Disbursing Emergency Relief through Utilities: Evidence from Ghana

On-line Appendix

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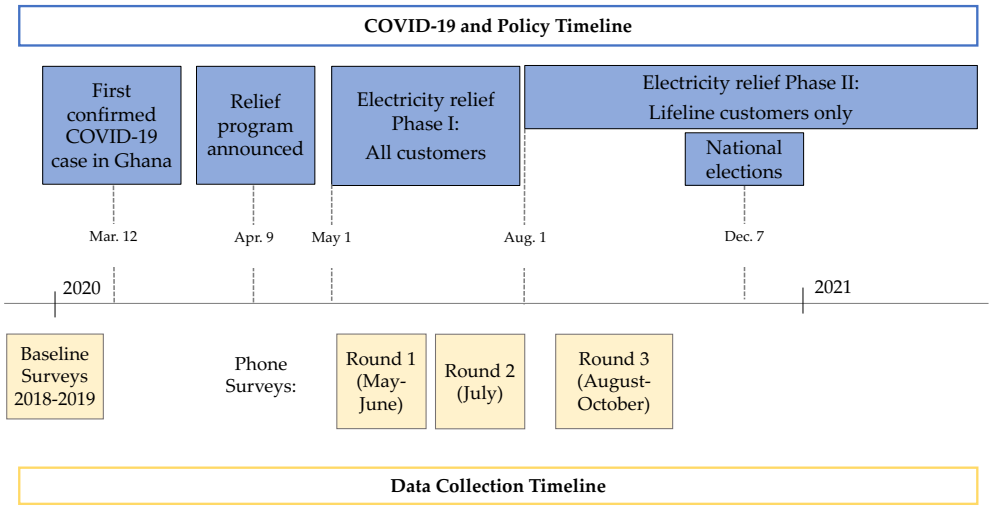
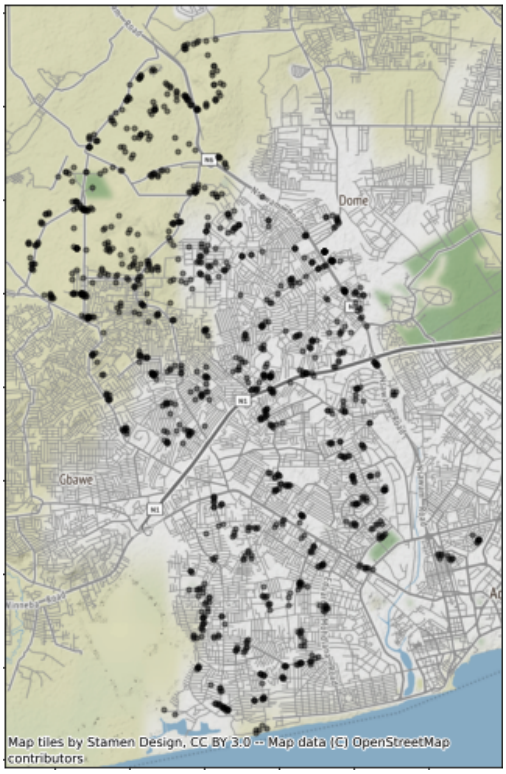
Appendix A: Additional Figures

Figure A1: Timeline of policy programs and surveying activities



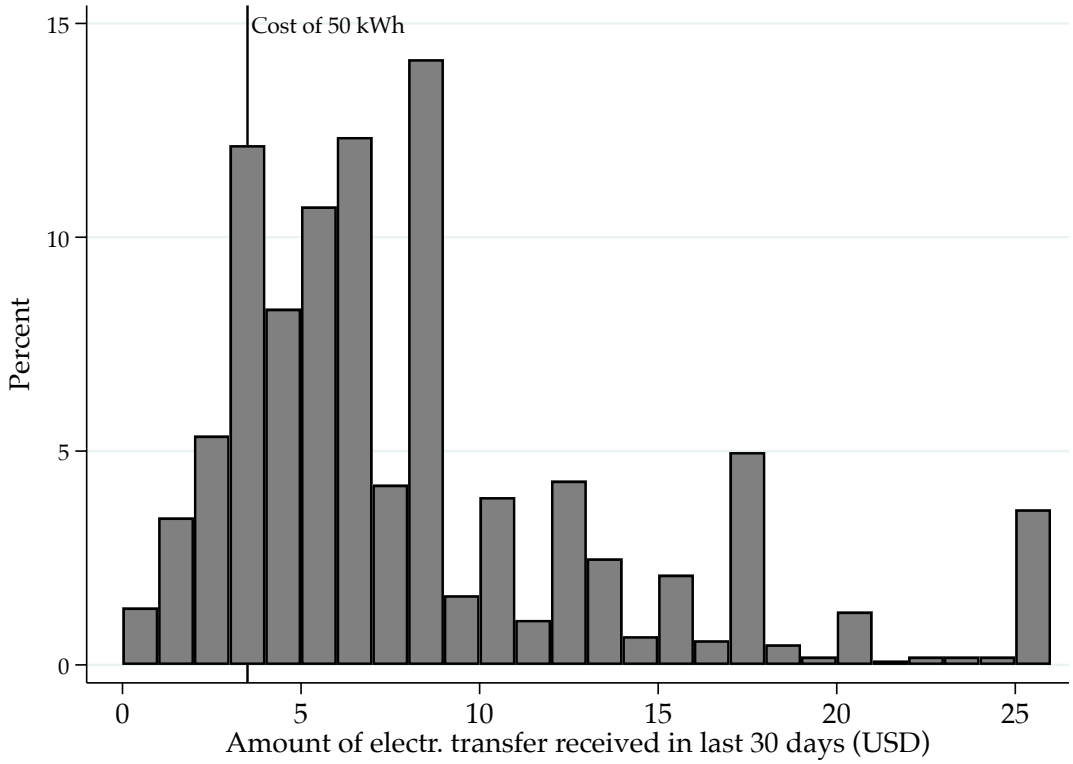
Timeline of the starts and endings of electricity relief program phases and the rounds of survey data collection.

