Supplementary Information:

Barriers to handpump serviceability in Malawi: Life-cycle costing for sustainable service delivery

1. Afridev Life-cycle Costs
2. Distribution of Households and tariffs
3. Shortfall in potential financial resources

Jonathan P. Truslove, Andrea B. Coulson, Emma Mbalame and Robert. M Kalin

1. Afridev Life-cycle Costs

Table S1. Life-cycle of Afridev components and estimated costs from suppliers for a borehole of 30m.

Afridev component	No. installed	Life-cycle (Years)		Supplier 1 (MWK)	Supplier 2 (MWK)	Supplier 3 (MWK)	Supplier 4 (MWK)	Supplier 5 (MWK)	Supplier 6 (MWK)	Average Cost (MWK)
		Worst	Best							
Head (Full Assembly – Cover, Case, Bolts, Spout)	1	10	15	N/A	34600	N/A	N/A	44500	69500	49533
Handle Assembly	1	10	15	N/A	N/A	N/A	N/A	36500	42500	39500
Rodhanger Assembly	1	5	8	4946	N/A	N/A	N/A	4650	N/A	4798
Fulcrum Pin Assembly	1	5	8	3935	N/A	N/A	N/A	4250	6950	5045
Fulcrum Pin Bush-Bearings	2	1	2	675	N/A	N/A	N/A	475	450	533
Hanger Pin Assembly	1	5	8	3035	N/A	N/A	N/A	3975	3950	3653
Hanger Pin Bush Bearings	2	1	2	675	N/A	N/A	N/A	475	450	533
Pedestal	1	10	15	N/A	20000	N/A	N/A	N/A	N/A	20000
Rods (3m)	9	3	5	8432	7500	N/A	N/A	11500	9000	9108
Bottom Rod (3m)	1	3	5	N/A	15000	N/A	N/A	N/A	N/A	15000
Rod Centralisers	9	2	3	562	N/A	N/A	N/A	466	450	493
Rising main pipe (3m)	9	3	5	5958	N/A	N/A	N/A	6500	6950	6469
Top Sleeve	1	3	5	675	N/A	N/A	N/A	1200	N/A	937
Flapper	1	3	5	450	N/A	N/A	N/A	1200	N/A	825
Socket (Double End)	8	3	5	N/A	1200	600	N/A	1200	1150	1038
Rising Main Centralisers	8	3	5	675	N/A	N/A	N/A	490	N/A	582

Table S1 (cont.)

Cylinder Assembly	1	5	8	40022	N/A	N/A	N/A	45000	59500	48174
Plunger Body	1	3	5	6970	N/A	N/A	N/A	6800	9500	7757
Cup Seal (U-seal)	1	2	3	337	N/A	N/A	N/A	220	450	336
Plunger Bobbin	1	2	3	337	N/A	N/A	N/A	360	N/A	349
Foot Valve Body	1	3	5	N/A	N/A	N/A	N/A	3200	2950	3075
O-ring	1	2	3	225	N/A	N/A	N/A	110	N/A	167
Foot Valve Bobbin	1	2	3	337	N/A	N/A	N/A	360	N/A	349
Cone Flange	1	10	15	N/A	N/A	N/A	N/A	4500	6950	5725
Compression Cone	1	5	8	1349	N/A	N/A	N/A	3000	2950	2433
Rope	1	10	15	N/A	6500	N/A	N/A	6500	7500	6833
Area Mechanic Contract (Operations)	1	-	-	3373	N/A	N/A	N/A	N/A	N/A	3373
Transport costs (Operations)	1	-	-	1124	N/A	N/A	N/A	N/A	N/A	1124

*where 1USD = 738.64 MWK as of 9th of December 2019.

Table S2. Life-cycle cost of Afridev over 15-year design life

Worst Case						Best Case					
Year	Occurrences	R.R Cost (MWK)	Cumulative R.R Cost (MWK)	T.OpEx Cost (MWK)	Cumulative T.OpEx Cost (MWK)	Year	Occurrences	R.R Cost (MWK)	Cumulative R.R Cost (MWK)	T.OpEx Cost (MWK)	Cumulative T.OpEx Cost (MWK)
1	2	2133	2133	6630	6630	1	0	0	0	0	0
2	7	7603	10064	12100	25359	2	2	2133	2133	6630	6630
3	11	172088	178527	176584	220673	3	5	5471	7603	9967	23226
4	7	7603	186459	12100	428087	4	2	2133	9736	6630	46453
5	7	66236	252695	70733	706234	5	9	169955	179691	174452	244131
6	16	177042	426440	181539	1165920	6	7	7603	187294	12100	453909
7	2	2133	428573	6630	1632235	7	0	0	187294	0	663687
8	7	7603	436504	12100	2110650	8	7	66236	253530	70733	944198
9	11	172088	604967	176584	2765650	9	5	5471	259001	9967	1234676
10	19	181040	786335	185536	3606186	10	11	172088	431088	176584	1701739
11	2	2133	788468	6630	4453352	11	0	0	431088	0	2168802
12	16	177042	962213	181539	5482056	12	7	7603	438692	12100	2647965
13	2	2133	964346	6630	6517390	13	0	0	438692	0	3127127
14	7	7603	972277	12100	7564824	14	2	2133	440824	6630	3612920
15	16	233116	1201768	237613	8849871	15	21	285443	726267	289940	4388651

*Where R.R = Recommended Repairs and T.OpEx = Total Operations Expenditure.

