TOR for Consultancy services to tender and monitor the implementation of a smart grid pilot project in DPDC distribution network.

N.B: TOR may change during RFP document finalizing period.
Table of Contents

Glossary .................................................................................. 3
1. Background ........................................................................ 4
  1.1 The Electricity sector in Bangladesh .................................. 4
  1.2 About DPDC ...................................................................... 5
  1.3 The Smart Grid Pilot Project ............................................ 5
  1.4 Other parallel innovation projects in DPDC ......................... 6
  1.5 Scope of Work (In month) ................................................... 7

2. Smart Grid Pilot Project Description ..................................... 8
  2.1 Pilot project Area ............................................................... 9
  2.2 Subproject1: DMS ............................................................ 9
  2.3 Subproject 2: Substation adaptation and automation ............. 9
  2.4 Subproject 3: Feeder Automation .................................... 10
  2.5 Subproject 4: Distribution Transformer monitoring ............... 10
  2.6 Subproject 5: Redundant Telecommunication ....................... 10
  2.7 Project Implementation challenges: ................................... 11

3. Tasks Description ................................................................. 14
  3.1 Tasks and Objectives of the assignment ............................. 14
  3.2 Phase A1: Review of the technical assumptions and definition of final project scope .... 15
  3.3 Phase A2: Preparation of the tender document ................. 15
  3.4 Phase A3: Proposal Evaluation and Contractor Selection ......... 21
  3.5 Phase A4: Tendering capacity Building to DPDC .................. 21
  3.6 Phase B1: Project execution monitoring ............................ 21
  3.7 Phase B2 Testing/Commissioning .................................... 22

4. Qualification of Experts ......................................................... 24
  4.1 Scope of Competences Requested ..................................... 24
  4.2 Expert Qualification ...................................................... 24
  4.3 Estimated Person/month .................................................. 26

5. Time Schedule and Reporting .............................................. 27
  5.1 Time Schedule ............................................................... 27
  5.2 Reporting .................................................................. 27
## Glossary

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACR</td>
<td>Automatic Circuit Re-closer</td>
</tr>
<tr>
<td>ALS</td>
<td>Automated Load Switches</td>
</tr>
<tr>
<td>AMI</td>
<td>Advanced Metering Infrastructure</td>
</tr>
<tr>
<td>CVR</td>
<td>Conservation Voltage Reduction</td>
</tr>
<tr>
<td>DMS</td>
<td>Distribution Management System</td>
</tr>
<tr>
<td>DPDC</td>
<td>Dhaka Power Distribution Company</td>
</tr>
<tr>
<td>DT</td>
<td>Distribution Transformer</td>
</tr>
<tr>
<td>FLISR</td>
<td>Fault Location, Isolation and Service Re-saturation</td>
</tr>
<tr>
<td>GIS</td>
<td>Geographical Information System</td>
</tr>
<tr>
<td>GoB</td>
<td>Government of Bangladesh</td>
</tr>
<tr>
<td>HES</td>
<td>Head End System</td>
</tr>
<tr>
<td>IED</td>
<td>Intelligent Electronic Devices</td>
</tr>
<tr>
<td>kV</td>
<td>Kilo Volt</td>
</tr>
<tr>
<td>MDMS</td>
<td>Meter Data Management System</td>
</tr>
<tr>
<td>NOCS</td>
<td>Network Operations and Customers Services</td>
</tr>
<tr>
<td>OMS</td>
<td>Outage Management System</td>
</tr>
<tr>
<td>ONR</td>
<td>Optimal Network Reconfiguration</td>
</tr>
<tr>
<td>SAS</td>
<td>Substation Automation System</td>
</tr>
<tr>
<td>SCADA</td>
<td>Supervisory Control and Data Acquisition</td>
</tr>
<tr>
<td>ToR</td>
<td>Terms of Reference</td>
</tr>
</tbody>
</table>
1. Background

1.1 The Electricity sector in Bangladesh

The utility electricity sector in Bangladesh has one National Grid with an installed capacity of 15,379 MW as on February 2017. The present installed electricity generation capacity in Bangladesh is just meeting the demand which is in ever growing mode (27 Millions of clients). This has happened after the strong efforts of the Government to raise the generation capacity through installing new power stations by both public and private sectors. In 1974-75, the installed electricity generation capacity was 667 MW whereas in August 2016 it was 12780 MW including the 600 MW power import from India. While the peak of generation in 2017 was 9507 MW, the quality of power cannot be maintained because of the shortage of generation and insufficient capacity and low quality of transmission and distribution network.

Only two-thirds of Bangladesh’s population is currently connected to the electricity grid. This indicates an untapped potential market of up to 60 million people connecting to the national grid in coming years as Bangladesh continues its growth trajectory. Electricity demand in Bangladesh is projected to reach 34,000 megawatts (MW) by 2030. Total investment in the sector over the next 15 years is estimated at $70.5 billion. The maximum power demand in the country has always been increasing and the rate has increased over the past couple of years. To meet the growing demand, the Government of Bangladesh made a major institutional restructuring in the sector.

Aside from these changes in the sector, a modernization of the electrical grid specifically focused in distribution is expected. Smart solutions with new bricks of technology should be tested and deployed massively in the future. The launch of a pilot project can be one way to validate technology and to test new offer in services for end user of a Distribution Company.

Even though at present the smart grid system doesn’t exist currently in Bangladesh, except the deployment of prepaid meters. Full deployment of prepaid meters all over the country is targeted in 2021, in line with the 7th five year plan and the Sustainable Development Goal (SDG). Different projects with prepayment have been already put in place which impact more than 6 million clients.

Smart Grid just emerges in the list of projects for the Power Division, MPEDMR. Currently the GoB emphasizes the priority for financing the generation projects and gradually transforming the power sector to smarter system.

