

**Marayong ZS**

CPI escalation =

WACC =

4.76%

Items	Option 1		Option 2	
	New 11kV building and replace all TXs		New indoor substation and replace all 3 TXs	
<b>Project Management</b>				
Project Management & Project Definitions	617,722		1,085,722	
<b>Indoor 33kV Bays</b>				
Feeders	0		553,460	
Bus Sections	0		448,292	
<b>Indoor 11kV Bays</b>				
Feeders	1,554,526		1,318,178	
Bus sections	200,985		169,823	
<b>Transformer Bays</b>				
Bays	661,847		847,308	
Transformer Costs	1,980,000		1,980,000	
Bunds / Sound Walls / Blast Walls / Fire Suppression	1,500,000		1,310,000	
<b>AFIC Equipment</b>				
SFU & Injection Cells	0		301,000	
<b>Building &amp; Switchyard</b>				
Building/Transformer Runway/Fencing/Landscaping/Building Fire Suppression	3,120,000		5,401,100	
<b>Ancillary Equipment</b>				
11kV Aux Switchboard/Aux. Transf./Batteries & chargers/Radio System/ New SCADA	216,000		550,303	
Underfrequency Load Shedding	33,966		33,966	
<b>Additional Costs</b>				
Mains	724,879		1,940,133	
Distribution	1,400,000		1,400,000	
Major Equipment Storage	83,610		122,640	
On Site Security	0		0	
Changeover	200,000		100,000	
Removal of Exist. Transformers	60,000		60,000	
Removal of Exist. Equip. & fence	25,000		95,000	
Demolition of Exist. Bldg & Sw. Yard			1,105,550	
33kV Cable Sealing Ends	60,000			
<b>Total</b>	<b>12,438,535</b>		<b>18,822,475</b>	
Total including CPI for 3 yrs				
Ronded to nearest \$100,000				

Future works

5,172,119

515,119

Year

Indexing factor

Present Cost of the works

**Total project including futre works**
**17,610,654**
**19,337,594**

**Prefered Option**  
**Option Cost**

**2**  
**18822475**

1 2 3

**Fixed Value**  
**%**

**10.66%** **41.47%** **41.47%** **6.40%**

	2016/17 (Sunk Costs)	2017/18	2018/19	2019/20	2020/21	Total (nearest \$10,000)
Project cost (\$Real)	\$160,000	\$2,006,476	\$7,805,680	\$7,805,680	\$1,204,638	\$18,982,475
Project cost (\$Real)	\$200,000	\$2,000,000	\$7,800,000	\$7,800,000	\$1,200,000	\$19,000,000
Project cost (\$Nominal)	\$200,000	\$2,000,000	\$8,000,000	\$8,200,000	\$1,300,000	\$19,700,000
Overheads	\$100,000	\$610,000	\$2,420,000	\$2,480,000	\$390,000	\$6,000,000
Contingency		\$535,000	\$535,000	\$410,000	\$620,000	\$2,100,000
Total including overheads	\$300,000	\$3,145,000	\$10,955,000	\$11,090,000	\$2,310,000	\$27,800,000

**Option**  
**Option Cost**

**1**  
**12438535**

**Fixed Value**  
**%**

**10.66%** **41.47%** **41.47%** **6.40%**

	2016/17 (Sunk Costs)	2017/18	2018/19	2019/20	2020/21	Total (nearest \$10,000)
Project cost (\$Real)	\$160,000	\$1,325,948	\$5,158,260	\$5,158,260	\$796,066	\$12,438,535
Project cost (\$Nominal)	\$200,000	\$1,326,000	\$5,287,000	\$5,416,000	\$856,000	\$12,885,000
Total costs (\$Nominal, nearest \$100,000)	\$200,000	\$1,300,000	\$5,300,000	\$5,400,000	\$900,000	\$12,900,000

Option Comparison

Marayong ZS Present Costs					
Option No	Option Detail	Cost of works	Present Cost of works	Present cost of future works	Present Cost
1	New 11kV building and replace all TXs	\$12,438,535	\$11,113,399	\$5,172,119	\$16,285,518
2	New Indoor Substation and replace all TXs	\$18,822,475	\$16,817,227	\$515,119	\$17,332,347

## Future Cost of Options

Current Year	2017	Depreciated life (Years)	
Residual year (45y)	2062	Power TX	50
Residual year (10y)	2027	CB	45
Residual year (20y)	2037	VT	45
Cost of 25MVA 33/11kV TX Renewal	\$1,506,000	Other assets	45
33kV VT Replacement	\$70,000		
33kV CB Bay Replacement	\$344,000	Marayong ZS Revised life (years)	
Maintenance per year of Marayong TX	\$16,010	TX3	44
Maintenance per year of New TX	\$1,553	TX1 and 2	49
Maintenance cost per year of Marayong Switchyard	\$3,319	33kV VTs	58
Maintenance cost per year of New 33kV indoor switchboard	\$1,719	CBs	30

### Option 1(45y)

Item	Cost	Remaining life	Year	Residual Value	NPV
Future Replacement of 3x33kV VTs	-\$210,000	5	2022	\$23,000	-\$164,000
Future redevelopment of Substation	-\$10,336,066	16	2033	\$3,675,000	-\$4,458,000
Maintenance of Transformers					-\$320,000
Maintenance of 33kV switchgear					-\$67,000
Maintenance of 11kV Switchgear					-\$163,119
Total					-\$5,172,119

### Option 2(45y)

Item	Cost	Remaining life	Year	Residual Value	NPV
Maintenance of Transformers					-\$320,000
Maintenance of indoor 33kV switchboard					-\$32,000
Maintenance of 11kV Switchgear					-\$163,119
					-\$515,119

Marayong ZS - Qualitative Option Risk Assessment																												
Option No	Option Detail	Safety				Environment and Community					Construction					Operating & Maintenance					Reliability				Sustainability			
		Detail	Likelihood of event	Consequence	Item Score	Total Score	Detail	Likelihood of event	Consequence	Item Score	Total Score	Detail	Likelihood of event	Consequence	Item Score	Total Score	Detail	Likelihood of event	Consequence	Item Score	Total Score	Detail	Likelihood of event	Consequence	Item Score	Total Score		
1	New 11kV building and replace all TXs	Contains old tunnel board in old control building resulting in shock	C	3	100	Outdoor switchyard  Increases substation footprint (reduces public areas)	C	2	20	Work in live tunnel board - Space constraints resulting in delays  Construction in switchyard - Space constraints resulting in delays	E	1	10		Outdoor switchyard with no bus section breakers	D	2	100	Outdoor switchyard with no bus section breakers (increases outage duration)  All new power transformers with low risk of internal failures	C	3	100	First stage of redevelopment but with all new power transformers  Increased constraints increased contrainrnts with ussage of land	C	2	20		
		Outdoor switchyard	A	3	4		D	3	500		E	1	10		11kV busbar must be solid	D	2	100		C	2	20						
													11kV main switchboard in separate building to main control room		D	2	100											
													Control building maintenance		E	1	10											
													33kV Switchyard mainenance		D	1	5											
2	New indoor substation and replace all TXs	Indoor 33kV switchgear		0	Attractive, compact indoor design			0	Construction of a large control building (but on a greenfield site)	B	2	2		All new low maintenance equipment			0	Indoor 33kV switchboard with bus section breakers and bus-bar protection			0	Substation completely redeveloped  Greater flexibility with freed up land			0			
		Single control building		0																								
CODE	Extreme risk				High risk				Moderate risk				Low risk															