Public Financial Management Reform Project (PFMRP)-Establishment of the Unit Cost of Infrastructure in Ghana

Unit Cost of Infrastructure Estimator and Budget Tool-Final User Guide Ministry of Finance/Public Procurement Authority

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List of Abbreviations

Abbreviation	Meaning
AAC	Asphalt, Cement, Concrete
AESL	Architectural & Engineering Services Limited
AR	Ashanti Region
BAR	Brong Ahafo Region
ССВ	COCOBOD
CF	Consolidated Fund
CR	Central Region
DFR	Department of Feeder Roads
DSD	Double Surface Dressing
DUR	Department of Urban Roads
ECG	Electricity Company of Ghana
ER	Eastern Region
GAR	Greater Accra Region
GHA	Ghana Highway Authority
GHS	Ghana Cedi
GOG	Government Of Ghana
GRAV	Gravelling
GRIDCo	Ghana Grid Company
НА	Heavy Angle
IP	Intermediate Pole
kV	Kilovolt
LA	Light Angle
LV	Low Voltage
MMDAs	Metropolitan, Municipal and District Assemblies
MoF	Ministry of Finance
MRH	Ministry of Roads and Highways
MVA	Mega Volt Ampere
NEDCo	Northern Electricity Distribution Company
NR	Northern Region
O&M	Operation and Maintenance
PCU	Project Coordination Unit
PFMRP	Management Reform Project
PPA	Public Procurement Authority
PPME	Public Procurement Model of Excellence
RF	Road Fund
RTU	Remote Terminal Unit
SP	Section Pole
SSD	Single Surface Dressing
ТР	Terminal Pole
UER	Upper East Region
USD	United States Dollars
UWR	Upper West Region
VfM	Value for Money
VRA	Volta River Authority
VT	Voltage Transformer
WR	Western Region
XLPE	Cross-Linked Polyethylene

1. Background of the Project

1. Background of the Project

1.1. Background

¹The ability to understand the level and components of investment required to support the development of infrastructure in developing countries is increasingly becoming very important for governments, donor agencies and financial institutions operating in these countries. These institutions need to know how much the investment in the infrastructure will cost and how those costs are determined in order to plan the financing and execution of these projects to achieve the best value for money.

Currently, the Public Procurement Authority (PPA) maintains a data base for common user items and therefore has reference prices for such items. However, PPA does not have a similar database for infrastructure, which accounts for a significant proportion of Ghana's national budget. The lack of reference prices leads to unrealistic budget estimates in the procurement plan for which many times the actual prices for delivering the infrastructure is are very different from the costs in the budget estimates.

Procurement reforms have progressed well over the years with the following notable achievements:

- Preparation of procurement tools including: draft procurement regulations, manuals (Procurement, Procurement Records Management, and Contract Management), Standard Bidding Documents, and various Policy Guidelines such as those on the application of Framework Agreements, Low and Minor Value Procurements;
- Putting in place the necessary systems for informing stakeholders about procurement in Ghana;
- Development and delivery of various training programs to public and private sector procurement practitioners and policy makers, including: contractors, suppliers and consultants;
- Development of a Public Procurement Model of Excellence (PPME) tool for measuring performance of procuring entities;
- Establishment of an Appeals and Complaints Panel for the successful administrative review;
- Introduction and implementation of the Sustainable Public Procurement concept;
- Publication and launch of the Scheme of Service for Procurement Class of the Civil/Local Government Service; and
- Preparation for the introduction of e-procurement.

Notwithstanding the above achievements, the procurement system in Ghana currently faces a number of challenges which are yet to be addressed. These challenges include, among others a lack of a reference price data base for infrastructure.

There is a common perception in Ghana that the cost of providing infrastructure is too high compared to other countries. However, there is no concrete data or system to prove this or otherwise, across the various types of infrastructure. The objective of this study is to provide a basis for comparative reference to facilitate cost benchmarking for these infrastructure projects.

²The need to establish the unit cost of infrastructure in Ghana has emerged due to the recurring problem of unrealistic budget estimates due to a lack of reference prices as well as actual prices of projects exceeding estimates. This causes huge strains on the Government's financial resources and hampers the development of the nation as a whole.

The cost of any infrastructure project varies based on technical requirements as well as the local circumstances such as the time of the year when the project is implemented, location, inflation, currency, foreign exchange costs etc. These factors tend to have a significant impact on the project costs and cause variations in the cost of delivery of infrastructure projects.

A database tool on the cost of the components of standard infrastructure projects is essential to support a benchmarking system which will ensure that the estimated total cost of the projects will deliver Value for Money (VfM) by reflecting realistic prices. This type of tool will allow the user to vary the elements identified

¹ Establishment of the Unit Cost of Infrastructure in Ghana - Project Terms of Reference

² Establishment of the Unit Cost of Infrastructure in Ghana - Project Terms of Reference

(major cost drivers) in order analyse how changing these factors affect the cost of delivering the project. This will help inform the decision making process of how much investment will be required, contingency arrangements and budgeting considerations. This can then help control unforeseen cost overruns, allow additional verification of key cost items and support any justifications for project cost items where necessary.

The Ministry of Finance (MoF) through financing from the World Bank is undertaking the Public Financial Management Reform Project (PFMRP) – Establishment of the Unit Cost of Infrastructure in Ghana ("the Project"), with the objective of creating a database tool to serve as a reference point for costing infrastructure development projects in Ghana whilst providing the benefits identified.

The sectors assessed as part of this study include:

- Roads;
- Buildings;
- Water and Sewerage systems; and
- Power (hydro, solar, wind, thermal, combined cycle plants, power barges, gas and other fuel plants).

This user guide was prepared to guide users on how to use the unit cost of infrastructure estimator and budget tool and also explain, to some extent, the basis of some of the assumptions applied in building the database.



2. The User Interface of the Unit Cost Estimator and Budget Tool

2. The User Interface of Home Page of the Unit Cost Estimator and Budget Tool

2.1. Home Page User Interface

The entire unit cost estimator and budget tool resides in a Microsoft Excel spreadsheet. The landing page of the tool (see Figure 2-1 below) identifies the infrastructure sectors available as well as their sub-categories where applicable.

Each sector is name and sub-category can be clicked on to take the user to the selected sector or sub-category in order to view and interact with the unit cost estimator and budget tool for that sector.

Apart from Power, the main infrastructure sectors (Roads, Buildings and Water) on the home page are linked to their sheets and can be accessed by clicking on the names. The power sector has been split into Generation, Sub Transmission 33kV, Transmission 161kV and Distribution. The unit cost estimator and budget tool for each of these Power sub-categories can be accessed by clicking on their names on the home page.



Alternatively, the user can look through the spreadsheet tabs to select a sector or sector sub-category of interest to interact with the unit cost estimator and budget tool. Figure 2.1 shows screenshot of the home page and the linked sectors and sector sub categories. The linked sectors and sector sub categories are the only accessible aspects of the homepage.

Figure 2-1: User Interface of the Home Page

	Α	В	С	D		E	F	G H	I J	K	L	M	N
1	UBLIC OF G	PL	iblic					Unit Cost of I	nfrastruct	ure Estima	ator		
2		Pr A	Procurement			& Infrastruct	ure Projec	t Budget T	ool				
3			linon	.,									
4	REMENT	🥙 Imj	proving	efficiency an	d								
5		tra	nsparen	cy in Public I	Procurement	1							
6													
7													
9													
10													
11		То	Which S	Sector Does	SYour Proje	ect Belor	ng?						
12													
13		Buil	dings										
14		Roa	ds										
15		Wat	er										
16		Pow	er (<u>Generation</u>									
17			-	Sub Transmiss	ion 33kV								
18			1	Transmission 1	<u>161kV</u>								
19			<u> </u>	<u>Distribution</u>									
20													
21		Res	ource Lil	brary									
22													
23		UCC	I Tool Te	chnical Refere	ence								
24		UCC	I User M	anual									
25													
26													
27													
28													
29													
31													
32													
	• •	Home	Roads	Water	Buildings	Powe	er-Distribution	Power-Generation	Power-Trans	🕂 : 🔳			

2.2. Sector and subsector User Interface

In the subsequent sections of this user guide, the user interface for the unit cost estimator and budget tool have been set out explained for each sector namely; roads, water, power and buildings. Each of these have been developed based on the nature of the data collected. Subject to the collection of more data, analysis of the additional data and review of the model build the interface may be updated to reflect the level of quantity and quality of data.

Where necessary, the individual sector sections also identify any noteworthy information that have informed the assumptions made by sector experts in developing the various components of the tool as well as any additional technical information necessary for users to apply in their interaction with the tool.

The following model approaches were applied:

- Road Sector: Data Segmentation;
- Building Sector: Data Segmentation;
- Power Sector: Component Cost; and
- Water Sector: Component Cost

An important aspect of the tool which must be noted by all users across the tool is summarised in the following key:

Figure 2-2: Input/ Output key

Input Required Output

Cells in the interface with the colour labelled **'Input required'** imply that the user will have to enter a value in these cells in order to interact with the interface. Cells in the tool with the colour labelled **'Output'** are cells which produce an outcome based on selected input items in the tool.

3. Road Sector Unit Cost Estimator and Budget Tool

3. Road Sector Unit Cost Estimator and Budget Tool

3.1. User interface

3.1.1. Road Sector Unit Cost Estimator

The road sector unit cost estimator was developed with the data segmentation modelling approach. This approach was adopted because a moderately sized historical record of contracts with a reasonable number of cost drivers that reflect the nature of the road sector in Ghana was obtained.

The historical road contract data was stratified into groups defined by the value of cost drivers and used the median historical inflation-adjusted project costs to estimate the unit cost of road infrastructure for a road project belonging to the identified segment.

The main cost drivers the analysis of the road sector identified included the following:

- The delivering Road Agency/Authority;
- The intervention type applied;
- The surface type used (paved or unpaved);
- The nature of the surfacing;
- Administrative region;
- Funding source;
- Carriageway type; and
- Number of kilometres of road to be constructed.

A screen shot of the user interface for the road sector unit cost estimator is shown below with the selectable cost drivers and the window where the unit cost output is presented after selecting the applicable drivers.

Figure 3-1: User Interface of the Road Sector Unit Cost Estimator

1 2 3 4	Public Procurement Authority Improving efficiency and	Roads Sector UCOI Estimator Budget Tool			
5	transparency in Public Procurement		Input Required		
6			Output		
7					
9					
10	Road Infrastructure Unit Cost Estimator				
11					
12	Cost Drivers	Select Options for Project			
13	Road Agency Authority	ALL			
14	Intervention Type	ALL			
15	Surface type	ALL			
16	Surfacing	ALL			
17	Region	ALL			
18	Funded By	ALL			
19	Carriageway	SINGLE			
20	How many kilometers of road to be constructed?	1.00			
21					
22					
23	2017 Median Unit Cost	1,728.52		USD per Kilometer per 2-La	ne Road
24					
25					
26					
27					
28	Cost Estimate	1,728.52		USD	



3.1.2. Road Sector Budget Tool

The road sector budget tool allows the user to include the cost of other factors that relate to the development of the road project. The budget tool under this project was developed based on the experience of road sector experts as well as based on interaction with the key stakeholders in the sector in Ghana.

The pre-set elements of the road sector project budget tool include budget allocation for:

- Feasibility studies/ Project Planning;
- Detailed Engineering Design (Consultancy Services); and
- Contract Administration (Construction Supervision).

Provision was made as a guide to what proportion of the initial infrastructure cost should be allocated to the above items. These options can be seen under the **'Provision Guidance'** header. These help the user apply some informed basis to selecting an appropriate percentage value where his or her input is required for the applicable item under the **'User Budget Provision'**.

The budget tool for the road sector also allows the user to enter any additional items that may not fall within the three items above set within the project budget tool for the roads sector. These include items such as:

- Inflation;
- Extension of time; and
- Utility Relocation, etc.

Below is a screenshot of the road sector budget tool.

D Е G **Roads Sector** Public Procurement UCOI Estimator Authority Budget Tool 3 4 Improving efficiency and transparency in Public Procurement 5 Input Required 6 Output **Road Sector Project Budget Tool** 29 30 31 Budget Item Provision Guidance Receommended Application User Budget Provision Amoun 32 33 Infrastructure Cost 864.26 34 35 Feasibility studies/ Project Planning 0.5% - 1.0% 0.0% Always 36 37 0.0% Detailed Engineering Design (Consultancy Services) 1.5% - 4.5% Optional 38 39 40 Contract Administration (Constuction Supervision) 3.5% - 7.5% Optional 0.0% 41 Miscellaneous Other Expenses Optional <20% 0.0% 42 Description: 43 44 45 Total Budget Cost 864.26 USD 46

Figure 3-2: User Interface of the Roads Sector Project Budget tool

3.2. How to use the Road Sector Unit Cost Estimator

The first stage of interaction with the road sector unit cost estimator is to select the applicable option for each cost driver listed. The road sector unit cost tool has 8 user selected/input required items which inform the computed unit cost for the sector. Out of these 8 user selected/input required items, 7 of them are drop-downs from which the user has to select options under those items.

10 11

12

17 18 19

20 21

The dropdown items include:

- The delivering Road Agency/Authority [Road Agency Authority];
- The intervention type applied **[Intervention Type]**;
- The surface type used [Surface Type];
- The nature of the surfacing **[Surfacing]**;
- Administrative region [Region];
- Funding source [Funded by];
- Carriageway Type [Carriageway]

The options for each of the dropdowns are listed in Table 3-1 below.

Figure 3-3: User selected section-Road Sector Unit Cost Estimator

Public Procurement Authority Improving efficiency and transparency in Public Procurement	Roads Sector UCOI Estimator Budget Tool	Input Required Output			
		Output			
Road Infrastructure Unit Cost Estimator					
6 18 I					
Cost Drivers	Select Options for Project				
Road Agency Authority	ALL				
Intervention Type	ALL				
Surface type	ALL				
Surracing	ALL				
Region	ALL				
Funded By	ALL				
Carriageway	SINGLE				
How many kilometers of road to be constructed?	1.00				

Table 3-1: Road Unit Cost- Cost Driver Item and Corresponding Drop-down Options

Cost Driver Item	Drop down Options	
Road Agency Authority	ALL (All Agencies/Authorities)	
	Department of Feeder Roads (DFR)	
	Department of Urban Roads (DUR)	
	Ghana Highways Authority (GHA)	
Intervention Type	ALL (All Intervention types)	Construction
	Overlay	Part Reconstruction (Partial Reconstruction)
	Reconstruction	Grading
	Regravel (Regravelling)	Rehabilitation
	Resealing	Reshaping
	Routine Maintenance	Spot Improvement
	Surfacing	Upgrading
Surface Type	ALL (All Surface types)	
	Paved	
	Unpaved	
Surfacing	ALL (All Surfacing)	ACC (Asphalt Cement Concrete)
	DSD (Double Surface Dressing)	GRAV (Gravelling)
	OVERLAY	CONCRETE
	SSD (Single Surface Dressing)	
Region	ALL (All regions)	AR (Ashanti Region)
	BAR (Brong Ahafo Region)	CR (Central Region)
	ER (Eastern Region)	GAR (Greater Accra Region)

Cost Driver Item	Drop down Options	
	NR (Norther Region)	UER (Upper East Region)
	UWR (Upper West Region)	VR (Volta Region)
	WR (Western Region)	
Funded by	ALL (All Funding sources)	CCB (COCOBOD)
	CF (Consolidated Fund)	GOG (Government of Ghana)
	RF (Road Fund)	OTHER
Carriageway	SINGLE	

Please note that when the 'ALL' option is selected for any criteria it selects all historical contracts with have all with all the applicable drop down options in computing the unit cost.

In order to select any item from the dropdown options, move your mouse cursor to the cell below the header 'Select Options for Project' in line with a corresponding cos driver. A downward pointing arrow will appear on the right side of the cell (See Figure 3-4). Figure 3-4: Drop down button selector

Select Options for Project

Click on the downward pointing arrow to activate the list of dropdowns. See Figure 3-5 below (*Suggestion: in order to make the dropdowns more visible you can increase the magnification/ zoom of the Excel spreadsheet*).

Figure 3-5: Activated drop down options selection



Figure 3-6: User Input Section – Road Sector Unit Cost Estimator

Funded By	ALL
Carriageway	SINGLE
How many kilometers of road to be constructed?	1.00

Once the respective options for each of the corresponding cost drivers have been selected, the user enters the number of kilometres of the project **'How many kilometres of road to be constructed'** in the input area highlighted in red in figure 3-6 above. The Roads sector unit cost tool will then report a unit cost estimate i.e. **'2017 Median Unit Cost'** of the project.

Depending on the number of kilometres entered in the corresponding cell inputs, the unit cost of the road project will also change as well as the **'Cost estimate'** item which reflects the total cost of the road infrastructure being reviewed in the tool. (See Figure 3-7 below)

a Road
5

3.2.1. Summary of Steps-Road Sector Unit Cost Estimator

- 1. Select the options for each cost driver with a drop-down (e.g. Road Agency Authority, Surfacing, Region, etc.) as may apply to your scenario;
- 2. At the **'How many kilometres of road to be constructed?'** query enter the road length to be constructed in the input required section; and
- 3. The Median Unit Cost will be produced for USD per kilometre per 2-lane road as well as the Cost Estimate that will be incurred for constructing a road project with the user selected characteristics.

Key Points to note on the use of the Road Sector Unit Cost Estimator

- It is recommended that the tool should be used by a technical person who understands and can interpret the content. All results and interpretations are the sole responsibility of the user;
- The contract cost data used comprise solely of project costs for various interventions at the **award prices**. It therefore expresses the unit cost of the intervention without consideration of any variations, extensions of time or any other changes to the original contract awarded;
- For this current version of the tool, the scope of the data is confined to projects for the various interventions for **only 2-lane single carriageway roads**;
- Output of unit cost estimator for the road sector feeds into the budget tool. The road sector unit cost is expressed in USD/km whilst budget tool estimate is expressed in USD for full length of intervention type;
- The output of unit cost per intervention type is the calculated median value of all relevant cost values. It does not report the average/mean cost;
- To avoid errors, it is suggested that the user systematically selects the various components logical sequence from top to down;
- As much as possible, no selection should indicate **ALL**. Any cell showing that should be change to a specific descriptor;
- It is assumed that the user knows which options for each cost driver go with other cost drivers for e.g. not selecting wrong options such as PAVED for '**Surface Type**' and then selecting GRAVEL for '**Surfacing**'; and
- It should be noted that where there is no contract in the database that satisfies the unique set of parameters the user has entered, no unit cost estimate will be reported. This may be resolved in the future update of the database as more contract data is collected and analysed. It should be remembered that this tool reports on similar real contracts found in its database.

3.3. How to use the Road Sector Budget Tool

The cost estimate derived from the unit cost estimator feeds into the budget tool as the **'Infrastructure Cost'**. Users are only required to provide input in the form of percentages for the 8 budget line items as highlighted in Figure 3-8 at the **'User Budget Provision'** column of the tool. As mentioned earlier, the **'Provision guidance'** provided should enable the user to apply some informed basis to select an appropriate percentage required under the **'User Budget Provision**.

The budget line items for which users would provide the input for include:

- Feasibility Studies/Project Planning;
- Detailed Engineering Design (Consultancy Services);
- Contract Administration (Construction Supervision); and
- Miscellaneous Other Expenses.

Additionally, the budget tool for the roads sector also allows the user to enter any additional items that may not fall within the items above set within the project budget tool for the sector. These include items such as:

- Inflation;
- Extension of time;
- Force Majeure;
- Defective Design;
- Resettlement Compensation;
- Utility Relocation; and
- Delayed Payment etc.

This input area for the budget line item as can be seen in figure 3-8 below.

Figure 3-8: User Input Section-Road Sector Budget Tool

ludget item	Provision Guidance	Receommended Application	User Budget Provisio
nfrastructure Cost			~
easibility studies/ Project Planning	0.5%-1.0%	Always	0.0%
etailed Engineering Design (Consultancy Services)	1.5% - 4.5%	Optional	0.0%
ontract Administration (Constuction Supervision)	3.5%-7.5%	Optional	0.0%
Aiscellaneous Other Expenses*	<20%	Optional	0.0%
Pescription			\sim

Once the user inputs the budget provision percentages for each of the corresponding budget line items, the road sector budget tool will report a budget estimate i.e. '**Total Budget Cost'.** The total budget cost is derived from the outcomes of the budget line items calculated as percentages of the Infrastructure Cost and added to the infrastructure cost amount obtained from the unit cost estimator (See Figure 3-9 below).

Figure 3-9: Road Sector Total Budget Cost Output

ludget item	Provision Guidance	Receommended Application	User Budget Provision	Amount
nfrastructure Cost				23,111,242.11
easibility studies/Project Planning	0.5%-1.0%	Always	08%	184,889.94
etailed Engineering Design (Consultancy Services)	1.5%-4.5%	Optional	0.0%	1 A A
ontract Administration (Constuction Supervision)	3.5% - 7.5%	Optional	0.0%	
Alscellaneous Other Expenses* Asscription:	<20%	Optional	0.0%	
Ascellaneous Other Expenses" Nescription:	<20%	Optional	0.0%	-

Key Points to note on the use of the Road Sector Budget Tool

- Apart from Project Planning/Feasibility Studies, all the other budget line items are optional. In scenarios where Project Planning/Feasibility Studies have already been covered under the allocation for the project, users are not required to make any allocation for it in the budget tool. However, for some projects, this is assigned as an Administrative Cost;
- For consultancy services for design studies that do not include construction supervision, use the option **Detailed Engineering Design (Consultancy Services)**;
- For consultancy services meant for the supervision of the construction of works only, use the option **Contract Administration;** and
- In cases where consultancy services are for both design and construction supervision, then both options 2 and 3 above should be used accordingly.

4. Buildings Sector Unit Cost Estimator and Budget Tool

4. Buildings Sector Unit Cost Estimator and Budget Tool

4.1. User interface

4.1.1. Buildings Sector Unit Cost Estimator

The buildings sector unit cost estimator similarly was developed with the data segmentation modelling approach. This approach was adopted because a moderately sized historical record of contracts with a reasonable number of cost drivers that reflect the nature of the buildings sector in Ghana was obtained.

The historical buildings contract data was stratified into groups defined by the value of cost drivers and the median historical inflation-adjusted project costs used to estimate the unit cost of infrastructure for a building project belonging to the identified segment.



The main cost drivers identified for the buildings sector include the following:

- Type of Building Infrastructure;
- Building Sub-Type;
- Number of Storeys;
- Region;
- Urban/Rural;
- Terrain;
- Season Start;
- Finishes Level;
- Services Level;
- External works;
- Funding Source;
- Procurement Type; and
- Area of Project (Sq. Metres per floor) User Input

A screen shot of the user interface for the buildings sector unit cost estimator is shown below with the selectable cost drivers and the window where the unit cost output is presented after selecting the applicable drivers.