Figure A2: Distribution of respondents across Accra, Ghana



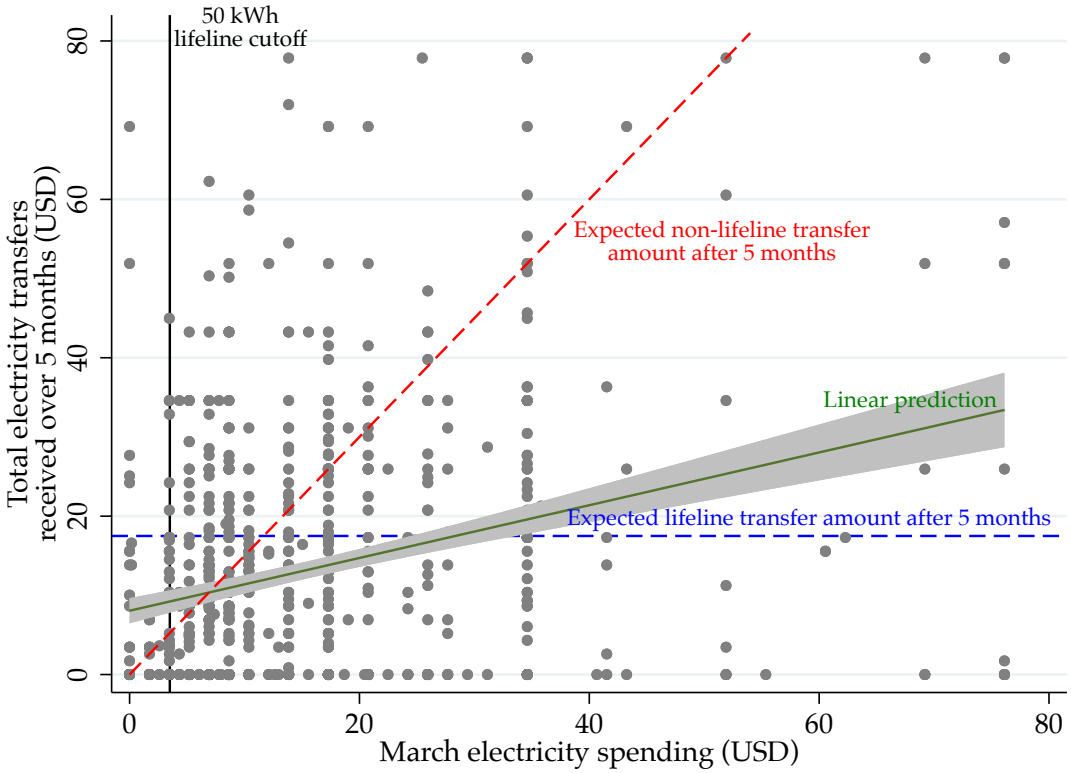
The location of respondents at the time of initial enrollment (June 2018 - March 2019).

Figure A3: Histogram of monthly electricity transfer amounts, excluding non-recipients



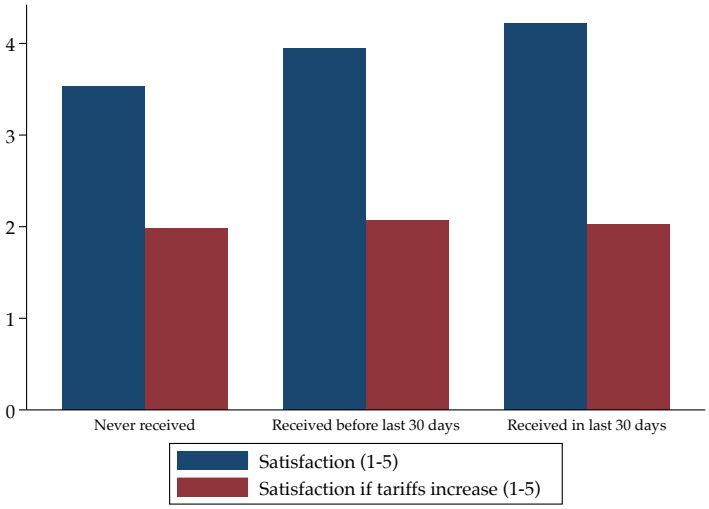
Data are pooled across all rounds. Though 31.4% of respondents had not received any transfers by the third round of surveys in September-October, across all rounds 66.1% of respondents report not receiving any transfer in the last 30 days. These 0 values are omitted from the figure to better observe the rest of the distribution. The last bin aggregates all observations above 26 USD. The vertical bar indicates the cost of 50 kWh, which is the intended monthly transfer amount for all lifeline households.

Figure A4: Actual and expected total electricity transfers received over 5 months of relief program, by baseline electricity spending



Data show the distribution of respondent reports of total transfers received as of the last survey, 5 months from the first disbursements. The black line indicates the cutoff for lifeline status. Expected transfer for lifeline households is five times the cost of 50 kWh, the lifeline monthly transfer amount. Expected transfer amount for non-lifeline households is three times half of March electricity spending, reflecting their 50% transfer. The green line and shading represents a linear prediction of total electricity transfers by baseline spending (95% CI).

Figure A5: Electricity relief program satisfaction, by transfer receipt



Satisfaction is rated from 1 (very unsatisfied) to 5 (very satisfied). Respondents are first asked their satisfaction with the current program, and then their satisfaction if the utility has to increase electricity future tariffs to fund it.

Appendix B: Additional Tables

Table A1: Comparison of 2020 Covid Survey households to Greater Accra Area households

	2020 Covid Survey	2010 Census	2015 Labor Force Survey	2017 GLSS	2017 GLSS
Respondent* is male	0.70	-	0.63	0.67	0.67
	(0.46)	-	(0.48)	(0.47)	(0.47)
Respondent* age	29.14	-	40.46	45.39	45.17
	(9.00)	-	(14.63)	(14.43)	(15.54
Household size	4.05	3.69	2.58	3.46	3.88
	(2.68)	-	(1.74)	(2.11)	(2.69)
Of which adults	2.78	-	1.69	2.11	2.14
	(1.75)	-	(0.95)	(1.20)	(1.30)
Of which children (<18)	1.26	-	0.89	1.34	1.75
	(1.60)	-	(1.22)	(1.48)	(1.89)
Phones in household	2.47	2.83	-	3.02	2.45
	(1.47)	-		(1.88)	(1.89)
Grid connection? (=1)	1.00	0.94	0.97	0.94	0.81
	-	-	(0.17)	(0.23)	(0.39)
Has a generator (=1)	0.04	0.01	0.07	0.02	0.01
	(0.19)	-	(0.25)	(0.15)	(0.08)
Has a TV (=1)	0.94	-	0.85	-	-
	(0.24)	-	(0.36)	-	-
Households	1,245	450,749	728	1,271	14,009
Sample	Accra West utility customers	Accra Metro Area households	Greater Accra urban households	Greater Accra urban households	All Ghana households

The 2020 Covid Survey survey is drawn entirely from urban households in three Accra West electricity districts in Accra Metropolitan Area. Summary statistics for the 2010 Census are for all households in the Accra Metropolitan Area. Summary statistics for the 2015 Labor Force Survey and 2017 GLSS are for urban households in the Greater Accra Region, which includes the Accra Metropolitan Area and surrounding districts. Both of these surveys are designed to be representative at the region level and by urban/rural location. For comparison, we also include summary statistics for all households in Ghana from the 2017 GLSS. Survey weights are applied to generate representative estimates. Data from the Census, LFS, GLSS, are provided by the Ghana Statistical Service.

