ANNEXURE 8: BENEFIT POINTS METHOD OF PRIORITISATION

1 INTRODUCTION

To facilitate with decisions around technology selection, and specifically whether grid technology is likely to be viable for certain clusters of loads, a simple and transparent rule of thumb has been developed using '*benefits points'*[1].

Each potential project would accrue a number of '*economic benefit points'* in order to take in to account social and economic benefits that arise from rural electrification. A system of allocating 'benefit points' has been developed in order to try and quantify these social benefits as well.

The 'benefit points' system essentially allocates 1 point to the electrification of a rural household and then compares the electrification of other institutions and industries against this reference.

- As an example, electrification of a small shop or other trader, is considered to provide a 3-times more economic benefit as a household on the basis of the potential for increased income generation that may accrue through electrification.
- Electrification of a Health Centre (HC4) accrues 70 benefit points.
- The benefits point allocation system aims to take into account both the size of the load (in kWh), its contribution to the overall financial feasibility of the line extension, as well as its weighting for the social benefits.

The benefit points for proposed projects are summed to assess the total potential benefit of a particular project. ***Table 1*** provides the rationalised and simplified benefits points system used for pre-feasibility assessments, which ties in with the data available in Uganda.

[1] This system was first proposed for use in Namibia and South Africa and has been adapted for use in Uganda.

Table 1: Rationalised economic benefit points for clusters of loads

Category		Comment or qualification	BP Suggestion	Average fixed BP to use if no additional data available
HQ's (districts, counties, subcounties), Trading Centres and Villages	*HQ's and Trading Centres (includes MoLG buildings, informal traders, medium scale businesses)*	Size d (more than 1,000 households)	1,200	1,200
		Size c (from 400-1,000 households)	750	750
		Size b (from 100-400 households)	450	450
		Size a (less than 100 households)	150	150
		Other villages	100	100
	IDP Camps	Size e (more than 2,000 households)	1,200	1,200
		Size d (more than 1,000 households)	500	500
		Size c (from 500-1,000 households)	250	250
		Size b (from 100-500 households)	150	150
		Size a (less than 100 households)	100	100
Private	*Corporate*	Radio sites and cell-phone sites	100	100
	Industrial	Factories or private sector non-agricultural industry	Variable depending on kW power	4000
	Mines	Gold and base metals	4,000	4,000
		Copper / tantalite	2,000	2,000
		Granite	3,000	3,000
		Sandstone (large)	1,000	1,000
		Sandstone (small)	500	500
Health	*Health Centres*	HCII	10	10
		HCIII	30	30
		HCIV	70	70
	Hospital	District hospitals		200

Table 1 cont'd

Category		Comment or qualification	BP Suggestion	Average fixed BP to use if no additional data available
Agriculture	*Agricultural plant*	Agricultural storage & beneficiation (tea, fish, coffee or any other large factories	Variable depending on power or energy	
		Cotton ginneries		4000
		Coffee wet plant		250
		Tea factory		5000
		Fish-processing Plant		2500
		Fish-landing Type 1		100
Education	*Schools*	Primary / post primary		12
		Secondary		22
		Tertiary		35
		Hostel: full boarding		20
Water	*Water supply*	Depending on level of establishment and energy consumption (often currently running on diesel)	Variable on kWh required	
		District water supply pressurising pumps (potable water)		40
		District water purification plant		40
		District water lifting / supply		40
		County water lifting / purification		20
		Village water lifting / purification		10
		School / Health Centre supply	Included	

2 BENEFIT POINTS ANALYSIS APPLIED TO RURAL POWER-LINE EXTENSION

The consultant has developed rules of thumb for identifying viable grid extension projects based on the extensive analyses of 300 plus grid line proposals. These rules of thumb have been found to apply subject to certain global assumptions. The key parameter used is the (*metres of 33kV line)/Benefit Point* for a line extension, as outlined in the Figure and Table below:

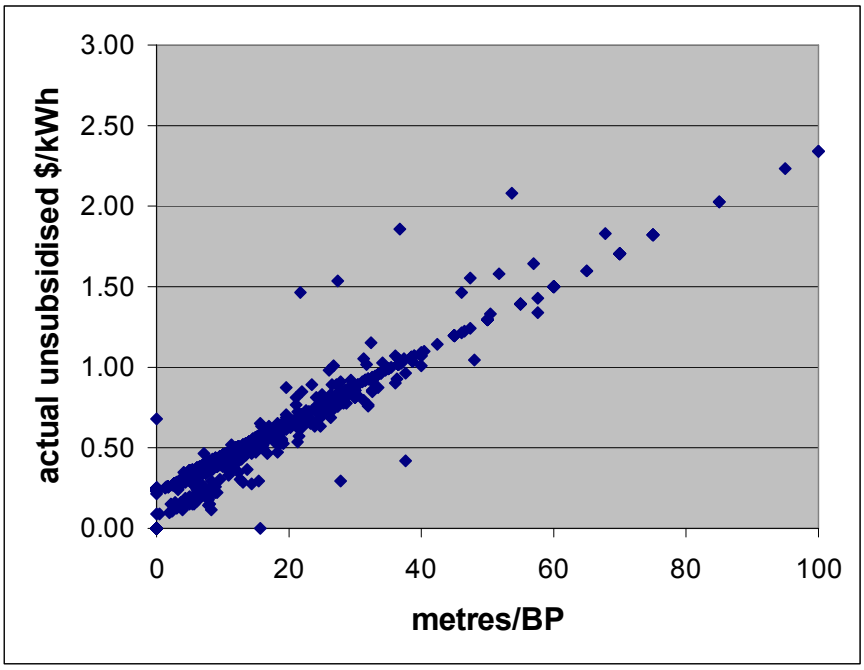

Figure 1: Levelised electricity cost versus metres/BP for the 1,200 grid lines analysed

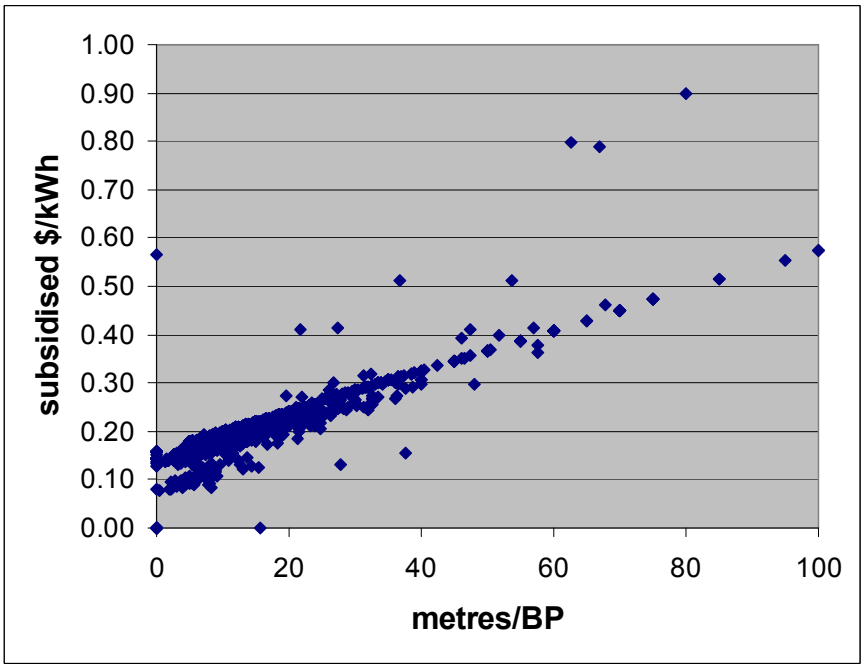

Figure 2: Subsidised electricity cost versus metres/BP for the 1,200 grid lines analysed with REA Subsidy Policy levels

Table 2: Rules of thumb for grid extension viability, using the Benefits Point system (for 33kV lines at USD17,000 per km)