Figure 4-1: User Interface of the Buildings Sector Unit Cost Estimator

A	в	С	D	E	F
	Public Procurement Authority Improving efficiency and	Buildings Sector UCOI Estimator Budget Tool			
5 6 7	Carisparency in Public Procurement		Input Required Output		
10	Building Infrastructure Unit Cost Estimator				
11 12 13	Cost Drivers	Select Options for Projec	π		
14 15	Building Type Building Sub-Type	ALL			
16 17	Number of Storeys Region	ALL			
18 19	Urban/Rural Terrain	ALL			
20 21	Season Start Finishes Level	ALL			
22	External Works	ALL			
25	Procurement Type	ALL			
27 28	Area of Project (Sq Meters per floor)	1			
29 30 31	Unit Cost	426.44		USD per Square Meter of Bui	Iding
32 33					
35	Cost Estimate	426.44		USD	

4.1.2. Buildings Sector Budget Tool

The buildings sector budget tool allows the user to include the cost of other factors that relate to the development of the building project. The budget tool under this project was developed based on the experience of buildings sector experts as well as based on interaction with the key stakeholders in the sector in Ghana.

The pre-set elements of the buildings sector project budget tool include budget allocation for:

- Project Formulation/Preparation;
- Project Coordination Unit (PCU) Management and Monitoring;
- Implementing Metro/Municipal/District Assembly;
- Consultants Pre-Contract Phase;
- Consultants Post-Contract Phase;
- Post Contract Follow-up Activities by PCU; and
- Potential Stakeholder Engagement.

Provision was made as a guide as to what proportion of the initial infrastructure cost should be allocated to the above items. These options can be seen under the **'Provision Guidance'** header. This enables the user to apply some informed basis to selecting an appropriate percentage where his or her input is required under the **'User Budget Provision'**. Here, the user can enter a percentage value for any of the applicable items provided.

The budget tool for the buildings sector also allows the user to enter any additional items that may not fall within the items above set within the project budget tool for the buildings sector. These include items such as:

- Relocation of underground utility services e.g. Water, telephone cables etc.
- Relocation of underground drainage works; and
- Any other item not covered in the budget.

Below is a screenshot of the buildings sector budget tool.

Figure 4-2: User Interface of the Buildings Sector Project Budget tool

	A	В	С		D	E	F	G		н
1 2 3 4		Public Procurement Authority Improving efficiency and transparaerus in Public Procurement	Buildings Secto UCOI Estimator Budget Tool	r						
5 6 7		unisparency in round risearennen.		Input Require Output	ed					
37		Buildings Sector Project Budget Tool								
38 39 40		Budget Item	Provision Guidance	r -		Application	User Budget Provision	Amou	nt	
41 42		Total Infrastructure Cost						426.44	4	
43 44		Project Formulation/Preparation	1.0%			Always	0.0%	-		
45 46		Project Coordination Unit (PCU); Management and Monitoring	3.0%			Always	0.0%			
47 48		Implementing Metro/Municipal/District Assembly sub-office	1.5%			Optional	0.0%			
49 50		Consultants; Pre-Contract Phase	3.0%			Always	0.0%			
51 52		Consultants; Post-Contract Phase	5.0%			Always	0.0%			
53 54		Post Contract Follow-up activities by PCU	1.0%			Optional	0.0%	-		
55 56		Potential stakeholder engagement	0.5%			Optional				
57 58 59 60			1% - 3%			Depends on Strategy	0.0%			
61		Total Budget Cost					0.0%	426.44	4 USD	i I

4.2. How to use the Buildings Sector Unit Cost Estimator

The first stage of interaction with the buildings sector unit cost estimator is to select the applicable option for each cost driver listed. The buildings sector unit cost tool has 13 user selected/input required items which inform the computed unit cost for the sector. Out of these 13 user selected/input required items, 12 of them are drop-downs from which the user has to select the options under those items.

The dropdown items include:

- General Type of building [Building Type];
- Specific Type of building [Building Sub-Type];
- Number of storeys for the building [Number of Storeys];
- Administrative region [Region];
- Nature of the building's location [Urban/Rural];
- Type of terrain for the building [Terrain];
- Type of season project starts [Season Start];
- Level of building finish to be applied [Finishes Level];
- Building service level to be applied [Services Level];
- Level of building external works to be applied [External works];
- The funding organisation for the building project [Funding Source]; and
- Method of procurement being applied [Procurement Type].

Figure 4-3: User selected section-Buildings Sector Unit Cost Estimator

4	A	B	C	D
1 2 3 4		Public Procurement Authority Improving efficiency and	Buildings Sector UCOI Estimator Budget Tool	
5 6 7		transparency in Public Procurement		Input Required Output
10		Building Infrastructure Unit Cost Estimator		
11 12 13		Cost Drivers	Select Options for Proje	ect
14		Building Type	ALL	
15		Building Sub-Type	ALL	
16		Number of Storeys	ALL	
17		Region	ALL	
18		Urban/Rural	ALL	
19		Terrain	ALL	
20		Season Start	ALL	
21		Finishes Level	ALL	
22		Services Level	ALL	
23		External Works	ALL	
24		Funding Source	ALL	
25		Procurement Type	ALL	
26				
27		Area of Project (Sq Meters per floor)	\checkmark	1

The options for each of the dropdowns are listed in Table 4-1 below.

Table 4-1: Buildings Unit Cost- Cost Driver Item and Corresponding Drop-down Options

Cost Driver Item	Drop down Options			
Building Type	ALL (BUILDING TYPES)			
	RESIDENTIAL			
	COMMERCIAL			
	EDUCATIONAL			
	GENERAL			
	HEALTH			
	INDUSTRIAL			
	OFFICE			
	SPORTS			
Building Sub-Type	ALL (ALL BUILDING SUB-TYPES)	FENCE WALL		
	ADMINISTRATION BLOCK	HOSPITAL		
	APARTMENTS	HOSTEL		
	ASSEMBLY HALL	LABORATORY BLOCK		
	AUDITORIUM BLOCK	LECTURE HALL		
	BUNGALOW	MARKET		
	CAR PARK	OFFICE		
	CLASSROOM	SEMI-DETACHED		
	CONFERENCE CENTRE	SPORTS		
	DORMITORY	STAFF		
	EXAMINATION HALL	STORES		
	DINING HALL	TRAINING CENTRE		
	FACULTY			
Number of Storeys	LL (ALL NUMBER OF STOREYS)			
	1 (One)			
	2 (Two)			
	3 (Three)			
	4 (Four)			
	5 (Five)			
	6 (Six)			
Region	ALL (ALL REGIONS)	NORTHERN		
	GREATER ACCRA	BRONG AHAFO		
	CENTRAL	UPPER EAST		
	VOLTA	UPPER WEST		
	EASTERN	ASHANTI		
Urban/Rural	ALL (ALL URBAN/RURAL)			

Cost Driver Item	Drop down Options	
	URBAN	RURAL
Terrain	ALL (ALL TERRAINS)	
	NORMAL	
	ABNORMAL	
Season Start	ALL (ALL SEASONS)	
	DRY	
	WET	
Finishes Level	ALL (ALL FINISHES LEVELS)	MEDIUM
	LOW	HIGH
Services Level	ALL (ALL SERVICES LEVELS)	MEDIUM
	LOW	HIGH
External Works	ALL (ALL EXTERNAL WORKS)	MEDIUM
	LOW	HIGH
Funding Source	ALL (ALL FUNDING SOURCES)	GOG
	GETFUND	SSNIT
	M.O.E	OTHER
	WORLD BANK	
Procurement Type	ALL (ALL PROCUREMENT TYPES)	
	NATIONAL COMPETITION	
	РРР	
	SELECTIVE TENDER	

Please note that when the 'ALL' option is selected for any criteria it selects all historical contracts with all the applicable drop down options in computing the unit cost.

In order to select any item from the dropdown options, move your mouse cursor to the cell below the header 'Select Options for Project' in line with a corresponding cost driver. A downward pointing arrow will appear on the right side of the cell (See Figure 4-4).

Click on the downward pointing arrow to activate the list of dropdowns. See Figure 4-5 below (*Suggestion: in order to make the dropdown options more visible you can increase the magnification/ zoom of the Excel spreadsheet*).

Figure 4-4: Drop down button selector

Select Options for Proje	ect
ALL	D
ALL	

Figure 4-5: Activated drop down options selection



Once the user selects options for each of the corresponding cost drivers, the buildings sector unit cost tool will report a unit cost estimate i.e. '**Unit Cost'**. This value is reported just below the 'Area of Project (Sq. Metres per floor)' cost driver. Depending on the number of square metres per floor **(Area of Project (Sq. Metres per floor)** entered in the corresponding cell inputs, the unit cost of the building project will also change as well as the **'Cost estimate'** item which reflects the total cost of the building infrastructure being reviewed in the tool. (See Figure 4-6 below)

Figure 4-6: Buildings Sector Unit Cost and Cost Estimate Output



4.2.1. Summary of Steps-Buildings Sector Unit Cost Estimator

- 1. Select the options for each cost driver with a drop-down (e.g. Building type, Building sub-type, Number of Storeys etc.) as may apply to your scenario.
- 2. At the **Area of project (Square metres per floor)** query, enter the floor area to be constructed in the input required section.
- 3. The Unit Cost will be produced for USD per square metre of building as well as the total cost estimate that will be incurred for constructing the building project with the user selected characteristics.

Key Points to note on the use of the Buildings Sector Unit Cost Estimator

- It is recommended that the tool should be used by a technical person who understands and can interpret the content. All results and interpretations are the sole responsibility of the user;
- The contract cost data used comprise solely of project costs for various building infrastructure at the **award prices**. It therefore expresses the unit cost of providing the building infrastructure without consideration of any variations, extensions of time or any other changes to the original contract awarded;
- Output of unit cost estimator for the buildings sector feeds into the budget tool. The buildings sector unit cost is expressed in USD/m² whilst the budget tool estimate is expressed in USD;
- The output of unit cost per building infrastructure type is the calculated median value of all relevant cost values. It does not report the average/mean cost;
- To avoid errors, it is suggested that the user systematically selects the various components logical sequence from top to down;
- As much as possible, no selection should indicate **ALL**. Any cell showing that should be changed to a specific descriptor;
- It is assumed that the user knows which options for each cost driver go with other cost drivers for e.g. not to select wrong options such as RESIDENTIAL for 'Building Type' and then selecting CLASSROOM for 'Building Sub-Type';
- It should be noted that where there is no contract in the database that satisfies the unique set of parameters the user has entered, no unit cost estimate will be reported. This may be resolved in the future update of the database as more contract data is collected and analysed. It should be remembered that this tool reports on similar real contracts found in its database.

4.3. How to use the Buildings Sector Budget Tool

The cost estimate derived from the unit cost estimator feeds into the budget tool as the **'Total Infrastructure Cost'**. Users are only required to provide input in the form of percentages for the 8 budget line items as highlighted in Figure 4-7 below at the **'User Budget Provision'** column of the tool. As mentioned earlier, the **'Provision guidance'** provided should enable the user to apply some informed basis to select an appropriate percentage required under the **'User Budget Provision**.

The budget line items for which users would provide input for include:

- Project Formulation/Preparation;
- Project Coordination Unit (PCU) Management and Monitoring;
- Implementing Metro/Municipal/District Assembly;
- Consultants Pre-Contract Phase;
- Consultants Post-Contract Phase;
- Post Contract Follow-up Activities by PCU; and
- Potential Stakeholder Engagement.

Additionally, the budget tool for the buildings sector allows the user to enter any additional items that may not fall within the items above set within the project budget tool for the buildings sector. These include items such as:

- Relocation of underground utility services e.g. Water, telephone cables etc.
- Relocation of underground drainage works; and
- Any other item not covered in the budget.

These input area for the budget line item as can be seen in Figure 4-7 below.

Figure 4-7: User Input Section-Buildings Sector Budget Tool

Buildings Sector Project Budget Tool			
Judget Item	Provision Guidance	Application	User Budget Provision
otal Infrastructure Cost		1	
roject Formulation/Preparation	1.0%	Always [0.0%
roject Coordination Unit (PCU); Management and Monitoring	3.0%	Always [0.0%
mplementing Metro/Municipal/District Assembly sub-office	1.5%	Optional	0.0%
onsultants; Pre-Contract Phase	3.0%	Always [0.0%
onsultants; Post-Contract Phase	5.0%	Always	0.0%
ost Contract Follow-up activities by PCU	1.0%	Optional [0.0%
otential states	0.5%	Optional	0.0%
	1% - 3%	Depends on Strategy	0.0%

Once the user inputs the budget provision percentages for each of the corresponding budget line items, the buildings sector budget tool will report a budget estimate i.e. '**Total Budget Cost'**. The total budget cost will be derived from the outcomes of the budget line items calculated as percentages of the Total Infrastructure Cost and added to the total infrastructure cost amount obtained from the unit cost estimator (See Figure 4-8 below).

Figure 4-8: Buildings Sector Total Budget Cost Output

udgetitem	Provision Guidance	Application	User Budget Provision	Amount
otal Infrastructure Cost				426.44
roject Formulation/Preparation	1.0%	Always	1.0%	4.26
roject Coordination Unit (PCU); Management and Monitoring	3.0%	Always	0.0%	
nplementing Metro/Municipal/District Assembly sub-office	1.5%	Optional	0.0%	2
onsultants; Pre-Contract Phase	3.0%	Always	0.0%	
onsultants; Post-Contract Phase	5.0%	Always	0.0%	-
ost Contract Follow-up activities by PCU	1.0%	Optional	0.0%	
otential stakeholder engagement	0.5%	Optional	0.0%	-
Ì	1%-3%	Depends on Strategy	0.0%	
				-

Key Points to note on the use of the Buildings Sector Budget Tool

- Output of the unit cost estimator for the buildings sector feeds into the budget tool. The buildings sector unit cost is expressed in **USD/m²** whilst the budget tool estimate is expressed in **USD**;
- To avoid errors, it is suggested that the user only inputs the absolute values i.e. 1, 2, 3 etc. for the various components in the applicable areas; and
- It is also recommended that users consider the provision guidance in making their input. It is worth noting that these guidelines were derived based on expert experience as well as from interactions with key stakeholders within the sector.

5. Water Sector Unit Cost Estimator and Budget Tool

5. Water Sector Unit Cost Estimator and Budget Tool

5.1. User Interface

5.1.1. Water Sector Unit Cost Estimator

The water Sector cost estimator was developed with the Component Cost modelling approach. This approach was adopted because a moderate number of contracts with a reasonable number of cost drivers that reflect the nature of the water sector in Ghana. In this approach, an exhaustive list of project components was developed and component costs derived from the mostly standard priced Bill of Quantities in the contract documents obtained from sector agencies."

The water unit cost estimator has been designed to reflect the main systems indicative of the sector as follows:



- Conventional Town Water Systems; and
- Point Source System

The main cost drivers the analysis of the water sector identified under the above mentioned systems is shown in the following table.

No.	Conventional Town Water Systems	Point Source System
1	Number of Boreholes	Number of Boreholes
2	Number of 5K Raw Water Pumping Systems	Number of Hand Pumps
3	Concrete/Rockfill Dam (m)	Number of Iron Removal Plant
4	Concrete/Rockfill Weir (m)	
5	Impoundment Intake (m2)	
6	Side Intake (m2)	
7	Riser and Hydraulic Heads (No.):	
	• #90mm	
	• #100mm	
8	Power Supply System (Set)	
9	Typical System Control Office (No.)	
10	Typical Package Treatment Plant (No.)	
11	Typical Pump Control Room (No.)	
12	Typical Public Standpipe (No.)	
13	Typical Direct House Connection (No.)	
14	Total Transmission Main, HDPE PN16 (Metres):	
	• # 63mm	
	• # 90mm	
	• # 110mm	
	• # 125mm	
	• # 160mm	
	• # 200mm	
15	Total Distribution Main, HDPE PN10 (Metres):	
	• # 32mm	
	• # 03mm	
	 # 90mm # 110mm 	
	 # 110mm # 125mm 	
	• # 160mm	
	• # 200mm	
	" 	<u> </u>

Table 5-1: Water Sector Unit Cost Drivers (Components)

No.	Conventional Town Water Systems	Point Source System
16	Elevated Conc. Storage Tanks (Cubic Meter):	
	• 50m3	
	• 100m3	
	• 120m3	
	• 150m3	
	• 250m3	

Screen shots of the user interface for the water sector unit cost estimator are shown below with the respective cost drivers and the window where the unit cost output is presented.

Figure 5-1: User Interface of the Water Sector Unit Cost Estimator

	A	в	c	D	E	F		G	1	i pe	â.
1	-	Public .	Water Sector								
2	Superior Car	Public	UCOI Estimator & Budget Tool								
3		Authority									
4		Autionty									
5	State and the	Improving efficiency and transparency in Public Procurement		Input Required							
7	-	and parenty in route rice are in the		Uutput							
8											
9		Water Supply Infrastructure Unit Cost Estimator	Point Source								
10											
11		A Conventional Town Water Systems			B Point Source Syste	m					
		A contentional four water systems			b. rome obtailer by ste						
12		Contraction	Coloris Continue Contractions		Card Driver	Colore Oneiron					
13		Cost Drivers	Select Options for Project		Cost Drivers	Select Options	for Project				
15		Number of Boreholes	0		#of Boreholes	0					
16		Number of 5K Raw Water Pumping Systems	0		#of Hand Pumps	0					
17		Concrete/Rockfill Dam (m)	0		#Iron Removal Plant	0					
18		Concrete/Rockfill Weir (m)	0								
20		Earth Dam (m)	0								
21		Side Intake (m2)	o								
conc.											
23											
24		Riser & Hydraulic Heads (No.)	0								
26		#100mm	0								
27											
28		Power Supply System(Set)	0								
29		Typical System Control Office(No.)	0								
31		Typical Pump Control Room(No.)	0								
32		Typical Public Standpipe(No.)	0								
33		Typical Direct House Connection(No.)	0								
35		Total Transmission Main, HDPE PN16 (Meters)									
36		#63mm	0								
37		#90mm	0								
39		#125mm	0								
40		#160mm	0								
41		#200mm	0								
42		Total Distribution Main, HDPE PN10 (Meters)									
43		#32mm #63mm	0								
45		#90mm	0								
46		#110mm	0								
47		#125mm	0								
40		# 160mm	0								
50		Flevated Conc. Storage Tanks (Cubic Meter)									
51		50m ³	0								
52		100m ³	0								
53		120m ⁵	0								
54		150m ³	0								
55		250m ³	0								
~											
57		Unit Cost General Items / Preliminaries		USD 24	7 596 - 1596	0	0.00 USD				
59		Physical Contingency		15%	10% - 15%						
60		Cost Estimate	-		USD						

5.1.2. Water Sector Budget Tool

The water sector budget tool allows the user to include the cost of other factors that relate to the development of the water project. The budget tool under this project was also developed based on the experience of water sector experts as well as based on interactions with the key stakeholders in the sector in Ghana.

The pre-set elements of the buildings sector project budget tool include budget allocation for:

- Project Formulation/Preparation;
- Project Implementation Agency Management and Monitoring;
- Technical Assistance for Implementing Agency project management;
- Implementing agency sub-office(Regional Office) monitoring;
- Decentralized Local Authority Management of the project;
- Feasibility studies / Project Planning;
- Detailed Design;
- Post Contract Follow-up activities by Implementing Agency;
- Potential stakeholder engagement; and
- Others.

Provision was made as a guide to what proportion of the initial infrastructure cost should be allocated to the above items. These options can be seen under the **'Provision Guidance'** header. This enables the user to apply some informed basis to selecting an appropriate percentage where his or her input is required under the **'User Budget Provision'**. Here, the user can enter a percentage value for any of the applicable items provided.

The budget tool for the water sector also allows the user to enter any additional items that may not fall within the items above set within the project budget tool for the sector. These include items such as:

- Post Project O&M/Sustainability Monitoring/Support; and
- Project Environmental/Social Impact Support.

Below is a screenshot of the water sector budget tool.

Figure 5-2: User Interface of the Water Sector Budget Tool

Water Sector Project Budget Tool				
Budget Item	Provision Guidance	Receommended Application	User Budget Provision	Amount
Infrastructure Cost				
Project Formulation/Preparation	0.5%-1%	Always	0.0%	-
Project Implementation Agency Management and Monitoring	196-396	Always	0.0%	2
Technical Assistance for Implementing Agency project management	196-396	Optional	0.0%	-
Implementing agency sub-office(Regional Office) monitoring	0.5%-1%	Always	0.0%	÷
Decentralized Local Authority Management of the project	0.5% - 1%	Depends on Strategy	0.0%	÷
Feasibility studies / Project Planning	196-396	Always	0.0%	-
Detailed Design	196-396	Always	0.0%	
Post Contract Follow-up activities by Implementing Agency	0.5%-1%	Optional	0.0%	-
Potential stakeholder engagement	0.5% - 1%	Optional	0.0%	2
Other*:	Varies	Optional		2
Total Budget Cost				- USD

5.2. How to use the Water Sector Unit Cost Estimator

The first stage of interaction with the water unit cost estimator is to select the applicable type of water system for the project from a drop-down menu located at the upper section of the estimator. The options for the drop-down menu include:

- Conventional Town Water Supply System; and
- Point Source System.

In order to select any item from the dropdown options, move your mouse cursor to the coloured cell next to the header **'Water Supply Infrastructure Unit Cost Estimator'** and click on that cell. A downward pointing arrow will appear on the right side of the cell (See Figure 5-3).

Figure 5-3: Drop-down Button Selector



Click on the downward pointing arrow to activate the list of dropdowns. See Figure 5-4 below (*Suggestion: in order to make the dropdowns more visible you can increase the magnification/ zoom of the Excel spreadsheet*).

Figure 5-4: Activated drop down options selection (Point Source or Conventional Water System)

Water Supply Infrastructure Unit Cost Est	imato	ল
	Point Source Conventional Water System	

Once the dropdown list has been activated, the user can then select the applicable option and then proceed to input the applicable number or values for the cost drivers listed under the respective water supply system selected from the drop-down menu. It is imperative that users enter the numbers or values for the cost drivers that are specifically applicable to their identified project and system.

The input sections for the estimator are highlighted in Figure 5-5 as follows.

Figure 5-5: User input sections-Water Sector Unit Cost Estimator



Once the user enters the various values for each of the corresponding cost drivers under the selected system, the water sector unit cost tool will report a unit cost estimate i.e. '**Unit Cost'**. After establishing a unit cost, users must provide values for two key items namely '**General items/Preliminaries'** and '**Physical Contingency'** which are calculated as percentages of the unit cost determined to arrive at the '**Cost estimate**'. A range of values has been provided for this two items to guide users on the appropriate percentage values to input.

