PUBLIC UTILITIES REGULATORY COMMISSION

AN OVERVIEW OF REGULATORY KEY PERFORMANCE INDICATORS AND BENCHMARKS FOR ELECTRICITY AND WATER UTILITIES

PURC/WP/2022/04

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LIST OF KEY ABBREVIATIONS AND ACRONYMS

CAIDI	Customer Average Interruption Duration Index
EBIT	Earnings Before Interest and Tax
EBITDA	Earnings Before Interest, Tax, Depreciation and Amortization
KPA	Key Performance Area
KPI	Key Performance Indicator
kWh	Kilowatt-hour
MW	Megawatt
MWh	Megawatt-hour
RAB	Regulatory Asset Base
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index

1.0 INTRODUCTION

The Public Utilities Regulatory Commission (PURC) in pursuance of the PURC Act, 1997, (Act 538) is mandated to develop regulatory key performance indicators and benchmarks for Electricity, Water and Natural Gas Utilities in Ghana. This mandate is an important part of efficient public utility regulation and a useful tool in continually assessing and monitoring the overall performance and operations of the regulated utilities.

The purpose of this document is to identify and develop parameters that can be used by PURC to assess, monitor, and evaluate the operational performance of the regulated power and water utilities by identifying international best benchmarking and key performance indicators across ten countries globally. The findings of the study would build upon the existing benchmarks the Commission has over the years relied on to undertake its tariff setting and performance monitoring responsibilities.

2.0 METHODOLOGY

2.1 Overall Approach

The overall approach to this study has been structured by five tasks, including an inception phase which was used to clarify the key definitions, scope, objectives, and data to be used in the work. The five tasks each correspond to specific and distinct aspects of key performance areas as requested in the original terms of reference of the work, namely:

- ***Task 1:*** *Identify and document benchmarks in the electricity and water sectors*:
  The goal of this task is to gather and assess indicators for tariff setting and performance monitoring.

- ***Task 2:*** *Identify, categorize, and document general and industry-specific benchmarks for electricity and water utilities in 10 countries*:
  The goal of this task is to gather, assess and categorize indicators (relating to utility benchmarks, industry specific benchmarks, and regional economic-related benchmarks) from two countries per continent (i.e Africa, Europe, North America, South America, and ASEAN/Pacific).

- ***Task 3:*** *Documentation of countries and their corresponding benchmark data in spreadsheets of the Excel Application of the Microsoft Office Suite*.

- ***Task 4:*** *Liaise with the ICT Department of the Commission to upload the documented benchmark values on the PURC website (www.purc.com.gh) and also the Database Management System (DBMS) of the PURC*.
  The goal of this task is to make the output of this study easily accessible, easily visualized and highly interactive.

- ***Task 5:*** *Ensure the undertaking of periodic updates of benchmarking data on the website and DBMS on a quarterly and annual basis*.

In order to execute the tasks identified above, a performance benchmarking approach was adopted for the study. This approach involves the selection of key performance indicators (KPIs) that reflect major elements of utility day-to-day operations, including technical, operational, and financial indices of the electricity and water sectors. A framework was then developed to compare the performance of the sectors in selected countries and utilities using the indices identified. This framework is based on:

a. a designed excel template containing country data on the KPIs, and
b. a benchmarking working model comprising formulas with key parameters whose values are to be determined.

2.2 Scope

This benchmarking study is limited to 15 countries across five continents namely, Africa, Europe, South America, North America, and ASEAN/Pacific regions. Countries considered in this benchmarking study, included Kenya and Uganda (for both electricity and water), Canada and the United States of America (for both electricity and water), Chile and Ecuador (electricity sector), Brazil and Argentina (water sector), Denmark (water sector), the United Kingdom (electricity), Georgia (electricity and water sector), Australia and Mongolia (water sector), India and Philippines (electricity).

2.2.1 Criteria for Country Selection

Specifically, two countries each from both electricity and water sectors per continent were considered for the purposes of this study. These countries were identified and selected based on their economic classifications, and technical classification of the electricity and water sectors.

The economic classification of countries considered in the study included; population size, income-levels, GDP per capita, and the level of human development (HDI); while the technical classification included; the number of electricity customers, electricity consumption per capita, electricity access rate, water coverage ratio, and the sector structure along the value chain. These classifications were considered to provide coherence in the comparative analysis of indicators specified, and to ensure a fairly equal representation of country structures across the globe.