*The respondent for the 2020 Covid survey may be an adult other than the head of household, as long as they are able to answer questions about the household's electricity use and expenditure and about household consumption. The survey does not separately ask about the characteristics of the head of household, or other adults in these households. For the Labor Force Survey and GLSS, we present data on the head of household for comparison.

Table A2: Summary statistics, pooled across rounds

	Mean	SD	Min	25^{th}	50^{th}	75^{th}	Max	N
Household characteristics								
Number of adults (>=18)	2.79	1.76	1.0	2.0	2.0	4.0	11.0	1245
Number of children (<18)	1.27	1.61	0.0	0.0	1.0	2.0	9.0	1245
Respondent age	29.13	9.00	18.0	22.0	27.0	34.0	65.0	1245
Respondent is male (=1)	0.71	0.46	0.0	0.0	1.0	1.0	1.0	1245
Household-Firm during GW deployment	0.02	0.15	0.0	0.0	0.0	0.0	1.0	1243
Do you have a generator in working condition?	0.04	0.19	0.0	0.0	0.0	0.0	1.0	1245
Sum of appliance types held	7.37	2.93	0.0	5.0	7.0	9.0	24.0	1245
Household in same location in round 3 as in round 1	0.96	0.20	0.0	1.0	1.0	1.0	1.0	1131
HH total spending per capita in past 7 days (USD)	159.30	585.43	0.2	16.7	27.7	59.7	8857.6	3339
HH food spending per capita in past 7 days (USD)	8.97	8.47	0.0	4.2	6.9	11.5	121.1	3323
Any loans last 12 months (=1)	0.51	0.50	0.0	0.0	1.0	1.0	1.0	768
Any formal loans last 12 months (=1)	0.09	0.28	0.0	0.0	0.0	0.0	1.0	768
Electricity connection and use								
Shares meter with other users	0.46	0.50	0.0	0.0	0.0	1.0	1.0	1130
Count of meter users, including respondent	2.19	1.79	0.0	1.0	1.0	3.0	15.0	1130
Pays landlord/other household for electricity	0.26	0.44	0.0	0.0	0.0	1.0	1.0	1245
Days since last paid landlord for electricity	16.36	19.87	0.0	6.0	12.0	21.0	210.0	808
Amount of last landlord payment for electricity (USD)	5.07	3.88	0.0	3.5	3.5	6.9	34.6	816
Prepaid meter	0.91	0.28	0.0	1.0	1.0	1.0	1.0	1245
Current balance on prepaid meter (USD)	5.74	8.17	0.0	1.0	3.3	6.9	51.9	1116
Number of prepaid meter topups in last 30 days	1.85	1.34	0.0	1.0	2.0	2.0	9.0	2305
Average topup amount in last 30 days (USD)	10.31	15.16	0.0	4.3	8.6	10.4	519.0	2307
Number of days between prepaid meter topups in February	20.92	21.80	0.0	14.0	15.0	30.0	300.0	2126
Electricity spending in past month (USD)	12.72	12.28	0.0	5.2	8.6	17.3	69.2	3247
Electricity spending in March (USD)	15.80	15.64	0.0	6.9	10.4	17.3	207.6	1125
Lifeline customer according to March spending	0.13	0.33	0.0	0.0	0.0	0.0	1.0	1112
Government perceptions								
Overall Govt/NPP support (1-5)	3.64	0.93	1.0	3.0	4.0	4.0	5.0	3339
Trust govt to care for citizens (1-5)	3.60	1.12	1.0	3.0	4.0	4.0	5.0	3339
NPP addressing Dumsor (1-5)	4.12	0.82	1.0	4.0	4.0	5.0	5.0	3285
Relative party Dumsor performance (1-5)	4.05	0.94	1.0	4.0	4.0	5.0	5.0	3049
NPP addressing Covid (1-5)	4.06	0.87	1.0	4.0	4.0	5.0	5.0	3285
Electricity relief experience								
Aware of electricity relief program (=1)	0.97	0.16	0.0	1.0	1.0	1.0	1.0	1244
Satisfied with electricity relief program (=1)	0.91	0.29	0.0	1.0	1.0	1.0	1.0	2174
Received electricity relief by time of round 1 interview	0.47	0.50	0.0	0.0	0.0	1.0	1.0	3152
Received electricity relief by time of round 3 interview	0.69	0.46	0.0	0.0	1.0	1.0	1.0	3152
Ever received electricity relief	0.59	0.49	0.0	0.0	1.0	1.0	1.0	3339
Received electricity relief in last 30 days	0.35	0.48	0.0	0.0	0.0	1.0	1.0	3323
Amount of electr. transfer received in last 30 days (USD)	3.03	7.10	0.0	0.0	0.0	4.3	173.2	3081
Amount of electr. transfer expecting to get monthly (USD)	8.66	11.50	0.0	3.5	6.9	8.6	259.5	2383
Amount of electr. relief received in total (USD)	12.79	19.13	0.0	0.0	6.9	20.5	259.5	940