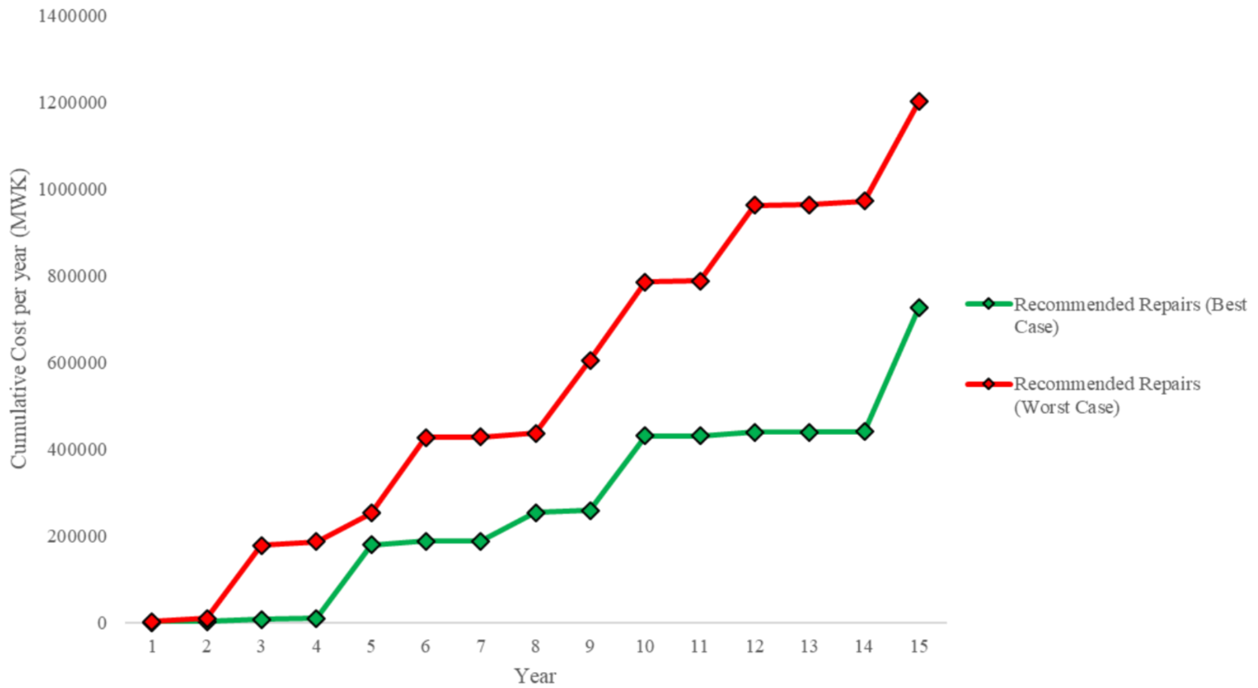

Figure S1. Recommended Repairs cumulative costs (MWK)

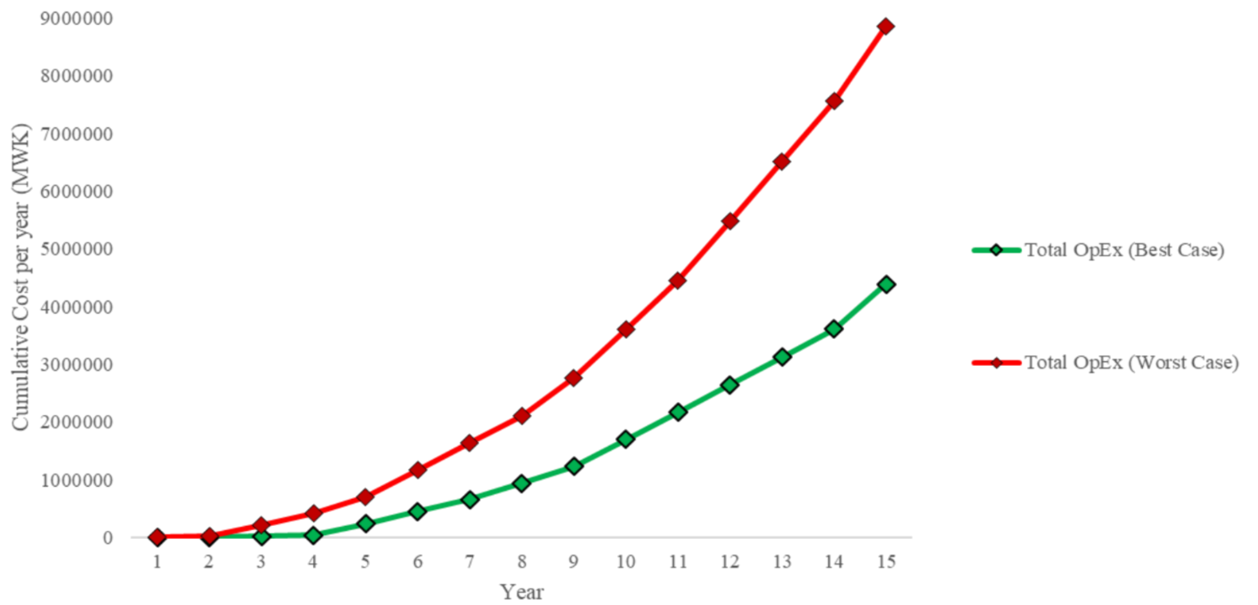

Figure S2. Total Operations Expenditure (T.OpEx) cumulative costs (MWK)

2. Distribution of Households and tariffs

Tariffs are the primary financial mechanism to finance the necessary O&M for rural water points in the form of household contributions or user fees (United Nations, 2018). The potential financial resources available to a service provider can determined by the tariff amount, the frequency of collection and the number of contributing households. Table S3 describes the groupings of user and tariff amount. Figure S3 presents the distribution of potentially contributing households and the grouping of tariff amounts with respect to the tariff collection frequency scenarios.