Specific criteria for the selection of countries for each continent are presented in Table 1 and Table 2. In Africa, Kenya and Uganda were considered for both the electricity and water sectors. Kenya, classified as a lower-middle income country[1], and Uganda classified as a low-income country, provide a fair representation of the income status of most African countries. The social and economic dimensions of both countries, in terms of their Human Development Index (HDI) scores, 0.579 (medium HDI) for Kenya and 0.528 (low HDI) for Uganda, are general reflections of the average achievement of Africans in key dimensions of human development. That is, the level of educational attainment, health conditions, and standard of living.

[1] New World Bank Country Classifications (2021/2022) classifies lower-middle-income countries based on GDP per capita between $1,046-$4,095, and low income countries with GDP per capita less than $1,045.

Table 1: Criteria for Country Selection

Country		Economic Criteria										Technical Criteria
		Country Classification (2021/2022)				HDI (2022)	GDP per Capita	Population	Electricity Customers	Electricity Access Rate	Unbundled Sector Structure	Electricity Consumption per capita
		High	Upper-Middle	Lower-Middle	Low							
Africa	Kenya			x		x	x	x	x	x	x	x
	Uganda				x	x	x	x	x	x	x	x
North America	USA	x				x	x	x	x	x	x	x
	Canada	x				x	x	x	x	x	x	x
South America	Chile		x			x	x	x	x	x	x	x
	Ecuador		x			x	x	x	x	x	x	x
	Brazil		x			x	x	x				
	Argentina		x			x	x	x				
Europe	Georgia		x			x	x	x	x	x	x	x
	Denmark	x				x	x	x				
	UK	x				x	x	x	x	x	x	x
ASEAN/ Pacific	India			x		x	x	x	x	x	x	x
	Philippines			x		x		x	x	x	x	x
	Australia	x				x		x				
	Mongolia		x			x		x	x			

Table 2: Economic Classification of Countries

Country	Economy Classification by Income	Population (Millions)	GDP Per Capita	Electricity Consumption (kWh/Capita)	No. of Electricity Customers	Electricity Access Rate
Ghana	LMI	31.07	1,960	351	5,000,258	83.5%
Uganda	LMI	48.16	897	215	1,657,178	57.2%
Kenya	LMI	56.22	2,199	164	7,500,000	69.7%
India: Andhra Pradesh Telangana Uttar Pradesh	LMI	1,406.63 54.60 38.51 231.52	 2,480 3,321 1,043	805 1,254 1,904 618	 3,500,000 8,400,000	97.8%
Philippines	LMI	112.51	3,160	696	24,130,000	95.6%
United Kingdom	HI	67.22	8,334	5,130	6,000,000	100.0%
Georgia	UMI	3.71	4,850	2,694	2,635,402	100.0%
USA	HI	334.81	56,200	12,994	156,500,000	100.0%
Canada	HI	38.39	43,100	15,588		100.0%
Chile	UMI	19.25	15,000	3,880	6,610,328	100.0%
Ecuador	UMI	18.09	4,800	1,500	5,368,493	97.3%
Australia	HI	25.99	56,100	10,071		

Juxtaposing the population size of both countries to the respective electricity access rates shows that on average, a moderate percentage of the population has stable access to electricity. Similar to Ghana, both countries in the 1990s undertook electricity sector reforms, mainly involving the unbundling of vertically integrated government utilities into generation, transmission, and distribution.

North American countries, the USA and Canada are both classified as high-income countries with GNI per capita greater than $12,695.[2] This level of income status is also consistent with the very high HDI scores for both countries (0.922 for Canada and 0.92 for the USA), an indication of higher quality of life and standard of living. These indicators also confirm the full electrification access rates of both countries as well as the relatively high energy consumption per capita, providing a distinct difference with the corresponding indicators for Ghana. Additionally, due to the federal system of governance in both countries, electricity and water utilities were selected from states with unbundled utility service structures, taking into consideration the size of customer population, total electricity generation capacity, and capital cost figures relatively comparable with the indicators for Ghana.

Countries selected in South America, for both electricity and water sectors, were considered based on similarities of their economic structures. That is, Ecuador and Chile (for electricity sector analysis), and Brazil and Argentina (for water sector analysis) are all upper-middle income countries, with GNI per capita between $4,096-$12,695. The high HDI scores for these countries are indications of the fairly good living standards of the population (Ecuador 0.758, Chile 0.847, Brazil 0.761, Argentina 0.83), with comparably high electrification rates (Chile 100%, Ecuador 97.3%) and water access coverage (Brazil 97%, Argentina 97%). Given that Chile was the first country in the world to implement a comprehensive electricity sector reform, their regulation and general institutional arrangements of the sector provide a model for comparative analysis with other countries selected for the study.