Table A3: Correlates of electricity connection characteristics

	Prepaid meter	Pays intermediary	Shared meter	March lifeline household
Number of adults (>=18)	0.003	-0.031***	-0.012	-0.002
	(0.005)	(0.007)	(0.008)	(0.006)
Number of children (<18)	-0.004	-0.010	-0.000	-0.013**
	(0.005)	(0.008)	(0.009)	(0.006)
Respondent age	0.001	-0.002	-0.004**	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Respondent is male (=1)	-0.011	0.000	-0.000	0.024
	(0.017)	(0.027)	(0.029)	(0.020)
Household-Firm during GW deployment	0.075	0.015	-0.084	-0.000
	(0.055)	(0.085)	(0.086)	(0.065)
Do you have a generator in working condition?	0.063	-0.060	-0.012	0.012
	(0.043)	(0.067)	(0.069)	(0.051)
Sum of appliance types held	0.002	-0.018***	-0.007	-0.006*
	(0.003)	(0.005)	(0.005)	(0.003)
Electricity spending in March (USD)	0.001*	-0.003***	-0.001	-0.006***
	(0.001)	(0.001)	(0.001)	(0.001)
Lifeline customer according to March spending	-0.022	0.249***	0.036	
	(0.025)	(0.039)	(0.043)	
Pays landlord/other household for electricity			0.637***	0.147***
			(0.033)	(0.023)
Prepaid meter			0.088	0.025
			(0.064)	(0.036)
Observations	1110	1110	1015	1110
Dependent Variable Mean	0.915	0.256	0.458	0.128

Data are from the first time households are observed, in survey round 1. Data on March lifeline status are missing for 132 households. "Pays intermediary" indicates that the household pays someone else for their electricity (often a landlord) rather than paying the utility directly.

Table A4: Correlates of transfer receipt: electricity and water

	Electricity	Electricity	Water
Pays landlord/other household for electricity	-0.092***	-0.142***	-0.104**
	(0.031)	(0.039)	(0.042)
Prepaid meter	0.248***	0.250***	0.206***
	(0.041)	(0.069)	(0.076)
Sum of appliance types held	0.015***	0.009	0.024***
	(0.004)	(0.006)	(0.006)
Electricity spending in March (USD)	-0.001*	-0.001	0.000
	(0.001)	(0.001)	(0.001)
Lifeline customer according to March spending	-0.181***	-0.167***	0.038
	(0.039)	(0.048)	(0.053)
Observations	3029	912	912
Dep. Var. Mean	0.574	0.697	0.443
Sample	All	Wave 3	Wave 3

SEs clustered at household level. Week and day of week fixed effects and household controls included but not shown. The dependent variable is a dummy for whether the respondent ever received a particular type of transfer. Columns 1 and 2 report on the electricity transfer and column (3) reports on the water transfer. Only households in wave 3 were asked about receiving the water transfer, so the sample in columns 2 and 3 include only households in wave 3 that were aware of the water relief program.

Table A5: Transfer receipt and household consumption and food security

	Expenditure per capita	Food exp. per capita	Worry about having enough food	Days adults skipped meals
Received electricity relief	-1.295	0.078	-0.028	-0.099
in last 30 days	(2.251)	(0.485)	(0.026)	(0.102)
Received electricity relief	1.942	0.196	-0.039	0.059
but not in last 30 days	(2.781)	(0.521)	(0.029)	(0.111)
Observations	3270	3246	3271	3269
Control Mean	34.659	9.060	0.214	0.849

SEs clustered at household level. Household, week, and day of week fixed effects included but not shown. Identification of impacts comes from variation in the timing of transfer receipt, and impacts should be interpreted as suggestive. Dependent variables are measured over the last 7 days. Expenditures in columns 1 and 2 are in USD.).

Table A6: Transfer receipt and household electricity purchasing behavior

	Electricity spending	Pre-paid meter balance	Number of top-ups	Average top-up amount	Outages due to non-payment
Received electricity relief	-1.232*	0.761	-0.181	-0.994	-0.124*
in last 30 days	(0.692)	(0.968)	(0.113)	(3.322)	(0.070)
Received electricity relief	-1.530**	0.027	-0.070	-2.325	-0.079
but not in last 30 days	(0.766)	(1.235)	(0.135)	(4.122)	(0.078)
Observations	3130	780	2039	2043	2177
Control Mean	12.798	4.638	1.930	59.404	0.456

SEs clustered at household level. Household, week, and day of week fixed effects included but not shown. Identification of impacts comes from variation in the timing of transfer receipt, and impacts should be interpreted as suggestive. Dependent variables are measured over the last 30 days. Amounts in columns 1, 2, and 4 are in USD. Column 1 includes all households; remaining columns include only households with pre-paid meters.).

Table A7: Transfer receipt and level of support for current government

	Govt Support =1	Govt Support =2	Govt Support =3	Govt Support =4	Govt Support =5	Govt Support >3
Received electricity relief in last 30 days	-0.028*	-0.024	-0.060*	-0.005	0.116***	0.112***
	(0.014)	(0.019)	(0.034)	(0.035)	(0.026)	(0.037)
Received electricity relief but not in last 30 days	-0.016	-0.020	-0.070*	0.025	0.082***	0.106***
	(0.014)	(0.020)	(0.039)	(0.041)	(0.026)	(0.040)
Baseline - Overall Govt/ NPP support (1-5)	-0.028***	-0.036***	-0.022	0.049***	0.037***	0.086***
	(0.008)	(0.009)	(0.016)	(0.016)	(0.011)	(0.017)
Observations	1406	1406	1406	1406	1406	1406
No Subsidy Mean	0.047	0.088	0.353	0.398	0.115	0.513

SEs clustered at household level. Week and day of week fixed effects and household controls included but not shown. All outcome dummies are based on the respondent's support for the current government/NPP, on a scale from 1 to 5, where 3 indicates political neutrality.

Table A8: Transfer receipt and specific respondent political perspectives

	Trust NPP to Care for Citizens	NPP Addressing Covid	NPP Adressing Dumsor	NPP vs NDC Dumsor
Received electricity relief in last 30 days	0.307***	0.296***	0.217***	0.149*
	(0.080)	(0.066)	(0.061)	(0.085)
Received electricity relief but not in last 30 days	0.149*	0.191***	0.092	0.116
	(0.084)	(0.071)	(0.066)	(0.084)
Baseline - Overall Govt/NPP support (1-5)	0.206***	0.110***		
	(0.036)	(0.029)		
Baseline - NPP addressing Dumsor (1-5)			0.075***	
			(0.027)	
Baseline - Relative party Dumsor performance (1-5)				0.162***
				(0.039)
Observations	1406	1380	1360	1092
No Subsidy Mean	3.426	3.870	4.000	3.952

SEs clustered at household level. Week and day of week fixed effects and household controls included but not shown. All outcome variables are on a scale from 1 to 5 where 1 reflects very unfavorable views of NPP (or alternatively very favorable views of NDC) and 5 reflects very favorable views of NPP. Columns 1, 2, and 3 are the respondent's assessment of NPP's performance in different areas. Column 4 is the respondent's assessment of the relative performance of NDC and NPP in addressing Dumsor (when each party was in power). The controls for the respondent's political responses during GW deployment surveys are defined similarly.