Key parameter: ***(metres of 33kV/BP)***	**Line viability** **(typical)**	**Typical selling price without subsidy** **(USc/kWh)**	**Typical selling required with REA subsidy** **(USc/kWh)**
m/BP < 10	Viable without subsidy	<25c	<15c
10> m/BP > 40	Viable with subsidy	25c - 100c	15c - 30c
40> m/BP > 100	Viable with subsidy and if clustered with other more viable lines	100c – 250c	30c - 50c
m/BP>100	Subsidised tariff similar to diesel mini-grid or stand-alone options. Other alternative technologies to be evaluated.	> 250c	> 60c

3 BENEFIT POINTS ANALYSIS APPLIED TO TECHNOLOGY SELECTION

As alluded to in the table above, the benefits point system can be used to determine the viability of extending the existing network on an incremental basis to a particular load centre, providing a cut-off distance for additional line extensions. These cut-off distances are summarised for key load centres below.

Table 3: Rules of thumb grid extension cut-offs for key identified load centres, versus the next most appropriate technologies, using the Benefits Point system

			Alternative energy supply			Grid extension cut-off using BP method	
		Benefit Point allocated	Preferred Technology	Capex (gen)	Tariff	Tariff parity with alt energy supply	Tariff parity (subsidised) with alt energy supply
Sector	**Load type**			**USD**	**Usc/kWh**	**km**	**km**
Trading centres	TC d	1,200	diesel mini-grid	47,952	77	31	143
	TC c	750		33,167	77	20	89
	TC b	400		22,495	82	11	51
	TC a	200		17,055	99	6.7	30.6
IDP Camps	IDP e	1,200		46,479	79	32	147
	IDP d	750		33,157	83	21	96
	IDP c	500		25,219	89	15	69
	IDP b	300		20,096	95	10	44
	IDP a	150		16,182	120	6	28
Village	Village	100		14,231	130	4.4	20.1
School	Senior Secondary	35	diesel/pv	25000	220	3	12
	Primary	22	pv	5000	220	1.6	7.5
Health	Hospital	200	diesel	41,600	100	7	31
	HC IV	70	diesel/pv	25,000	150	4	16
	HC III	30	pv	15,000	230	2.3	10.7
	HC II	10	pv	5,000	230	0.8	3.6
Mines	Gold mine	4,000	diesel	227,500	40	54	247
	Copper / tantalite	2,000		98,800	40	27	124
	Granite	3,000		98,800	40	41	185
	Sandstone (large)	500		299,000	40	7	31
	Sandstone (small)	500		21,580	40	7	31
Agriculture	Cotton ginnery	2,500	diesel	98,800	40	34	155
	Tea factory	5,000		156,000	40	68	309
	Coffee wet	200		30,160	50	3	15
	Commercial Farm	100		30,160	60	2	9
	Fish processing plant	2,500		70,200	45	38	174
	Fish landing site	100		15,860	100	3	15
Cellphone mast	Cellphone	100	diesel	18,720	100	3.4	15.5
Tourist site	Tourist site	100	diesel/pv	10,000	100	3	15

The method for determining the grid cut-off distance is for unsubsidised breakeven:

1. From Figure 1, above, read off the m/BP equivalent to the cost/kWh for the competing technology. (ie for TC d, read of 77c/kWh = 25m/BP)

2. Grid breakeven distance (m) = BP of the load cluster x metres/BP.

   (ie 26m/BP x 1,200 BP /1000 = 31km)

This method can be used for more complex clusters or groups of loads too, by adding together the BP of all clustered loads, as indicated in the next section.

4 BENEFIT POINTS FOR FUTURE PROJECT IDENTIFICATION

There is a real probability that Districts will identify additional electrification projects as part of the process of decentralisation. This will include possible additional important trading centres that could be either grid or mini-grid electrified.

- A system of 'Benefit Points' developed to provide 'rules of thumb' to determine line ' mini-grid viability
- Benefit Point systems gives relative weighting to each potential electricity consumer based on energy consumption and broader economic benefits

- Provides a simple correlation between energy cost against metres of 33 kV per benefit point
- A suite for forms developed for screening of energy projects by District Engineer / Energy Officer, and for passing local level passing information back to REA
- These forms use detailed analysis of loads within each Trading Centre or settlement rather than using the aggregate figures in the table above.