Table S3. User and tariff amount grouping

Value	No. of Users Group	No. of Households Group	No. of Tariffs (MWK)
1	>0 & <= 75	15	<=100
2	>75 & <=150	30	>100 & <=200
3	>150 & <=225	45	>200 & <=300
4	>225 & <=300	60	>300 & <=400
5	>300 & <=375	75	>400 & <=500
6	>375 & <=450	90	>500 & <=600
7	>450 & <=525	105	>600 & <=700
8	>525 & <=600	120	>700 & <=800
9	>600	>120	>800 & <=900
10	-	-	>900 & <=1000
11	-	-	>1000 & <=2000
12	-	-	>2000

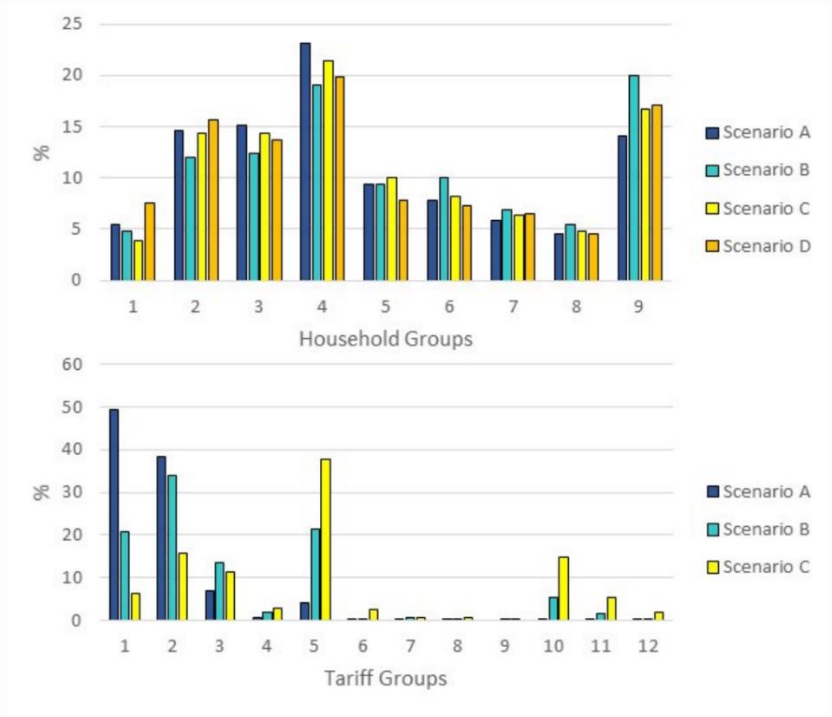

Figure S3. Household groups (above) and tariff groups (below) by tariff collection scenarios

The trend of household groups is consistent across all four scenarios. User groupings primarily fall within the design limit, with the largest distribution in group 4 (approximately 60 households). The distribution sharply declines following this group with a notable increase in the final group in all scenarios (above 120 households). As households commonly obtain water from multiple sources, it is possible that these water points are considered secondary sources. Hence the large proportion of cases in the final grouping (greater than double the Afridev design limit of 120 households). Households utilising multiple water points may not financially contribute to all water points. Therefore, usage above the design limit of the Afridev may not receive tariffs from all recorded households, impacting the potential financial resources available for O&M.

When concerning the tariff amount the distribution of the scenarios is more pronounced, primarily falling in groups 1-5 and 10-12. Firstly, scenario A primarily falls within the first two tariff groups with significantly low occurrences above group 5 (approximately 500 MWK). This is to be expected due to the frequent collection of tariffs, thus important for the tariff to be an affordable amount when collected per month. Scenario B similarly falls within 500 MWK. The larger distribution of tariffs compared to Scenario A could be attributed to the variations of costs associated with each repair, and therefore higher tariffs may be considered for more costly repairs as the Afridev ages. Scenario C expresses primarily falls within group 5 (approximately 500MWK) due to the infrequency of the collection period when compared to scenario A. However, financial resources per annum would significantly differ between the scenarios to meet the required O&M costs during the life-cycle of the Afridev handpump. Finally, scenario D presents cases where no tariff has set by the service provider. Table S4 presents the reported explanations why no tariff has been set.

Table S4. Reasons why no tariff is set (Scenario D)

Variable	n	%
External Support	642	18.09
Lack of training	1313	37.00
Lack of understanding	20	0.56
Enough money or other forms of community fundraising	313	8.82
Reluctance to pay	299	8.42
Non-functional/Unreliable water point	128	3.61
Lack of coordination/Negligence	172	4.85
Perception water is free	67	1.89
Poor water quality	26	0.73
New water point or have yet to experience breakdown	167	4.71
Ask community for contributions when needs arises	376	10.59
Other	26	0.73

Lack of training for the service provider is the most common reported reason why no tariff is set in the rural areas (37%). Other variables in Table 2 can also be associated with lack of training such as lack of understanding (0.56%), lack of coordination/negligence (4.85%), new water point or have yet to experience breakdown (4.71%) and ask community for contributions when needs arise (10.59%). Other forms of financing have also been reported. External support from institutions, local government or NGOs attributes to 18.09% of cases, however there may be a perception that the responsibility falls with someone else (RWSN Executive Steering Committee, 2010; Koehler *et al.*, 2018) resulting in a lack of financing and O&M. Enough money or other forms of community fundraising attributes to 8.82% of cases which raises the question if this is sufficient for O&M across the life-cycle of infrastructure. It is well recognised throughout studies that external support and continued training of service provision is essential to the continued service delivery of the water supply at the community level (Harvey and Reed, 2006; Whittington *et al.*, 2009; RWSN Executive Steering Committee, 2010; Foster, 2013). These variables of poor capacity building at the local level further highlight the inappropriateness of the standardised CBM model for rural water supply.