Table A9: Respondent support for governing party and transfer amount

	(1)	(2)	(3)	(4)	(5)
Amount of electr. transfer received in last 30 days (USD)	0.017*** (0.004)	0.020*** (0.006)	0.021*** (0.006)	0.009** (0.004)	
Baseline - Overall Govt/NPP support (1-5)			0.219*** (0.037)		
Amount of electr. relief received in total (USD)					0.005*** (0.001)
Observations	2847	1305	1305	2954	838
Mean Transfer Amount Among Recipients	8.372	8.528	8.528	8.378	22.228
Household Controls	Yes	Yes	Yes	No	Yes
Household Fixed Effects	No	No	No	Yes	No
Sample	All Households	Households with Baseline	Households with Baseline	All Households	Round 3 Households

SEs clustered at household level. Week and day of week fixed effects included but not shown. The dependent variable is the enumerator's overall assessment of the respondent's support for the governing political party NPP, based on their responses to questions on the government's performance on specific issues. The assessment is on a scale from 1 to 5 where 1 reflects very unfavorable views of NPP (or alternatively very favorable views of the opposition) and 5 reflects very favorable views of NPP. The control variable for the respondent's baseline political perspective during 2018-2019 surveys is defined similarly.

Table A10: Correlates of voting in 2020 election

	(1)	(2)	(3)	(4)
Baseline - Overall Govt/NPP support (1-5)	0.016 (0.052)			
Supports Government/NPP		0.123** (0.050)		0.206** (0.087)
Ever received electricity relief			0.098* (0.054)	0.166** (0.084)
Supports Government/NPP=1 × Received				-0.136 (0.107)
Observations	91	213	213	213
Control Mean	0.824	0.779	0.794	0.679

The dependent variable is a dummy for voting in Ghana's 2020 election. Household controls based on round 3 survey data included but not shown. Results should be interpreted as correlations and not as causal effects. All survey households were contacted for a short follow-up automated phone survey about the 2020 election. Our response rate was 20%–respondents are younger, less likely to be male, and have fewer appliance types on average than non-respondents.

Table A11: Prior political affiliation and electricity transfer receipt

	(1)	(2)	(3)	(4)
Prepaid meter	0.255***	0.259***	0.255***	0.267***
	(0.057)	(0.057)	(0.058)	(0.064)
Pays landlord/other household for electricity	-0.136***	-0.138***	-0.142***	-0.137***
	(0.045)	(0.045)	(0.046)	(0.049)
Sum of appliance types held	0.017***	0.017***	0.017***	0.020***
	(0.005)	(0.005)	(0.006)	(0.006)
Electricity spending in March (USD)	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Baseline - Overall Govt/NPP support (1-5)	-0.010			
	(0.017)			
Baseline - Supported Government/NPP		0.031		
		(0.038)		
Baseline - Supported Opposition/NDC		0.060		
		(0.048)		
Baseline - NPP addressing Dumsor (1-5)			0.007	
			(0.018)	
Baseline - Relative party Dumsor performance (1-5)				-0.000
				(0.017)
Observations	1406	1406	1381	1191
Dep. Var. Mean	0.535	0.535	0.536	0.541

The dependent variable is a dummy for ever having received any electricity transfer at the time of the survey. SEs clustered at household level. Week and day of week fixed effects and household controls included but not shown. The omitted category in column (2) is Neutral/Supported neither party during GW deployment. Relative party Dumsor performance in column (4) asks respondents to compare the performance of the two parties when they were in power, with a higher score indicating better relative performance by NPP relative to NDC.

Table A12: Responses to electricity transfer and cash loan tradeoff scenarios

	Mean	SD	Min	25^{th}	50^{th}	75^{th}	Max	N
Willingness to accept transfer given next year increase in electricity costs								
Estimated monthly transfer amount (GHS)	49.94	69.22	0.0	20.0	40.0	50.0	1500.0	1131
Prefer no transfer if have to repay same amount next year (=1)	0.79	0.41	0.0	1.0	1.0	1.0	1.0	1131
Prefer no transfer if have to pay - unsure about next year financial situation	0.50	0.50	0.0	0.0	1.0	1.0	1.0	724
Prefer no transfer if have to pay - unsure about COVID next year	0.05	0.22	0.0	0.0	0.0	0.0	1.0	724
Prefer no transfer if have to pay - will have to pay more than received	0.15	0.36	0.0	0.0	0.0	0.0	1.0	724
Prefer no transfer if have to pay - electricity prices will stay high	0.09	0.28	0.0	0.0	0.0	0.0	1.0	724
Prefer no transfer if have to pay - not right to ask to pay for free electricity	0.48	0.50	0.0	0.0	0.0	1.0	1.0	724
Prefer no transfer if have to pay - wealthier households/businesses should pay	0.05	0.21	0.0	0.0	0.0	0.0	1.0	724
Prefer no transfer if have to pay - government should pay with other taxes	0.16	0.37	0.0	0.0	0.0	0.0	1.0	724
Prefer no transfer if have to pay - won't receive this much transfer	0.06	0.23	0.0	0.0	0.0	0.0	1.0	724
Willingness to accept loan given next year repayment amount								
Starting amount for loan and time transfer scenarios (GHS)	235.05	96.51	120.0	120.0	240.0	360.0	360.0	775
Ratio of amount willing to repay to amount of loan offered	1.03	0.66	0.1	0.1	1.1	1.6	2.0	775
Prefer no loan if have to repay same amount next year (=1)	0.41	0.49	0.0	0.0	0.0	1.0	1.0	775
Prefer no loan - uncertain about finances next year	0.06	0.25	0.0	0.0	0.0	0.0	1.0	297
Prefer no loan - uncertain about COVID next year	0.01	0.10	0.0	0.0	0.0	0.0	1.0	297
Prefer no loan - loan offer too small	0.54	0.50	0.0	0.0	1.0	1.0	1.0	297
Prefer no loan - want more time to repay	0.01	0.12	0.0	0.0	0.0	0.0	1.0	297
Prefer no loan - don't believe it would be given	0.09	0.28	0.0	0.0	0.0	0.0	1.0	297
Prefer no loan - have enough money for expenses	0.17	0.38	0.0	0.0	0.0	0.0	1.0	297
Prefer no loan - don't want to go into debt	0.31	0.46	0.0	0.0	0.0	1.0	1.0	297
Prefer no loan - don't want to add to my loans balance	0.00	0.06	0.0	0.0	0.0	0.0	1.0	297
Prefer no loan - afraid of misusing loan	0.20	0.40	0.0	0.0	0.0	0.0	1.0	297
Prefer no loan - concerned about payment flexibility	0.01	0.08	0.0	0.0	0.0	0.0	1.0	297

