Presentation from 2016 World Water Week in Stockholm

www.worldwaterweek.org

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Centre for Global Development

Institute of Public Health and Environmental Engineering



Impacts of improving services to the poor on City Water Demand

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Links between services for the poor and bulk water supply



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Water & Sanitation for the Urban Poer

DISCUSSION PAPER

How do improved services to slum areas impact water demand at the city level?

Modelling domestic water consumption in Nairobi and Accra

The Subtainable Development Goals (SDGs) sof out the target of achieving universal access to a barlie stater apply by 2000. Coupled with applicable probability of goals in low-income unban areas, this will result in increasing pressure on urban utilities worldwide to enhance levels of access and service to low-income consumers. Alongside the uppert need for worter service improvements delivered at scale, water resources in many regions are coming under ever-greater pressure from exogeneous tactors such as pollution and climate change, making it vital to understand the impacts that planned water supply improvements may have on city-wide water resources.

As part of its 2002-2005 DFID-funded research programme. WSUP atmet to strengthen the support available to utilities in this area by commissioning a modelling study. The study set out to quantify the relative impact of improved water service provision in skarn areas within the context of a water basin serving a city. The resulting modelling tool is available on the WSUP websits and provides a practical networke for utility matagers is projecting the demand implications of specific service improvement in their city.

This Discussion Paper presents the context, methodology, results and conclusions of the study. The results suggest that significant service improvements and associated health benefits might be realised in siture districts with each minimal increases in oilywide water demand. The paper is based on the linul report of the researchers from the University of Leads.



A fairly 'simple' framework

Water supply is	Pre	dictable	Unpredictable		
	Available > x days per week	Available < x days per week	Available > x days per week	Available < x days per week	
At home	Highest level of service				
In the yard					
Delivered to home					
Carried to home				Lowest level of service	
	←				

Increasing accessibility

Increasing reliability

Methods



- Secondary data review
- Primary data collection (household surveys and focus groups)
- Use of existing GIS-based consumption mapping (Nairobi) GWOPA and IFRA
- Modelling overall demand and future changes based on scenario planning

Water source type drives consumption





Key results



Water Ac	cess Source	Mean (lpcd)	Median (lpcd)	Standard Deviation (lpcd)	N in sample
Carried to	property	27.8	25.0	12.2	55
Delivered	to property	43.5	45.7	22.4	11
In yard	<= 4 days per week	33.2	28.6	19.7	21
,	> 4 days per week	50.9	58.6	21.5	10
In dwellin	g	69.0	60.0	52.3	27



So what do we mean by scenarios?



- Increasing accessibility
- Increasing reliability (predictability and/or hours of service)
- Reducing losses
- Geographical targeting



Population and service level

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D Satter D Sancara D Sancara Na Change	O in deeling P Druges O Televent is property O Connects property O to theoge	O Terese - Anes Association - Anes O United as - Adapt O United as - Adapt O United as - Adapt O United Association O SAT O Terese	Qinge Qilanian Qilani Tangar Qilani Tangar

Gradies of Neoutle Data







Yéet:		Đe:	teks.		After intervention			
	Total Population	Total Water use: IM Rtm/stl	Network Water use (M. Brety'yr)	Energy Use 30WR/w0	Total Population	Total Water use 3M http://wi	Network Water use (Military/pr)	Everyp Use HWHVy
11	1139094	87717	77244	18541	5139004	69568	79695	10011
1	1178200	18506	98223	18770	5176296	00077	80087	29144
.5	1214329	89917	79210	10002	5354629	80807	81109	19160
-4	1252502	93340	00257	19343	3252580	92959	82147	29632
.5	1291801	92204	81276	19481	3291881	94134	85306	29068
14	33333945	88391	823.96	19728	3351945	95330	84357	20118
. 2	8572792	94582	05415	19979	\$372792	98554	100.000	20578
	5414443	85507	84523	20239	3414445	97800	805 38	20054
	5454017	27254	85450	20497	3456817	99072	37045	20000
10	1100235	10331	06001	10763	1900295	300999	85531	11171
11	7544417	19952	07977	21095	3544417	301691	80037	21447
12	2503424	130955	89176	21312	3559484	103641	01260	21729
13	3635460	102213	90494	21595	3635460	304419	915.09	22016
14	3662.967	325695	91656	21884	3662367	105824	95705	22530
15	3750229	505,306	92936	22170	3750229	307259	15068	12609
2.6	3779009	200546	94343	22479	3770069	100125	80458	22934
17	1020911	200017	95570	22785	3820912	account	87728	33236
18	3679765	1096448	96940	20000	3879396	411244	00160	22044
19	2001713	111150	980.06	25438	8881712	114992	120568	23968
20	8964723	DITES.	99765	20748	8684721	120000	102038	34199
23	010040	114218	101217	2/077	4200840	316517	109621	24537
11	4204307	115847	332704	24417	4294097	318176	105038	24563
23	4150513	117514	1340.27	24784	4350523	119671	100564	25795
14	4208143	119218	105788	25118	4338145	121002	108167	25585
25	4208904	120958	107979	25480	4355994	101970	100785	25962