The willingness to pay by community members is well-recognised factor in rural water supply. While this can affect scenarios with an established tariff, in the case of Scenario D the willingness to pay can potentially be attributed to the collapse of a financial mechanism. In Table S2 this can be attributed to two areas: the condition of the water point (Non-functional/Unreliable (3.61%) and poor water quality (0.73%)) and socio-cultural characteristics (perception water is free (1.89%) and Reluctance to pay (8.42%)).

Firstly, the non-functional/unreliable indicates the water point is not producing water as is intended. While it is possible that the lack of understanding financial mechanism have for the continued service delivery of assets may be a contributing factor, poor construction or improper siting of water points contribute to premature failure. The poor water quality variable highlights this as saline water was the most common of the cases.

Secondly, the perception of water and the quality of service provision contributes to the premature failure of water points and management. The cases of reluctance to pay are attributed to poverty and inability to pay in the communities. It is also attributed to a mistrust in the service provider or from previous interference with the collected financial resources. Previous studies have also supported these findings in willingness to pay (van den Broek and Brown, 2015), reinforcing the understanding that CBM is has reached its limit as an appropriate method for service delivery.

It is clear infrastructure and management requires continued support and monitoring to ensure sustainable services at the local level (RWSN Executive Steering Committee, 2010; Carter and Ross, 2016). The reasons behind why no tariffs are in place are useful narratives when understanding and supporting the wider local contexts, which has been absent from traditional CBM approaches.

3. Shortfall in potential financial resources

The potential annual financial resources under each scenario for O&M was calculated using the following matrix:

$$\begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m1} & a_{m2} & \cdots & a_{mn} \end{bmatrix} = A_{ij}$$

Where, a = Potential financial resources (MWK), m = Set tariff group (MWK), n = No. of potentially contributing households' group. The household and tariff amounts are presented in Table S3.

Table S5. Household and tariff amount grouping

Value	m (MWK)	n (households)
1	<=100	15
2	>100 & <=200	30
3	>200 & <=300	45
4	>300 & <=400	60
5	>400 & <=500	75
6	>500 & <=600	90
7	>600 & <=700	105
8	>700 & <=800	120
9	>800 & <=900	-
10	>900 & <=1000	-
11	>1000 & <=2000	-

The model was run for a low, medium and high value in each of the tariff groups (i.e. for group >100 and <=200 MWK, the values 101MWK (low), 150MWK (medium) and 200MWK (high) were applied). The potential financial resources across the 15 year period were determined using the following steps:

$$\begin{gathered} Step\ 1 = y_1 = (cA)_{ij} \\ Step\ 2 = y_2 = y_1 + (cA)_{ij} \\ \vdots \\ Step\ n = y_{n+1} = y_n + (cA)_{ij} \end{gathered}$$

Where, y_n = Year n of the life-cycle, A = Potential Financial Resources Matrix, i = Set tariff (MWK), j = No. of potentially contributing households and c =Frequency of Tariff based on the designated scenario (scalar) specified as: Scenario A multiplying the matrix by 12; Scenario B was determined based on the results of the life-cycle model. If a component was replaced in a given year in the Afridev life-cycle then the matrix is applied; Scenario C required no scalar; Scenario D was omitted as no other financial information was available.

The annualised potential financial resources for each scenario were weighed against the cumulative costs of the Afridev across the 15 year design life for best and worst case R.R. and T.OpEx models, outlined in section 1. The minimum, average and maximum year of potential shortfall was determined for each scenario. This is presented in the following tables and figures.

Table S6. Scenario A – Recommended Repairs (R.R) projected year of shortfall

Household Group	Year of Shortfall	Tariff Group 1	2	3	4	5	6	7	8	9	10	11
1	Min	1	3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	Avg	3	5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	Max	5	10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
2	Min	1	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	Avg	4	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	Max	10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
3	Min	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	Avg	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	Max	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
4	Min	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	Avg	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	Max	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
5	Min	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	Avg	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	Max	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
6	Min	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	Avg	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	Max	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
7	Min	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	Avg	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	Max	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
8	Min	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	Avg	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	Max	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

* Where #N/A represents no shortfall within the 15 year design life of the Afridev