Depending on the values entered in the input sections, the unit cost of the water project will change as well as the **'Cost estimate'** item which reflects the total cost of the water infrastructure being reviewed in the tool. (See Figure 5-6 below)

Figure 5-6: Water Sector Unit Cost and Cost Estimate Output


5.2.1. Summary of Steps-Water Unit Cost Estimator

- 1. Select the option for the applicable water supply system from the drop-down menu (ie. Conventional Town Water Supply System and Point Source System);
- 2. Enter the applicable values or numbers in the input required section; and
- 3. The Unit Cost in USD will be produced as well as the total cost estimate that will be incurred for establishing the water infrastructure with the user selected characteristics.

Key Points to note on the use of the Water Sector Unit Cost Estimator

- It is recommended that the tool should be used by a technical person who understands and can interpret the content. All results and interpretations are the sole responsibility of the user;
- The contract cost data used comprise solely of project costs for various water infrastructure projects at the **award prices**. It therefore expresses the unit cost of providing the water infrastructure without consideration of any variations, extensions of time or any other changes to the original contract awarded;
- The output of the unit cost estimator for the water sector feeds into the budget tool. The water sector unit cost and budget tool estimate are expressed in **USD**;
- The output of unit cost per water infrastructure type is the calculated median value of all relevant cost values. It does not report the average/mean cost; and
- To avoid errors, it is suggested that the user only inputs the absolute values i.e. 1, 2, 3 etc. for the various components in the applicable areas.



5.3. How to use the Water Sector Budget Tool

The cost estimate derived from the unit cost estimator feeds into the budget tool as the **'Total Infrastructure Cost'**. Users are only required to provide input in the form of percentages for the 8 budget line items as highlighted in Figure 5-7 at the **'User Budget Provision'** column of the tool. As mentioned earlier, the **'Provision guidance'** provided should enable the user to apply some informed basis to select an appropriate percentage required under the **'User Budget Provision**.

The budget line items for which users would provide the input for include:

- Project Formulation/Preparation;
- Project Implementation Agency Management and Monitoring;
- Technical Assistance for Implementing Agency project management;
- Implementing agency sub-office(Regional Office) monitoring;
- Decentralized Local Authority Management of the project;
- Feasibility studies / Project Planning;
- Detailed Design;
- Post Contract Follow-up activities by Implementing Agency;
- Potential stakeholder engagement; and
- Others [User selected-Optional]

The budget tool for the water sector also allows the user to enter any additional items that may not fall within the items above set within the project budget tool for the sector. These include items such as:

- Post Project O&M/Sustainability Monitoring/Support; and
- Project Environmental/Social Impact Support.

This input area for the budget line item as can be seen in Figure 5-7 below.

Figure 5-7: User Input Section - Water Sector Budget Tool

Budget Item	Provision Guidance	Receommended Application	User Budget Provision
Infrastructure Cost			0
Project Formulation/Preparation	0.5% - 1%	Always	0.0%
Project Implementation Agency Management and Monitoring	1% - 3%	Always	0.0%
echnical Assistance for Implementing Agency project management	1%-3%	Optional [0.0%
mplementing agency sub-office(Regional Office) monitoring	0.5% - 1%	Always [0.0%
ecentralized Local Authority Management of the project	0.5% - 1%	Depends on Strateg	0.0%
easibility studies / Project Planning	1%-3%	Abways [0.0%
betailed Design	1% - 3%	Always [0.0%
ost Contract Follow-up activities by Implementing Agency	0,5% - 1%	Optional [0.0%
otential stakeholder engagement	0.5% - 1%	Optional [0.0%
chart:	Varies	Optional	

Once the user inputs the budget provision percentages for each of the corresponding budget line items, the water sector budget tool will report a budget estimate i.e. '**Total Budget Cost'.** The total budget cost will be derived from the outcomes of the budget line items calculated as percentages of the Total Infrastructure Cost and added to the total infrastructure cost amount obtained from the unit cost estimator (See Figure 5-8 below).

Figure 5-8: Water Sector Total Budget Cost Output

Bundeles Guidence	Recommended Instruction	Dans Burdens Bassisters	Amount
Provisión Guidance	Neceommended Application	user budget Provision	Amount
		0	1,542,396.08
0.5% - 1%	Always	1.0%	15,423.96
18-38	Abways	2.0%	30,847.92
1%-3%	Optional	0.0%	
0.5% - 1N	Always	0.0%	4
0.5%+3%	Depends on Strategy	0.0%	
1%-3%	Always	0.0%	
1%-3%	Always	0.0%	12
0.5%-1%	Optional	0.0%	
0.5% - 1%	Optional	0.0%	1.9
Varies	Optional		4
	Provision Guidance 0.5% - 1% 1% - 3% 1% - 3% 0.5% - 1% 1% - 3% 0.5% - 1% 0.5% - 1% 0.5% - 1% 0.5% - 1% Varies	Provision Guidance Recommended Application 0.5% - 1% Always 1% - 3% Optional 0.5% - 1% Optional 0.5% - 1% Depends on Strategy 1% - 3% Always 1% - 3% Always 0.5% - 1% Optional 0.5% - 1% Optional	Provision Guidance Recommended Application User Budget Provision 0.5% - 1% Always 2.0% 1% - 3% Always 2.0% 1% - 3% Optional 0.0% 0.5% - 1% Always 0.0% 0.5% - 1% Depends on Strategy 0.0% 1% - 3% Always 0.0% 0.5% - 1% Optional 0.0% 0.5% - 1% Optional 0.0% Varies Optional 0.0%

Key Points to note on the use of the Water Sector Budget Tool

- The output of the unit cost estimator for the water sector feeds into the budget tool. The water sector unit cost and budget tool estimate are expressed in **USD**;
- To avoid errors, it is suggested that the user only inputs the absolute values i.e. 1, 2, 3 etc. for the various components in the applicable areas; and
- It is also recommended that users consider the provision guidance in making their input. It is worth noting that these guidelines were derived based on expert experience as well as from interactions with key stakeholders within the sector.

6. Power Sector Unit Cost Estimator and Budget Tool

6. Power Sector Unit Cost Estimator and Budget Tool

6.1. User Interface-Power Distribution

6.1.1. Power-Distribution Unit Cost Estimator

The Unit Cost Estimator and Budget Tools for the Power Sector due to inherent characteristics was split into four categories namely:

- Power Generation;
- Power Distribution;
- Power Transmission 161Kv; and
- Power Sub-Transmission 33Kv.

Similar to the water sector unit cost estimator, the unit cost estimator for

power distribution was developed using the Component Cost modelling approach. The minimal size of contracts obtained made it necessary to adopt this approach to enable the cost drivers that are representative of the power sector in Ghana to be determined from the available data,

As expected under this approach, an exhaustive list of project components was developed and current pricing from the market for components was used to build a complete project cost profile based on an item-by-item aggregation.

The main cost drivers identified from the analysis of the power distribution sector are shown in the following table.

No.	Cost Driver	Main Component	Sub-Components (Features)
1	Wood Poles & Accessories	 Intermediate Pole (IP) Light Angle Pole (LA) Section Pole (SP) T-OFF Heavy Angle (HA) Terminal Pole (TP) 	 11m HT Wood Poles for (33kV) 11m HT Wood Poles for (11kV) 9m LV Wood Poles(0.433kV)
2	Conductors	Conductor Size & Length (in Km)	 LV - 4x120AAC LV - 4x50AAC HT - 3x120AAC
3	Substation Equipment & Accessories	 50kVA 100kVA 200kVA 315kVA 500kVA (Partial Package) 500kVA (Full Package) 800kVA 800kVA (Partial Package) 800kVA (Full Package) 800kVA (Full Package) 	 11/0.433KV PMT 33/0.433KV PMT

Table 6-1: Power Distribution Sector Unit Cost Drivers and Components



A screen shot of the user interface for power distribution sector unit cost estimator is shown in figure 6-1 with the cost drivers and the window where the unit cost output is presented.

Figure 6-1: User Interface of the Power Distribution Unit Cost Estimator

	A	В	c	D	E
1	100	Public	Power Sector		
2	6 Carl	Procurement	UCOI Estimator		
2	(i(()i)	Authority	Budget Tool		
4		Improving efficiency and	budget root		
5		transparency in Public Procurement		Input Required	
6				Output	
-				and we appendix	
9		Power Infrastructure Unit Cost Estimator	Type of Power Project:	Distribution	
10					
10					
11					
12					
13		Cost Drivers	Select Options for Project		
14		00175			
15		POLES			
17		Wood Poles & Accessories (No)	11m HT Wood Poles for (11kV)	11m HT Wood Poles for (33	kV) 9m LV Wood Poles(0.433kV)
18		Intermediate Pole (IP)	0	0	0
19		Light Angle Pole (LA)	0	0	0
20		Section Pole (SP)	0	0	0
21		I-OFF	0	0	0
23		Terminal Pole (TP)	0	0	0
24			-		-
25					
26		CONDUCTORS		1000000000	
27			LV - 4x120AAC	LV - 4x50AAC	HT-3x120AAC
29		Conductor Size & Length (Km)	0	0	0
30					
22					
34		SUBSTATION EQUIPMENT & ACCESSORIES (No)			
35			11/0.43	33KV PMT	33/0.433KV PMT
36		50kVA		0	0
37		100kVA		0	0
38		200kVA		0	0
39		315kVA		0	0
40		500kVA		0	
41		500kVA (Partial Package)		0	
42		500kVA (Full Package)		0	
43		800kVA		0	
44		800kVA (Partial Package)		0	
45		800kVA (Full Package)		0	
46				10	
47					
48		Total Infrastructure Cost (USD)		8	
49		Contingency (USD)			
50					
51		Grand Total USD (0.433kV LV Distribution Network)		14	
52					

Unit Cost of Infrastructure Estimator and Budget Tool-Final User Guide

6.1.2. Power-Distribution Budget Tool

The power distribution budget tool allows the user to include the cost of other factors that relate to the development of a power distribution project. The budget tool developed here was also based on the experience of power sector experts as well as based on interactions with the key stakeholders in the sector in Ghana.

The identified elements of the power distribution budget tool include budget allocation for:

- Project Formulation/Preparation;
- Pre-Feasibility Studies (Financial Arrangements & Consultant Procurement);
- Feasibility Studies (Project Planning & Preliminary Design);
- Detailed Design;
- Contract Administration (Including Stakeholder engagement and social enquiry);
- Project Implementation Agency Management and Monitoring;
- Post Contract Follow-up activities by Implementing Agency; and
- Provision for Others.

Provision was made as a guide to what proportion of the initial infrastructure cost should be allocated to the above items. These options can be seen under the **'Provision Guidance'** header. This enables the user to apply some informed basis to selecting an appropriate percentage where his or her input is required under the **'User Budget Provision'**. Here, the user can enter a percentage value for any of the applicable items provided.

The budget tool for the power distribution sector also allows the user to enter any additional items that may not fall within the items above set within the project budget tool for the sector. These include items such as:

- Land acquisition; and
- Environmental and Social Impact Assessment etc.

Below is a screenshot of the power distribution budget tool.

Figure 6-2: User Interface of the Power Distribution Budget Tool

	Public Procurement Authority Improving efficiency and	Power Sector UCOI Estimator Budget Tool				
5	transparency in Public Procurement		Output			
7 54 55	Power Sector (Distribution) Project Budget To	ol				
56	Budget Item	Provision Guidance		Application	User Budget Provision	Amount
57 58 59	Infrastructure Cost					3 <u>4</u>
60 61	Project Formulation/Preparation	1.0%		Always	0.0%	
62 63	$\label{eq:pre-Feasibility} Pre-Feasibility Studies (Financial Arrangements \& Consultant Procurement)$	1%- 2%		Always	0.0%	
64 65	Feasibility Studies (Project Planning & Preliminary Design)	1%-2%		Always	0.0%] .
66	Detailed Design	2% - 3%		Always	0.0%] .
67 68 69	Contract Administration (Including Stakeholder engagement and social enqu	2% - 5%		Always	0.0%	
70 71	Project Implementation Agency Management and Monitoring	4% - 7%		Always	0.0%	
72 73	Post Contract Follow-up activities by Implementing Agency	1%-2%		Always	0.0%	· ·
74 75 76	Provision for Others	1% - 3%		Depends on Strategy	0.0%] .
78	Total Budget Cost					- USD

6.2. How to use the Power-Distribution Unit Cost Estimator

Essentially, the power distribution unit cost estimator only requires users to make inputs or entries for the applicable cost drivers and components for their project. The input sections of the power distribution unit cost estimator are highlighted in the figure below.

Figure 6-3: User Input Sections - Power Sector Distribution Unit Cost Estimator

	8	c	D	£
(PER)	Public	Power Sector		
11 11	Procurement	U00I Estimator		
28	Authonity	Budget Tool		
A CONTRACTOR	Improving efficiency and transparency in Public Procurement		Input Required	
			Dutput	
			0573850	
	Power Infrastructure Unit Cost Estimator	Type of Power Project:	Distribution	
	Cast Drivers	Select Options for Project		
	POLIS			
	Wood Poles & Accessories (No)	11m HT Wear for (11kV)	11m HT Wood Tales for	(33KV) 9m LV V 0 0 0 0 10 433
	Intermediate Pole (IP)	0	0	0
	Light Angle Pole (LA)	0	0	
	Section Pole (SP)		0	0
	Heavy Angle (HA)	ă	ő	a a
	Terminal Pole (TP)	i i i	a a	
	Construction (
	compocitons	LV-4x120AAC	LV-ANDLAC	HT-3x120AAC
		1000 1000 1000	1.000	
	Conductor Size & Length (Km)	0	0	0
	SUBSTATION EQUIPMENT & ACCESSORIES (No)			
		11/0.4	33KV PMT	33/0.433KV PMT
	SORVA		0	
	1000444			0
	1004774			
	200kVA	1	0	0
	200kVA 315kVA	1	0	ê
	200kVA 315KVA 500kVA	1	0000	\odot
	200kVA 315kVA S00kVA S00kVA S00kVA (Partial Package)	1	0 0 0	0
	200kVA 315kVA S00kVA S00kVA (Partial Package) S00kVA (Full Package)	(0 0 0 0	\bigcirc
	200kVA 315kVA 500kVA 500kVA (Partial Package) 500kVA (Full Package) 800kVA	(\mathbf{O}
	200kVA 315kVA 500kVA 500kVA (Partial Package) 500kVA (Full Package) 800kVA (Partial Package)	(Ü
	200kVA 315kVA SO0kVA SO0kVA (Partial Package) SO0kVA (Full Package) 800kVA (Partial Package) 800kVA (Partial Package)			0
	200kVA 315kVA SO0kVA (Partial Package) SO0kVA (Full Package) 800kVA (Partial Package) 800kVA (Partial Package) 800kVA (Full Package)			\bigcirc
	200kVA 315kVA S00kVA (Partial Package) S00kVA (Full Package) 800kVA (Full Package) 800kVA (Partial Package) 800kVA (Full Package)			0
	200kVA 315kVA SO0kVA SO0kVA (Partial Package) SO0kVA (Partial Package) SO0kVA (Partial Package) SO0kVA (Partial Package) SO0kVA (Partial Package) Total Infrastructure Cost (USD) Continence (USD)	(0
	200kVA 315kVA S00kVA S00kVA (Partial Package) S00kVA (Full Package) 800kVA 800kVA (Partial Package) 800kVA (Full Package) Total Infrastructure Cost (USD) Contingency (USD)			0
	200kVA 315kVA S00kVA (Partial Package) S00kVA (Full Package) 800kVA (Partial Package) 800kVA (Partial Package) 800kVA (Full Package) Total Infrastructure Cost (USD) Contingency (USD) Grand Total (USD)			0

Once the user enters the various values for each of the corresponding cost drivers, the power distribution unit cost estimator reports a unit cost estimate i.e. '**Total Infrastructure Cost**', '**Contingency**' value and a '**Grand Total**' based on the entries made. Depending on the values entered in the input sections, the unit cost of the power distribution project will change as well as the Contingency and Grand Total values (See Figure 6-4).

Figure 6-4: Power Distribution Unit Cost and Cost Estimate Output

33			
34	SUBSTATION EQUIPMENT & ACCESSORIES (No)		
35		11/0.433KV PMT	33/0.433KV PMT
36	50kVA	1	1
37	100kVA	1	1
38	200kVA	1	1
39	315kVA	1	1
40	500kVA	1	
41	500kVA (Partial Package)	1	
42	500kVA (Full Package)	1	
43	800kVA	1	
44	800kVA (Partial Package)	1	
45	800kVA (Full Package)	1	
46			
47	where a substant for a state way to a substant		
48	Total Infrastructure Cost (USD)		
43	Contingency (USD)	19,574.15	
50			
51	Grand Total USD (0.433kV LV Distribution Network)	<15,315.70	>
52		and the second	
0.0			

6.2.1. Summary of Steps-Power-Distribution Unit Cost Estimator

- 1. Enter the applicable value or number in the input required sections for the 11/0.433KV PMT or the 33/0.433KV PMT; and
- 2. The total infrastructure cost in USD will be produced as well as the Grand Total (0.433kV LV Distribution Network) that will be incurred for establishing the water infrastructure with the user provided information.

Key Points to note on the use of the Power Distribution Unit Cost Estimator

- It is recommended that the tool should be used by a technical person who understands and can interpret the content. All results and interpretations are the sole responsibility of the user;
- The contract cost data used comprise solely of project costs for various power distribution infrastructure projects at the **award prices**. It therefore expresses how much it would cost to distribute power without consideration of any variations, extensions of time or any other changes to the original contract awarded;
- Output of unit cost estimator for power distribution feeds into the budget tool. The power distribution infrastructure cost and budget tool estimate are expressed in **USD**; and
- To avoid errors, it is suggested that the user only inputs absolute values i.e. 1, 2, 3 etc. for the various components in the applicable areas.



6.3. How to use the Power-Distribution Budget Tool

The cost estimate derived from the unit cost estimator feeds into the budget tool as the **'Total Infrastructure Cost'.** Users are only required to provide input in the form of percentages for the 8 budget line items as highlighted in Figure 6-5 at the **'User Budget Provision'** column of the tool. As mentioned earlier, the **'Provision guidance'** provided should enable the user to apply some informed basis to select an appropriate percentage required under the **'User Budget Provision**.

The budget line items for which users would provide the input include:

- Project Formulation/Preparation;
- Pre-Feasibility Studies (Financial Arrangements & Consultant Procurement);
- Feasibility Studies (Project Planning & Preliminary Design);
- Detailed Design;
- Contract Administration (Including Stakeholder engagement and social enquiry);
- Project Implementation Agency Management and Monitoring;
- Post Contract Follow-up activities by Implementing Agency; and
- Provision for Others.

The budget tool as mentioned earlier also allows the user to enter any additional items that may not fall within the items above set within the project budget tool for the sector. These include items such as:

- Land acquisition; and
- Environmental and Social Impact Assessment etc.

Figure 6-5: User Input Section – Power Distribution Budget Tool

iget item	Provision Guidance	Application	User Budget Provision
astructure Cest			\sim
ject Formulation/Preparation	1.0%	Always	0.0%
Feasibility Studies (Financial Arrangements & Consultant Procurement)	1%-2%	Aways	0.0N
sibility Studies (Project Planning & Preliminary Design)	1%-2%	Always	0.0%
ailed Design	29-39	Aways	0.0%
tract Administration (Including Stakeholder engagement and social enquiry)	2%-5%	Always	0.0%
ect Implementation Agency Management and Monitoring	4%-7%	Always	0.0%
t Contract Follow-up activities by implementing Agency	1%-2%	Always	0.0%
	18-38	Depends on Strategy	0.0%

Once the user inputs the budget provision percentages for each of the corresponding budget line items, the power distribution budget tool will report a budget estimate i.e. '**Total Budget Cost**'. The total budget cost will be derived from the outcomes of the budget line items calculated as percentages of the Infrastructure Cost and added to the infrastructure cost amount obtained from the unit cost estimator (See Figure 6-6)

Figure 6-6: Power Distribution Total Budget Cost Output

dgat litam	Provision Guidance	Application	User Budget Provision	Anoun
haltwiture Cost				25.413.26
(ect Formulation/Preparation	3.05	Always	109	216.19
e Feasibility Itsudies (Financial Arrangementa & Consultant Procurement)	295-295	Atmanys	2.0%	592.39
easibility Studies (Project Planning & Previoninary Design)	1%-28	Abacays	0.0%	-
betailed Geslign	29-39	Always	0.0%	
Certract Administration Decluding Statisficider angagement and social angulys	28-58	Norman	0.0%	
voject implementation Agency Management and Monitoring	496-736	Always	0.0%	
foot Contract. Follow-up activities by Impliamenting Agency	1%-2%	Always	0.0%	· ·
7	196-296	Depends on Strategy	0.0%	

Key Points to note on the use of the Power Distribution Budget Tool

- The output of the unit cost estimator for the power distribution feeds into the budget tool. The power distribution unit cost and budget tool estimate are expressed in **USD**;
- To avoid errors, it is suggested that the user only inputs the absolute values i.e. 1, 2, 3 etc. for the various components in the applicable areas; and
- It is also recommended that users consider the provision guidance in making their input. It is worth noting that these guidelines were derived based on expert experience as well as from interactions with key stakeholders within the sector.

6.4. User Interface- Power Transmission 161kV

The unit cost estimator for power transmission was also developed using the Component Cost modelling approach. The main cost drivers identified from the analysis of the power transmission are shown in the following table.

No.	Cost Driver	Main Component	Sub-Components
1	Transmission Bulk Supply Substation	161kV Power Equipment	 161/34.5kV 25/33MVA power transformer complete 161/34.5kV 10/13MVA power transformer complete 34.5kV/0.433-0.250kV, 250kVA Auxiliary transformer complete 34.5kV/0.433-0.250kV, 250kVA Grounding transformer complete
		Circuit Breaker	 161kV Dead tank SF6 Circuit breaker with remote & local control (set of 3-phase) independent pole operation type complete with supporting structures (no) 34.5kV Dead tank SF6 Circuit breaker (set of 3-phase)
		Steel Structures	 161kV line gantries (Lot) 34.5kV Feeder structures for all feeders (Lot) Steel supporting structure for all 34.5kV Equipment (Lot) 34.5kV Feeder structures for power transformers (Lot)
		Underground Cable	34.5kV copper underground cable 120sq.mm(3core) 3cables per phase including termination kits(for 34.5kV Feeder) (Lot)
		34.5kV Capacitor Banks & Bus Bar Rating	34.5kV Bus Bar rated 1500A
2	161 kV Transmission Lines	2x265sq.mm TOUCAN Conductor (Km)	
		Tower Type (no.)	 Tower Type XX Tower Type YY Tower Type ZZ Tower Type 90 Degree Angle Distance from Warehouse to Project Site (km)
3	Civil Works (Tower Foundation(no.))	 Foundation in poor soil Foundation in good soil Foundation in Unfractured Rock Foundation in wet soil 	XX FoundationYY FoundationZZ Foundation
4	Tower Extensions	Basic Tower Body -5:	 XX Tower Type Extension YY Tower Type Extension ZZ Tower Type Extension
		First Body Extension +/- 0:	XX Tower Type ExtensionYY Tower Type Extension

Table 6-2: Power Transmission Unit Cost Drivers (Components)

No.	Cost Driver	Main Component	Sub-Components
			ZZ Tower Type Extension
		Second Body Extension +5:	XX Tower Type Extension
			YY Tower Type Extension
			ZZ Tower Type Extension

Screen shots of the user interface for power transmission unit cost estimator are shown in figure 6-7 with the cost drivers and the window where the unit cost output is presented.