Table A13: Correlates of respondent decision to reject a transfer/loan that must be repaid in one year

	(1) Electr. Transfer	(2) Cash Loan
Received electricity relief in last 30 days	-0.067	-0.031
	(0.054)	(0.058)
Received electricity relief but not in last 30 days	0.019	0.015
	(0.034)	(0.042)
Satisfaction with relief program (1-5)	-0.054***	-0.040**
	(0.015)	(0.018)
Any loans last 12 months (=1)	-0.048	-0.240***
	(0.033)	(0.038)
Any formal loans last 12 months (=1)	-0.013	-0.031
	(0.065)	(0.064)
Prefer no loan if have to repay same amount next year (=1)	0.113***	
	(0.031)	
Observations	733	733
Mean - No Transfers Received	0.814	0.454

Round 3 respondents only. Week and day of week fixed effects and controls for household characteristics included but not shown. The outcome variable in column (1) is a dummy for whether the respondent would reject the electricity transfer now if they have to repay the same amount next year in the form of higher electricity tariffs. Column (2) is a dummy for whether the respondent would reject a loan offer now if they have to repay the same amount next year (i.e., rejecting an interest-free loan payable in one year).

Appendix C: Sample and Data Notes

Sample

We survey 1,245 respondents currently residing in Accra, Ghana. The sample consists entirely of ECG customers in Accra West who we had previously surveyed in 2018 and 2019 as part of Klugman et al. (2019). Original enrollment was done quasi-randomly, in the vicinity of a set of control and treatment sites based on an electricity construction program, and are likely to be roughly representative of lower- and middle-income residents of Accra. We refer to the surveys conducted during this original enrollment as the GridWatch (GW) deployment surveys. Participants enrolled in this study had been surveyed in June 2019 at the latest, before they were contacted for this survey in 2020.

Each respondent was surveyed either 2 or 3 times across three rounds of data collection. 86.5% of respondents are surveyed in all three rounds, 12.7% are surveyed in two rounds, and 0.9% are surveyed only in the first round. The first round of data collection was from May 7-June 22 during the first half of the initial 3 month universal relief program. Round 2 was from June 25-July 29 during the second half of the initial program. Round 3 was from August 24 through October 26 after the program was extended only for lifeline electricity customers. To limit any increased risk of our research on our study population, all surveys were conducted over the phone. The survey included modules on household composition, electricity connections and expenditures, electric appliances, expenditures in the last 7 days, food security, credit, government relief, and perceptions of the government.

Transfer receipt

The survey includes a section on the electricity relief program. Respondents are first asked about their awareness of the program, knowledge of its characteristics, and the transfer amount they expect to be eligible to receive. They are then asked about their experience with the program. In each survey observation, transfer receipt is coded as 1 if the respondent said they had ever received a transfer at the time of the survey, and 0 if they said they had not received a transfer or if they do not know. We further break down the timing of transfer receipt by distinguishing among observations in which the respondent has received a transfer and can name the amount they received in the last 30 days, and observations where the respondent has received a transfer but not in the last 30 days. In addition to asking about the transfer amount received in the last 30 days in each round, we also ask respondents in round 3 to report the total amount of electricity transfers received to date.

In addition to asking about transfer receipt in each round, we also ask respondents in round 3 to retrospectively confirm whether they had received a transfer by the time of their previous interviews, as many respondents were uncertain about transfer receipt during the first two survey rounds. Measures of transfer receipt based on responses during each round and round 3 recall differ for 8.9% of observations, primarily for respondents who said they did not know if they had received a transfer during the earlier survey rounds. Our measures of transfer receipt for our analyses of program efficiency and distributional implications are based on the recall responses from round 3. Analyses of willingness to pay and program satisfaction are based on transfer receipt responses in each round, as perspectives at the time of the survey should be affected by the respondent's understanding of their transfer receipt at the time of the survey.

Electricity meter and payment types

We distinguish among households based on their type of meter connection and how they pay for their electricity. Pre-paid meter customers must regularly pay to 'top up' their electricity credits ex

ante. Post-paid meter customers receive monthly bills charging them for their electricity use ex post. Customers labeled 'Direct' pay electricity bills to or purchase credit from ECG or associated vendors directly. Customers labeled 'Landlord' pay a landlord or other household for their electricity use. In rounds 1 and 2, respondents that paid a landlord or other household did not indicate a meter type. This information was collected in round 3. All electricity connection information is updated based on the responses given in round 3.

Difficulty using transfer size discontinuity for identification

The transfer size discontinuity around the 50 kWh cutoff is an ideal setting for a regression discontinuity to estimate the impact of transfer size on socioeconomic outcomes. Unfortunately, this is infeasible in this context. The cutoff applies to electricity *usage* rather than *expenditure*. For pre-paid customers—who comprise 91% of our sample—ECG's central billing system only logs credit purchases: usage is only recorded locally at the meter, and must be recovered manually (more detail on this below). Furthermore, since expenditure is more salient than usage, our survey measures electricity expenditure. Finally, due to global travel restrictions, we have been unable to meet with ECG to obtain updated usage data for post-paid customers.

Political perspectives

Respondents are asked four questions relating to their political perspectives: how much they trust the New Patriotic Party (NPP) - the current governing party in Ghana - to care for citizens, how well they think the NPP has performed in addressing the COVID-19 pandemic, how well they think the NPP has performed in addressing the 'Dumsor' power outages, and how well they think NPP has performed in addressing 'Dumsor' relative to the National Democratic Congress (NDC) - the previous governing party in Ghana. For all questions, the respondents give an answer from 1 to 5, where 5 reflects a very favorable view of NPP and 1 a very unfavorable view. Based on responses to these four questions, enumerators rate the respondent's overall support for NPP relative to NDC, again on a scale from 1 to 5 and without asking the respondent. These questions are asked at the end of survey to minimize risk of respondents refusing to continue.