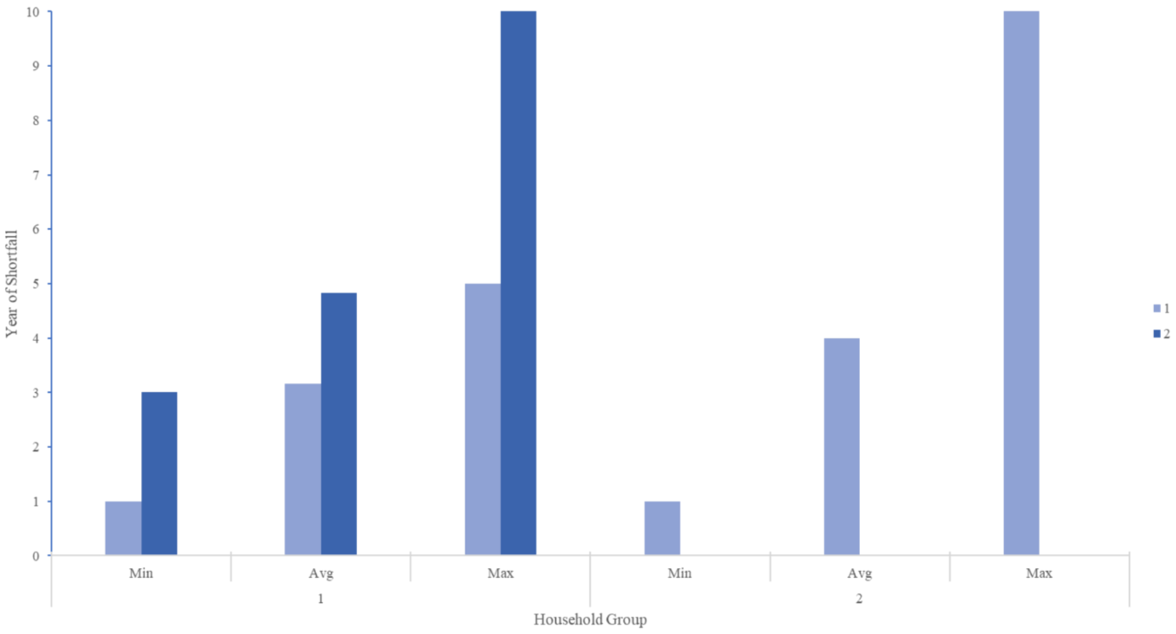

Figure S4. Scenario A – R.R forecasted year of shortfall

Table S7. Scenario A – Total Operations Expenditure (T.OpEx) projected shortfall

Household Group	Year of Shortfall	Tariff Group										
		1	2	3	4	5	6	7	8	9	10	11
1	Min	1	3	3	3	3	4	5	5	6	6	#N/A
	Avg	3	4	4	5	5	6	7	7	8	8	#N/A
	Max	5	5	6	6	7	8	9	10	10	11	#N/A
2	Min	1	3	3	5	6	6	7	8	#N/A	#N/A	#N/A
	Avg	3	4	6	7	8	9	10	12	#N/A	#N/A	#N/A
	Max	5	6	8	10	11	12	14	15	#N/A	#N/A	#N/A
3	Min	1	3	5	6	7	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	Avg	3	6	7	9	11	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	Max	6	8	10	12	15	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
4	Min	1	3	6	7	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	Avg	3	6	9	11	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	Max	6	10	12	15	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
5	Min	1	4	6	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	Avg	4	7	10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	Max	7	11	15	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
6	Min	1	5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	Avg	4	8	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	Max	8	12	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
7	Min	1	5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	Avg	4	9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	Max	9	14	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
8	Min	1	6	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	Avg	5	10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	Max	10	15	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

* Where #N/A represents no shortfall within the 15 year design life of the Afridev