Figure 6-7: User Interface of the Power Transmission Unit Cost Estimator

A	в			c	D	
1.1.1			Power C	ector	N.	
SUBLIC OF ONE	Public		Fower 5	ector		
E CALLON	Procurement		UCOI Estir	nator		
	Authority		Budget To	lol		
	Improving efficiency and		-			
	transparency in Public Procurement			1	nput Required	
					Dutput	
-						
	Power Infrastructure Unit Cost Estimator		Type of Po	ower Project:	Transmission	
1				12107-121010-0101211-022	and the second secon	
	Power Transmission 161kV					
	Fower Industrission LOLKV					
	Cast Drivers		Calant O	and for Designed		
	COST Drivers		Selectopti	ons for Project		
	TRANSMISSION BULK SUPPLY SUBSTATION					
	161kV POWER EQUIPMENT (No)					
	161/34.5kV 25/33MVA power transfomer complete			0		
	161/34.5kV 10/13MVA power transfomer complete			0		
	34.5kV/0.433-0.250kV, 250kVA Auxialliary transformer complete			0		
	34.5kV/0.433-0.250kV, 250kVA Grounding transformer complete			0		
	CIRCUIT BREAKER (No)					
	161kV Dead tank SF6 Circuit breaker with remote & local control (set of 3-phase) independent	pole operation				
	type complete with supporting structures (no)			0		
	34.5kV Dead tank SF6 Circuit breaker (set of 3-phase)			0		
	STEEL STRUCTURES (No)					
	161kV line gantries (Lot)			0		
	34.5kV Feeder structures for all feeders (Lot)			0		
	Steel supporting structure for all 34.5kV Equipment (Lot)			0		
	34.5kV Feeder structures for power transfomers (Lot)			0		
	UNDERGROUND CABLE (m)					
	34.5kV copper underground cable 120sq.mm(3core) 3cables per phase including termination k	kits(for 34.5kV				
	Feeder) (Lot)			0		
	24 SEV CADACITOR BANKS & BUS BAR BATING (No)					
	34.5kV Bus Bar rated 1500A	0				
1	TOT KY TRANSMISSION LINES					
e	5 Lines (2x265sg.mm) TOUCAN Conductor (Km)	0				
i i	TOTAL NUMBER OF TOWERS	0				
1	TOWER TYPE (no.)					
1	Fower Type XX (Suspension Tower)	0				
1	Fower Type YY (Tension or Light Angle)	0				
1	Fower Type ZZ (Terminal)	0				
1	Fower Type 90 Degree Angle	0				
	Distance from Warehouse to Project Site (km)	0				
		100000000000000000000000000000000000000				
0	CIVIL WORKS (TOWER FOUNDATION(no.))	XX FOUNDAT	TION	YY FOUNDATION	ZZ FOUNDATION	
	roundation in poor Sõll	0		0	0	
	Foundation in Unfractured Rock	0		0	U	
	Foundation in wet soil	0		0	0	
1		v				
1	TOWER EXTENSIONS(no.)	XX TOWER TYPE E	KTENSION	YY TOWER TYPE EXTENSIO	N ZZ TOWER TYPE EXTENSION	
6	Basic Tower Body -5	0		0	0	
F	First Body Extension +/- 0	0		0	0	
S	Second Body Extension +5	0		0	0	
	Sub-rotal: Bulk Supply Substation (USD)		1000			
5	SUD-LOCALL TOTIKY TRANSMISSION LINES (USD)		260			
	Contingency (10%)					
1	Secol Fred		51			
6	Grand Total USD		1.2			
1	Fotal Equipment Cost (161kV Transmission Network)					

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6.4.1. Power Transmission Budget Tool

The power transmission budget tool allows the user to include the cost of other factors that relate to the development of a power transmission project. For the purposes of the budget tool, the factors put together under this project were based on the experience of power sector experts as well as based on interactions with the key stakeholders in the sector in Ghana.

The identified elements of the power transmission sector budget tool include budget allocation for:

- Project Formulation/Preparation;
- Pre-Feasibility Studies (Financial Arrangements & Consultant Procurement);
- Feasibility Studies (Project Planning & Preliminary Design);
- Detailed Design;
- Preliminaries (Site Preparation, Boundary Works, Sub-Station yard surfacing);
- Contract Administration (Including Stakeholder engagement and social enquiry);
- Project Implementation Agency Management and Monitoring;
- · Post Contract Follow-up activities by Implementing Agency; and
- Provision for Others.

Provision was made as guide to what proportion of the initial infrastructure cost should be allocated to the above items. These options can be seen under the **'Provision Guidance'** header. This enables the user to apply some informed basis to selecting an appropriate percentage where his or her input is required under the **'User Budget Provision'**. Here, the user can enter a percentage value for any of the applicable items provided.

The budget tool for power transmission also allows the user to enter any additional items that may not fall within the items above set within the project budget tool for the sector. These include items such as:

- Land acquisition; and
- Environmental and Social Impact Assessment etc.

Below is a screenshot of the power transmission budget tool.

Figure 6-8: User Interface of the Power Transmission Budget Tool

Power Sector (Transmission-161kV) Project Budget Tool				
Budget Item	Provision Guidance	Application	User Budget Provision	Amount
Infrastructure Cost				
Project Formulation/Preparation	1.0%	Always	0.0%	· ·
Pre-Feasibility Studies (Financial Arrangements & Consultant Procurement)	1%-2%	Always	0.0%	· ·
Feasibility Studies (Project Planning & Preliminary Design)	1%-2%	Always	0.0%	· ·
Detailed Design	2%-5%	Always	0.0%	· ·
Preliminaries (Site Preparation, Boundary Works, Sub-Station yard surfacing)	3% - 5%	Always	0.0%	· ·
Contract Administration (Including Stakeholder engagement and social enquiry)	1.0%	Always	0.0%	· ·
Project Implementation Agency Management and Monitoring	4%-7%	Always	0.0%	· ·
Post Contract Follow-up activities by Implementing Agency	1%-2%	Always	0.0%	•
Provision for Others"	1% - 3%	Depends on Strategy	0.0%	· ·
				100

6.5. How to use the Power Transmission Unit Cost Estimator

The power transmission unit cost estimator only requires users to make inputs or entries for the applicable cost drivers and components for their project. The input sections of the power distribution unit cost estimator are highlighted in the figure below.

Figure 6-9: User Input Sections -Power Transmission Unit Cost Estimator

er Sector Esometor er Taal of Power Project	Inger Finalmet Cupur Transmission
er Sector Estimator er Tool of Power Project	Nov Regined Capa Transmission
ESO mbtor et Tool of Power Project	Inger Fingenet Curper Transmission
et Tool	Nov Regined Capa Transmission
of Power Project	Insur Required Curpa Transmission
of Power Project.	Inger Texpled Cuper Transmission
of Power Project	Inger Tragmand Cupar Tramsmission
al Power Project	Cupa Transmission
of Power Project	Transmission
of Power Project	Transmission
of Power Project	Transmission
of Power Project:	Transmission
1103342121223	
Options for Fragect	
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and the second second	
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1.12	
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0	
0	
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	and the second
10 million (1990)	and the second
100000000000000000000000000000000000000	
HI FOLNOATION	IT FOUNDATION
3.1	8 · · · · · · · · · · · · · · · · · · ·
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
Sector Street	Statement of the local division of the local
a	Contraction of the second s
Contraction of the local division of the loc	Statement of the local division of the local
and the second s	INCOME STOCKER THE EXTENSION
ALL DATE OF LOCAL	the state of the s
A MICAUMPELO	
A BROAD FOLLO	: 2
a arrown roller	
a moourration	
A MICAU TALLA	
A BROAD AVELON	-
	Designers for Frequent 0 0 0 0 0 0 0 0 0 0 0 0 0

Once the user enters the various values for each of the corresponding cost drivers, the power sector distribution unit cost tool will report results for the following based on the entries made:

- Sub-total: Bulk Supply Substation (USD);
- Sub-total: 161kV Transmission Lines (GHS);
- Contingency (10%);
- Grand Total USD; and
- Total Equipment Cost (161kV Transmission Network).

This is shown in Figure 6-10 as follows.

Unit Cost of Infrastructure Estimator and Budget Tool-Final User Guide

Figure 6-10: Power Transmission Unit Cost and Cost Estimate Output



6.5.1. Summary of Steps-Power Transmission Unit Cost Estimator

- Enter the applicable value or number in the input required sections; and
- Results for the following will be generated:
 - Sub-total: Bulk Supply Substation (USD);
 - Sub-total: 161kV Transmission Lines (GHS);
 - \succ Contingency (10%);
 - ➢ Grand Total USD; and
 - > Total Equipment Cost (161kV Transmission Network).

Key Points to note on the use of the Power Transmission Unit Cost Estimator

- It is recommended that the tool should be used by a technical person who understands and can interpret the content. All results and interpretations are the sole responsibility of the user;
- The contract cost data used comprise solely of project costs for power transmission infrastructure projects at the **award prices**. It therefore expresses how much it would cost to transmit 161 kV power without consideration of any variations, extensions of time or any other changes to the original contract awarded;
- The output of the unit cost estimator for power transmission feeds into the budget tool. The power transmission infrastructure cost and budget tool estimate are expressed in **USD**; and
- To avoid errors, it is suggested that the user only inputs absolute values i.e. 1, 2, 3 etc. for the various components in the applicable areas.



6.6. How to use the Power Transmission Budget Tool

The cost estimate derived from the unit cost estimator i.e. Grand Total (USD) feeds into the budget tool as the **'Infrastructure Cost'**. Users are only required to provide input in the form of percentages for the 9 budget line items as highlighted in Figure 6-11 at the **'User Budget Provision'** column of the tool. The **'Provision guidance'** should enable the user to apply some informed basis to select an appropriate percentage required under the **'User Budget Provision**.

The budget line items for which users would provide the input include:

- Project Formulation/Preparation;
- Pre-Feasibility Studies (Financial Arrangements & Consultant Procurement);
- Feasibility Studies (Project Planning & Preliminary Design);
- Detailed Design;
- Preliminaries (Site Preparation, Boundary Works, Sub-Station yard surfacing);
- Contract Administration (Including Stakeholder engagement and social enquiry);
- Project Implementation Agency Management and Monitoring;
- · Post Contract Follow-up activities by Implementing Agency; and
- Provision for Others.

The budget tool as mentioned earlier also allows the user to enter any additional items that may not fall within the items above set within the project budget tool for the sector. These include items such as:

- Land acquisition; and
- Environmental and Social Impact Assessment etc.

Figure 6-11: User Input Section – Power Transmission Budget Tool

rower Sector (Transmission-Totky) Project Bodget Tool				
Budget Rem	Provision Guidance	Application	Ver Budget Provision	
Infrastructure Cost				
Project Formulation/Preparation	1.0%	Abrays	0.0%	-
Pre-Feasibility Studies (Financial Amagements & Consultant Procurement)	76-2N	Abrage	0.0%	
Feasibility Studies (Project Planning & Preliminary Decign)	Ri 2N	Alwayz	0.0%	
Defailed Design	2% -8%	Abragi	0.0%	+
Preliminaries (Site Preparation, Boundary Vorkz, Sub-Station yard surfacing)	3%-5%	Айнара	0.0%	
Contract Administration (Including Stakeholder engagement and social enguing)	1.0%	Abrays	0.0%	
Project Implementation Agency Management and Monitoring	4% - 7%	Abrage	aos	1
Post Caused and the Up activities by Implementing Agency	16-2N	Alvays	0.0%	
Provision for Others'	15-25	Depends on Strategy	0.0%	

Once the user inputs the budget provision percentages for each of the corresponding budget line items, the power transmission budget tool will report a budget estimate i.e. '**Total Budget Cost**'. The total budget cost will be derived from the outcomes of the budget line items calculated as percentages of the Infrastructure Cost and added to the initial infrastructure cost amount obtained from the unit cost estimator (See Figure 6-12)

Figure 6-12: Power Transmission Total Budget Cost Output

				2002/2010 100
"novision for Others"	N-25	Depends on Strategy	0.0%	
Post Contract Follow up actuation by Inglementing Agency	10 2%	Alvage	0.01	
Project implementation Agency Management and Monitoring	ex - 7x	Abrage	0.8%	
contract Administration (Including Diskatolider ongagement and social expansi)	19%	Abrage	0.PK	-
Nelminaries (Site Phoparation, Boundary Vick.s, Sub-Station, gard participag)	3N-9N	Abriqui	6.IN	
betallied Design	2x-8x	Abrage	0.in;	-
easibility Studies (Project Planning & Preliminary Design)	to get	Aways	0.0N	
e Frashiliy Studies (Financial Astangements & Consultant Photosement)	tv its	Ahringt	2.95	440,043.76
topest Formulation/Preparation	18%	Abrings	100	220.0010
frastrestere Cost				22,002,107,00
udget from	Provision Guidance	Applic ation	Une Budget Presidine	Annual
ower Sector (Transmission-161kV) Project Budget Tool				

Key Points to note on the use of the Power Transmission Budget Tool

- The output of the unit cost estimator for power transmission feeds into the budget tool. The power transmission unit cost and budget tool estimate are expressed in **USD**;
- To avoid errors, it is suggested that the user only inputs the absolute values i.e. 1, 2, 3 etc. for the various components in the applicable areas; and
- It is also recommended that users consider the provision guidance in making their input. It is worth noting that these guidelines were derived based on expert experience as well as from interactions with key stakeholders within the sector.

6.7. User Interface- Power Sub-Transmission 33kV

The unit cost estimator for power sub-transmission was also developed using the Component Cost modelling approach. The main cost drivers identified from the analysis of power sub-transmission are shown in the following table.

No.	Cost Driver	Main Component	Sub-Components
1	Sub-Transmission Bulk Supply Point	33kV Indoor 3000A Double Busbar Switchgear - GIS	 33kV I/D Incomer Panel, c/w 2000A CB, VTs & 1000/2000/5/5/5A 33kV I/D Feeder Panel, c/w 1250A CB, VTs & 600/1200/5/5A 33kV Auxiliary Transformer Cubicle equipped with Fuse/Switch 33kV 3000A Busbar Sectionaliser Panel
		11kV Indoor Switchgear - 2000A Busbar Rating- GIS	 11kV I/D Feeder Cubicle C/W 630A CB, Overcurrent and Earthfault Relays, Metering CTs, Reclosing Relays and Sensitive Earthfault Relays, Earth Switch, Instanteneous and Max. Demand Ammeter, KWhr and KVAhr Meter 11kV I/D Bus Coupler C/W 2000A CB, Protection and Metering CTs and Relays 11kV Auxiliary transformer Cubicle couplered with Euro (Switch)
		Power Transformer, OLTC Panel & NGRs	 30/39 MVA ONAN/ONAF 33/11KV Power Transformer 11kV Neutral Earth Resistor, Isolator & 800/5A Current Transformer
		100kVA, 400/230V 50Hz Standby Generator	 100kVA, 400/230V 50Hz Standby Generator c/w Manual changeover between the two (2) station service transformers and the Generator (no.) 200kVA Auxiliary Transformer 33kV/400V/230V (no.) LV AC Distribution Board (no.)
		Provision of Scada Facility	Central Event Monitoring and Evaluation system, Remote Terminal Unit (RTU) Micom C264 Complete with radio and wire all SCADA alarm and signal command points in individual control panels to RTU (Complete with all accessories to make functional)
		Civil Works & Earth Grid	 50 Sq. mm. Copper Earth Grid for land area Xm by Xm All relevant civil works associated with the substation work (Lot)

Table 6-3: Power Sub-Transmission Unit Cost Drivers (Components)

No.	Cost Driver	Main Component	Sub-Components
		Power & Control Cables	 1x500sq.mm XLPE(33kV) Copper Cable for the connection of GRIDCo Transformers to the 33kV Incomer Cubicle (m) 1x500sq.mm XLPE(11kV) Copper Cable for the connection of the Power Transformers to the 11kV Transformer Cubicle (m)
2	Primary Sub-Station (Indoor & Outdoor)	33kV Indoor 2000A Single Busbar Switchgear - GIS	 33kV I/D Feeder Panel, c/w 1250A CB, VTs & 600/1200/5/5A 2-Core CTs 33kV I/D Busbar Coupler Cubicle c/w 2000A CB & 1000/2000/5/5A 2-core CTs
		11kV Indoor Switchgear - 2000A Busbar Rating- GIS	 11kV I/D Feeder Cubicle C/W 630A CB, Overcurrent and Earthfault Relays, Metering CTs, Reclosing Relays and Sensitive Earthfault Relays, Earth Switch 1kV I/D Transformer Cubicle, C/W 2000A CB, Overcurrent and Earthfault Relays. Differential and Metering 11kV Auxiliary transformer Cubicle equipped with Fuse and the switchgear should be SCADA ready 11kV I/D Sectionalising Cubicle C/W 2000A CB, Protection and Metering CTs and Relays: the isolators should be motorised and the switchgear should be SCADA ready
		33kV Outdoor Incomer/Feeder Bay	 33kV O/D 1250A Circuit Breaker c/w Support Structures 3kV O/D CT (600/300/5/5A) c/w Metallic Support Structure for the outgoing feeders
		33kV Outdoor Transformer Bay	33kV O/D 1250A Circuit Breaker c/w Support Structures
		Power Transformer, OLTC Panel & NGRs	 20/26 MVA ONAN/ONAF 33/11kV Power Transformer with indoor busings 10/13 MVA ONAN/ONAF 33/11kV Power Transformer with indoor busings 5MVA ONAN/ONAF 33/11kV Power Transformer with indoor busings 2.5MVA ONAN/ONAF 33/11kV Power Transformer with indoor busings
		Auxiliary Power Supply Equipment (DC &AC)	100kVA Auxiliary Transformer 11kV/400V/220V for indoor stations

No.	Cost Driver	Main Component	Sub-Components
		Power & Control Cables	 1x500sq.mm XLPE(33kV) Copper Cable for the connection of the Power Transformers to the 33kV Transformer Cubicle (1 run/phase) 1x300sq.mm XLPE(11kV) Copper Cable for the connection of the Power Transformers to the 11kV Transformer Cubicle (3 runs/phase) (m) 4 x 95sq.mm XLPE (LV) Al Cable for connection between auxiliary transformer and LV AC Distribution Board (m)
		Civil Works & Earth Ond	 Foundation of lighting structure or lightning mast (no)
3	Tower Construction	Distance	 Distance from Warehouse to Project Site (km) Rocky Excavation (Number)
		Tower Lines (Distance covered in kilometers)	 Tower Type SS Tower Type AC Tower Type DE Tower Type 90 degree angle
		 Civil Works (Tower Foundation): SS Double (400sq.mm AAC) AC Double (400sq.mm AAC) 90 Degree Angle DE Double (400sq.mm AAC) 	Poor/wet SoilSubmerged
4	33kV Network Underground	Route Details (in metres): Feeder 1	 Road (Asphalt (R(A)) Road (Butimen) Road (pavement) Road (normal ground) R(NG) Pavement (P) Concrete {C} Entrances (pavement) Entrances (normal ground) E(NG) Entrances (concrete) E{C} Entrances (Bitumen) Entrances (Tiles) Grassed Surfaces Tiled Surfaces Normal Ground (NG) Number of Underground Circuits in same trench (of 3 cables per cct) 4-inch thrust boring (m) 6-inch thrust boring (m) Number of thrust boring locations Excavation and reinstatement in rocky ground (m) Number of Indoor Termination for 1 x 630sq.mm XLPE

No.	Cost Driver	Main Component	Sub-Components	
			• Number of Outdoor Termination	1
			for 1 x 630sq.mm XLPE	
			Number of joint	
			• Cable Truss (m)	
5	11kV Network	No Of UG Circuits to be created	• Double circuit trench (11kV)	
	Underground		• Single circuit trench (11kV)	
		Underground Cable Portion:	• LENGTH (m): 1X240Al	
		Feeder 1	• LENGTH (m): 3X185Al	
			Number of Underground Circuits same trench	s in
			• 4-inch thrust boring (m)	
			• 6-inch thrust boring (m)	
			Number of thrust boring locations	
			• Pavement Block Surfaces (m)	
			• Concrete Surfaces (m)	
			• Grassed Surfaces (m)	
			Number of entrances to cross	
			• Number of joints for 1x240mm2/	Al
			• Number of joints for 3x185mm2Al	
			Number of EOS per set	
			• Number of EFS per set	
			• Cable Truss (m)	
			Number of Outdoor Termination	S
			for 1x240mm2Al	
			• Number of Indoor Terminations 1x240mm2Al	for
			• Number of Outdoor Termination	s
			for 3 x 185mm2 Al	
			• Number of Indoor Terminations 3x185mm2Al	for

Screen shots of the user interface for power transmission sector unit cost estimator are shown in figure 6-13 with the cost drivers and the window where the unit cost output is presented.