In Europe, the UK (for electricity sector analysis) and Denmark (for water sector analysis) provide relatively identical economic and technical structures, with respect to their high income-level status, very high living standards (per HDI definition), full electrification, and water coverage rates, and high electricity consumption per capita. Comparing electricity and water sector KPIs of high-income countries with a lower-middle income country like Ghana helps in drawing experiences and lessons for better regulation. Georgia (for both electricity and water sector analyses) similarly has relatively full electricity access (100%) and water coverage (100%) rate also provides interesting lessons as an upper-middle income country in Europe, despite its relatively small population size.

Countries selected for Asia included India and Philippines (for electricity) and Australia and Mongolia (for water). Considering the federal system of governance in India and population size of 1billion, three utilities each from a state were sampled based on total generation capacity, customer size, and revenue levels comparable with that of Ghana.

[2] New World Bank Country Classifications (2021/2022

2.3. Data Collection

The study draws on a variety of secondary data sources as indicated below.

- Existing benchmark values and the PURC Rate Setting Guidelines provided a starting point for the general aim of this study. These documents were reviewed and discussed amongst team members to inform the benchmark criteria, indicators, and specific approach of the study.

- Existing public databases – key national and international data sources such as World Bank, Eurostat, OECD, AfDB, IEA, and International Benchmarking Network (IBNET) have been major sources for this work. Information provided by these sources includes data on the various indices related to both electricity and water regulation, prices and quality of service.

- Annual reports of the various country electricity and water utilities and their regulators largely provided credible utility-level and country-level data on the indicators.

The list of countries and utilities considered for the study with corresponding sources from which data on the KPIs were obtained is presented in Table 3.

Table 3: Data Source by Country and Utility Selected

Continent	Sector	Country	Utilities or Regulator	Data Sources
Africa	Electricity	Kenya	1. Kenya Power 2. Kenya Transmission Company (KETRACO) 3. Energy and Petroleum Regulatory Authority (EPRA)	Ketraco 2020 Annual Report, Kenya Power 2021 Annual Report
		Uganda	1. Electricity Regulatory Authority 2. UMEME 3. Uganda Electricity Transmission Company	UMEME Annual Report 2020, ERA Annual Report 2020, Uganda's Electricity Sector Reforms and Institutional Restructuring (2012)
	Water	Kenya	3. Water Services Regulatory Board (WASREB)	WASREB Impact Report 2019,
		Uganda	National Water and Sewerage Corporation	Water and Environment Sector Performance Report 2019, The International Benchmarking Network
		Rwanda	WASAC	The International Benchmarking Network (2017)
Europe	Electricity	Georgia	1. Energo-Pro Georgia 2. Georgian National Energy and Water Supply Regulatory Commission	Georgian State ElectroSystem 2019/2020 Annual Report, Georgia 2020 Energy Policy Review,

			3. Georgian Water and Power	
		United Kingdom	1. Office of Gas and Electricity Markets 2020/2021 Annual Report 2 National Grid Electricity Transmission	National Grid ESO Transmission Losses 2019, National Grid Electricity Transmission 2019/2020 Annual Report
	Water	Georgia	Georgian Water and Power	The International Benchmarking Network (2020)
		Belgium	SWDE	The International Benchmarking Network (2020)
		Romania	Apa Brasov	The International Benchmarking Network (2020)
		Denmark	Aarhus Vand A/S	The International Benchmarking Network (2015)
South America	Electricity	Chile	1. Enel Generación Chile 2. National Energy Commission	Annual Reports
		Ecuador	1. ARCONEL Agency for Regulation and Control of Electricity	Annual Reports
	Water	Brazil	Companhia de Ise Esgotos de Roraima	The International Benchmarking Network (2015)
		Argentina	AySA SA	The International Benchmarking Network (2014)
North America	Electricity	USA	Consolidated Edison Company of New York (CECONY) Inc.	Annual Report for Consolidated Edison, Inc. (2020)
		Canada	Ontario Energy Board	Annual Distribution Rates
	Water	USA	New York American Company Ltd.	
		Canada	Ontario Municipal Water Association	
Asean and Pacific	Electricity	India	Andhra Pradesh, Telangana, Uttar Pradesh	
		Philippines	Meralco	Meralco Annual Reports
	Water	Australia	Albury City Council	The International Benchmarking Network (2013)
		Fiji	Water Authority	The International Benchmarking Network (2020)

2.4 Analysis

This study made use of a variety of analytical techniques to develop some key performance indicators relevant to the Commission's rate-making process. Findings of these are presented in Tables 5 and 6.