By consequence this smart grid pilot funded by AFD would be a main tool for the development of a new technology/system bringing innovation in favor of modernizing the sector and enabling for a customer-centric approach as well. The repeatability attached to the validation of the smart bricks remains an essential part of the benefits of the program.

Additional context and information is given in the annexes (extract from EQMS report about Smart Grid program from GoB).
1.2 About DPDC

In Dhaka, there are two distribution companies namely, DPDC and DESCO. DPDC (Dhaka Power Distribution Company Limited) has an operating service area of about 250 square kilometers and provide distribution services to more than one million customers of Dhaka City Corporation areas and Narayanganj city, Siddirgonj, Fatullah and Moketpur under Narayanganj districts through 36 nos. of Network Operations and Customers Services (NOCS) offices. The distribution system consists of 72 nos. of substation which has 36 no’s 132/33 kv, 2 no’s 132/11 kv and 136 no’s 33/11 kv transformer and 5730 kilometers distribution line.

Maximum capacity of DPDC at present is 2748 MW at 132 kV level and 3689MW at 33kV level. During the activity 2019-2020, DPDC has distributed 7.7 TWH to its 1,35,5079 clients, which represents a growth of 5.6% of the volume of distributed electricity compared to previous year.

The missions of DPDC are:
- To deliver quality electricity with service excellence;
- To make electricity available on demand within the geographical area of DPDC;
- To ensure customers’ satisfaction;
- To develop new mindset for all of the employees congruent with corporate culture;
- To reach self-sufficiency and profitability by increasing income and reducing expenditure.

Currently, the major 5 challenges & problems of DPDC are built on:
- Long and Frequent Service Interruption
- High technical and non-technical losses
- Unnecessary load shedding due to the absence of a Distribution Management System (DMS)
- Low Power Factor
- Lack of on-line monitoring system of substations, feeders and distribution transformers, which lead to undetected conditions of network working outside allowed operational limit.

1.3 The Smart Grid Pilot Project

The Smart Grid pilot project will implement and evaluate the Smart Grid technologies used to apply automatic and centralized fault location, isolation and service re-saturation (FLISR) and optimal network reconfiguration (ONR) at the substation and feeder level. The demonstration seeks to improve service reliability by reducing outage frequency and duration time and to decrease electricity losses. Moreover, distribution transformer monitoring will be installed to monitor in real time the loading and generate alarm if critical conditions are reached.

To implement the selected Smart Grid functionality the project will modernize the substations and implement substation automation to be able to be remotely controllable and implement functionalities from the control center. To implement the smart grid functionality, feeder automation will also be implemented by installing communicating field devices such as Automatic Circuit Re-closers (ACR) and Load Switches. A redundant communication infrastructure will be put in place to continuously assure the service reliability.
To summarize, the Smart grid pilot project include the following components:

<table>
<thead>
<tr>
<th></th>
<th>Subproject 1</th>
<th>Subproject 2</th>
<th>Subproject 3</th>
<th>Subproject 4</th>
<th>Subproject 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Installation of online DMS in the control center to be interfaced with ABB SCADA/OMS i.e. in a word Special warning should be highlighted for managing a SINGLE database between the different systems and the interoperability with the ABB equipment.</td>
<td>Substation modernization and automation</td>
<td>Feeder automation</td>
<td>Distribution Transformer monitoring</td>
<td>Redundant telecommunication infrastructure</td>
</tr>
</tbody>
</table>

1.4 Other parallel innovation projects in DPDC

There are several other innovation projects happening in DPDC, to solve some of the challenges that are being faced by DPDC, notably:

1. **Control center** modernization through a new SCADA, an OMS and an offline DMS from ABB.
2. Deployment of **smart meters** and Advanced Metering Infrastructure
3. Deployment of **capacitor banks**
4. **Upgrade** and construction new **grid infrastructure** (substations/lines).

These parallel innovation projects represent a critical point for the successful implementation of the AFD smart grid project. Most critical is the interface between the SCADA/OMS/DMS system from ABB, planned to be commissioned at the end of 2020, and the integration with the substation automation system to which it has to be integrated. Not just the IT, hardware, software interface needs to be checked, but also, the delay of implementation of one project will preclude the successful implementation of the other. Another critical interface is between the advanced metering infrastructure (AMI) and the outage management system, which is a prerequisite for the OMS/DMS to have real time outage information and optimally perform FLISR functionalities.

The consultant will be in charge to make sure that the interfaces between the projects are covered for successful project implementation.
1.5 **Scope of Work (In month)**

The scope of work of the consultant is subdivided in the following tasks/phases.

1. Phase A1: Review technical assumptions and definition of final project scope
2. Phase A2: Preparation of the detailed tender document
4. Phase A4: Capacity building on tender writing to DPDC
5. Phase B1: Project execution monitoring

![Diagram showing the scope of work phases and their durations]
2. **Smart Grid Pilot Project Description**

The Smart Grid pilot project will implement and evaluate the Smart Grid technologies used to apply automatic and centralized fault location, isolation and service restoration (FLISR) and optimal network reconfiguration (ONR) at the substation and feeder level. The demonstration seeks to improve service reliability by reducing outage frequency and duration time and to decrease electricity losses. Moreover, distribution transformer monitoring will be installed to monitor in real time the loading and generate alarm if critical conditions are reached.

To implement the selected Smart Grid functionality the project will modernize the substations and implement substation automation to be able to be remotely controllable and implement functionalities from the control center. To implement the smart grid functionality, feeder automation will also be implemented by installing communicating field devices such as Automatic Circuit Re-closers (ACR) and Load Switches. A redundant communication infrastructure will be put in place to continuously assure the service reliability.