	в	C.	n
	1	Power Sector	
C	Public Procurement	UCOI Estimator	
	Authority	Budget Tool	
COREAR OF	Improving efficiency and transparency in Public Procurement		Input Required
			Output
-			
	Power Infrastructure Unit Cost Estimator	Type of Power Project:	Sub-Transmission
	Power Sub-transmission 33kV		
	Cost Drivers	Select Options for Project	
	SUB-TRANSMISSION BULK SUPPLY POINT		
	33kV Indoor 3000A Double Busbar Switchgear - GIS (No)		
	33kV I/D Incomer Panel, c/w 2000A CB, VTs & 1000/2000/5/5/A	0	
	33KV I/D Feeder Panel, c/w 1250ACB, VIS & 600/1200/5/5A	0	
	33kV 3000A Busbar Sectionaliser Panel	0	
	11kV Indoor Switchgear - 2000A Busbar Rating- GIS (No)		
	11kV I/D Feeder Cubicle C/W 630A CB, Overcurrent and Earthfault Relays, Metering CTs, Reclosing Relays and		
	Sensitive Earthfault Relays, Earth Switch, Instanteneous and Max. Demand Ammeter, KWhr and KVAhr Meter	0	
	11kV I/D Bus Coupler C/W 2000ACB, Protection and Metering CI's and Kelays 11kV Auxilliany transformer Cubicle equipped with Fuse/Switch	0	
	TTRY Adviniary dansionner obbide equipped with deelowitch		
	Power Transformer, OLTC Panel & NGRs (No)		
	30/39 MVA ONAN/ONAF 33/11KV Power Transformer	0	
	11kV Neutral Earth Resistor, Isolator & 800/5A Current Transformer	0	
	100kVA, 400/230V 50Hz Standby Generator (No) 100kVA, 400/220V 50Hz Standby Generator (/v Manual changeves between the two (2) station service		
	transformers and the Generator (no.)	0	
	200kVA Auxiliary Transformer 33kV/400V/230V (no.)	0	
	LV AC Distribution Board (no.)	0	
	Provision of SCADA Facility (No)		
	Central Event Monitoring and Evaluation system, Remote Terminal Unit (RTU) Micom C264 Cor	nplete with radio	
	and wire all SCADA alarm and signal command points in individual control panels to RTU (Com	plete with all	
	accessories to make functional)		0
	Civil Works & Earth Grid (No)		
	EO So man Connex Earth Crid for land area Ver by Ver		
	So sq. min. copper cartin drid for fand area xin by xin		0
	All relevant civil works associated with the substation work (Lot)		0 0
	All relevant civil works associated with the substation work (Lot)		0 0
	All relevant civil works associated with the substation work (Lot) Power & Control Cables (No)		0
	All relevant civil works associated with the substation work (Lot) Power & Control Cables (No) (m) 1.500.500.500.500.500.500.500.500.500.50		0 0 0
	All relevant civil works associated with the substation work (Lot) Power & Control Cables (No) (m) 1x500sq.mm XLPE(11kV) Copper Cable for the connection of the Power Transformers to the 11 Cubicle (m)	kV Transformer	0 0
	All relevant civil works associated with the substation work (Lot) Power & Control Cables (No) (m) 1x500sq.mm XLPE(11kV) Copper Cable for the connection of the Power Transformers to the 11 Cubicle (m)	kV Transformer	0 0 0 0
	All relevant civil works associated with the substation work (Lot) Power & Control Cables (No) (m) 1x500sq.mm XLPE(11kV) Copper Cable for the connection of the Power Transformers to the 11 Cubicle (m)	KV Transformer	0 0 0
	All relevant civil works associated with the substation work (Lot) Power & Control Cables (No) (m) 1x500sq.mm XLPE(11kV) Copper Cable for the connection of the Power Transformers to the 11 Cubicle (m)	KV Transformer	0 0 0
	All relevant civil works associated with the substation work (Lot) Power & Control Cables (No) (m) 1x500sq.mm XLPE(11kV) Copper Cable for the connection of the Power Transformers to the 11 Cubicle (m) PRIMARY SUB-STATION (INDOOR & OUTDOOR)	KV Transformer	0 0 0
	All relevant civil works associated with the substation work (Lot) Power & Control Cables (No) (m) 1x500sq.mm XLPE(11kV) Copper Cable for the connection of the Power Transformers to the 11 Cubicle (m) PRIMARY SUB-STATION (INDOOR & OUTDOOR)	kV Transformer	0 0 0
	All relevant civil works associated with the substation work (Lot) Power & Control Cables (No) (m) 1x500sq.mm XLPE(11kV) Copper Cable for the connection of the Power Transformers to the 11 Cubicle (m) PRIMARY SUB-STATION (INDOOR & OUTDOOR) 33kV Indoor 2000A Single Busbar Switchgear - GIS (No)	kV Transformer	0 0 0
	All relevant civil works associated with the substation work (Lot) Power & Control Cables (No) (m) 1x500sq.mm XLPE(11kV) Copper Cable for the connection of the Power Transformers to the 11 Cubicle (m) PRIMARY SUB-STATION (INDOOR & OUTDOOR) 33kV Indoor 2000A Single Busbar Switchgear - GIS (No) 33kV I/D Feeder Panel, c/w 1250A CB, VTs & 600/1200/5/SA 2-Core CTs	kV Transformer	0 0 0 0
	All relevant civil works associated with the substation work (Lot) Power & Control Cables (No) (m) 1x500sq.mm XLPE(11kV) Copper Cable for the connection of the Power Transformers to the 11 Cubicle (m) PRIMARY SUB-STATION (INDOOR & OUTDOOR) 33kV Indoor 2000A Single Busbar Switchgear - GIS (No) 33kV I/D Feeder Panel, c/w 1250A CB, VTs & 600/1200/5/5A 2-Core CTs 33kV I/D Busbar Coupler Cubicle c/w 2000A CB & 1000/2000/5/5A 2-core CTs	kV Transformer	0 0 0 0
	All relevant civil works associated with the substation work (Lot) Power & Control Cables (No) (m) 1x500sq.mm XLPE(11kV) Copper Cable for the connection of the Power Transformers to the 11 Cubicle (m) PRIMARY SUB-STATION (INDOOR & OUTDOOR) 33kV Indoor 2000A Single Busbar Switchgear - GIS (No) 33kV I/D Feeder Panel, c/w 1250A CB, VTs & 600/1200/5/5A 2-Core CTs 33kV I/D Busbar Coupler Cubicle c/w 2000A CB & 1000/2000/5/5A 2-core CTs	kV Transformer	0 0 0 0
	All relevant civil works associated with the substation work (Lot) Power & Control Cables (No) (m) 1x500sq.mm XLPE(11kV) Copper Cable for the connection of the Power Transformers to the 11 Cubicle (m) PRIMARY SUB-STATION (INDOOR & OUTDOOR) 33kV Indoor 2000A Single Busbar Switchgear - GIS (No) 33kV I/D Feeder Panel, c/w 1250A CB, VTs & 600/1200/5/5A 2-Core CTs 33kV I/D Busbar Coupler Cubicle c/w 2000A CB & 1000/2000/5/5A 2-core CTs 11kV Indoor Switchgear - 2000A Busbar Rating- GIS (No)	kV Transformer	0 0 0 0
	All relevant civil works associated with the substation work (Lot) Power & Control Cables (No) (m) 1x500sq.mm XLPE(11kV) Copper Cable for the connection of the Power Transformers to the 11 Cubicle (m) PRIMARY SUB-STATION (INDOOR & OUTDOOR) 33kV Indoor 2000A Single Busbar Switchgear - GIS (No) 33kV I/D Feeder Panel, c/w 1250A CB, VTs & 600/1200/5/5A 2-Core CTs 33kV I/D Busbar Coupler Cubicle c/w 2000A CB & 1000/2000/5/5A 2-core CTs 11kV Indoor Switchgear - 2000A Busbar Rating- GIS (No) 11kV I/D Feeder Cubicle C/W 630A CB, Overcurrent and Earthfault Relays, Metering CTs, Reclo	kV Transformer	0 0 0 0
	All relevant civil works associated with the substation work (Lot) Power & Control Cables (No) (m) 1x500sq.mm XLPE(11kV) Copper Cable for the connection of the Power Transformers to the 11 Cubicle (m) PRIMARY SUB-STATION (INDOOR & OUTDOOR) 33kV Indoor 2000A Single Busbar Switchgear - GIS (No) 33kV Indoor 2000A Single Busbar Switchgear - GIS (No) 33kV I/D Feeder Panel, c/w 1250A CB, VTs & 600/1200/5/5A 2-Core CTs 33kV I/D Busbar Coupler Cubicle c/w 2000A CB & 1000/2000/5/5A 2-core CTs 11kV Indoor Switchgear - 2000A Busbar Rating- GIS (No) 11kV I/D Feeder Cubicle C/W 630A CB, Overcurrent and Earthfault Relays, Metering CTs, Reclo Sensitive Earthfault Relays, Earth Switch	kV Transformer	0 0 0 0 0
	All relevant civil works associated with the substation work (Lot) Power & Control Cables (No) (m) 1x500sq.mm XLPE(11kV) Copper Cable for the connection of the Power Transformers to the 11 Cubicle (m) PRIMARY SUB-STATION (INDOOR & OUTDOOR) 33kV Indoor 2000A Single Busbar Switchgear - GIS (No) 33kV I/D Feeder Panel, c/w 1250A CB, VTs & 600/1200/5/5A 2-Core CTs 33kV I/D Busbar Coupler Cubicle c/w 2000A CB & 1000/2000/5/5A 2-core CTs 11kV Indoor Switchgear - 2000A Busbar Rating- GIS (No) 11kV I/D Feeder Cubicle C/W 630A CB, Overcurrent and Earthfault Relays, Metering CTs, Reclo Sensitive Earthfault Relays, Earth Switch 1kV I/D Transformer Cubicle, C/W 2000A CB, Overcurrent and Earthfault Relays. Differential an	kV Transformer	0 0 0 0 0 0
	All relevant civil works associated with the substation work (Lot) Power & Control Cables (No) (m) 1x500sq.mm XLPE(11kV) Copper Cable for the connection of the Power Transformers to the 11 Cubicle (m) PRIMARY SUB-STATION (INDOOR & OUTDOOR) 33kV Indoor 2000A Single Busbar Switchgear - GIS (No) 33kV Indoor 2000A Single Busbar Switchgear - GIS (No) 33kV I/D Feeder Panel, c/w 1250A CB, VTs & 600/1200/5/5A 2-Core CTs 33kV I/D Busbar Coupler Cubicle c/w 2000A CB & 1000/2000/5/5A 2-core CTs 11kV Indoor Switchgear - 2000A Busbar Rating- GIS (No) 11kV I/D Feeder Cubicle C/W 630A CB, Overcurrent and Earthfault Relays, Metering CTs, Reclo Sensitive Earthfault Relays, Earth Switch 1kV I/D Transformer Cubicle, C/W 2000A CB, Overcurrent and Earthfault Relays. Differential an 11kV Auxilliary transformer Cubicle equipped with Fuse and the switchgear should be SCADA r	kV Transformer	0 0 0 0 0 0 0 0
	All relevant civil works associated with the substation work (Lot) Power & Control Cables (No) (m) 1x500sq.mm XLPE(11kV) Copper Cable for the connection of the Power Transformers to the 11 Cubicle (m) PRIMARY SUB-STATION (INDOOR & OUTDOOR) 33kV Indoor 2000A Single Busbar Switchgear - GIS (No) 33kV Indoor 2000A Single Busbar Switchgear - GIS (No) 33kV I/D Feeder Panel, c/w 1250A CB, VTs & 600/1200/5/5A 2-Core CTs 33kV I/D Busbar Coupler Cubicle c/w 2000A CB & 1000/2000/5/5A 2-core CTs 11kV Indoor Switchgear - 2000A Busbar Rating- GIS (No) 11kV I/D Feeder Cubicle C/W 630A CB, Overcurrent and Earthfault Relays, Metering CTs, Reclo Sensitive Earthfault Relays, Earth Switch 1kV I/D Transformer Cubicle, C/W 2000A CB, Overcurrent and Earthfault Relays. Differential an 11kV Auxilliary transformer Cubicle equipped with Fuse and the switchgear should be SCADAr 11kV I/D Sectionalising Cubicle C/W 2000A CB, Protection and Metering CTs and Relays: the is	kV Transformer	
	All relevant civil works associated with the substation work (Lot) Power & Control Cables (No) (m) 1x500sq.mm XLPE(11kV) Copper Cable for the connection of the Power Transformers to the 11 Cubicle (m) PRIMARY SUB-STATION (INDOOR & OUTDOOR) 33kV Indoor 2000A Single Busbar Switchgear - GIS (No) 33kV I/D Feeder Panel, c/w 1250A CB, VTs & 600/1200/5/5A 2-Core CTs 33kV I/D Busbar Coupler Cubicle c/w 2000A CB & 1000/2000/5/5A 2-core CTs 11kV Indoor Switchgear - 2000A Busbar Rating- GIS (No) 11kV I/D Feeder Cubicle C/W 630A CB, Overcurrent and Earthfault Relays, Metering CTs, Reclo Sensitive Earthfault Relays, Earth Switch 1kV I/D Transformer Cubicle, C/W 2000A CB, Overcurrent and Earthfault Relays. Differential an 11kV Auxilliary transformer Cubicle C/W 2000A CB, Protection and Metering CTs and Relays: the is motorised and the switchgear should be SCADA ready	kV Transformer	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
	All relevant civil works associated with the substation work (Lot) Power & Control Cables (No) (m) 1x500sq.mm XLPE(11kV) Copper Cable for the connection of the Power Transformers to the 11 Cubicle (m) PRIMARY SUB-STATION (INDOOR & OUTDOOR) 33kV Indoor 2000A Single Busbar Switchgear - GIS (No) 33kV I/D Feeder Panel, c/w 1250A CB, VTs & 600/1200/5/5A 2-Core CTs 33kV I/D Busbar Coupler Cubicle c/w 2000A CB & 1000/2000/5/5A 2-core CTs 11kV Indoor Switchgear - 2000A Busbar Rating- GIS (No) 11kV I/D Feeder Cubicle C/W 630A CB, Overcurrent and Earthfault Relays, Metering CTs, Reclo Sensitive Earthfault Relays, Earth Switch 1kV I/D Transformer Cubicle, C/W 2000A CB, Overcurrent and Earthfault Relays. Differential an 1kV Auxilliary transformer Cubicle c/W 2000A CB, Protection and Metering CTs and Relays: the is motorised and the switchgear should be SCADA ready	kV Transformer	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
	All relevant civil works associated with the substation work (Lot) Power & Control Cables (No) (m) 1x500sq.mm XLPE(11kV) Copper Cable for the connection of the Power Transformers to the 11 Cubicle (m) PRIMARY SUB-STATION (INDOOR & OUTDOOR) 33kV Indoor 2000A Single Busbar Switchgear - GIS (No) 33kV I/D Feeder Panel, c/w 1250A CB, VTs & 600/1200/5/5A 2-Core CTs 33kV I/D Busbar Coupler Cubicle c/w 2000A CB & 1000/2000/5/5A 2-core CTs 11kV Indoor Switchgear - 2000A Busbar Rating- GIS (No) 11kV I/D Feeder Cubicle C/W 630A CB, Overcurrent and Earthfault Relays, Metering CTs, Reclo Sensitive Earthfault Relays, Earth Switch 1kV I/D Transformer Cubicle, C/W 2000A CB, Overcurrent and Earthfault Relays. Differential an 11kV Auxilliary transformer Cubicle equipped with Fuse and the switchgear should be SCADA r 11kV I/D Sectionalising Cubicle C/W 2000A CB, Protection and Metering CTs and Relays: the is motorised and the switchgear should be SCADA ready 33kV Outdoor Incomer/Feeder Bay (No)	kV Transformer	0 0 0 0 0 0 0 0 0 0 0 0 0
	All relevant civil works associated with the substation work (Lot) Power & Control Cables (No) (m) 1x500sq.mm XLPE(11kV) Copper Cable for the connection of the Power Transformers to the 11 Cubicle (m) PRIMARY SUB-STATION (INDOOR & OUTDOOR) 33kV Indoor 2000A Single Busbar Switchgear - GIS (No) 33kV Indoor 2000A Single Busbar Switchgear - GIS (No) 33kV I/D Feeder Panel, c/w 1250A CB, VTs & 600/1200/5/5A 2-Core CTs 33kV I/D Busbar Coupler Cubicle c/w 2000A CB & 1000/2000/5/5A 2-core CTs 11kV Indoor Switchgear - 2000A Busbar Rating- GIS (No) 11kV I/D Feeder Cubicle C/W 630A CB, Overcurrent and Earthfault Relays, Metering CTs, Reclo Sensitive Earthfault Relays, Earth Switch 1kV I/D Transformer Cubicle, C/W 2000A CB, Overcurrent and Earthfault Relays. Differential an 11kV Auxilliary transformer Cubicle equipped with Fuse and the switchgear should be SCADA r 11kV I/D Sectionalising Cubicle C/W 2000A CB, Protection and Metering CTs and Relays: the is motorised and the switchgear should be SCADA ready 33kV Outdoor Incomer/Feeder Bay (No) 33kV 0/D 1250A Circuit Breaker c/w Support Structures	kV Transformer	0 0 0 0 0 0 0 0 0 0 0 0 0

Figure 6-13: User Interface of the Power Sub-Transmission Unit Cost Estimator

33kV Outdoor Incomer/Feeder Bay (No)		
33kV O/D 1250A Circuit Breaker c/w Support Structures	0	
3kV O/D CT (600/300/5/5A) c/w Metallic Support Structure for the outgoing feeders	0	
33kV Outdoor Transformer Bay (No)		
33kV O/D 1250A Circuit Breaker c/w Support Structures	0	
Power Transformer, OLTC Panel & NGRs (No)		
20/26 MVA ONAN/ONAF 33/11kV Power Transformer with indoor busings	0	
10/13 MVA ONAN/ONAF 33/11kV Power Transformer with indoor busings	0	
5MVA ONAN/ONAF 33/11kV Power Transformer with indoor busings	0	
2.5MVA UNANJUNAF 33/11KV Power Transformer with Indoor busings	U	
Auxiliary Power Supply Equipment (DC &AC) (No)		
100kVA Auxiliary Transformer 11kV/400V/220V for indoor stations	0	
Power & Control Cables (m)		
1x500sq.mm XLPE(33kV) Copper Cable for the connection of the Power Transformers to the 33kV Transfor	mer	
Cubicle (1 run/phase)	0	
1x300sq.mm XLPE(11kV) Copper Cable for the connection of the Power Transformers to the 11kV Transfor	mer	
Cubicle (3 runs/phase) (m)	0	
4 x 95sq.mm XLPE (LV) AI Cable for connection between auxilliary transformer and LV AC Distribution Boa	rd (m) 0	
Civil Works & Earth Grid (m2)		
150 Sq. mm. Copper Earth Grid for Xm by Xm		
Foundation of lighting structure or lightning mast (no)	0	
Distance From Warehouse.	0	
Distance in on warehouse to reject one (kin)		
Double Circuit Tower Lines (km)		
Tower Type SS (0°-3°) - 400sq.mm AAC	0	
Tower Type AC (3°- 60°) - 400sq.mm AAC	0	
Tower Type DE (30°- 60°) - 400sq.mm AAC Tower Type 90° - 400sq.mm AAC	0	
Civil Works (Tower Foundation) (No)	Poor/wet Soil	Submerg
lower Type SS (0°-3°) Tower Type AC (3°-60°)	0	0
Tower Type Actor - 50 7	0	0
Tower Type DE (30°-60°)	0	0
Rocky Excavation (Number)	0	
33kV NETWORK UNDERGROUND		
ROUTE DETAILS (in metres)	FEEDER 1	
Gutter (G)	0	
Gutter Cable Truss (G)	0	
Road (Asphalt (R(A))	0	
Road (Butimen)	0	
Road (pavement)	0	
Road (normal ground) R(NG)	0	
Pavement (P)	0	
Concrete {C}	0	
Entrances (pavement)	0	
Entrances (normal ground) E(NG)	0	