2.4.1 Electricity Generation - New Entrant Power Plants

a. Derivation of the Approved Fixed O&M Benchmark Percentage to the Initial Infrastructure/Capital Cost

FOMExt = PAInC * γ

Where:

FOMExt	is Initial Fixed Operation and Maintenance Expenses
PAInC	is PURC Approved Initial Infrastructure Cost
γ	is PURC Approved Fixed O&M Benchmark Percentage

b. Derivation of Non-Fuel Variable O&M Benchmark Percentage to Major Maintenance and Consumables Costs

NFVOMCt = PAMMCC * λ

Where:

NFVOMCt	Is Initial Non-Fuel Variable Operation and Maintenance Costs
PAMMCC	Is PURC Approved Major Maintenance and Consumables Costs
λ	is PURC Approved NFVOM Benchmark Percentage

2.4.2 Electricity *Distribution* and Supply

a. Determination of Other Operating Expense categorised into operation and maintenance expense, administration and general expense o for First Regulatory Year in Regulatory Control Period

OpExt = PAEDNAV * γ

Where:

OpExt	means First Regulatory Control Period Operating Expenses
PAEDNAV	means PURC Approved Electricity Distribution Network Asset Value
γ	means PURC Approved Operating Efficiency Benchmark Percentage

b. Determination of Other Operating Expense for subsequent regulatory control period

$OpEx(LegDisNAs)_{t+1} = OpEx(LegDisNAs)_t + (OpEx(LegDisNAs)_t * \alpha) + (VNCLegDisNAs * \mu)$

Where:

$OpEx(LegDisNAs)_{t+1}$	means Forecast Operating Expenses of Electricity Distribution Utility

	in respect of Legacy Distribution Network Assets
OpEx(LegDisNAs)t	means Base Year Operating Expenses of Electricity Distribution Utility in respect of Legacy Distribution Network Assets
α	means Projected Average Inflation Defined as (CPIt+1 – CPIt)/CPIt[1]
VNCLegDisNAs	means Value of Newly Commissioned Legacy Distribution Network Assets
μ	means Percentage of Value of Newly Commissioned Legacy Assets Dedicated to Operating Expenses as Approved by the Commission

2.4.3 Water Production, Transmission, *Distribution and Supply*

a. Other Operating Expense for First Regulatory Year

OpExt = PAWPAV * γ

Where:

OpExt	means First Regulatory Control Period Operating Expenses
PAWPAV	means PURC Approved Water Production Asset Value
γ	means PURC Approved Operating Efficiency Benchmark Percentage

b. Other Operating Expense for Subsequent Regulatory year

$OpEx(LegWPAs)_{t+1} = OpEx(LegWPAs)_t+(OpEx(LegWPAs)_t*\alpha)+(VNCLegWPAs*\mu)$

Where:

$OpEx(LegWPAs)_{t+1}$	means Forecast Operating Expenses
$OpEx(LegWPAs)_t$	means Base Year Operating Expenses
α	means Projected Average Inflation Defined as $(CPI_{t+1}–CPI_t)/CPI_t$
VNCLegWPAs	means Value of Newly Commissioned Legacy Water Production Assets
μ	means Percentage of Value of Newly Commissioned Legacy Water Production Assets dedicated to Operation and Maintenance Expenses as Approved by the Commission

3. DEFINITION OF KEY PERFORMANCE BENCHMARK INDICATORS

The set of KPIs compiled for this study are presented and defined in Table 4. These indicators are categorized under generation, transmission, and distribution for the electricity sector, and categorized under water coverage and water quality for the water sector.

The KPIs identified formed the basis of country comparison and performance, as well as a yardstick for measuring the progress of Ghana on the utility benchmarking index.

Table 4: Definition of Key Performance Indicators for Electricity and Water Sectors

Category	Indicator	Unit	Definition
Country Indicator	Population	#	Number of people/inhabitants of a country
	Electricity Access Rate	%	The percentage of people in a given country that have relatively stable access to electricity
Electricity Generation	Total Capital Cost	USD/kW	The minimum acceptable rate of return on capital investment; including the cost of debt and the cost of equity
	Equity Component	%	Financial return achieved by shareholders in a given utility during a regulatory control period
	Debt Component	%	The effective interest rate a utility must pay on its current debt to fund its operations
	Corporate Tax	%	Tax imposed on the net income/profit of a utility
	Cost of Equity	%	The rate of return on investment that is required by the shareholders of a utility
	Cost of Debt	%	The effective interest rate the utility pays on its current debt to fund its operations
	Fixed O&M Cost	USD/kW/yr	
	Non Fuel VOM Cost	USD/kWh	
Electricity Transmission	Maximum Transmission Network Capacity	kVA	
	Network Length	km	
	Regulated Asset Base: Per 330kV lines	USD/GWh	
	Regulated Asset Base: Per 161kV lines	USD/GWh	
	Regulated Asset Base: Per 69kV lines	USD/GWh	
	Number of Substations	#	
	Number of Transformers	#	
	Operating Expenses	mUSD	
	Human Resource Expenses	mUSD	