The objectives of the Smart Grid Pilot Project include:

- Assessing the positive impact of substation and feeder automation managed by the DMS in the control center in Kataban.
- Improving the distribution network observability through monitoring and control of the secondary substations, feeders, and distribution transformers
- Improving service reliability through automated system for fault detection, isolation and service restoration in the 11 kV network.
2.1 Pilot project Area
The test bed for the Smart Grid pilot project is DPDC areas has been proposed by DPDC through a consultation meeting, and include the following 5 nos. substations, which are shown in below:

<table>
<thead>
<tr>
<th>Substations</th>
<th>Capacity</th>
<th>Feeders</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asad Gate 33/11 kV</td>
<td>Substations</td>
<td>5 nos.</td>
</tr>
<tr>
<td>Green Road 33/11 kV</td>
<td>Substation capacity</td>
<td>294 MVA</td>
</tr>
<tr>
<td>Jigatola 33/11 kV</td>
<td>Number of 11 kV Feeders</td>
<td>68</td>
</tr>
<tr>
<td>Lalmatia 33/11 kV</td>
<td>Length 11 kV Feeders Overhead</td>
<td>228.64 km</td>
</tr>
<tr>
<td>Satmosjid 33/11 kV</td>
<td>Length 11 kV Underground</td>
<td>70.65 km</td>
</tr>
<tr>
<td></td>
<td>Number of Distribution Transformers</td>
<td>3003</td>
</tr>
</tbody>
</table>

Table 1: key figures of the pilot project area.

Feeders are operated radially, but they form loops, so by installing load switches for increasing the sources of the feeder to maintain continuous power supply.

2.2 Subproject1: DMS
An online DMS will be interfaced with the ABB SCADA/OMS system in Kataban main control room. Through the distribution network model, the DMS will allow to have a complete overview of the status of the network down to the 11 kV feeders and 11/0.4 kV distribution transformers. DMS will also allow performing advanced substation and feeder automation functionalities such as automatic fault, location, isolation and service restoration.

2.3 Subproject 2: Substation adaptation and automation
2.3.1 2A: Substation modernization
To be able to install a Substation Automation System (SAS) at the pilot project substations, the substations equipment have to be able to be remotely controlled, which means that the current manually operated circuit breakers need to be replaced with motorized ones, and that the electromechanical relays must be replaced with numerical IEDs.

Substation modernization includes:

- Replacement of 11 and 33 kV switchgear with remotely controlled one (33 kV switchgear are replaced as part of CBD1000 project financed by AFD)
- Replacement of 11 and 33 kV relays with IEDs (33 kV relays are replaced as part of the CBD1000 project financed by AFD)

2.3.2 2B: Substation Automation
Substation Automation System (SAS) will enable to remotely monitor, control and coordinate the distribution components installed in the substation. This is in opposition to existing substations, which are controlled via conventional control systems comprised of a set of manually operated control panels, located in the substation control room.

Once the SAS will be connected to the SCADA/DMS system at the control center, control inputs to the SAS will be directly given by the SCADA/DMS with no human intervention needed.
2.4 Subproject 3: Feeder Automation

To be able to implement advanced feeder automation functionalities, such as Fault Location, Isolation and Service Restoration (FLISR), the feeder’s needs to be equipped with remotely controlled field devices. The field devices that have been identified relevant for the implementation of the Smart Grid Pilot Project are:

- **Automatic Circuit Re-closers (ACR)** to timely isolate faulty sections of the feeders to allow to restore power in unaffected portions of the feeders.
- **Automatic Load Switches (ALS)** with remote monitoring and control capabilities. They communicate with the SCADA/DMS/OMS system and get optimal control signals to reconfigure the feeders (by opening/closing switches) to supply power to healthy portions of the feeders.

No Remote Fault Indicator (RFI) are considered relevant, due to the capability of the ACR to both detect the fault, communicate it the control center and at the same time isolate the faulty portion of the feeder, without manual intervention. In the presence of ACR, the RFI are therefore redundant and not necessary field devices.

2.5 Subproject 4: Distribution Transformer monitoring

Thousands of distribution transformers (DTs) get burned each year in DPDC area due to overloading or phase imbalances of the DTs. For that reason the Smart grid pilot project include the installation of asset monitoring of distribution transformers will prevent overloading and will avoid phase-imbalances by redistributing the load to remove such imbalances on transformers. This will transform into huge financial savings for DPDC.

2.6 Subproject 5: Redundant Telecommunication

<table>
<thead>
<tr>
<th>Communication Link</th>
<th>Chosen Communication Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Communication substations – Control center</td>
<td>Fiber Optic</td>
</tr>
<tr>
<td>Secondary communication substation control center</td>
<td>Radio</td>
</tr>
<tr>
<td>Communication field devices – substations</td>
<td>Radio</td>
</tr>
<tr>
<td>Communication Dist. to control center</td>
<td>Cellular</td>
</tr>
</tbody>
</table>

2.6.1 Telecommunication between Substations and control center

The main network will ensure the communication between the Control Center and the 5 substations. It involves installing a fiber optic network on the company’s HTA network:

- 231Km with 11 kV
- 40 Km with 33 kV

REDUNDANT TELECOMMUNICATION

The radio system to be installed as secondary (redundant) network will provide secure and reliable radio coverage for all sites involved in this Pilot. In case of technical necessity, an addition of a repeater is possible.
2.6.2 Telecommunication between field devices and substations:
Radio communication is recommended for the communication link between the filed devices and the substation - It is possible to use the radio network installed for the Control Center – Substations Links by installing new modules or new equipment if needed.

2.6.3 Telecommunication between Distribution transformers and control center:
The communication between the meters of the distribution transformers (11/0.4 kV) and the control center will be carried out by the cellular network. The meters will send information to the control center about real time status and measurement of the transformer (current, loadings, energy, alarms, events, ...).