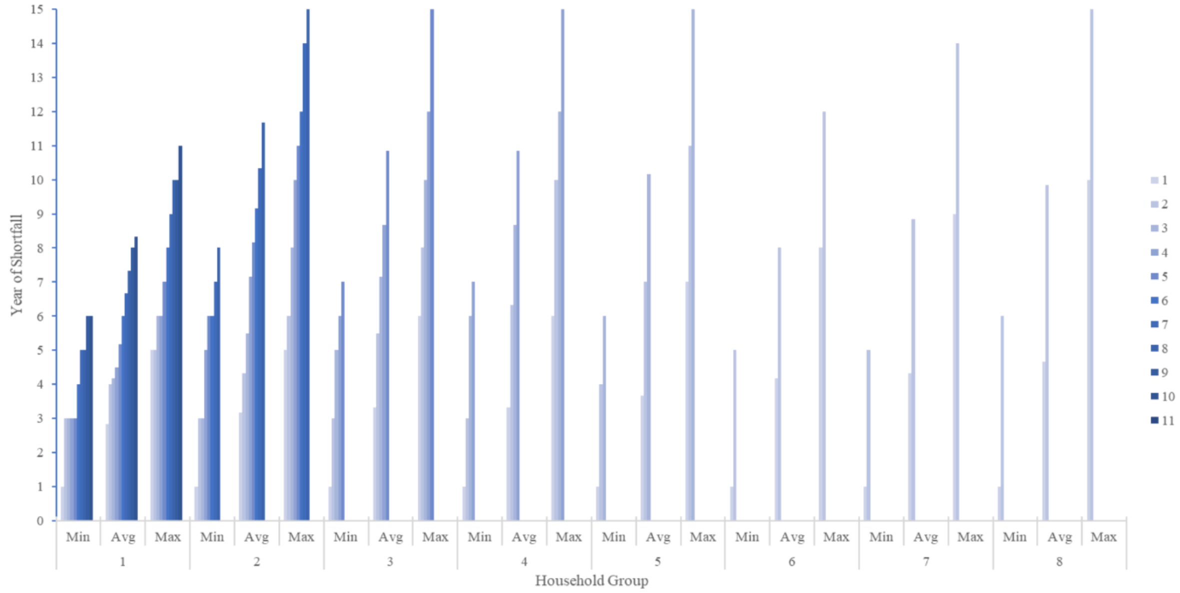

Figure S5. Scenario A – T.OpEx forecasted year of shortfall

Table S8. Scenario B – Recommended Repairs (R.R) projected shortfall

Household Group	Year of Shortfall	Tariff Group 1	2	3	4	5	6	7	8	9	10	11
	Min	1	1	2	2	2	2	2	3	3	3	3
1	Avg	2	2	3	3	3	3	4	4	4	4	4
	Max	2	3	3	3	3	4	5	5	5	5	5
	Min	1	2	2	2	3	3	3	3	3	3	3
2	Avg	2	3	3	4	4	4	4	4	4	4	4
	Max	3	3	4	5	5	5	5	5	5	5	5
	Min	1	2	2	3	3	3	3	3	3	3	3
3	Avg	2	3	4	4	4	4	4	4	4	4	4
	Max	3	4	5	5	5	5	5	5	5	5	5
	Min	1	2	3	3	3	3	3	3	3	3	3
4	Avg	2	3	4	4	4	4	4	4	4	4	4
	Max	3	5	5	5	5	5	5	5	5	5	5
	Min	1	2	3	3	3	3	3	3	3	3	3
5	Avg	2	4	4	4	4	4	4	4	4	4	4
	Max	3	5	5	5	5	5	5	5	5	5	5
	Min	1	2	3	3	3	3	3	3	3	3	3
6	Avg	2	4	4	4	4	4	4	4	4	4	4
	Max	4	5	5	5	5	5	5	5	5	5	6
	Min	1	3	3	3	3	3	3	3	3	3	3
7	Avg	3	4	4	4	4	4	4	4	4	4	5
	Max	5	5	5	5	5	5	5	5	5	5	7
	Min	1	3	3	3	3	3	3	3	3	3	3
8	Avg	3	4	4	4	4	4	4	4	4	4	5
	Max	5	5	5	5	5	5	5	5	5	5	7

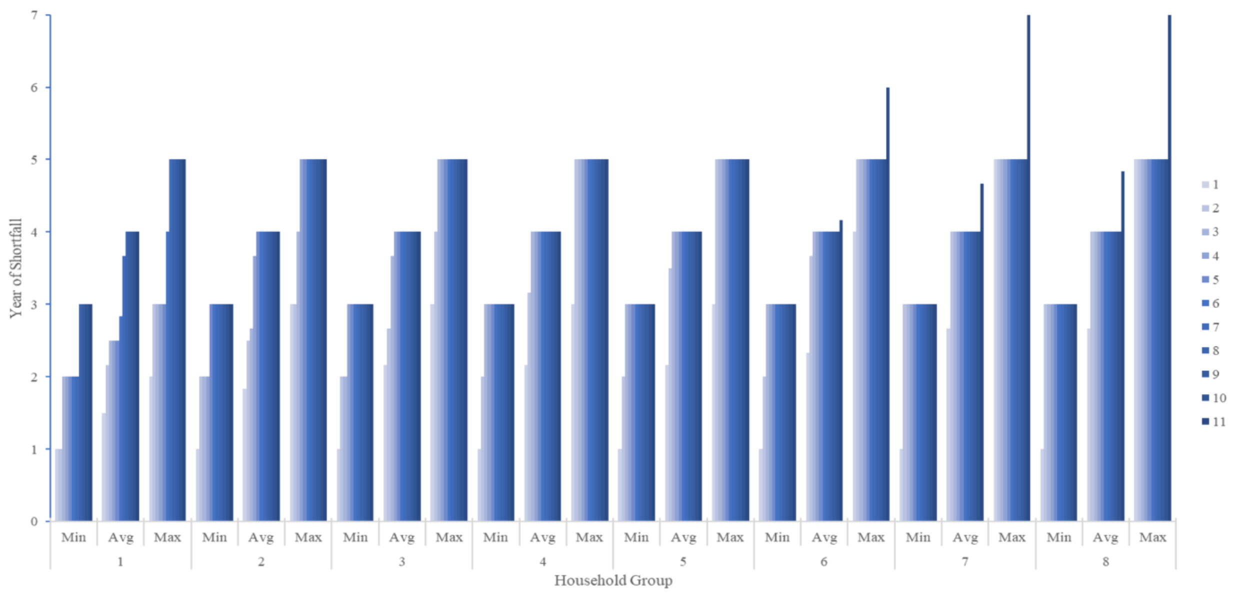

Figure S6. Scenario B – R.R forecasted year of shortfall

Table S9. Scenario B – Total Operations Expenditure (T.OpEx) projected shortfall

Household Group	Year of Shortfall	Tariff Group 1	2	3	4	5	6	7	8	9	10	11
1	Min	1	1	1	1	1	2	2	2	2	2	2
	Avg	2	2	2	2	2	3	3	3	3	3	3
	Max	2	2	2	2	3	3	3	3	3	3	4
2	Min	1	1	1	2	2	2	2	2	2	3	3
	Avg	2	2	2	3	3	3	3	3	3	4	4
	Max	2	2	3	3	3	3	3	4	4	4	5
3	Min	1	1	2	2	2	2	3	3	3	3	3
	Avg	2	2	3	3	3	3	4	4	4	4	4
	Max	2	3	3	3	3	4	4	4	4	4	5
4	Min	1	1	2	2	2	3	3	3	3	3	3
	Avg	2	2	3	3	3	4	4	4	4	4	4
	Max	2	3	3	4	4	4	4	5	5	5	5
5	Min	1	2	2	2	3	3	3	3	3	3	3
	Avg	2	3	3	3	4	4	4	4	4	4	4
	Max	3	3	3	4	4	4	5	5	5	5	5
6	Min	1	2	2	3	3	3	3	3	3	3	3
	Avg	2	3	3	4	4	4	4	4	4	4	4
	Max	3	3	4	4	4	5	5	5	5	5	5
7	Min	1	2	2	3	3	3	3	3	3	3	3
	Avg	2	3	3	4	4	4	4	4	4	4	4
	Max	3	3	4	4	5	5	5	5	5	5	5
8	Min	1	2	2	3	3	3	3	3	3	3	3
	Avg	2	3	3	4	4	4	4	4	4	4	4
	Max	3	4	4	5	5	5	5	5	5	5	5