Unit Cost of Infrastructure Estimator and Budget Tool-Final User Guide

Ref protance (Burnern) 0 Reference			
BT France (These) 0 BT France (These) 0 <td< td=""><td>124</td><td>Entrances (Bitumen)</td><td>0</td></td<>	124	Entrances (Bitumen)	0
action Grazzed Surfaces action bits Normal Ground (NG) action bits Number of Underground Circuits is same trench (of 3 cables per cct) action bits Anich thrust boring (m) action bits Science thrust boring (m) action bits Science thrust boring (m) action bits Escastion and reinstatement in rocky ground (m) action bits Escastion and reinstatement in rocky ground (m) action bits Escastion and reinstatement in rocky ground (m) action bits Escastion and reinstatement in rocky ground (m) action bits Escastion and reinstatement in rocky ground (m) action bits Escastion and reinstatement in rocky ground (m) action bits Escastion and reinstatement in rocky ground (m) action bits Escastion and reinstatement in rocky ground (m) action bits Escastion and reinstatement in rocky ground (m) action bits Double circuits ros and action bits Double circuits ros and action bits Double circuits ros and ac	125	Entrances (Tiles)	0
Tiled Surfaces 0 Number of Underground Circuits in same trench (of 3 cables per ctt) 0 Ainch thrust boring (m) 0 Number of plott 0 Dubbe (incut trench (11%)) 0 Sign (chrust trench (11%)) 0	126	Grassed Surfaces	0
100 Normal Forund (NG) 0 100 Number of Underground Circuits in same trench (of 3 cables per cct) 0 101 Grinch trust boring (m) 0 102 Grinch trust boring (m) 0 103 Number of Underground Circuits in same trench (of 3 cables per cct) 0 103 Grinch trust boring (m) 0 104 Excastion and reinstatement in rocky ground (m) 0 105 Number of Outdoor Termination for 1 & 630st, mm XLPE 0 103 Duble circuit trench (11 KØ) 0 104 Duble circuit trench (11 KØ) 0 105 Single circuit trench (11 KØ) 0 106 UNDERGROUND Cable Formitons To SE CREATED (No) NUMBER 105 Duble circuit trench (11 KØ) 0 106 UNDERGROUND Cable Formitons To SE CREATED (No) 0 107 UNDERGROUND Cable Formitons To SE CREATED (No) 0 106 UNDERGROUND Cable Formitons To SE CREATED (No) 0 107 UNDERGROUND Cable Formitons To SE CREATED (No) 0 108 UNDERGROUND Cable Formitons To SE CREATED (No) 0 109 Cable Trust boring (m) 0 100 UNDERGROUND Cable Formitons To SE CREATED (No) 0 108 Cable Trus	127	Tiled Surfaces	0
Number of Underground Circuits in same trench (of 3 cables per cct)	128	Normal Ground (NG)	0
00 Number of Underground Circuits in same trench (of 3 cables per cct) 0 102 G-inch thrust boring (m) 0 103 Number of Incides in same trench (of 3 cables per cct) 0 104 G-inch thrust boring (m) 0 105 Number of Incides in cocky ground (m) 0 104 Excavation and reinstatement in rocky ground (m) 0 105 Number of Outdoor Termination for 1 x 630sq.mm XLPE 0 106 TLIV INFORM CIRCIPACING 0 107 TLIV INFORM CIRCIPACING 0 108 Duble circuit trench (11XV) 0 104 UNDERGROUND CABLE PORTION FEEDER 1 105 Single circuit trench (11XV) 0 106 UNDERGROUND CABLE PORTION FEEDER 1 107 UNDERGROUND CABLE PORTION 1 108 UNDERGROUND CABLE PORTION 1 109 UNDERGROUND CABLE PORTION 1 100 HUNDER GROUND CABLE PORTION 1 101 UNDERGROUND CABLE PORTION 1 101 UNDERGROUND CABLE PORTION 1 101 UNDER GROUND CABLE PORTION	123		
101 4-inch thrust boring (nn) 0 102 6-inch thrust boring (no) 0 103 Number of thrust boring (no) 0 104 Excavation and reinstatement in nocky ground (n) 0 105 Number of locitor Termination for 1x 630sq, mm XLPE 0 105 Number of Joint 0 106 Duble Creating (n) 0 107 Number of Joint 0 108 Duble Creating (n) 0 109 Duble Creating (n) 0 109 Duble Creating (n) 0 100 Duble Creating (n) 0 101 Duble Creating (n) 0 102 Duble Creating (n) 0 103 Duble Creating (n) 0 104 Duble Creating (n) 0 105 Concreating (n) 0 106 Concreating (n) 0 107 Fenchthrust boring (n) 0 108 Concreating (n) 0 109 Concreating (n) 0 100 Concreating (n) 0 <t< td=""><td>130</td><td>Number of Underground Circuits in same trench (of 3 cables per cct)</td><td>0</td></t<>	130	Number of Underground Circuits in same trench (of 3 cables per cct)	0
92 G-inch thrust boring (m) 0 93 Number of Incode remnistion for 1 x 630s, mm XLPE 0 94 Number of Outdoor Terministion for 1 x 630s, mm XLPE 0 95 Number of Outdoor Terministion for 1 x 630s, mm XLPE 0 96 Cable Trues (m) 0 97 Duble circuit trans (n) 0 98 Number of Dutdoor Terministion for 1 x 630s, mm XLPE 0 98 Duble circuit trans (n) 0 98 Number of Dutdoor Terministion for 1 x 630s, mm XLPE 0 98 Number of Dutdoor Terministion for 1 x 630s, mm XLPE 0 98 Number of Dutdoor Terministion for 1 x 630s, mm XLPE 0 98 Number of Dutdoor Terministion for 1 x 630s, mm XLPE 0 98 Number of Dutdoor Terministion for 1 x 400n 0 98 Number of Dutdoor Terministion for 1 x 400n 0 99 A inch transt boring (n) 0 0 91 G-inch thrust boring (n) 0 0 92 Number of Joints for 1 x 40m ⁷ Al 0 0 93 Number of Joints for 1 x 40m ⁷ Al 0 0 <t< td=""><td>131</td><td>4-inch thrust boring (m)</td><td>0</td></t<>	131	4-inch thrust boring (m)	0
131 Number of thrust boring locations 0 132 Excavation and rocky ground (m) 0 133 Number of locator Termination for 1x 630sq, mm XLPE 0 134 Number of Joints 0 135 Diversity of Locator Termination for 1x 630sq, mm XLPE 0 136 Number of Joints 0 137 Diversity of Locator Termination for 1x 630sq, mm XLPE 0 138 Diversity of Locator Termination for 1x 630sq, mm XLPE 0 139 Diversity of Locator Termination for 1x 630sq, mm XLPE 0 139 Diversity of Locator Termination for 1x 630sq, mm XLPE 0 139 Diversity of Locator Termination for 1x 630sq, mm XLPE 0 139 Diversity of Locator Termination for 1x 630sq, mm XLPE 0 139 Diversity of Locator Termination for 1x 630sq, mm XLPE 0 140 Diversity of Locator Termination for 1x 630sq, mm XLPE 0 141 Diversity of Locator Termination for 1x 630sq, mm XLPE 0 141 Diversity of Locator Termination for 1x 630sq, mm XLPE 0 141 Diversity of Locator Termination for 1x 630sq, mm XLPE 0 152	132	6-inch thrust boring (m)	0
14 Eccavition and reinstatement in rocky ground (m) 0 0 16 Number of Outdoor Termination for 1 x 630sq, mm XLPE 0 0 16 Number of Outdoor Termination for 1 x 630sq, mm XLPE 0 0 16 INUMENT of Outdoor Termination for 1 x 630sq, mm XLPE 0 0 16 INUMENT of Outdoor Termination for 1 x 630sq, mm XLPE 0 0 16 INUMENT of Outdoor Termination for 1 x 630sq, mm XLPE 0 0 16 INUMENT of Outdoor Termination for 1 x 630sq, mm XLPE 0 0 16 INUMENT of Outdoor Termination for 1 x 630sq, mm XLPE 0 0 16 INUMENT of Diverson of Cecutits in same transh 0 0 0 16 INUMENT of INUX 240AI 0	133	Number of thrust boring locations	0
13 Number of lobor Termination for 1 x 630sg, mm XLPE 0 14 0 0 15 Number of joint 0 11 ILIXY NETWORK UNDERGOVIND 0 0 12 NUMBER of Under Termination for 1 x 630sg, mm XLPE NUMBER 11 ILIXY NETWORK UNDERGOVIND 0 0 12 NUMBER of Under GROVIND 0 0 12 NUMBER of Under GROVIND 0 0 12 NUMBER of Under GROVIND 0 0 14 NUMBER of Under GROVIND (MG) CIRCUITS TO BE CREATED (MG) 0 0 0 14 NUMBER of Under GROVIND 0 0 0 0 14 NUMBER of Under GROVIND 0<	134	Excavation and reinstatement in rocky ground (m)	0
Number of Outdoor Termination for 1 x 630aq, mm XLPE 0 Cable Truss (m) 0 <t< td=""><td>135</td><td>Number of Indoor Termination for 1 x 630sg.mm XLPE</td><td>0</td></t<>	135	Number of Indoor Termination for 1 x 630sg.mm XLPE	0
Number of joint Cable Truss (m) 0 114// NETWORK UNDERGROUND 0 114// Network Underground Circuits on Be CREATED (No) 0 114// Network Underground Circuits in Same trench 0 114// Network Underground Circuits in same trench 0 116// Number of Underground Circuits in same trench 0 116// Number of Underground Circuits in same trench 0 116// Number of Underground Circuits in same trench 0 116// Number of Underground Circuits in same trench 0 116// Number of Underground Circuits in same trench 0 116// Number of Dirts for 11240mm ³ Al 0 116// Number of Dirts for 11240mm ³ Al 0 116// Number of Oldsor Terminations for 11240mm ³ Al 0 116// Number of Oldsor Terminations for 11240mm ³ Al 0 116// Number of Oldsor Terminations for 3185mm ³ Al 0 116// Number of Oldsor Terminations for 3185mm ³ Al 0	136	Number of Outdoor Termination for 1 x 630sq.mm XLPE	0
Instrume Cable Truss (m) 0 Intrust Network UNDERGROUND NUMBER NUMBER Intrust Network UNDERGROUND (UG) CIRCUITS TO BE CREATED (No) NUMBER 0 Intrust Network UNDERGROUND (UG) CIRCUITS TO BE CREATED (No) NUMBER 0 Intrust Network UNDERGROUND (UG) CIRCUITS TO BE CREATED (No) NUMBER 0 Intrust Network UNDERGROUND CABLE PORTION FEEDER 1 0 Intrust Network UNDERGROUND CABLE PORTION FEEDER 1 0 Intrust Network UNDERGROUND CABLE PORTION FEEDER 1 0 Intrust Network Underground Circuits in same trench 0 0 Intrust Network Underground Circuits in same trench 0 0 Intrust Network Underground Circuits in same trench 0 0 Intrust Network Underground Circuits in same trench 0 0 Intrust Network Underground Circuits in same trench 0 0 Intrust Network Underground Circuits in same trench 0 0 Intrust Network Underground Circuits In same trench 0 0 Intrust Network Underground Circuits In same trench 0 0 Intrust Network U	137	Number of joint	0
INV NETWORK UNDERGROUND INV NETWORK UNDERGROUND UNDERGROUND (Val) CIRCUIT S BE CREATED (No) UNDERGROUND (Val) CIRCUIT S BE CREATED (No) Single circuit trench (11KV) Single circuit trench (11KV) UNDERGROUND CABLE PORTION EENSTH (m): X324041 IENSTH (m): X324041 Number of Underground Circuits in same trench Aucht thrust boring (m) Gend total boring (m) Number of Underground Circuits in same trench Aucht thrust boring (m) Single circuit trench (11KV) Single circuit trench (11KV) Number of Underground Circuits in same trench Aucht thrust boring (cations Represent Block Surfaces (m) Concrete Surfaces (m) Single circuit trench to cross Number of Joints for 1x240mm ² Al Number of Joints for 1x240mm ² Al Number of Ioints for 1x240mm ² Al Number of Ioints for 3x185mm ⁴ Al Number of Indoor Terminations for 3x185mm ⁴ Al Number of Ioints for 3x185mm ⁴ Al Sub-totali Sub Ketuor Nunderground	138	Cable Truss (m)	0
Number of loints for 1:240mm ⁷ Al 0 Number of lointary Substation Indoor & Outdoor 0	139		
NUMBERGROUND (UG) CIRCUITS OB ECREATED (No) 0 Double circuit trench (11k/) 0 Single circuit trench (11k/) 0 NUMBERGROUND CABLE PORTION FEEDER 1 LENGTH (m): X1240AI 0 Number of Underground Circuits in same trench 0 Single circuit trench (11k/) 0 Number of Underground Circuits in same trench 0 Single circuit trench (11k/) 0 Number of Underground Circuits in same trench 0 Single circuit trench (11k/) 0 Number of Circuits in same trench 0 Single circuit trench (11k/) 0 Number of Circuits in same trench 0 Single circuit trench (11k/) 0 Number of Circuits in same trench 0 Single circuit trench (11k/) 0 Number of Circuits (10k) 0 Rumber of Circuit Single (10k) 0 Number of Circuit Single (10k) 0 Number of Circuit Single (11k) 0 Number of	140	11kV NETWORK UNDERGROUND	
NUMBER NUMBER Double circuit trench (11W) 0 Single circuit trench (11W) 0 UNDERGROUND CABLE PORTION FEEDER 1 ILENGTH (m): 1X240AI 0 ILENGTH (m): 1X345AI 0 Single circuit sin same trench 0 Single circuit for (m): 1X240AI 0 ILENGTH (m): 1X240AI 0 ILENGTH (m): 1X345AI 0 Single circuit sin same trench 0 Single circuit single circuit sin same trench 0 Single circuit s	14.1		
Image Double circuit trench (11K/) Image 144 Single circuit trench (11K/) 0 144 Single circuit trench (11K/) 0 145 UNDERGROUND CABLE PORTION FEEDER 1 146 UNDERGROUND CABLE PORTION FEEDER 1 147 LENGTH (m): 3X135AI 0 148 Number of Underground Circuits in same trench 0 149 Number of Underground Circuits in same trench 0 151 G-inch thrust boring (m) 0 152 Number of Underground Circuits in same trench 0 153 Pavement Block Surfaces (m) 0 154 Concrets Surfaces (m) 0 155 Rumber of ploints for 3x185mm*AI 0 156 Number of EDS per sat 0 156 Number of Outdoor Terminations for 1x240mm*AI 0 157 Sub-total: Bulk Supply Point 0 158 Sub-total: Bulk Supply Point 0 159 Number of Outdoor Terminations for 1x240mm*AI 0 150 Sub-total: Bulk Supply Point	14.2	LINDERGROUND (LIG) CIRCUITS TO BE CREATED (No)	NUMBER
Number Outpersonance Outpersonance 100 0 0 101 0 0 101 101 0 101 101 0 101 101 0 101 101 0 102 101 0 103 101 0 104 101 0 105 101 0 105 101 0 105 101 0 105 101 0 105 101 0 105 101 0 105 101 0 105 101 0 105 101 0 105 101 0 106 Number of Joints for 1240mm*Al 0 107 Number of Outdoor Terminations for 1240mm*Al 0 108 Number of Uutdoor Terminations for 1240mm*Al 0 101 101 0	143	Double circuit tranch (11W)	0
Image of the construction (Linky) Image of the construction (Linky) Image of the construction (Linky) Image of the construction (Linky) Image of the construction (Linky) Image of the construction (Linky) Image of the construction (Linky) Image of the construction (Linky) Image of the construction (Linky) Image of the construction (Linky) Image of the construction (Linky) Image of the construction (Linky) Image of the construction (Linky) Image of the construction (Linky) Image of the construction (Linky) Image of the construction (Linky) Image of the construction (Linky) Image of the construction (Linky) Image of the construction (Linky) Image of the construction (Linky) Image of the construction (Linky) Image of the construction (Linky) Image of the construction (Linky) Image of the construction (Linky) Image of the construction (Linky) Image of the construction (Linky) Image of the construction (Linky) Image of the construction (Linky) Image of the construction (Linky) Image of the construction (Linky) Image of the construction (Linky) Image of the construction (Linky) Image of the construction (Linky) Image of the construction (Linky) Image of the construction (Linky) Image of the construction (Linky) Image of the construction (Linky) Image of the constru	14.4	Single circuit track (114/)	ő
Number PEEDER 1 147 LENGTH (m): 1X240Al 0 148 LENGTH (m): 1X240Al 0 149 LENGTH (m): 2X185Al 0 149 Aunder of Underground Circuits in same trench 0 150 Aunder of Underground Circuits in same trench 0 151 G-inch thrust boring (m) 0 152 Number of thrust boring (incations 0 153 Parement Block Surfaces (m) 0 154 Concrete Surfaces (m) 0 155 Orage Surfaces (m) 0 156 Number of joints for 1x240mm ³ Al 0 155 Number of Joints for 1x240mm ³ Al 0 156 Number of Undoor Terminations for 1x240mm ³ Al 0 151 Number of Undoor Terminations for 1x240mm ³ Al 0 152 Number of Undoor Terminations for 3x 185mm ³ Al 0 153 Sub-total: Bulk Supply Point 0 154 Sub-total: Bulk Supply Point 0 155 Sub-total: Bulk Supply Point 0 156 <td>145</td> <td></td> <td>•</td>	145		•
Number Number of loints for 1x240mm ² Al 0 100 0 0 0 101 0 0 0 0 102 Number of Indoor Terminations for 1x240mm ² Al 0 0 0 103 Number of Indoor Terminations for 1x240mm ² Al 0 0 0 103 Number of Indoor Terminations for 1x240mm ² Al 0 0 0 103 Number of Indoor Terminations for 1x240mm ² Al 0 0 0 104 Number of Indoor Terminations for 1x240mm ² Al 0 0 0 0 104 Number of Indoor Terminations for 1x240mm ² Al 0	140		EEEDER 1
1 Cubic In (III), 1A 2004 0 446 LENGT (III), 1A 2004 0 447 LENGT (III), 2A 2004 0 448 Number of Underground Circuits in same trench 0 0 541 G-inch thrust boring (m) 0 0 552 Pavement Block Surfaces (m) 0 0 553 Grassed Surfaces (m) 0 0 554 Concrete Surfaces (m) 0 0 555 Grassed Surfaces (m) 0 0 564 Number of foints for 1x240mm²Al 0 0 57 Number of foints for 3x185mm²Al 0 0 58 Number of Citop Terminations for 1x240mm²Al 0 0 59 Number of Indoor Terminations for 1x240mm²Al 0 0 50 Number of Indoor Terminations for 1x240mm²Al 0 0 50 Number of Indoor Terminations for 1x240mm²Al 0 0 0 51 Sub-total: Bulk Supply Point 0 0 0 0 0 0	140		FEEDERI
148 LENGTH (III): 3.1.253-1/ 0 149 Number of Underground Circuits in same trench 0 150 4-inch thrust boring (m) 0 151 6-inch thrust boring (m) 0 152 Number of thrust boring locations 0 153 Pavement Block Surfaces (m) 0 154 Concrets Surfaces (m) 0 155 Grassed Surfaces (m) 0 156 Number of entrances to cross 0 155 Grassed Surfaces (m) 0 156 Number of joints for 1x240mm ³ Al 0 157 Number of EfS per set 0 158 Number of Circuits for 1x240mm ³ Al 0 159 Number of Outdoor Terminations for 1x240mm ³ Al 0 150 Number of Indoor Terminations for 1x240mm ³ Al 0 0 151 Sub-total: Bulk Supply Point 0 0 153 Sub-total: Bulk Supply Point 0 0 154 Sub-total: Bulk Supply Point 0 0 156 Sub-tota	141	LENGTH (III). 1224041	U
133 Number of Underground Urus in same trench 0 134 4-inch thrust boring (m) 0 135 Granch thrust boring locations 0 136 Number of thrust boring locations 0 137 Number of sundaces (m) 0 138 Concrete Surfaces (m) 0 139 Grassed Surfaces (m) 0 139 Number of entrances to cross 0 139 Number of joints for 1x240mm ³ Al 0 139 Number of EOS per set 0 130 Number of Dudoor Terminations for 1x240mm ³ Al 0 130 Number of Outdoor Terminations for 1x240mm ³ Al 0 141 Cable Truss (m) 0 0 142 Number of Outdoor Terminations for 1x240mm ³ Al 0 0 143 Number of Indoor Terminations for 1x240mm ³ Al 0 0 144 Number of Indoor Terminations for 1x240mm ³ Al 0 0 145 Number of Indoor Terminations for 1x240mm ³ Al 0 0 145 Sub-total: Bulk Supply Point 0 0 146 Sub-total: Bulk Supply	148		U
100	14.9	Number of Underground Circuits in same trench	0
191 0 0 192 Number of thrust boring (m) 0 193 Number of thrust boring locations 0 194 Concrete Surfaces (m) 0 195 Grassed Surfaces (m) 0 196 Number of entrances to cross 0 197 Number of joints for 1x240mm ² Al 0 198 Number of joints for 1x240mm ² Al 0 198 Number of ES per set 0 199 Number of Didoor Terminations for 1x240mm ³ Al 0 191 Cable Truss (m) 0 192 Number of Outdoor Terminations for 1x240mm ³ Al 0 193 Number of Outdoor Terminations for 1x240mm ³ Al 0 193 Number of Outdoor Terminations for 3 x 185mm ³ Al 0 194 Number of Indoor Terminations for 3 x 185mm ³ Al 0 0 195 Sub-total: Bulk Supply Point - - 194 Sub-total: Bulk Supply Point - - 195 Sub-total: Bulk Supply Point - - 196 Sub-total: Bulk Supply Point - - 1	150	4-inch thrust boring (m)	0
102 Number of thirds tooing locations 0 103 Pavement Block Surfaces (m) 0 104 Concrete Surfaces (m) 0 105 Grassed Surfaces (m) 0 105 Grassed Surfaces (m) 0 105 Grassed Surfaces (m) 0 105 Number of entrances to cross 0 106 Number of joints for 1x240mm ² Al 0 105 Number of EDS per set 0 106 Cable Truss (m) 0 106 Cable Truss (m) 0 106 Cable Truss (m) 0 106 Number of Outdoor Terminations for 1x240mm ² Al 0 107 Cable Truss (m) 0 108 Number of Indoor Terminations for 1x240mm ² Al 0 108 Number of Indoor Terminations for 3 x 185mm ² Al 0 108 Number of Indoor Terminations for 3 x 185mm ² Al 0 108 Sub-total: Bulk Supply Point - 108 Sub-total: Bulk Supply Point - 109 Sub-total	151	6-inch thrust boring (m)	0
133 Pavement Block Surfaces (m) 0 154 Concrete Surfaces (m) 0 155 Grassed Surfaces (m) 0 156 Number of entrances to cross 0 157 Number of joints for 1x240mm ³ Al 0 158 Number of joints for 3x185mm ³ Al 0 159 Number of EIS per set 0 160 Number of EIS per set 0 161 Cable Truss (m) 0 162 Number of Outdoor Terminations for 1x240mm ³ Al 0 163 Number of Outdoor Terminations for 1x240mm ³ Al 0 164 Number of Outdoor Terminations for 3x185mm ³ Al 0 165 Sub-total: Bulk Supply Point 0 166 Sub-total: Bulk Supply Point 0 170 Sub-total: Suk Network Underground - 171 Sub-total: Suk Network Underground - 172 Sub-total: Suk Network Underground - 173 Sub-total: 11kV Network Underground - 174 Contingency (10%) - 175 Grand Total USD (33kV Sub-Transmission Network) - </td <td>152</td> <td>Number of thrust boring locations</td> <td>0</td>	152	Number of thrust boring locations	0
154 Concrete Surfaces (m) 0 155 Grassed Surfaces (m) 0 156 Number of entrances to cross 0 157 Number of joints for 1x240mm ³ Al 0 158 Number of joints for 3x185mm ³ Al 0 159 Number of EOS per set 0 160 Number of EOS per set 0 161 Cable Truss (m) 0 162 Number of Outdoor Terminations for 1x240mm ³ Al 0 163 Number of Indoor Terminations for 1x240mm ³ Al 0 164 Number of Outdoor Terminations for 3 x185mm ³ Al 0 165 Number of Indoor Terminations for 3 x185mm ³ Al 0 166 Number of Indoor Terminations for 3 x185mm ³ Al 0 165 Sub-total: Bulk Supply Point - 176 Sub-total: Bulk Supply Point - 170 Sub-total: Bulk Supply Point - 171 Sub-total: Bulk Supply Point - 172 Sub-total: Bulk Supply Point - 173 Sub-total: Bulk Supply Point - 174 Contingency (10%) - 175 Grand Total USD (33kV Sub-Transmission Network) -	153	Pavement Block Surfaces (m)	0
Instrume Grassed Surfaces (m) 0 Second Surfaces (m) 0 0	154	Concrete Surfaces (m)	0
156 Number of entrances to cross 0 157 Number of pionts for 1x240mm²Al 0 158 Number of Dionts for 3x185mm²Al 0 159 Number of DS per set 0 160 Number of DES per set 0 161 Cable Truss (m) 0 162 Number of Outdoor Terminations for 1x240mm²Al 0 163 Number of Indoor Terminations for 1x240mm²Al 0 164 Number of Outdoor Terminations for 3x185mm²Al 0 165 Number of Indoor Terminations for 3x185mm²Al 0 166 Number of Uutdoor Terminations for 3x185mm²Al 0 165 Number of Indoor Terminations for 3x185mm²Al 0 166 Number of Uutdoor Terminations for 3x185mm²Al 0 176 Sub-total: Bulk Supply Point 0 171 Sub-total: Bulk Supply Point - 172 Sub-total: Tower Construction - 173 Sub-total: 11kV Network Underground - 174 Contingency (10%) - 175 Contingency (10%) - 176 Grand Total USD (33kV Sub-Transmission Network) -	155	Grassed Surfaces (m)	0
157 Number of joints for 1x240mm²Al 0 158 Number of EOS per set 0 159 Number of EOS per set 0 160 Number of EDS per set 0 161 Cable Truss (m) 0 162 Number of Outdoor Terminations for 1x240mm²Al 0 163 Number of Outdoor Terminations for 1x240mm²Al 0 164 Number of Outdoor Terminations for 3 x 185mm²Al 0 165 Number of Indoor Terminations for 3 x 185mm²Al 0 166 Number of Indoor Terminations for 3 x 185mm²Al 0 167 Sub-total: Bulk Supply Point 0 170 Sub-total: Primary Sub-station Indoor & Outdoor 0 171 Sub-total: 33kV Network Underground 0 172 Sub-total: 33kV Network Underground 0 173 Sub-total: 33kV Network Underground 0 174 Grand Total USD (33kV Sub-Transmission Network) USD	156	Number of entrances to cross	0
Number of joints for 3x185mm ² Al 0 S8 Number of EOS per set 0 S9 Number of EOS per set 0 S6 Number of Utdoor Terminations for 1x240mm ³ Al 0 S63 Number of Utdoor Terminations for 1x240mm ³ Al 0 S64 Number of Indoor Terminations for 3 x 185mm ³ Al 0 S65 Number of Indoor Terminations for 3 x 185mm ³ Al 0 S66 Number of Indoor Terminations for 3 x 185mm ³ Al 0 S67 Number of Indoor Terminations for 3 x 185mm ³ Al 0 S68 Number of Indoor Terminations for 3 x 185mm ³ Al 0 S69 Sub-total: Bulk Supply Point - S61 Sub-total: Bulk Supply Point - S62 Sub-total: 33kV Network Underground - S63 Sub-total: 33kV Network Underground - S64 Contingency (10%) - - S7 Contingency		N	
Number of joints for 3x185mm ² Al 0 53 Number of ECS per set 0 60 Number of ECS per set 0 61 Cable Truss (m) 0 62 Number of Outdoor Terminations for 1x240mm ³ Al 0 63 Number of Indoor Terminations for 1x240mm ³ Al 0 64 Number of Indoor Terminations for 3 x 185mm ³ Al 0 65 Number of Indoor Terminations for 3 x 185mm ³ Al 0 66 Number of Indoor Terminations for 3 x 185mm ³ Al 0 765 Number of Indoor Terminations for 3 x 185mm ³ Al 0 766 0 767 Sub-total: Bulk Supply Point - 768 - 769 Sub-total: Tower Construction - 761 Sub-total: Suk Network Underground - 762 Sub-total: 11kV Network Underground - 763 Sub-total: 11kV Network Underground - 764 - - 765 - - 767	157	Number of Joints for 12240mm Al	0
153 Number of EUS per set 0 160 Number of EUS per set 0 161 Cable Truss (m) 0 162 Number of Outdoor Terminations for 1x240mm ² Al 0 163 Number of Indoor Terminations for 1x240mm ² Al 0 164 Number of Indoor Terminations for 3 x 185mm ² Al 0 165 Number of Indoor Terminations for 3 x 185mm ² Al 0 166 Number of Indoor Terminations for 3 x 185mm ² Al 0 165 Number of Indoor Terminations for 3 x 185mm ² Al 0 166 Number of Indoor Terminations for 3 x 185mm ² Al 0 167 Sub-total: Bulk Supply Point 0 168 Sub-total: Bulk Supply Point - 170 Sub-total: Super Sub-total: Outdoor - 171 Sub-total: Super	158	Number of Joints for 3x185mm*Al	0
Number of Explore set 0 61 Cable Truss (m) 0 62 Number of Outdoor Terminations for 1x240mm ³ Al 0 63 Number of Outdoor Terminations for 1x240mm ³ Al 0 64 Number of Outdoor Terminations for 3 x 185mm ³ Al 0 65 Number of Indoor Terminations for 3 x 185mm ³ Al 0 66 Number of Indoor Terminations for 3 x 185mm ³ Al 0 67 0 0 68 Number of Indoor Terminations for 3 x 185mm ³ Al 0 69 Sub-total: Bulk Supply Point 0 69 Sub-total: Bulk Supply Point - 70 Sub-total: Diver Construction - 71 Sub-total: 33kV Network Underground - 72 Sub-total: 11kV Metwork Underground - 73 Sub-total: 11kV Metwork Underground - 74 r - 76 - - 77 Grand Total USD (33kV Sub-Transmission Network) - USD	159	Number of EUS per set	0
101 Cable Truss (m) 0 162 Number of Outdoor Terminations for 1x240mm ³ Al 0 163 Number of Outdoor Terminations for 3 x 185mm ³ Al 0 164 Number of Indoor Terminations for 3 x 185mm ³ Al 0 165 Number of Indoor Terminations for 3 x 185mm ³ Al 0 166 Number of Indoor Terminations for 3 x 185mm ³ Al 0 167 0 0 168 Sub-total: Bulk Supply Point - 169 Sub-total: Primary Sub-station Indoor & Outdoor - 170 Sub-total: Sulk Number of Sutdoor - 171 Sub-total: Suk V Network Underground - 172 Sub-total: 11kV Network Underground - 173 Sub-total: 11kV Network Underground - 174 Contingency (10%) - - 178 Grand Total USD (33kV Sub-Transmission Network) - USD	160	Number of EFS per set	0
162 Number of Outdoor Terminations for 1x240mm*Al 0 163 Number of Indoor Terminations for 1x240mm*Al 0 164 Number of Outdoor Terminations for 3 x 185mm*Al 0 165 Number of Indoor Terminations for 3 x 185mm*Al 0 166 Number of Indoor Terminations for 3 x 185mm*Al 0 167 Sub-total: Bulk Supply Point 0 168 Sub-total: Bulk Supply Point - 170 Sub-total: Tower Construction - 171 Sub-total: 33kV Network Underground - 172 Sub-total: 11kV Network Underground - 173 Sub-total: 11kV Network Underground - 174 - - 175 Contingency (10%) - 178 Grand Total USD (33kV Sub-Transmission Network) -	161	Cable Truss (m)	0
Number of Indoor Terminations for 1x240mm ² AI 0 164 Number of Outdoor Terminations for 3 x 185mm ² AI 0 165 Number of Indoor Terminations for 3 x 185mm ² AI 0 165 Number of Indoor Terminations for 3 x 185mm ² AI 0 166 0 0 167 Sub-total: Bulk Supply Point - 168 - - 170 Sub-total: Primary Sub-station Indoor & Outdoor - 171 Sub-total: Therwork Underground - 172 Sub-total: 11kV Network Underground - 173 Contingency (10%) - 174 Grand Total USD (33kV Sub-Transmission Network) -	162	Number of Outdoor Terminations for 1x240mm*Al	0
164 Number of Outdoor Terminations for 3 x 185 mm ² Al 0 165 Number of Indoor Terminations for 3 x 185 mm ² Al 0 166 0 0 167 0 0 168 Sub-total: Bulk Supply Point - 169 Sub-total: Primary Sub-station Indoor & Outdoor - 171 Sub-total: Tower Construction - 172 Sub-total: 33kV Network Underground - 173 Sub-total: 11kV Network Underground - 174 Contingency (10%) - 178 Grand Total USD (33kV Sub-Transmission Network) -	163	Number of Indoor Terminations for 1x240mm ² AI	0
Number of Indoor Terminationsfor 3x185mm²Al 0 166 0 167 0 168 0 169 0 169 0 169 0 169 0 169 0 169 0 169 0 169 0 169 0 169 0 169 0 169 0 169 0 170 Sub-total: Primary Sub-station Indoor & Outdoor 171 Sub-total: SalkV Network Underground 172 Sub-total: 11kV Network Underground 173 Sub-total: 11kV Network Underground 174 0 175 Contingency (10%) 176 0 177 0 178 0 179 0 179 0 179 0 179 0 179 0 179 0 179 0 179 0 179 0 179 0 179 0 179 0 179 0	164	Number of Outdoor Terminations for 3 x 185mm ² Al	0
166	165	Number of Indoor Terminationsfor 3x185mm ² Al	0
167 - 168 Sub-total: Bulk Supply Point - 170 Sub-total: Primary Sub-station Indoor & Outdoor - 171 Sub-total: Tower Construction - 172 Sub-total: 33kV Network Underground - 173 Sub-total: 11kV Network Underground - 174 - - 175 Contingency (10%) - 176 - - 177 Grand Total USD (33kV Sub-Transmission Network) - 178 - -	166		
168 Sub-total: Bulk Supply Point - 169 Sub-total: Primary Sub-station Indoor & Outdoor - 170 Sub-total: Primary Sub-station Indoor & Outdoor - 171 Sub-total: 33kV Network Underground - 173 Sub-total: 11kV Network Underground - 174 - - 175 Contingency (10%) - 176 - - 177 Grand Total USD (33kV Sub-Transmission Network) -	167		
163 Sub-total: Bulk Supply Point - 170 Sub-total: Primary Sub-station Indoor & Outdoor - 171 Sub-total: Tower Construction - 172 Sub-total: SakV Network Underground - 173 Sub-total: 11kV Network Underground - 174 - - 175 Contingency (10%) - 176 - - 177 Grand Total USD (33kV Sub-Transmission Network) - 178 - -	168		
100 Sub-total: Primary Sub-station Indoor & Outdoor 111 Sub-total: Tower Construction 12 Sub-total: 33kV Network Underground 13 Sub-total: 11kV Network Underground 14	169	Sub-total: Bulk Supply Point	25
111 Sub-total: Tower Construction - 112 Sub-total: 33kV Network Underground - 113 Sub-total: 11kV Network Underground - 114 - - 115 Contingency (10%) - 116 - - 117 Grand Total USD (33kV Sub-Transmission Network) - 118 - -	170	Sub-total: Primary Sub-station Indoor & Outdoor	
112 Sub-total: 33kV Network Underground - 113 Sub-total: 11kV Network Underground - 114 - - 115 Contingency (10%) - 116 - - 117 Grand Total USD (33kV Sub-Transmission Network) - 118 - -	171	Sub-total: Tower Construction	
113 Sub-total: 11kV Network Underground - 174	172	Sub-total: 33kV Network Underground	19
174 - 175 Contingency (10%) 16 177 Grand Total USD (33kV Sub-Transmission Network) 178	173	Sub-total: 11kV Network Underground	22
115 Contingency (10%) 116 117 118 118 119 119 110 110 110 110 110 110	174	A LINE WITH A RAY	
175 Grand Total USD (33kV Sub-Transmission Network) - USD 178	175	Contingency (10%)	Se
111 Oraniu rukal USU (SSKV SUD-Transmission NetWork) - USD	1/6	Grand Tabel USD (221/15) h Temperaturian Network)	1000
10	111	Granu rotal Gov Sub-Itansmission network)	- 050
	110		