2.7 Project Implementation challenges:
PROJECT INTERFACES
There are three main innovation projects that are going on in DPDC, which bring complexity to the successful execution of the AFD project. The components of the projects to be interfaced are:
- Modernization of Kataban Central Control Room with SCADA, OMS and offline DMS from ABB.
- Smart metering deployment, including advanced metering infrastructure, head end system (HES), Meter Data management system (MDMS) and billowing software, financed by the Government of Bangladesh (GoB)
• Online DMS as part of the AFD Smart Grid pilot project.

INTERFACE CHALLENGES
The integration of an online DMS to the existing SCADA, OMS and offline DMS from ABB, brings complexity and uncertainty to the AFD Smart Grid pilot project. The Consultant should be really focused on the success of interoperability between systems.

All the smart grid components necessary for the deployment of the pilot project, including the online DMS, need to undergo public tendering, according to AFD rules. This means that the vendor of the online DMS may or may not be ABB.

If ABB is the preferred bidder, the system integration between the SCADA/OMS/offline DMS and the new online DMS will be managed internally by ABB and the interface challenges are low. In this case it is going to be ABB that will make sure that just one network model is shared between the different applications, will create the network mode, and will update the network model during the two years of support from ABB.

If another vendor will be the preferred bidder for the online DMS, more complexity are added to the system. First of all, different vendors may use different standards and protocols which may lead to the different component not to be compatible. This is something that will be taken care of during tendering phase. Secondly, the two systems (SCADA/OMS/offline DMS and the online DMS) need to operate with the same network model. It is going to be up to the two vendors to decide which will be the master network model and which one will need to be downgraded. In addition, having two different vendors makes the responsibilities of each one, in the post implementation phase, not totally defined. Questions such as who will upgrade the network model and who will be responsible for new substations integration, need to be carefully addressed during tendering phase. A single data base should be used for modeling the system.

Installing application in the control center from different vendors, it is not best practice, however it is possible. ABB itself mentioned us that if the two systems work with open standards, they should be able
to work together. This interoperability between systems should be proved by tests in the field and not only based on documentation or certificates.

Another uncertainty in having two vendors in the control center is to define the responsibility for the connection and integration of new substations in the control center as well as the responsibility for network model update.

POSSIBLE INTERFACE SOLUTIONS BETWEEN AFD AND ABB PROJECT

Three possible solutions are identified regarding the interface between the two projects:

1) **The online DMS will be tendered.** Network model and interoperability issues will need to be thoroughly be taken care of in the tendering phase by the next consultant.

   **PRO:**
   - If it works, Interoperability is proven.

   **CONS:**
   - Risk of having two vendors: interoperability and network model issues can arise.
   - Shared responsibilities on network model and integration of new substations
   - Not the most efficient solution: we envision that for the interfaces to happen, a considerable cost will be involved and redundant material will be needed.

2. **AFD directly procures ABB for the online DMS component.**

   **PRO:**
   - everything in the control center is managed by ABB
   - no interoperability and integration issues between smart grid applications (SCADA, DMS, OMS, GIS)

   **CONS:**
   - It is not common practice for AFD to do it, but if serious interoperability and implementation risks are proven, this option will be considered.

3. As the contract from ABB and DPDC is not signed yet (they are currently under contract negotiation) the scope of the ABB project could be changed from offline to online DMS (all the rest would remain the same). No challenges regarding system integration would occur and everything will be managed by ABB.

The budget allocated for the online DMS in the AFD project can be used to increase the number of substation, field devices, distribution transformer monitor in the pilot project.

   **PRO:**
   - everything in the control center is managed by ABB
   - no interoperability and integration issues between smart grid applications (SCADA, DMS, OMS, GIS)

   **CONS:**
   - Late contract negotiation stage, unsure if the scope of ABB project can still be changed.
3. Tasks Description

3.1 Tasks and Objectives of the assignment

Phase A1: Review technical assumptions and definition of final project scope
The consultant shall review the Due Diligence analysis of the Smart Grid pilot project carried out by 3E/Sofreco with focus on technical and economic assumptions. The consultant shall also finalize the scope of the pilot project with relevant stakeholders.

Phase A2: Preparation of the detailed tender document
The consultant shall be responsible for preparation of RFP tender document in line with specific project requirements defined in the Due Diligence Study of the Smart Grid pilot project. The consultant should ensure that the offered solution can be seamlessly integrated with the other projects happening in DPDC. The consultant should make sure that the interfaces (with interoperability covered at 100%) between the different projects are taken care of.

Phase A3: Proposal evaluation and contractor
The consultant shall be responsible to proposal evaluation together with DPDC and the selection of the preferred contractor. Moreover, it shall assist throughout the whole tender process, by organizing pre-bid conference (focused on interoperability), interaction with bidders & clarification of queries and technical evaluation for appointment of the contractor.

Phase A4: Capacity building on tender writing to DPDC
The consultant shall be responsible for training DPDC on tender writing for innovation projects. The goal is to give DPDC expertise to make them independent to tender similar next similar projects.

Phase B1: Project Execution Monitoring
The consultant shall supervise the implementation process carried out by the contractor in line with the tender document. The consultant should ensure that during project implementation phases. The interfaces between the AFD project and the other projects are covered.

Phase B2: Testing commissioning
The consultant shall validate successful implementation of the Smart Grid project by verifying completeness and compliance of facilities with contract requirements.

The objectives of the assignments are:
- Ensure interoperability between different components of the smart grid pilot project
- Ensure smooth integration between the AFD smart grid pilot project and the ABB and Smart Metering projects.
- Ensure smooth project implementation
- Minimize contracting, execution and implementation risks.
3.2 Phase A1: Review of the technical assumptions and definition of final project scope

The consultant shall be responsible for the review of the Due Diligence study for the Smart Grid pilot previously done by 3E/Sofreco, with a focus on technical and economic assumptions. The review is necessary for the Consultant to be able to write detailed and accurate tender specifications.