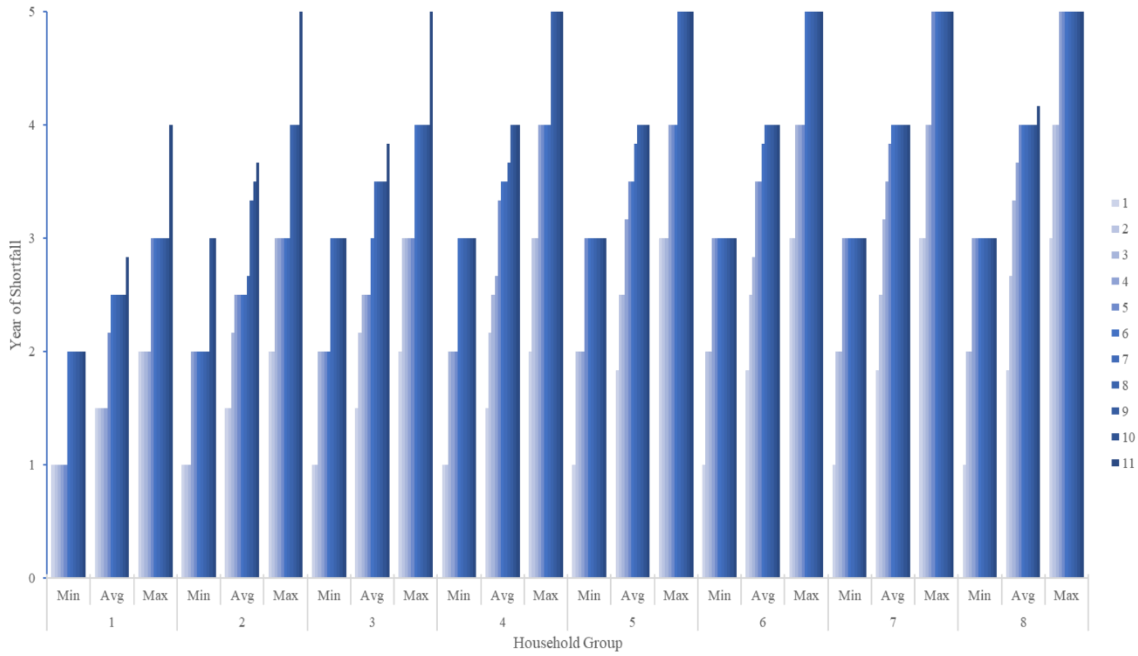

Figure S7. Scenario B – T.OpEx forecasted year of shortfall

Table S10. Scenario C – Recommended Repairs (R.R) projected shortfall

Household Group	Year of Shortfall	Tariff Group										
		1	2	3	4	5	6	7	8	9	10	11
1	Min	1	1	2	2	3	3	3	3	3	3	3
	Avg	2	3	4	4	4	4	4	4	4	4	4
	Max	3	5	5	5	5	5	5	5	5	5	5
2	Min	1	2	3	3	3	3	3	3	3	3	#N/A
	Avg	2	4	4	4	4	4	4	4	4	4	#N/A
	Max	5	5	5	5	5	5	5	5	5	5	#N/A
3	Min	1	2	3	3	3	3	3	3	3	3	#N/A
	Avg	3	4	4	4	4	4	4	5	7	7	#N/A
	Max	5	5	5	5	5	5	5	10	10	15	#N/A
4	Min	1	3	3	3	3	3	3	3	#N/A	#N/A	#N/A
	Avg	3	4	4	4	4	5	7	8	#N/A	#N/A	#N/A
	Max	5	5	5	5	5	10	10	15	#N/A	#N/A	#N/A
5	Min	1	3	3	3	3	3	#N/A	#N/A	#N/A	#N/A	#N/A
	Avg	3	4	4	4	5	7	#N/A	#N/A	#N/A	#N/A	#N/A
	Max	5	5	5	5	10	15	#N/A	#N/A	#N/A	#N/A	#N/A
6	Min	1	3	3	3	3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	Avg	3	4	4	5	7	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	Max	5	5	5	10	15	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
7	Min	1	3	3	3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	Avg	3	4	4	6	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	Max	5	5	5	10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
8	Min	1	3	3	3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	Avg	3	4	5	7	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	Max	5	5	10	15	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

* Where #N/A represents no shortfall within the 15 year design life of the Afridev