6.7.1. Power Sub-Transmission Budget Tool

The power sub-transmission budget tool allows the user to include the cost of other factors that relate to the development of a power sub-transmission infrastructure project. The budget tool here was also developed based on the experience of power sector experts as well as based on interactions with the key stakeholders in the sector in Ghana.

The identified elements of the buildings sector project budget tool include budget allocation for:

- Project Formulation/Preparation;
- Pre-Feasibility Studies (Financial Arrangements & Consultant Procurement);
- Feasibility Studies (Project Planning & Preliminary Design);
- Preliminaries (Site Preparation, Boundary Works, Sub-Station yard surfacing);
- Detailed Design;
- Contract Administration (Including Stakeholder engagement and social enquiry);
- Project Implementation Agency Management and Monitoring;
- · Post Contract Follow-up activities by Implementing Agency; and
- Provision for Others.

Provision was made as a guide to what proportion of the initial infrastructure cost should be allocated to the above items. These options can be seen under the **'Provision Guidance'** header. This enables the user to apply some informed basis to selecting an appropriate percentage where his or her input is required under the **'User Budget Provision'**. Here, the user can enter a percentage value for any of the applicable items provided.

The budget tool for the power sub-transmission sector also allows the user to enter any additional items that may not fall within the items above set within the project budget tool for the sector. These include items such as:

- Land acquisition; and
- Environmental and Social Impact Assessment etc.

Below is a screenshot of the power transmission budget tool.

Figure 6-14: User Interface of the Power Sub-Transmission Budget Tool

Power Sector (Sub-transmission-33kV) Project Budget Tool				
Budget Item	Provision Guidance	Application	User Budget Provision	Amount
Infrastructure Cost				
Project Formulation/Preparation	1.0%	Always	0.0%	
Pre-Feasibility Studies (Financial Arrangements & Consultant Procurement)	1%-2%	Always	0.0%	
Feasibility Studies (Project Planning & Preliminary Design)	1%-2%	Always	0.0%	
Preliminaries (Site Preparation, Boundary Works, Sub-Station yard surfacing)	2%-5%	Always	0.0%	· ·
Detailed Design	3% - 5%	Always	0.0%	
Contract Administration (Including Stakeholder engagement and social enquiry)	1.0%	Always	0.0%	
Project Implementation Agency Management and Monitoring	4% - 7%	Always	0.0%	
Post Contract Follow-up activities by Implementing Agency	1%-2%	Always	0.0%	
Provision for Others	1% - 3%	Depends on Strategy	0.0%	
Total Budget Cost				
				- USD

6.8. How to use the Power Sub-Transmission Unit Cost Estimator

The power sub-transmission unit cost estimator only requires users to make inputs or entries for the applicable cost drivers and components for their project. The input sections of the power distribution unit cost estimator are highlighted in the figure below.

Figure 6-15: User Input Sections -Power Sub-Transmission Unit Cost Estimator

A	8	¢	D
	Public Procurement Authority	Power Sector UCOI Estimator Budget Tool	
5 6 7	transparency in Public Procurement		Input Required Dutput
5	Power Infrastructure Unit Cost Estimator	Type of Power Project:	Sub-Transmission
10	Power Sub-transmission 33kV		
12	Cost Drivers	Select Options for Project	
15	SUB-TRANSMISSION BULK SUPPLY POINT		
16 17 18 19 20 21	33kV Indoor 3000A Double Busbar Switchgear - GIS (No) 33kV 1/D Incomer Panel, c/w 2000A CB, VTs & 1000/2000/5/5/5A 33kV 1/D Feeder Panel, c/w 1250A CB, VTs & 600/1200/5/5A 33kV Auxilliary Transformer Cubicle equipped with Fuse/Switch 33kV 3000A Busbar Sectionaliser Panel		
23	11kV Indoor Switchgear - 2000A Busbar Rating- GIS (No)		
24 25 26	11kV I/D Feeder Cubicle C/W 630A CB, Overcurrent and Earthfault Relays, Metering CTs, Reclosing Relays and Sensitive Earthfault Relays, Earth Switch, Instanteneous and Max. Demand Ammeter, KWhr and KVAhr Meter 11kV I/D Bus Coupler C/W 2000A CB, Protection and Metering CTs and Relays 11kV Auxilliary transformer Cubicle equipped with Fuse/Switch	0 0	
28 23 30	Power Transformer, OLTC Panel & NGRs (No) 30/39 MVA ONAN/ONAF 33/11KV Power Transformer 11kV Neutral Earth Resistor, Isolator & 800/5A Current Transformer	0	
31 32	100kVA, 400/230V 50Hz Standby Generator (No) 100kVA, 400/230V 50Hz Standby Generator c/w Manual changover between the two (2) station service		
33	transformers and the Generator (no.)		
34 35	200KVA Auxiliary Transformer 35KV/400V/230V (no.) LV AC Distribution Board (no.)		

37	Provision of SCADA Facility (No)
	Central Event Monitoring and Evaluation system, Remote Terminal Unit (RTU) Microm C254 Complete with radio
	and white all Schuke area and again command points in individual control panels to kilo (complete with all accessinglet to make functional)
13	eccessives so mere remained by
10	Civil Works & Earth Grid (No)
41	50 Sq. mm. Copper Earth Grid for land area Xm by Xm 0
12	All relevant civil works associated with the substation work (Lot)
13	
14	Power & Control Cables (No)
45	(m) 0
	1x500sq.mm XLPE(11kV) Copper Cable for the connection of the Power Transformers to the 11kV Transformer
16	Cubicle (m) 0
17	
45	
50	PRIMARY SUB-STATION (INDOOR & OUTDOOR)
51	
52	33kV Indoor 2000A Single Busbar Switchgear - GIS (No)
53	33kV I/D Feeder Panel, c/w 1250A C8, VTs & 600/1200/5/5A 2-Core CTs 0
54	33kV I/D Busbar Coupler Cubicle c/w 2000A CB & 1000/2000/5/SA 2-core CTs 0
55	11W/Jackson Switchesson 2000 A Burcher Partian (JIS (No)
10	1144 moves switchgest - 2000A based nating- dis (no) 114/1/D Earder Cubicle C/W 6304 CB Overcurrent and Earthfault Relays: Materiae CTs. Reclasing Relays and
57	Sensitive Farthfault Relays Farth Switch
58	1KV I/D Transformer Cubicle, C/W 2000A CB. Overcurrent and Earthfault Relays, Differential and Metering 0
59	11kV Auxilliary transformer Cubicle equipped with Fuse and the switchgear should be SCADA ready 0
	11kV I/D Sectionalising Cubicle C/W 2000A CB, Protection and Metering CTs and Relays: the isolators should be
60	motorised and the switchgear should be SCADA ready 0
61	
2.3.4	
62	33kV Outdoor Incomer/Feeder Bay (No)
62 63 64	33kV Outdoor Incomer/Feeder Bay (No) 33kV O/D 1250A Circuit Breaker c/w Support Structures 3kV O/D CT (600/300/5/5A) c/w Metallic Support Structure for the outgoing feeders
62 63 64	33kV Outdoor Incomer/Feeder Bay (No) 33kV O/D 1250A Circuit Breaker c/w Support Structures 3kV O/D CT (600/300/5/5A) c/w Metallic Support Structure for the outgoing feeders
62 63 64	33kV Outdoor Incomer/Feeder Bay (No) 33kV O/D 1250A Circuit Breaker c/w Support Structures 3kV O/D CT (600/300/5/5A) c/w Metallic Support Structure for the outgoing feeders 33kV Outdoor Incomer/Feeder Bay (No) 33kV O/D 1250A Circuit Breaker c/w Support Structures 0
62 63 64 3 4	33kV Outdoor Incomer/Feeder Bay (No) 33kV O/D 1250A Circuit Breaker c/w Support Structures 3kV O/D CT (600/300/5/5A) c/w Metallic Support Structure for the outgoing feeders 33kV Outdoor Incomer/Feeder Bay (No) 33kV O/D 1250A Circuit Breaker c/w Support Structures 33kV O/D 1250A Circuit Breaker c/w Support Structures 33kV O/D 1250A Circuit Breaker c/w Support Structures 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D CT (600/300/5/5A) c/w Metallic Support Structures
62 63 64 2 3 4	33kV Outdoor Incomer/Feeder Bay (No) 33kV O/D 1250A Circuit Breaker c/w Support Structures 3kV O/D CT (600/300/5/5A) c/w Metallic Support Structure for the outgoing feeders 33kV Outdoor Incomer/Feeder Bay (No) 33kV O/D 1250A Circuit Breaker c/w Support Structures 0 33kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D 1250A Circuit Breaker c/w Support Structure for the outgoing feeders
62 63 64 2 3 4 5 6	33kV Outdoor Incomer/Feeder Bay (No) 33kV O/D 1250A Circuit Breaker c/w Support Structures 3kV O/D CT (600/300/5/5A) c/w Metallic Support Structure for the outgoing feeders 33kV Outdoor Incomer/Feeder Bay (No) 33kV O/D 1250A Circuit Breaker c/w Support Structures 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D CT (600/300/5/5A) c/w Metallic Support Structure for the outgoing feeders 0 3kV O/D CT (600/300/5/5A) c/w Metallic Support Structure for the outgoing feeders 0 3kV Outdoor Transformer Bay (No)
2 3 4 5 6 7 8	33kV Outdoor Incomer/Feeder Bay (No) 33kV O/D 1250A Circuit Breaker c/w Support Structures 3kV O/D CT (600/300/5/5A) c/w Metallic Support Structure for the outgoing feeders 33kV Outdoor Incomer/Feeder Bay (No) 33kV O/D 1250A Circuit Breaker c/w Support Structures 3kV O/D 1250A Circuit Breaker c/w Support Structure for the outgoing feeders 0 33kV O/D 1250A Circuit Breaker c/w Support Structure for the outgoing feeders 0 33kV O/D 1250A Circuit Breaker c/w Support Structure for the outgoing feeders 0 33kV O/D 1250A Circuit Breaker c/w Support Structure for the outgoing feeders 0
2 3 4 5 6 7 8 9	33kV Outdoor Incomer/Feeder Bay (No) 0 33kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D CT (600/300/5/5A) c/w Metallic Support Structure for the outgoing feeders 0 33kV O/D 1250A Circuit Breaker c/w Support Structures 0 33kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 0 0 0
2 64 64 2 3 4 6 6 7 8 9 9 0	33kV Outdoor Incomer/Feeder Bay (No) 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D CT (600/300/5/5A) c/w Metallic Support Structure for the outgoing feeders 0 3kV O/D CT (600/300/5/5A) c/w Metallic Support Structure for the outgoing feeders 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D 1250A Circuit Breaker c/w Support Structure for the outgoing feeders 0 3kV O/D CT (600/300/5/5A) c/w Metallic Support Structures 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0<
2 3 4 5 6 7 7 8 9 9 0 1	33kV Outdoor Incomer/Feeder Bay (No) 0 33kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D CT (600/300/5/5A) c/w Metallic Support Structure for the outgoing feeders 0 33kV Outdoor Incomer/Feeder Bay (No) 0 33kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D CT (600/300/5/5A) c/w Metallic Support Structure for the outgoing feeders 0 3kV O/D CT (600/300/5/5A) c/w Metallic Support Structures 0 3kV O/D CT (600/300/5/5A) c/w Metallic Support Structures 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
22 3 4 5 6 6 4 7 6 4 7 6 9 9 0 1 1 2 9	33kV Outdoor Incomer/Feeder Bay (No) 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D CT (600/300/5/5A) c/w Metallic Support Structure for the outgoing feeders 0 33kV O/D 1250A Circuit Breaker c/w Support Structure for the outgoing feeders 0 33kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D 1250A Circuit Breaker c/w Support Structure for the outgoing feeders 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 0 0 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0/13 MVA ONAN/ONAF 33
2 3 4 6 6 7 8 9 0 1 1 2 3 4	33kV Outdoor Incomer/Feeder Bay (No) 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D CT (600/300/5/5A) c/w Metallic Support Structure for the outgoing feeders 0 3kV O/D 1250A Circuit Breaker c/w Support Structure for the outgoing feeders 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 0 0 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 0 0 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 <t< td=""></t<>
2 3 4 5 6 7 8 9 0 1 2 3 4 5 5	33kV Outdoor Incomer/Feeder Bay (No) 0 33kV O/D 1250A Circuit Breaker c/w Support Structure for the outgoing feeders 0 3kV O/D CT (600/300/5/5A) c/w Metallic Support Structure for the outgoing feeders 0 33kV O/D 1250A Circuit Breaker c/w Support Structures 0 33kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D CT (600/300/5/5A) c/w Metallic Support Structures 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D CT (600/300/5/5A) c/w Metallic Support Structures 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 0 0 0 3kV O/D 1250A Circuit Breaker c/w Support Structures 0 0 0 0 0 0 0 0 0 0 0/12 50A Circuit Breaker c/w Support Structures 0 0/12 50A Circuit Breaker c/w Support Structures 0 0/12 50A Circuit Breaker c/w Support Structures 0 0/13 MVA ONAN/ONAF 33/11kV Power Transformer with indoor busings 0 10/13 MVA ONAN/ONAF 33/11kV Power Transformer with indoor busings 0 2.5MVA ONAN
2 3 4 8 67 8 9 0 1 2 3 4 5 6	33kV Outdoor Incomer/Feeder Bay (No) 0 3kV O/D CT (600/300/5/5A) c/w Metallic Support Structure for the outgoing feeders 0 33kV O/D CT (600/300/5/5A) c/w Metallic Support Structure for the outgoing feeders 0 33kV O/D 1250A Circuit Breaker c/w Support Structures 0 3kV O/D CT (600/300/5/5A) c/w Metallic Support Structures 0 3kV O/D CT (600/300/5/5A) c/w Metallic Support Structures 0 3kV O/D CT (600/300/5/5A) c/w Metallic Support Structure for the outgoing feeders 0 3kV O/D CT (600/300/5/5A) c/w Metallic Support Structure for the outgoing feeders 0 3kV O/D CT (600/300/5/5A) c/w Metallic Support Structures 0 0 0 0 3kV O/D CT (600/300/5/5A) c/w Metallic Support Structures 0 0 0 0 3kV O/D CT (600/300/5/5A) c/w Metallic Support Structures 0 0 0 0 3kV O/D CT (600/300/5/5A) c/w Metallic Support Structures 0 0 0 0 0/12 S0A Circuit Breaker c/w Support Structures 0 0/26 MVA ONAN/ONAF 33/11kV Power Transformer with indoor busings 0 10/13 MVA ONAN/ONAF 33/11kV Power Transformer with indoor busings 0 2.MVA ONAN/ONAF 33/11kV
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	TOWER CONSTRUCTION
	Distance From Warehouse. Distance from Warehouse to Project Site (km)
	Double Circuit Tower Lines (km)
	Tower Type SS (0*-3*) - 400sq.mm AAC Tower Type AC (3*- 60*) - 400sq.mm AAC Tower Type DE (30*- 60*) - 400sq.mm AAC Tower Type DE (30*-60*) - 400sq.mm AAC
	rower tilte to a wooddraw user
	Civil Works (Tower Foundation) (No) Tower Type 55 (0*.3*) Tower Type AC (3*.60*)
	Tower Type 50" Tower Type DE (30"- 60")
	Porto Extravation Number
	novský koncernistven (menimer)
	3 JAV NETWORK UNDERGROUND
	ROUTE DETAILS (in metres) Gutter (G)
	Gutter Cable Truss (G) Road (Asphalt (R(A))
	Road (Butimen)
	Road (pavement)
	Road (normal ground) K(NG) Pavement (P)
	Concrete (C)
	Entrances (pavement)
	Entrances (normal ground) E(NG)
	Entrances (concrete) E[C]
124	Entrances (Bitumen)
1211	Entrances (Tries) Grassed Surfaces
121	Tiled Surfaces
128	Normal Ground (NG)
122	Number of Understound Circuits in same trench lof 3 cables per cct)
101	4-inch thrust boring (m)
10.2	6-inch threat boring (m)
100	Number of thrust boring locations
107	Number of Indoor Termination for 1 x 630sa mm XLPE
136	Number of Outdoor Termination for 1 x G30zq.mm XLPE
107	Number of joint
108	Cable Truss (M)
560	11AV NETWORK UNDERGROUND
102	UNDERGROUND (UG) CIRCUITS TO BE CREATED (No)
540	Double circuit trench (1187)
168	Single circuit trench (11kV)
161	
149	I ENOTE INVESTIGATION
545	LENGTH (m): ZX1ESAU
143	Number of Underground Circuits in seme trench
156	4-inch thrust boring (m)
69	6-inch thrust boring (m)
112	Number of thrust boring locations
153	Pavement Block Surfaces (m)
104	Concrete surgices (TI) Granned Surfaces (m)
14	Number of entrances in crisis
	TO BE DONE NO RECORDER AND A MARKED AND A MA