The consultant, together with relevant stakeholders (AFD, DPDC, ABB), will define which one the three solutions is the most suitable and less risky one for all the stakeholders. Based on that, if necessary the consultant shall redistribute the budget allocated of the online DMS.

3.3 Phase A2: Preparation of the tender document

The consultant shall prepare all the bidding documents for tendering all the necessary equipment necessary for the successful implementation of the Smart Grid pilot project. The bidding documents include:

- technical specifications
- necessary drawings
- All project preparatory documents deemed necessary for the project.

The consultant shall decide if to opt for a single or a multiple EPC contractor (i.e. one single contractor for the entire project or multiple contractors for separate parts of the project)

While preparing tender document, the consultant should ensure that the offered solution can be integrated with the ABB SCADS/OMS project, as well as with the Smart Metering Project.
The items listed below, are considered critical for successful project implementation. The consultant should take care of the following items throughout the tender specifications writing, in the proposal evaluation and in the project execution and monitoring phase.

1. **INTEROPERABILITY**

   The consultant should ensure uniform data standards between different technologies, systems, and applications and ensure interoperability through robust testing with manufacturers and industry partners. The consultant should not just trust the open standards of the supplier but challenge the supplier to prove the systems are interoperable before contract signature. Intelligent devices should be configured and tested to comply with National Institute of Standards and Technology (NIST) standards to help ensure interoperability between Smart Grid technologies.

2. **INTERFACE BETWEEN ABB AND AFD PROJECT**

   During the tendering and implementation phase, the consultant shall ensure that the system integration between the ABB SCADA/OMS and the third party vendor DMS are possible and require minimal system interface upgrade to be successfully integrated.

3. **INTERFACE BETWEEN Smart Metering and AFD/ABB project**

   During tendering phase the consultant shall make sure that measurement from the smart meters as part of the GoB project can be successfully integrated with the DMS and OMS in the control center, to optimize the outage detection time.

4. **CYBERSECURITY**

   The consultant should develop cyber security (in line with the state of the art) specific procurement contract in the tendering phase. The consultant should demand that products meet cyber security standards and should define those standards early in the process. Moreover, the consultant should request that vendors take responsibility for security over the full product lifecycle.

5. **SINGLE NETWORK MODEL**

   The consultant shall ensure that in case a third party DMS is selected, a single network model will be shared between all the application in the control center (SCADA, OMS, GIS, online DMS and offline DMS). The consultant will have to discuss with ABB, where should the repository of the main network model be, and see how it can be integrated to the main GIS used by DPDC.

6. **DEFINE FUTURE VENDORS RESPONSABILITIES**

   The consultant shall make sure that the responsibilities of the vendors and the interface between the two vendor’s responsibilities are addressed. It should be defined for example, who will be responsible on the network model upgrade and for the connection interface of new substations.

7. **E&S IN LINE WITH AFD’S PROCUREMENT RULES (SPECIFICALLY FOR SAFETY IN THE FIELD):** The consultant shall make sure that the vendor will follow the environmental and social aspect according to AFD’s procurement rules in the whole project lifecycle. The consultant shall make sure that the vendor will also obey the safety rule in the field during execution period according to the guide line of AFD and local rules and regulations to making a safe working place for every worker and local people.
### 3.3.1 Overview of the components to be tendered

The table below gives a list of project components and subcomponents for which the consultant shall write detailed tendering specification. The subprojects need to be elaborated further based on the experience of the consultant.

<table>
<thead>
<tr>
<th>Smart Grid Brick</th>
<th>Item</th>
<th>Quantity</th>
<th>Sub-items</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Online DMS</strong></td>
<td>Distribution management system (DMS)</td>
<td>1</td>
<td>DMS software, NMS software, Network Software, Dispatch Training Simulator, DMS application server, Communication Server, NMS servers, Firewall and LAN Switches network equipment, Time &amp; frequency synchronization system, Annual Maintenance Contract Services, Cyber security audit</td>
</tr>
</tbody>
</table>
| **Substation modernization** | 11kV Switchgear with Relay & Control Panel in:  
  - Lalmatia  
  - Green Road | 2 | |
| **Substation Automation** | SAS installation in:  
  - Lalmatia (13 outgoing + 2 incoming feeders)  
  - Satmosjid (12 outgoing + 2 incoming feeders)  
  - Green Road (10 outgoing + 2 incoming feeders) | 3 | Bay control Unit and controller – OBS and IEDs, Local Station Human Machine Interface (HMI), Redundant managed switched Ethernet Local Area Network, Gateway for remote control, Power Supply, SAS Software, Peripheral equipment, Training, Maintenance |
| **Feeder Automation** | Automatic Circuit re-closers and control | 205+ | ACR, IED device, Control unit, Power supply |
| | OH Load Switches and Control | 234+ | |
| **Distribution Transformer monitor** | Meters for Distribution transformers equipped with a GPRS module including assembly, testing and commissioning | 3003+ | Meters, TLCom |
| **Communication Infrastructure** | Optical Fiber between Control Center and 5 Substations including studies, engineering, assembly, testing and commissioning | 271 Km of Fiber | Active Equipment, NMS |
| | Radio communication network between Control Center and 5 | 1 | Telecom Equipment, Repeater, Pylon |
3.3.2 Subproject 1: Distribution Management System

The consultant shall define the functionalities that need to be integrate in the DMS. The functionalities shall include, but not be limited to:

- Network Model
- Topology analyzer
- Online power flow
- Switching order management
- Load shedding/under load switching
- Health asset management
- Distribution State Estimation
- Fault Calculation
- Contingency analysis
- Relay protection verification
- Volt/VAR Optimization(VVO)
- Conservation voltage reduction(CVR)
- Optimal Network Reconfiguration (ONR)
- Fault Location, Isolation and Service Restoration (FLISR)

The consultant should ask for international standard protocol and open architecture. It is recommended that the consultant, prior to contract signature, will ask to the shortlisted suppliers for demonstration in the field, the capability of the vendor’s DMS to interface and be interoperable with the existing system at Kataban Control center.