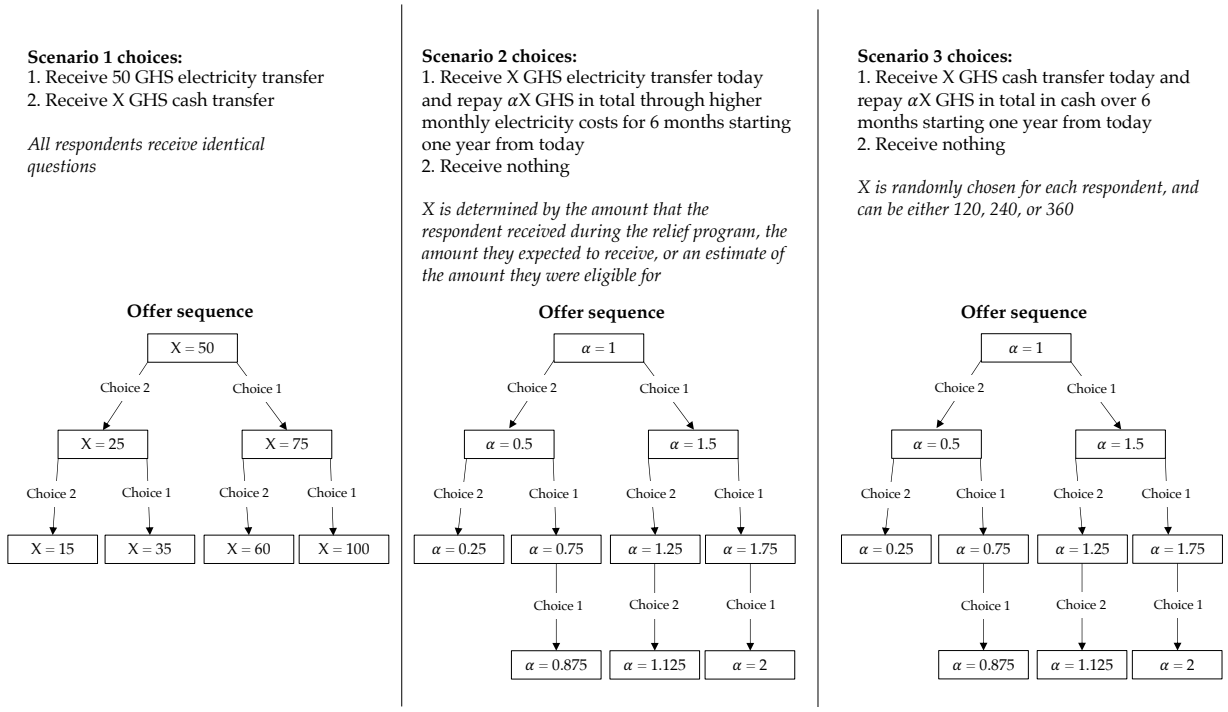
WTP Scenarios

The survey includes three willingness to pay (WTP) elicitation modules. In all three cases, WTP is elicited using a contingent valuation approach through an iterated sequence of dichotomous choice questions. These questions take the form of hypothetical tradeoffs, where the respondent is asked to choose one of two options, and subsequent options are varied depending on the prior response in an iterated manner to increase the precision of the WTP estimates. This stated preference approach is a common method for eliciting WTP for goods or services (Alberini and Cooper 2000), including WTP for electricity in different African countries (Abdullah and Jeanty 2011; Deutschmann, Postepska, and Sarr 2021; Sievert and Steinbuks 2020). The sequence of choices is similar in style to negotiating over a price, a process that is well understood in African countries (Whittington et al. 1990). We reduce the risk of hypothetical bias by presenting the WTP scenarios in the context of the existing government electricity transfer program.

The three WTP modules are identical in structure, though the nature of the choices varies. In the first, respondents are asked to choose whether they would prefer to receive a 50 GHS electricity transfer or a cash transfer of a varying amount. In the other two, respondents are asked whether they would prefer to receive a specified transfer of electricity or cash that they would have to repay a varying multiple or fraction of next year, or to receive nothing. In all three cases, what varies across the iterated sequence of choices is the amount of cash respondents are willing to give up in order to receive the offered transfer. The first amount presented to respondents is always identical in value

to the amount of the transfer. The sequence of choices is structured such that the amount of cash respondents must give up increases in the next question if the respondent is willing to pay or give up the current amount, and decreases if the respondent is not willing to pay the current amount. Figure A6 illustrates the sequence of choices presented to respondents in each WTP scenario. We use the highest cash amount the respondent is willing to give up as the estimate of their WTP for the offered transfer.

Figure A6: Willingness to pay elicitation method



WTP scenario 1 follows a series of questions asking respondents about their knowledge of the government electricity relief program. The scenario aims to elicit households' willingness to pay (WTP) for a 50 GHS electricity transfer. This amount was chosen to match the median and mean monthly electricity transfer expected in our sample under the government COVID-19 relief program (determined during pilot surveys), and is intended to make the scenarios more realistic.

The first prompt is "*Suppose that the government allows you to choose between two options for its electricity relief program. If you choose Option 1 you will receive 50 GHS towards your electricity spending. If you choose Option 2 you will receive 50 GHS as a cash transfer to your mobile money account. The electricity transfer can only pay for electricity, but the cash transfer can be used to pay for anything you prefer. Would you prefer Option 1, 50 GHS towards your electricity spending, or Option 2, a 50 GHS cash transfer?*". Subsequent prompts keep Option 1 the same but vary the amount in Option 2, where the amount increases (decreases) if the respondent chose electricity (cash) in the previous question. Respondents who prefer 50 GHS in electricity to 50 GHS in cash are asked to give reasons why they prefer electricity.

WTP scenario 2 elicits WTP for electricity relief in terms of the increase in electricity costs next year that respondents are willing to pay to receive an electricity transfer today. These questions follow a module asking the respondent about their experience with the government electricity relief program so far. Respondents are reminded about their responses, and told "Let us suppose that you receive [amount] GHS on average for each of the 6 months of the electricity relief program this year."

The offered transfer amount varies by respondent. Respondents who received a transfer in the last 30 days are offered the amount they received. Respondents who reported the monthly amount they expected to receive are offered that amount. Respondents with neither of these values are offered an estimate of their monthly transfer amount based on their March electricity consumption. The median total amount offered (over the proposed 6 months) was 240 GHS and the mean was 300 GHS.