65

\$23

FEEDER 1 UNDERGINOUND CASUE POINTION EDNGTH (m): 32240A LENGTH (m): 32240A Number of Underground Circuits in same trench 4-inct threat boring (m) 6-inct threat boring (m) Number of threat boring locations Pavement Block Surfaces (m) Concrete Surfaces (m) Orassed Surfaces (m) Number of entrances to cross Number of joints for 1x240mm²Al Number of joints for 3x35mm²Al Number of DOS perset Oahle Truss (m) Number of Duddoor Terminations for 1x240mm³Al Number of Duddoor Terminations for 1x240mm³Al Number of Duddoor Terminations for 1x240mm³Al Number of Duddoor Terminations for 5 x 185mm³Al Sala netah Balk Supply Paint Sala-tetah Priming Sub-station Indeer & Outdoor Sala-tetah Salar Research Underground Sala-tetah Salar Research Underground Sala-tetah Salar Research Underground Contingency (10%) Grand Total USD (334W Seb-Transmission Metwork) 050 Once the user enters the various values for each of the corresponding cost drivers, the power sub-transmission unit cost tool will automatically generate results for the following based on the entries made:

- Sub-total: Bulk Supply Point;
- Sub-total: Primary Sub-station Indoor & Outdoor;
- Sub-total: Tower Construction;
- Sub-total: 33kV Network Underground;
- Sub-total: 11kV Network Underground;
- Contingency (10%);
- Grand Total (GHS); and
- Grand Total USD.

This is shown in figure 6-16 below.

Figure 6-16: Power Sub-Transmission Unit Cost and Cost Estimate Output



6.8.1. Summary of Steps-Power Sub-Transmission Unit Cost Estimator

- 1. Enter the applicable value or number in the input required sections; and
 - The following results will be generated:
 - Sub-total: Bulk Supply Point;
 - Sub-total: Primary Sub-station Indoor & Outdoor;
 - Sub-total: Tower Construction;
 - Sub-total: 33kV Network Underground;
 - Sub-total: 11kV Network Underground;
 - Contingency (10%);
 - Grand Total (GHS); and
 - Grand Total USD.

2.

Key Points to note on the use of the Power Sub-Transmission Unit Cost Estimator

- It is recommended that the tool should be used by a technical person who understands and can interpret the content. All results and interpretations are the sole responsibility of the user;
- The contract cost data used comprise solely of project costs for various power sub-transmission infrastructure projects at the **award prices**. It therefore expresses how much it would cost for the transmission of 33kV power without consideration of any variations, extensions of time or any other changes to the original contract awarded;

- The output of the unit cost estimator for power sub-transmission feeds into the budget tool. The power sub-transmission infrastructure cost and budget tool estimate are expressed in **USD**; and
- To avoid errors, it is suggested that the user only inputs absolute values i.e. 1, 2, 3 etc. for the various components in the applicable areas.



6.9. How to use the Power Sub-Transmission Budget Tool

The cost estimate derived from the unit cost estimator i.e. Grand Total (USD) feeds into the budget tool as the **'Infrastructure Cost'**. Users are only required to provide input in the form of percentages for the 9 budget line items as shown in Figure 6-17 at the **'User Budget Provision'** column of the tool. The **'Provision guidance'** should enable the user to apply some informed basis to select an appropriate percentage required under the **'User Budget Provision**.

The budget line items for which users would provide the input include:

- Project Formulation/Preparation;
- Pre-Feasibility Studies (Financial Arrangements & Consultant Procurement);
- Feasibility Studies (Project Planning & Preliminary Design);
- Preliminaries (Site Preparation, Boundary Works, Sub-Station yard surfacing);
- Detailed Design;
- Contract Administration (Including Stakeholder engagement and social enquiry);
- Project Implementation Agency Management and Monitoring;
- Post Contract Follow-up activities by Implementing Agency; and
- Provision for Others.

The budget tool as mentioned earlier also allows the user to enter any additional items that may not fall within the items above set within the project budget tool for the sector. These include items such as:

- Land acquisition; and
- Environmental and Social Impact Assessment etc.

Figure 6-17: User Input Section – Power Sub-Transmission Budget Tool

ladget iken	Provision Guidance	Application	User Budget Provision
drastructure Cost			\sim
roject Formulation/Preparation	tási	Alvagz	885
re-Feasibility Studies (Financial Arrangements & Consultant Procurement)	tto-276	Abrays 📃	485
earibility Studies (Project Planning & Preliminary Design)	16-2%	Always 🛄	62N
reliminaries (Site Preparation, Boundary Works, Sub-Station gard surfacing)	2N - 9N	Abrags 📃	60%
eralled Design	211-924	Alwayz 📃	92N.
consum Administration (Including Stakeholder engagement and posial engaing)	tórs	Alvags 🛄	68%
roject Implementation Agency Management and Monitoring	4N-7N	Айчира 🛄	60N
out Costnast Follow-up activities by Implementing Agency	84-2%	Abrags 📃	62%
Statement of the statem			1 1

Once the user inputs the budget provision percentages for each of the corresponding budget line items, the power sub-transmission budget tool will report a budget estimate i.e. '**Total Budget Cost**'. The total budget cost will be derived from the outcomes of the budget line items calculated as percentages of the Infrastructure Cost and added to the initial infrastructure cost amount obtained from the unit cost estimator (See Figure 6-18)

Figure 6-18: Power Sub-Transmission Total Budget Cost Output

Provision Guidance	Application	User Budget Provision	Apount
		_	~
tóte	Abrieja 🚺		
N-2N	Abrays 📃	0.0%	
N-2X	Abraga 📃	0.0%	`
in-th	Abrays 🛄	0.0%	
26-86	Always 📃	à thị	
tón	Ahragi	4.0%	
4% - 7%	Abragit 🚺	9.0%	_
N-2N	Abrage 🛄	0.0%	_
N-2N	Depends on Strategy	. 9.9%	_
	Provision Guidance 10% 1% 2% 1% 2% 2% 4% 2% 4% 10% 4% -2% 1% 2%	Provision Buildance Application	Provision Buildance Application Duer Dudget Provision 10% Avage 0.0% 50% Avage 0.0%

Key Points to note on the use of the Power Sub-Transmission Budget Tool

- The output of the unit cost estimator for power sub-transmission feeds into the budget tool. The power sub-transmission unit cost and budget tool estimate are expressed in **USD**;
- To avoid errors, it is suggested that the user only inputs the absolute values i.e. 1, 2, 3 etc. for the various components in the applicable areas; and
- It is also recommended that users consider the provision guidance in making their input. It is worth noting that these guidelines were derived based on expert experience as well as from interactions with key stakeholders within the sector

6.10. User Interface- Power Generation

The unit cost estimator for power generation was developed based on the types of generation currently existent in the power sector. This is mainly made up of the following:

- Solar;
- Hydro;
- Thermal Combine Cycle Plants; and
- Thermal Gas Combustion Turbine

A screen shot of the user interface for the power generation unit cost estimator is shown in figure 6-19 with the cost drivers and the window where the unit cost output is presented.

Figure 6-19: User Interface of the Power Generation Unit Cost Estimator

-24	AB	C	D	E
1 2 3 4 5	Public Procurement Authority Improving efficiency and transparency in Public Procurement	Power Sector UCOI Estimator Budget Tool	Input Required	
7 8			output	
9	Power Infrastructure Unit Cost Estimator	Type of Power Project:	Generation	
10				
13	Cost Drivers	Select Options for Project		
17	Type of Generation	Capacity (MW)	Unit Cost (US\$/MW)	Total Installed Cost (US\$)
18	Solar		216,271	0.00
19	Hydro		2,465,324	0.00
20	Thermal - Combine cycle plants	(1,474,419	0.00
21	Thermal - Gas Combustion turbine		1,250,677	0.00
22				
23	Contingency (10%)			
24				
25	Grand Total USD			
1011				

6.10.1. Power Generation Budget Tool

The power generation budget tool allows the user to include the cost of other factors that relate to the development of a power generation infrastructure project. Similar to the other budget tools, the budget tool for power generation was developed based on the experience of power sector experts as well as based on interactions with the key stakeholders in the sector in Ghana.

The identified elements of the buildings sector project budget tool include budget allocation for:

- Project Formulation/Preparation;
- Pre-Feasibility Studies (Financial Arrangements & Consultant Procurement);
- Feasibility Studies (Project Planning & Preliminary Design);
- Preliminaries (Site Preparation, Boundary Works, Sub-Station yard surfacing);
- Detailed Design;
- Contract Administration (Including Stakeholder engagement and social enquiry);
- Project Implementation Agency Management and Monitoring;
- Post Contract Follow-up activities by Implementing Agency; and
- Provision for Others.

Provision was made as a guide to what proportion of the initial infrastructure cost should be allocated to the above items. These options can be seen under the **'Provision Guidance'** header. This enables the user to apply some informed basis to selecting an appropriate percentage where his or her input is required under the **'User Budget Provision'**. Here, the user can enter a percentage value for any of the applicable items provided.

The budget tool for the power generation sector also allows the user to enter any additional items that may not fall within the items above set within the project budget tool for the sector. These include items such as:

- Land acquisition; and
- Environmental and Social Impact Assessment etc.

Below is a screenshot of the power generation budget tool.

Figure 6-20: User Interface of the Power Generation Unit Cost Estimator

Power Sector (Generation) Project Budget Tool				
Budget Item	Provision Guidance	Application	User Budget Provision	Amount
Infrastructure Cost				÷
Project Formulation/Preparation	1.0%	Always	0.0%	· ·
Pre-Feasibility Studies (Financial Arrangements & Consultant Procurement)	1%-2%	Always	0.0%	•
Feasibility Studies (Project Planning & Preliminary Design)	1%-2%	Always	0.0%	
Detailed Design	2% - 5%	Always	0.0%	
Preliminaries (Site Preparation, Boundary Works, Sub-Station yard surfacing)	3% - 5%	Always	0.0%	
Contract Administration (Including Stakeholder engagement and social enquiry)	1.0%	Always	0.0%	
Project Implementation Agency Management and Monitoring	4% - 7%	Always	0.0%	
Post Contract Follow-up activities by Implementing Agency	1%-2%	Always	0.0%	
Provision for Others'	1% - 3%	Depends on Strategy	0.0%	
Total Budget Cost				- USD

Unit Cost of Infrastructure Estimator and Budget Tool-Final User Guide

6.11. How to use the Power Generation Unit Cost Estimator

The power generation unit cost estimator only requires users to make inputs or entries for the applicable cost drivers and components for their project. The input sections of the power distribution unit cost estimator are highlighted in the figure below.

Figure 6-21: User Input Sections -Power Generation Unit Cost Estimator

	8	c	D	E
	Public Procurement Authority	Power Sector UC0I Estimator Budget Tool		
-	transparency in Public Procurement		Input Required Dutput	
	Power Infrastructure Unit Cost Estimator	Type of Power Project:	Generation	
	Cost Drivers	Select Options for Project	-	
	Cost Drivers Type of Generation	Select Options for Project	Unit Cost (US#/W	V) Total Installed Cost (USP)
	Cost Drivers Type of Generation Iolar	Select Options for Project Capacity of	Unit Cost (USHIW 216.5	V) Total Installed Cost (US1) 271 0.00
	Cost Drivers Type of Generation Inter Hydro	Select Options for Project Capacity A	0 Unit Cost (USB/W 0 2%) 0 2,405.0	V) Total Installed Cost (USB) 271 0.00 124 0.00
	Cost Drivers Type of Generation Edge Nydro Thermal-Combine cycle plants	Select Options for Project Capacity of	Unit Cost (US#M 282 0 2,465.0 0 1,474.4	V) Total Installed Cost (US#) 271 0.00 124 0.00 473 0.00
	Cost Drivers Type of Generation Foliar Hydro Thermal-Cast Combine cycle plants Thermal-Cast Combustion turbine	Select Options for Project Copuolity of	V) Unit Cost (US#M 0 2465 0 2465 0 14744 0 12908	V) Total Installed Cost (US1) 271 0.00 124 0.00 45 0.00 177 0.00
	Cost Drivers Type of Generation Tolar Hydro Thermal - Combine cycle plants Thermal - Cas Combustion turbine	Select Options for Project Coposity of	VI Unit Cost (US114) 0 285 0 2.465 0 1.4744 0 1.250.6	V) Total Installed Cost (US1) 271 0.00 124 0.00 149 0.00 177 0.00
	Cost Drivers Type of Generation Solar Hydro Thermal-Combine cycle plants Thermal-Cas Combustion turbine Contingency (10%)	Select Options for Project Capacity of	V) Unit Cost (US#IM 0 2465 0 2,4653 0 12506	V) Total Installed Cost (US1) 0.00 124 0.00 128 0.00 129 0.00 127 0.00
	Cost Drivers Type of Generation totar Mydro Thermal-Combine cycle plants Thermal-Cast Combustion turbline Contingency (10%)	Select Options for Project Copusity of	VI Unit Cost (USHIM 0 285 0 2,4653 0 1250,6	MJ Total Installed Cost (USH) 0.00 221 0.00 0.24 0.00 19 0.00 177 0.00

Once the user enters the various values for each of the corresponding cost drivers, the power generation unit cost tool will automatically generate results for the following based on the entries made:

- Contingency (10%);
- Grand Total USD.

This is further illustrated in figure 6-22 below.

Figure 6-22: Power Generation Unit Cost and Cost Estimate Output

cust privers	select uptions for Project	
Type of Generation	Capacity (MV) Unit Cost (US\$/	MV) Total Installed Cost (US\$)
Solar	21	3,271 0.00
Hydro	2,465	,324 0.00
Thermal - Combine cycle plants	33 147	4,419 48,655,833,81
Thermal - Gas Combustion turbine	18 129	1,677 22,512,180.65
Contingency (10%)	7,116,801.45	
Grand Table 1860	a source of the	
Grand Total USD	78,284,815.90	
6.11.1. Summary of Steps-Power Transmission Unit Cost Estimator

- Enter the applicable value or number in the input required sections; and
- Results for the following will be generated:
- Contingency (10%);and
 - Grand Total USD.

Key Points to note on the use of the Power Generation Unit Cost Estimator

- It is recommended that the tool should be used by a technical person who understands and can interpret the content. All results and interpretations are the sole responsibility of the user;
- The contract cost data used comprise solely of project costs for various power generation infrastructure projects at the **award prices**. It therefore expresses how much it would cost to generate power without consideration of any variations, extensions of time or any other changes to the original contract awarded;
- The output of the unit cost estimator for power generation feeds into the budget tool. The power generation infrastructure cost and budget tool estimate are expressed in **USD**; and
- To avoid errors, it is suggested that the user only inputs absolute values i.e. 1, 2, 3 etc. for the various components in the applicable areas.



6.12. How to use the Power Generation Budget Tool

The cost estimate derived from the unit cost estimator i.e. Grand Total (USD) feeds into the budget tool as the **'Infrastructure Cost'**. Users are only required to provide input in the form of percentages for the 9 budget line items as highlighted in Figure 6-23 at the **'User Budget Provision'** column of the tool. The **'Provision guidance'** should enable the user to apply some informed basis to select an appropriate percentage required under the **'User Budget Provision**.

The budget line items for which users would provide the input include:

- Project Formulation/Preparation;
- Pre-Feasibility Studies (Financial Arrangements & Consultant Procurement);
- Feasibility Studies (Project Planning & Preliminary Design);
- Preliminaries (Site Preparation, Boundary Works, Sub-Station yard surfacing);
- Detailed Design;
- Contract Administration (Including Stakeholder engagement and social enquiry);
- Project Implementation Agency Management and Monitoring;
- Post Contract Follow-up activities by Implementing Agency; and
- Provision for Others.

The budget tool as mentioned earlier also allows the user to enter any additional items that may not fall within the items above set within the project budget tool for the sector. These include items such as:

- Land acquisition; and
- Environmental and Social Impact Assessment etc.

Figure 6-23: User Input Section - Power Generation Budget Tool

Protect from	Developer Dellares	And States	the second s
Couget Nem	Provision Guidance	Applieation	Usur Dedget Provision
Infrastructure Cost			\sim
Project Portulation/Preparation	1.0%	Advage	0.0%
Pre-Feasibility Studies (Financial Anangements & Consultant Procurement)	10. 2%	Always	0.0%
Feasibility Studies (Project Pilanning & Preliminary Design)	84.250	Abrage	0.0%
Detailed Detiign	258%	Advags	0.0%
Preliminantes (Site Preparation, Boundary Vorks, Sub-Station yard surfacing)	316 - 106	Advags	0.0%
Contract Administration (bolixing Stallaholder engagement and social engaing)	18%	Alvagi	0.0%
Project Implementation Agency Management and Monitoring	4N - PN	Advage	0.0%
Post Contrast Follow-up activities to Inclusionary Agency	16-25	Abrays	0.0%
Protection Count'	N-3N	Dependis on Strategy	0.0%

Once the user inputs the budget provision percentages for each of the corresponding budget line items, the power generation budget tool will report a budget estimate i.e. '**Total Budget Cost'**. The total budget cost will be derived from the outcomes of the budget line items calculated as percentages of the Infrastructure Cost and added to the initial infrastructure cost amount obtained from the unit cost estimator (See Figure 6-24)

Figure 6-24: Power Generation Total Budget Cost Output

et Rem	Provision Guidance	Application	Une Dedget Paravision	Anoun
structure Cost				78,204,08,90
or F consulation IP-reparation	18%	Always	10%	712,00 N
rasibility Dirudes (Financial Assangements II: Consultant Proceement)	19y 29	Abregt	385	LMON.32
alleg Skulline (Project Plansing & Preliminung Cesiger)	160 2N	Abragi	0.0%	
el Derign	28-98	Abragi	8.0%	
sharies (Sile Preparation, Boundary Works, Sub-Diration gard metaolog)	25-9N	Abregi	0.0%	
art. Administration (tholading Dirateholder engagement and social engaing)	tim	Abragt	0.8%	
rt Implementation Agence Management and Monitroling	ex. 7x	Abrage	0.0%	
Contract IF allow-up-activities by Inglementing Agemus	196-291	Abrage	0.0%	-
sion for Others"	N-21	Depends on Shakega	0.0h	

Key Points to note on the use of the Power Generation Budget Tool

- The output of the unit cost estimator for power generation feeds into the budget tool. The power generation unit cost and budget tool estimate are expressed in **USD**;
- To avoid errors, it is suggested that the user only inputs the absolute values i.e. 1, 2, 3 etc. for the various components in the applicable areas; and
- It is also recommended that users consider the provision guidance in making their input. It is worth noting that these guidelines were derived based on expert experience as well as from interactions with key stakeholders within the sector.