The following forms are provided

Grid Extension Survey form: for the entire planned line route, detailing the loads en-route and their load survey forms, and the total length and total BP accrued

Major Load Survey form: for major agricultural, mining and industrial loads, showing justification for BP allocation to the major load, which is carried forward to the *Grid Extension Survey Form*

Trading Centre Survey form: for settlements, showing the summation of smaller loads within the settlement and justifying the surveyed BP, rather than the generalised BP for the settlement, which is carried forward to the *Grid Extension Survey Form*.

[4] E.g., Trading Centre, Fish Landing Site, Fish Processing Plant, Cotton Ginnery, Coffee Factory (Wet or Dry) Mine, Hospital etc

GRID EXTENSION SURVEY FORM

District:		**Date:**	
Surveyor:			

Start/End of Proposed Extension	**Place Name**	**Length (km)**
Line Start Point: (UMEME T-off)		
Line Termination Point:		
Spur T-off point:		
Spur End point:		
	Total Line Length:	

Major Loads			
Load Type[4]	**Name**	**Survey form attached (Yes/No)**	**Benefit Points (Assumed or Determined)**

Social Sector Institutions			
Institution type	**Number**	**Benefit Points Allocated**	**Total**
Primary Sch		22	
Secondary Sch (Day)		35	
Secondary Sch (Board)			
Vocational School			
HC2		10	
HC3		30	
HC4		70	

Summary	
Total Benefit Points	
Total Line Length	
Metres/Benefit Point	

MAJOR LOAD SURVEY FORM

1. General Data			
Surveyor:		**Date:**	
District:			
Sub-county:			
Facility Name:			
Is the Facility Operational?	YES/NO		
Primary Activity (e.g., fish processing plant, mine etc):			
Details (i.e., type of mine – gold, cobalt):			

2. GPS Co-ordinates			
Eastings:		**Northings:**	

3. Electrification Status			
Is there UMEME grid?	YES/NO	Is there a diesel generator?	YES/NO
Is the generator for back-up?	YES/NO		
How long does the generator run per day?	hours	What size is the generator?	kVA

Loads to be surveyed and typical power requirements (for guidance)

Sector	Activity	Typical kVA	Typical Benefit Points
Industrial	Heavy Industrial	1,000	4,000
Mining	Gold	500	4,000
	Cobalt	250	2,000
Quarries	Granite	150-300	3,000
	Sand and stone (large)	500-1000	2,000
	Sand and stone (small)	<30	500
	Lime and limestone (quarried and transported elsewhere for beneficiation)	0	0
Agriculture	Cotton ginnery	500	2,500
	Tea factory	500	5,000
	Coffee wet	60	200
	Farm Commercial	150	100
	Fish processing plant	200	2,500
	Fish landing site	10	100

TRADING CENTRE / SETTLEMENT SURVEY FORM

4. General Data			
Surveyor:		**Date:**	
District:			
Sub-county:			
TC Name:			

5. GPS Co-ordinates			
Eastings:		**Northings:**	
Approx Area:	metres x metres		

6. Electrification Status			
Is there UMEME grid?		**Is there a mini-grid?**	

7. Trading Centre Data	**Benefits Point calculation**		
Description	**Number (Qty)**	**Benefit Point Allocation (BP)**	**Total Benefit Points (=Qty x BP)**
District HQ		50	
County HQ		30	
Sub-County HQ		20	
other Gov Offices (large)		15	
Households within settlement footprint		1 x 0.5	
Bakery		7	
Fish Store		7	
Salon		7	
Shops		7	
Bank		30	
Post Office		20	
Fuel		30	
Garage		30	
Battery Charger		10	
Dairy Chillers		40	

Grain Mills		30	
Welding		15	
Coffee Mill (dry)		40	
Wood Workshop		20	
Computer Centre		40	
Video Hall		10	
Bars		7	
Hotel		15	
Restaurant		15	
Police Post		50	
Prison		10	
Radio Station		200	
Cell Phone Mast		100	
Tourist site		100	
Church		10	
Mosque		10	
Primary School		10	
Secondary School (Day)		35	
Secondary School (Boarding)		45	
Health Centre II		10	
Health Centre III		30	
Health Centre IV		70	
		Total Number of Benefit Points	

Notes and Comments