductor with joints/terminations as interconnection among substation equipment in new Gulshan underground substation. The interconnection includes 11kV cable terminations from three (3) units of 33/11kV transformers to corresponding 11 kV GIS feeders. Both ends of the installing cables shall be protected by sealing ends from the factory until being jointed.
- (h) Design, supply, delivery, installation, testing & commissioning of power/auxiliary cable support, lighting, drainage and ventilation system in the underground substation and cable tunnel.

#### **2.4. Extension of Rampura Substation**

In the Rampura substation, which is designated as the supply substation for the new Gulshan substation by PGCB and DESCO, one feeder of 132 kV GIS shall be newly constructed and two existing feeders shall be reused. 132kV system busbar scheme at Rampura substation is 1+1/2 CB Bus type. The single line diagram of Rampura substation is attached as Appendix C1-1-E for tender purpose only. The Works shall include the connection of the newly installed equipment and cables to the existing 132 kV busbar.

- (a) Design, supply, installation, testing, and commissioning of 132 kV outdoor-type GIS (One diameter of 1 + 1/2 CB Bus type with 2 transmission line and 2 bus bar connections), where one transmission line bays is for future use and cables are not connected.
- (b) Design, installation and testing of new 132 kV GIS foundation
- (c) Design, supply, installation, and commissioning of 132 kV XLPE cable connection between an existing 132 kV double busbar and a new 132 kV GIS, and between necessary components.
- (d) Design, supply, installation, testing and commissioning of related local control panels, metering panels and incorporation of existing substation SCADA system
- (e) Design, supply, installation, and commissioning of three sets of transmission line protection relays, including two existing 132 kV transmission line bays. Design, modification, and commissioning of an existing busbar protection relay
- (f) Design, supply, testing and commissioning of optical fibre multiplexer devices for communication and protection of new transmission line bays.

#### **2.5. Power Cable Relocation and Protection**

Next to Gushan 132kV UGSS, PGCB and DESCO operates existing semi-indoor substation, and 132kV, 33kV, 11kV lines are installed on Road 134 and Road 135. The tunnel for the UGSS is constructed on Road 134 by relocating and protecting these installed cables. During the excavation work including exploration, 33kV/11kV distribution lines buried in the excavation area will be shutdown and de-energized by the Employer, but 132kV transmission lines will not be evacuated and will remain energized.

Prior to the commencement of the construction work, the Employer will make a maximum effort to identify all power cables which exist in the excavation areas of the project, which includes but not limited to UGSS site and the area for underground tunnel, to ensure the construction worker's safety.

As a part of the construction programme, the Contractor shall request the Employer for the shutdown, removal and relocation of the distribution lines inside and vicinity of the project area to develop a safe work plan and finalized design. The Employer shall make every reasonable effort to realize the requested measures on the distribution lines for the safety and efficient project implementation. Based on the given information and exploration results, the Employer must develop the network switching plan for the construction periods of the project while securing occupational safety of the construction workers. Then the Employer and the Contractor must agree the network switching plan.

Similarly, the distribution network plan for distribution lines' connection to newly built underground substations must be developed by the Employer and be agreed by the Contractor six (6) months prior to the first commissioning of the underground substation.

The 33kV and 11kV distribution lines owned by PGCB or DESCO, within the UGSS Site Boundary, cable shaft and tunnel area known before the Commencement Date will be relocated by the Contractor. The 132kV transmission lines owned by PGCB or DESCO should be protected by the Contractor in the situation where construction work is executed by its side.

The Employer now foresees excavation and construction work will be carried out with some cables remaining in the workplace, in order to maintain their network's supply reliability for critical infrastructure and customers, such as banks, hospitals, embassies. Also, the period of requested shutdown of the distribution lines may vary, some lines can be shutdown for months, some others may be de-energized only for the limited time specified by the Employer. The Employer and the Contractor coordinate the project's network shutdown plan for each distribution line and shutdown durations prior to the development of the detailed design. For tender purpose, the existing power cable on the project site based on information available on the Employer is attached as Appendix C1-1-C.