The first prompt is "*It is possible that ECG will have to increase electricity prices next year to pay for the current electricity transfers. Suppose that under the relief program where you receive [amount] GHS on average for each of the 6 months of the relief program this year,*[1] *you would have to pay some amount more each month for your electricity for the same 6 months next year. Would you prefer Option 1, receiving [amount] GHS in electricity transfers on average for each of the 6 months of the program this year, but paying [amount] GHS more each month for your electricity for the same 6 months next year, or Option 2, not receiving any electricity transfers this year and having no increase in your electricity costs next year?*". In subsequent prompts Option 1 is revised to change the amount to be paid in increased electricity costs next year. This amount increases (decreases) if respondents said they would choose Option 1 (Option 2) in the prior question. Respondents who choose Option 2 in the initial prompt (where the transfer amount equals the increase in electricity costs) are asked to give reasons why.

WTP scenario 3 follows a series of questions where the respondent is asked about their borrowing and credit experiences. It is identical in structure to electricity transfer-cost increase tradeoff scenario, but elicits WTP for a cash transfer in terms of the amount the respondent is willing to repay next year to receive the transfer today. Respondents are randomly offered a hypothetical loan of either 120, 240, or 360 GHS. These amounts were chosen so that the middle value is equal to the median total amount respondents would be offered in the electricity relief repayment scenario.

The first prompt is "*Let us suppose that you are offered [amount] GHS from a trusted source, which you would pay back starting one year from today in monthly installments over 6 months. Would you prefer Option 1, receiving [amount] GHS today and paying back [amount] in total over 6 months starting one year from today, or Option 2, not accepting the loan?*". Subsequent questions vary the amount to repay based on responses to the prior question. Respondents who choose Option 2 in the initial prompt (where the loan amount equals the repayment amount) are asked to give reasons why.

Exploring WTP for electricity responses

The distribution of responses to the first WTP exercise indicates that a significant share of respondents are willing to give up some amount of cash in order to receive a 50 GHS electricity transfer. We tested the reliability of these data in several ways.

First, 2 weeks into our first survey round we asked 2 senior field officers to call back respondents who had indicated preferring 50 GHS of electricity to 100 GHS of cash, to re-explain the question and make sure that they had understood it correctly. The respondents all confirmed that they had understood the question, and confirmed that their answers were intentional. Second, we conducted an emergency training with field officers to ensure that all were understanding these questions and presenting them to respondents in an identical fashion, and to emphasize that they go through these questions very carefully to ensure respondents understood. We found instances of very strong respondent preferences for electricity over cash across all field officers, and the distribution of responses looked very similar before and after this emergency training. The distribution of responses

[1] Most respondents were only eligible for 3 months under the actual relief program, but were asked to imagine that the program operated as described.

also looks similar across all three survey rounds. These two tests suggest that respondents are in fact understanding the questions and responding accurately.

Third, for all respondents that preferred 50 GHS of electricity to at least 50 GHS cash, we asked follow up questions asking why they prefer electricity. The shares are similar when considering respondents with the strongest preferences for electricity over cash. The responses indicate that respondents have legitimate reasons for preferring electricity to cash. Most commonly (61.5%), respondents stated "I would use the money for electricity anyway." While this does not address why respondents would be willing to give up cash in order to receive electricity, it emphasizes the inframarginality of the transfers to most recipients.

37.4% of respondents stated "I worry that I will spend the money on something else", suggesting a strong desire for commitment to spending on electricity by respondents, which is supported by anecdotes from our field officers when discussing these questions reporting that many respondents are willing to pay to ensure that some amount of money is committed to electricity spending. For example, one respondent stated "taking the [electricity transfer] ensures that the household can all benefit from this gift equally" and another stated "It is very important for my business that we have electricity and taking the transfer instead of the cash will help my business be successful."

20.7% stated "It takes too much time/effort to top up [purchase electricity credit]", relating to our argument about transaction costs of buying electricity. Indeed, several respondents stated that it would cost them more than 50 GHS to go and purchase electricity credit. For example, one stated "It will cost me more than 50 GHS to get to the ECG office because of transport and time lost. Therefore, it is worth it to just take the voucher and not have to worry about the hassle of getting to the ECG office." Even though the transfers are inframarginal for most households, they may save them some transaction costs. The median household tops up their electricity meter twice each month rather than purchasing all their credit at once. Receiving the transfer can thus reduce the number of trips to top up in a given month, even if it does not fully eliminate the need to go purchase some electricity. Indeed, we find that receiving a transfer in the last 30 days is associated with a reduction in the number of times customers go to top up their electricity meter in that same period.

Finally, respondents stated that "I worry about mobile money charges/costs" (9.7%) and that "I don't trust that the government will give me the money" (4.9%). These indicate some concerns about the actual value of a hypothetical offer of a 50 GHS mobile money transfer.

Additional notes

The COVID survey data are merged with data from the same respondents during the 2018-2019 GridWatch (GW) deployment surveys. Not all respondents were asked the same questions during those surveys, so regressions controlling for this 'baseline' data have a reduced sample size.

The surveys do not include specific questions on household employment, income, or wealth.

All continuous variables are winsorized for our analysis, with values above the 99th percentile replaced with the value at the 99th percentile.

In most regression tables, household controls are included but not shown unless otherwise indicated. Household controls include the the count of household adults (age 18 or older), count of household children (under age 18), the age and gender of the respondent, whether the household also operated a business at the same location when the household was originally surveyed in 2018-19, whether the household is connected to a prepaid meter (as opposed to postpaid), whether the household pays a landlord or other household for their electricity (as opposed to paying for electricity directly), whether the household shares its meter with other users, whether the household has a generator, the count of different appliance types held by the household, and the households spending on electricity in March (in USD). The count of appliance types is a sum of dummy variables

for whether the household owns the following types of electric appliances: air-conditioning system, TV receiver, fan, iron, lightbulb/lamp, radio, TV, refrigerator/freezer, blender, blow (hair) dryer, security camera, computer, cooking stove, DVD/CD player, halogen oven, hair straightener, heater, kettle, maize/grain processing machine, microwave, photocopying machine, printer, other printing-related appliance, other large matching for income purposes, rechargeable torch, rice cooker, sewing or other clothing machine, shaving/hair trimming machine, stereo/music system, tablet, toaster, washing machine, water pump, and welding machine.