Results tables

Possilation:

			Reliability		CONTRACTOR OF STREET
	. And the second se		eriadic		Coestart
	iteliable = 4 days	Reliable <4 days.	Unreliable >-R days	Unreliable < 4.das	Reliable 34/7
in dwelling	6422811	63976	B		250627
Circ plat	2450203	297704	D	- 9810	e
Delivered to property	22065	0	D	σ	0
Carried to property	\$27426	(a. ;	0	û.	(6)
property	Service .		Total scendarios	11 120304	L

Before intervention

Water used

				Bellobility		
		CONTRACTOR 105500	No. A Street Stree	Proofic	NAMES OF TAXABLE PARTY.	Constant
		Reliable > 4 days	Reliable 4.4 (Dell	Universitie > 4 days	Unreliable < 4 miles	Reliable 24/7
	in dwelling	T5046148	7074093	D	0	28042561
	De plot	105771967	8512603	0	365200	
Automa	Delivered to property	1010278	0	D	0	0
	Carried to property	12820207	¢.	8	Û	4
-	a constanti			Total water seei	240321156	Ares / day:

240321156 Wres / day 87717 Millines/w

Energy					a crista de Con
			Resolution		W
			eriodic.		Constant
	Residule - 4 (Bay)	Retaile < 4 mag.	United and a second second	Unrelative < 4-Steps	Reliable 24/7
by dwelling	15729229	1414099) D	0	8471700
Un plot	21155878	1302520	R .	<u>û</u> :	(d) (
Delivered to property	216/24	d d	ų.	U.	
Cerned to property	2508758	e .	ų.	0	

Total energy 50796145 kith/day

		FTER intervention			
apalation.		4417-2	Relativity		1
	Reliable > 4 days	Feliable = 4 days	Date:	limelable < i days	Caristant Reliable 24/7
n dwelling	642783	63976	6		230827
2h plid	1450001	732/90	0	1810	0
envered to property	D ⁽¹⁾	0	(e)	0	0
arried to property	18219		0		0

A second second second second second second	and the second sec	Reads at y						
Relative > 4 mys	Reliable < 4 days	Unverlable>#.days	Unreliable < 4 days	Relatie 24/7				
16349224	8213744	0		34006008				
80012462	10517940	0	140000	1				
8	1	6	0					
257773			4	Ű.				
	Belater > 4 mys B6340224 B9123402 D 257773	Belable > 4 myc Belable < 4 dws B6540224 B025744 B012442 30527941 0 # 25773 #	Heliotite > 6 myo Heliotite < 4 myo Normality N654224 1053344 0 80912442 1053784 0 0 2 0 25773 0 0	Heliable > 4 myc Heliable < 4 myc Ministratic < 4 myc Ministratic < 4 myc Ministratic < 4 myc N6549224 N023744 0 5 R01021442 30537941 0 5 B 2 0 0 257773 0 0 6				

207705729 Bites / Hay 75813 M Bles/w

		Relativity						
	11 W	Pet	iodic		Constant -			
	Reliable > 4 lity)	Reliable (-4 days)	Uveriable > 4 days	Unreliabler < 4 days	Relative 24/7			
in dealing	15729229	2434000	6	(D)	6472709			
On plat	21155877	5(1994)#	0	÷.	0			
Delivered to property	0			8				
Carvied to property	e .				0.			
			. Total energy	51812209 4	Wh/day			

Outcomes for eastern Nairobi



Households selected for service improvement	Service improvement	Impact on city water demand	Number of households
Households carrying water or getting water delivered	Yard tap (<4 days per week) with low reliability As above with high reliability	0.6% 3%	350,000
All households without a household connection	Household connection	15%	1.5 million



Marginal service improvements which have a significant social value to households may not have a major impact on bulk water demand

Understanding user behaviours can help to identify service improvements that are preferential for utility service providers

Simple modelling tools can provide a strong basis for assessing options but rely on reasonably strong household data from households which are not yet 'formal' customers