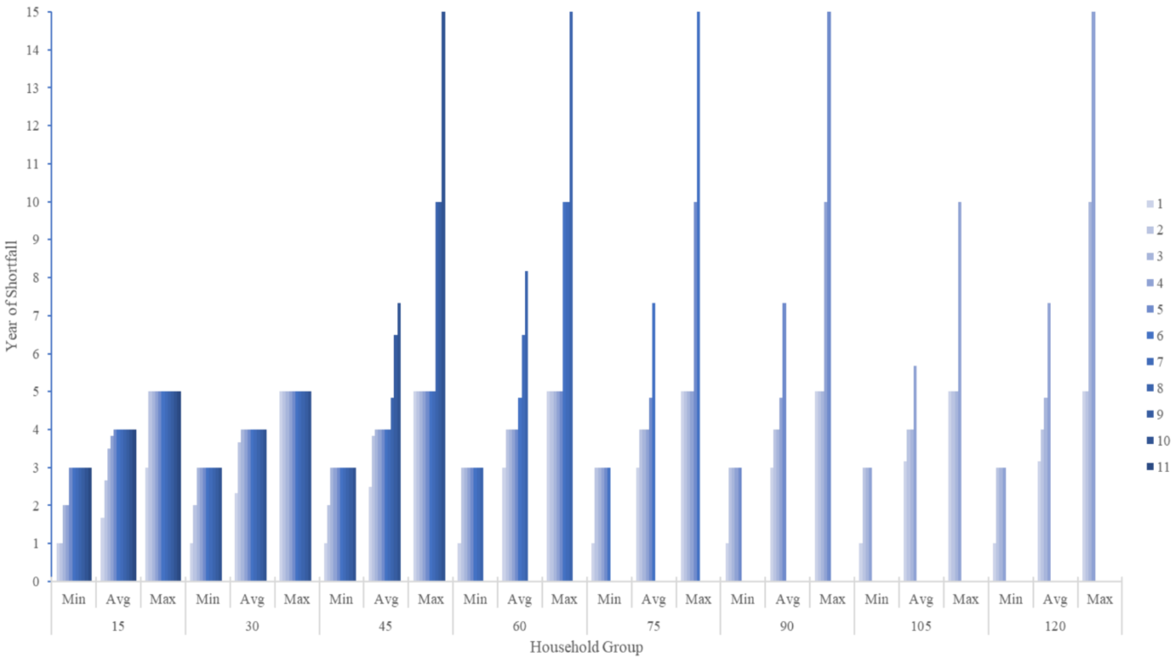

Figure S8. Scenario C – R.R forecasted year of shortfall

Table S11. Scenario C – Total Operations Expenditure (T.OpEx) projected shortfall

Household Group	Year of Shortfall	Tariff Group 1	2	3	4	5	6	7	8	9	10	11
1	Min	1	1	1	1	1	2	2	2	2	3	3
	Avg	2	2	2	2	2	3	3	3	4	4	4
	Max	2	2	3	3	3	4	4	5	5	5	5
2	Min	1	1	1	2	2	3	3	3	3	3	3
	Avg	2	2	3	3	4	4	4	4	4	4	4
	Max	2	3	4	5	5	5	5	5	5	5	6
3	Min	1	1	2	3	3	3	3	3	3	3	3
	Avg	2	3	3	4	4	4	4	4	4	4	5
	Max	3	4	5	5	5	5	5	5	5	5	7
4	Min	1	1	2	3	3	3	3	3	3	3	3
	Avg	2	3	4	4	4	4	4	4	4	5	6
	Max	3	5	5	5	5	5	5	5	6	6	9
5	Min	1	2	3	3	3	3	3	3	3	3	4
	Avg	2	3	4	4	4	4	4	5	5	5	7
	Max	3	5	5	5	5	5	6	6	6	6	10
6	Min	1	2	3	3	3	3	3	3	3	4	4
	Avg	2	4	4	4	4	4	5	5	5	6	7
	Max	4	5	5	5	5	6	6	6	7	7	11
7	Min	1	2	3	3	3	3	3	4	4	4	4
	Avg	2	4	4	4	4	5	5	5	6	6	8
	Max	4	5	5	5	6	6	6	7	7	8	12
8	Min	1	2	3	3	3	3	3	4	4	5	5
	Avg	2	4	4	4	4	5	5	6	6	7	9
	Max	5	5	5	5	6	6	7	8	8	9	13

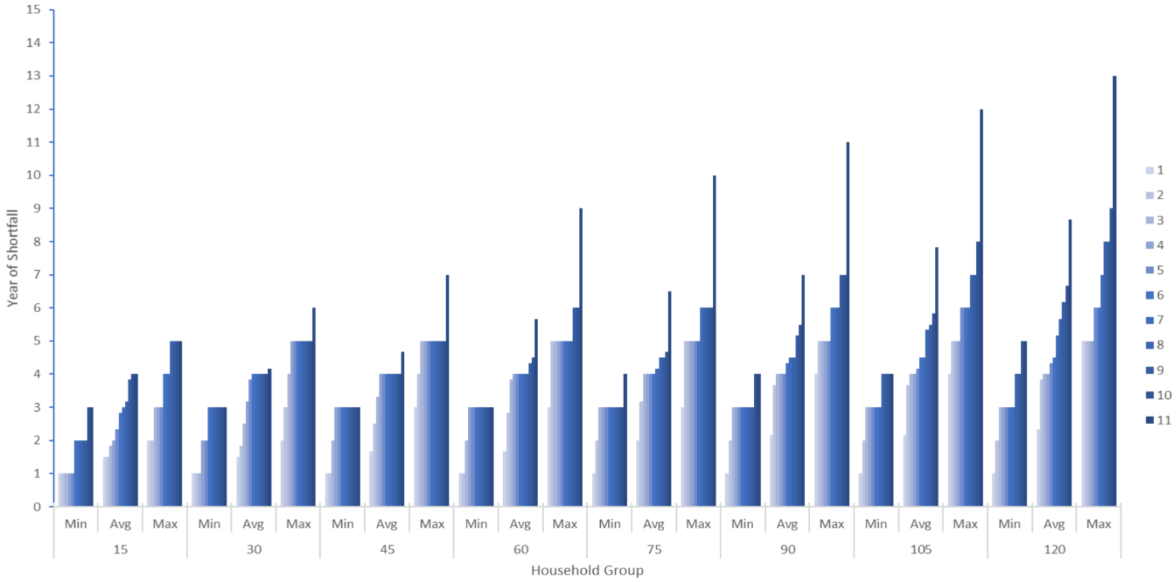

Figure S9. Scenario C – T.OpEx forecasted year of shortfall

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