Before contract signature, the consultant shall define the responsibilities of the vendor after supply and commissioning, together with ABB and DPDC. Questions such as “Who will be responsible for the integration of new substations to the system?” and “Who will be responsible for the network model expansion and upgrade?” need to be clarified early in the process.

The consultant shall make sure that just one network model is shared between the different applications in the control center. Today a single grid model presents the most effective architecture, it provides a single user interface for the distribution operator to perform and it eliminates the need to maintain and synchronize multiple network models. The consultant should therefore make sure that in the tendering document, the single network model requirement is brought up in execution period by the contractor.

3.3.3 Subproject 2: Substation Adaptation and Automation

The consultant shall write detailed tendering specification for Substation adaptation and automation. Substation adaptation shall include the replacement of switchgears and relays in two of the five substations. The remaining one are already equipped with a modern system.
The offered SAS shall support remote control and monitoring of 33/11 kV substations from Remote Control center via gateways. The scope shall include Design, detailed engineering, supply, installation and testing & commissioning of all hardware’s and software’s required for the SAS. Substation Automation System (SAS) for 3 nos. of substations to monitor and record all the electrical parameters and to control HT and LT circuit breakers.

<table>
<thead>
<tr>
<th>No.</th>
<th>Substation Name</th>
<th>Voltage Level</th>
<th>No. of Bays</th>
<th>SS to be modernized</th>
<th>SAS to be installed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lalmatia</td>
<td>33/11 kV</td>
<td>16</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>2</td>
<td>Satmosjid</td>
<td>33/11 kV</td>
<td>15</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>3</td>
<td>Green Road</td>
<td>33/11 kV</td>
<td>13</td>
<td>YES</td>
<td>YES</td>
</tr>
</tbody>
</table>

### 3.3.4 Subproject 3: Feeder Automation
The consultant shall specify that the contractor will be responsible for detailed engineering design, supply, installation and commissioning.

The consultant shall specify that the contractor will have to do a detailed study on the number and location of Load break switches (LB) and automatic circuit re-closers (ACR). The numbers that have been given in the Due Diligence study are based on approximations and assumptions. A detail optimization study needs to be carried out by the contractor.

### 3.3.5 Subproject 4: Distribution Transformer Monitoring
The consultant shall specify tendering requirements for the distribution transformer (DT) monitoring as well as the monitoring and visualization applications needed at the control center.

The consultant shall make sure that the measurements from the DT can be integrated in the SCADA system at the control center.

The consultant shall specify that DT monitoring should include the following sensors/devices:

- Load Parameters
- Load balance/imbalance
- Energy
- Power quality parameters
- Power on/off status
- Oil temperature and level
- Surface temperature and ambient temperature
3.3.6 **Sub project 5: Redundant Telecommunication**

The consultant shall review and tender the following communication infrastructure:

<table>
<thead>
<tr>
<th>Communication Link</th>
<th>Communication Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Communication between Substations to Control Center</td>
<td>Fiber Optic</td>
</tr>
<tr>
<td>Secondary communication between Substations and control center</td>
<td>RF Mesh</td>
</tr>
<tr>
<td>Communication between field devices and substations</td>
<td>RF Mesh</td>
</tr>
<tr>
<td>Communication between distribution transformers and Control Center</td>
<td>GPRS</td>
</tr>
</tbody>
</table>

The consultant shall specify that the network to be installed must be designed to ensure not only the communication between the Control Center and the 5 substations, but also the integration of future applications: VOIP, Video surveillance, Internet service.

The consultant shall specify that the network must be compatible with the IEC 60870-5-101, IEC 60870-5-104, IEC 61850 and IEEE 1613 with versatile data rates (RS-232 to GbE).

### 3.3.7 Other interfaces

The consultant should address in the tendering specification, the integration between the Advanced metering Infrastructure (AMI) and the Outage and distribution management systems. The AMI will shall be used by the DMS to get status on customer side in real-time which will facilitate the fault area localization and then minimize the outages duration.

### 3.3.8 Training

The consultant shall recommend and tender training sessions on the topics of all the components of the smart grid pilot project. The training sessions should include, but not be limited to:

<table>
<thead>
<tr>
<th></th>
<th>Intense operational training at vendor’s site</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1 year operational support at DPDC ( N.B This action should be detailed by the consultant: what will be covered? With local man power? Remote man power? Both with visits of specialist in case of complex issues)</td>
</tr>
<tr>
<td>3</td>
<td>Power System Analysis Course</td>
</tr>
<tr>
<td>4</td>
<td>DMS Application Software Course</td>
</tr>
<tr>
<td>5</td>
<td>Grid Model Training course</td>
</tr>
<tr>
<td>6</td>
<td>Dispatcher training course</td>
</tr>
<tr>
<td>7</td>
<td>Substation automation course</td>
</tr>
<tr>
<td>8</td>
<td>Feeder Automation Equipment Course</td>
</tr>
<tr>
<td>9</td>
<td>Feeder automation Functions Course</td>
</tr>
<tr>
<td>10</td>
<td>Telecom Course</td>
</tr>
</tbody>
</table>

The consultant may propose other relevant areas of learning for consideration by DPDC.
3.4 Phase A3: Proposal Evaluation and Contractor Selection

The consultant shall be responsible to proposal evaluation together with DPDC and the selection of the preferred contractor. In particular, the consultant shall:

- Assist the Client if necessary to provide adequate responses to all requests for clarifications.
- Assist and advise during the pre-bid meetings as required—Specifically during the test sessions in the field before contracting.
- Prepare amendments to the Bidding Documents and support the Client to issue same
- Participate in Bid Evaluations and prepare the associated evaluation reports in accordance with the Bidding Document requirements.
- Carry out Technical and Financial bid evaluations
- Assist and advise during contracts’ negotiations, signature of the contracts and compliance by the Contractors in the fulfillment of contracts’ conditions and effectiveness conditions
- Assist the Client to prepare and finalize the Notifications of Awards and notifications to unsuccessful bidders.
- E&S in line with AFD's procurement rules (specifically for safety in the field)

During contact signature phase, the consultant shall assist with DPDC to Factory Acceptance Test (FAT) of the tendered smart grid components. During this phase, the consultant shall ensure that all the requirements specified in the tender document, are met and that the main critical points identified at the beginning of this chapter, are addressed (Specifically with a warning on the interoperability.).

3.5 Phase A4: Tendering capacity Building to DPDC

The consultant shall provide an extensive training course to DPDC on writing tender document for innovation projects. DPDC has experience in tendering traditional grid assets such as substations and capacitor banks, but it is the first time they have to tender distribution automation and smart grid components. The idea is to provide to DPDC the necessary expertise, to be able to tender by themselves future innovation projects.

The training should happen during and after the creation of the tender document for the Smart grid pilot project.

3.6 Phase B1: Project execution monitoring

After the preferred bidder has been selected and the contract is signed, the consultant shall monitor the execution of the project. The goal is to minimize as much as possible the risks and the interface challenges between the different projects.

Special care has to be given to:

- Interoperability between all components of the smart grid pilot project
- Implementation of a single network model
- Integration between online DMS as part of the AFD project and SCADA/OMS/Offline DMS/GIS as part of the ABB project.
- Integration of SAS to SCADA/OMS/DMS in the control center.
- Integration of measurements from DT to SCADA system.
- Cyber security
Main Tasks for the Project execution monitoring include project management and engineering and construction supervision.

**Project Management:**
The consultant shall be responsible to:

1. Assist the Client in the contracts’ administration during the project execution including certification of monthly progress of works as required.
2. Advise in a timely manner on progress, potential issues, variations or potential variations in technical or cost items. This shall be done through the monthly reports issued by the Consultant.
3. Prepare a Project Implementation and completion report

**Engineering and Construction Supervision:**

1. The Consultant shall review, comment, certify and recommend on:
   - Contractor’s engineering design, specifications and drawings.
   - Supplier’s manufacturing procedures and processes.
2. Ensure that the works are qualitatively and quantitatively executed in conformity with the approved drawings and designs and in accordance with the requirements of the contract documents and approvals; he shall ensure that the firms compensate for any the failures or fault served during the visits and inspections by the Consultant and caused by the Contractor.
3. In general, he shall supervise, monitor, inspect, verify and certify qualitatively and quantitatively the execution of the works carried out by the Contractors, in order to confirm that the works are under taken as per the terms and conditions and specifications of the Contracts and in a cost effective, qualitative and timely manner.
4. Ensure that install at ions works are under taken in accordance with designs and drawings.
5. Ensure that the Contract sure executed in accordance with the work programme sand up dated regularly as required.
6. Verify the implementation and adherence to the procedures of the Quality Assurance Plans for the project, and review the procedures with the approval of the Client.
7. Promptly inform the Client of any environmental and/or social constraint that can have an impact on the Project (With a specific focus on safety of workers (with individual protection equipment))
8. If and when needed, make proposals to address environmental and social potential constraints that could have impacts on the works schedule or implementation, in order to avoid any delays for the works.

**3.7 Phase B2Testing/Commissioning**
Upon project completion, the consultant shall be responsible for testing and commissioning all the components of the smart grid pilot project.
Testing

1. On substantial completion of the project, the consultant shall assist the Client to perform checkouts and verify completeness and compliance of the project with contract requirements.

2. Participate in the final testing including the successful interface between the AFD and ABB project in the control center.

3. Carry out a detailed inspection of project’s components, in collaboration with the Client and the Contractors.

Commissioning

1. Participate in the acceptance testing and review of the result and issues are portion all tests in respect to the requirements of the contract.

2. Ensure if necessary the preparation of are portion any changes made to the installation to meet the requirements of the acceptance tests.

3. The Consultant will issue the commissioning reports and other corresponding minutes of project meetings and get them signed by the relevant take holders.
4. Qualification of Experts

4.1 Scope of Competences Requested

The consultant shall have 15 years of experience in writing technical tender specification, procurement, project management and project monitoring and control. The consultant shall have at least 5 project references. With 2 references in South Asia.

Ideally the consultant shall have experience on projects dealing with the interface between the DMS, OMS and SCADA from different vendors.

The consultant shall have 10 years of experience in the following areas.

- Power distribution system
- SCADA
- DMS
- OMS
- GIS
- Asset monitoring
- Substation and feeder automation
- IT infrastructure for smart grids
- Smart metering and Advanced metering infrastructure

4.2 Expert Qualification

The Consultant will be required to propose a team of experts with the necessary skills and experience in similar contracts and projects, whose experience shall include, but not be limited to the following:

- **Team Leader (International):** He is one of the team experts with a specific qualification for project management and at least 5 years’ experience of team leadership and at least 15 years’ experience in distribution activities and project management. He must have some experience on all aspects of the project;
- **Local Team Leader:** same qualifications as the international team leader but based in Dhaka, Bangladesh
- **SCADA Engineer (international):** The qualified engineer shall have a degree in engineering at least 15 years’ experience in the design of SCADA systems. The Engineer should have previous experience in procurement, engineering, business administration; knowledge of international standards; previous work experience in projects financed by international financial organization. Previous experience in developing countries is preferable;
- **DMS & OMS Specialist (International):** The Engineer shall have a degree in DMS and GIS technology and at least 10 years of relevant experience in power distribution sector DMS and GIS implementation. Previous experience in developing countries is preferable.
• **Distribution Power System Engineer(International):** The Engineer shall have a degree in engineering and at least 15 years of relevant experience in load forecasting, optimization, load flow, fault and steady state analysis, design/configuration of distribution network, proven track record in Consultancy and Feasibility Studies; proven track record with major distribution planning software used in utilities; knowledge of system operation and development; Previous experience in developing countries is preferable;

• **SAS and feeder automation engineer(International):** The Engineer shall have a degree in engineering and at least 10 years of experience in substation automation and feeder automation. Previous implementation for automatic fault location, isolation and service restoration (FLISR) functionalities; previous experience in developing countries is preferable.

• **Telecommunication Engineer(International):** The Engineer shall have a degree in engineering and at least 10 years of relevant experience in applying design and application of telecommunication systems used in SCADA and smart metering systems. Knowledge of international standards. Previous experience in developing countries in there going is preferable;

• **IT Specialist-networking and Software (International):** The Engineer shall have a degree in engineering and at least 10 years of relevant practical experience, proven track record in consultancy and feasibility studies. Specific professional experience in networking, enterprise software integrations, high capacity server system design in deploying and management. Knowledge of international standards and protocols for energy meters, SCADA, AMI systems and GIS – with also competency in cyber security;

• **AMI–Meter specialist (International):** The Engineer shall have degree in engineering at least 10 years of experience in the field of smart meter sasa consultant. They should have particular expertise in communication, standards, data security and interoperability of equipment. Experience with regulators and distribution operators is required;

• **Economist (International):** The Economist shall have a bachelor or higher degree in engineering with at least 10 years in economic and financial analysis of electrification projects. Experience on a project of dispatching or deployment of smart meters will be appreciated.

• **National Expert:** The Engineer(s) shall have a degree in engineering and at least 10 years of relevant experience in consultancy and feasibility studies. They should have a specific competency in environmental and social evaluation studies.

• **Commissioning Engineer:** The engineer shall have at least 10 years of experience in the site testing and commissioning of distribution grid components.

• **Quality Assurance/Factory acceptance and Audit Expert:** The engineer shall have at least 10 years of experience in factory audits, reviewing manufacturing, test and quality control procedures and witnessing in equipment acceptance tests (FAT)as well as their view and approval of quality plans and procedures and testing programmes.
## 4.3 Estimated Person/month

<table>
<thead>
<tr>
<th>Personnel</th>
<th>Person</th>
<th>Indicative breakdown per Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Months</td>
</tr>
<tr>
<td>Team Leader</td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td>Local Team Leader</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>SCADA Engineer</td>
<td>5</td>
<td>0.5</td>
</tr>
<tr>
<td>DMS &amp; OMS Specialist</td>
<td>5</td>
<td>0.5</td>
</tr>
<tr>
<td>Distribution Power-System Engineer</td>
<td>5</td>
<td>0.5</td>
</tr>
<tr>
<td>SAS engineer</td>
<td>5</td>
<td>0.5</td>
</tr>
<tr>
<td>Telecommunication Engineer</td>
<td>5</td>
<td>0.5</td>
</tr>
<tr>
<td>IT Specialist - networking and Software</td>
<td>5</td>
<td>0.5</td>
</tr>
<tr>
<td>AMI – Meter specialist</td>
<td>4</td>
<td>0.5</td>
</tr>
<tr>
<td>Economist</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>National Expert</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Commissioning Engineer</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Quality Assurance/Factory acceptance and Audit-Expert</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total Person Months for key staff</td>
<td>71</td>
<td>8.5</td>
</tr>
</tbody>
</table>

**N.B:** These person months or man months are not fixed. These man months may change during RFP document finalizing period.
5. Time Schedule and Reporting

5.1 Time Schedule

The consultancy service for the project is expected to commence in September 2020 for an estimated duration of 30 months.

The estimated durations and schedules of the various activities are as follows:

<table>
<thead>
<tr>
<th>Activity No.</th>
<th>Description</th>
<th>Duration (Calendar Months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase A1</td>
<td>Review technical assumptions and definition of final project scope</td>
<td>1</td>
</tr>
<tr>
<td>Phase A2</td>
<td>Preparation of the detailed tender document</td>
<td>5</td>
</tr>
<tr>
<td>Phase A3</td>
<td>Proposal Evaluation and Contractor Selection</td>
<td>5</td>
</tr>
<tr>
<td>Phase A4</td>
<td>Capacity building on tender writing to DPDC</td>
<td>3 (Parallel with A2 AND A3)</td>
</tr>
<tr>
<td>Phase B1</td>
<td>Project execution monitoring</td>
<td>18</td>
</tr>
<tr>
<td>Phase B2</td>
<td>Testing/Commissioning</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>Duration of the service</td>
<td>30</td>
</tr>
</tbody>
</table>

5.2 Reporting

<table>
<thead>
<tr>
<th>Phase</th>
<th>Deliverable</th>
</tr>
</thead>
</table>
| Deliverable Phase A1| 1. Inception Report  
                        | 2. Review of the Due Diligence Study by 3E/Sofreco                         |
| Deliverable Phase A2| 1. Tender Document.                                                        |
| Deliverable Phase A3| Results from the proposal evaluation                                        |
|                     | Contract with companies selected                                            |
| Deliverable Phase A4| Training Material for DPDC and results of training course                  |
| Deliverable Phase B1| Monthly Reports summarizing the Consultant’s activities during the period  |
|                     | under review.                                                              |
| Deliverable Phase B2| Project Testing and Commissioning Reports                                  |