	Maintenance Expenses	mUSD	
	Other Operating Expenses	mUSD	
	Overheads	mUSD	
	Number of Employees	#	Number of workers/staff of a utility
	Transmission Losses	%	The percentage of power dissipated or lost across the electric grid during transmission
	SAIFI	#	Average number of interruptions that a customer would experience
	SAIDI	hr	Average duration of interruption in the power supply
	Energy Not Supplied	GWh	A measure of the amount of customer demand that cannot be supplied within a region due to a shortage of generation, demand-side participation or interconnector capacity
Electricity Distribution	System Peak Demand	MW	Highest electrical power demand over a specified period
	Electricity Sales	GWh	Final sale of electricity from distribution to end-user
	Network Length	km	
	Sub-Transmission & Primary System (33-11kv)	km	
	Sub-Transmission & Primary System (34.5-33kv)	km	
	LV System (415-240v)	km	
	Number of Substations	#	The number of electrical installations at which electricity is received from one or more power stations for conversion from AC to DC, reducing the voltage, or switching before distribution by a low-tension network.
	Operating Expenses	mUSD	The costs incurred by the utility to provide day to day distribution services to its customers
	Human Resource Expenses	mUSD	
	Operation & Maintenance Expenses	mUSD	

	Administrative and General Expenses	mUSD	
	Distribution Losses	%	The percentage of total technical and commercial losses established by the utility
	Customer Strength	#	Number of customers of a utility
	Number of Meters	#	
	Metering Ratio	#	Percentage of customers' connections metered
	Number of Employees	#	
	SAIFI	#	Average number of interruptions that a customer would experience
	SAIDI	hr	Average duration of interruption in the power supply
	CAIDI	hr	Average outage duration per consumer and calculated
	Operating Expenses as % of RAB	%	
	Distribution Network Assets Dedicated to Operating Expenses	%	
	O&M Cost per Customer	%	
	Distribution Revenue per Customer	%	
Water Coverage	Water Coverage Ratio	%	Percentage of population with drinking water (individual connections and public distribution systems-stand pipes and kiosks) within the operational area of a utility.
	O&M Cost Coverage	#	
	Non-Revenue Water	%	Water that is produced but is subsequently lost or otherwise unaccounted for in the system
	Metering Ratio	%	Percentage of customers' connections metered
	Collection Ratio	%	
	Capacity Utilization	%	
	Physical and Chemical Compliance	%	Compliance with the number of tests carried out and tests results (chlorine residual) within the national standards for drinking water.

Water Quality	E-Coli Compliance	%	Compliance with the number of tests carried out and tests results (bacteriological) within the national standards for drinking water.
	Sampling Compliance Index	%	

4.0 FINDINGS/RESULTS

The electricity and water benchmark findings are presented in Tables 5 and 6.

4.1 Electricity Benchmark Indicators

Table 5: Electricity Benchmark Indicators across the Electricity Industry Value Chain

		Country By Region														
		Africa				Asia			Europe			North America			South America	
Electricity Value Chain Parameters	Unit	Ghana	Uganda	Kenya		India	Philippines		United Kingdom	Georgia		USA	Canada		Chile	Ecuador
Electricity Generation:																
Plant Type:																
Combined Cycle:																
Total Capital Cost	$/kW											2481	1224		1117	
Corporate Tax	%		30	30		30	30			15		21	26		15	25
Fixed O&M Cost	$/kW/yr											27.6			11.17	
Non-Fuel VOM Cost	$/MWh											5.84			3.5	
Simple Cycle:																
Total Capital Cost	$/kW											1175	570		722	
Fixed O&M Cost	$/kW/yr											16.3			7.22	
Non-Fuel VOM Cost	$/MWh											4.7			3.5	
FOM As A %age of Capital Cost	%															
Combined Cycle:												1.11%	0.00%		1.00%	
Simple Cycle:												1.39%	0.00%		1.00%	
Non-Fuel VOM Cost As A %age of Capital Cost	%															
Combined Cycle:												0.24%	0.00%		0.31%	
Simple Cycle:												0.40%	0.00%		0.48%	
Electricity Transmission:																

Maximum Transmission Network Capacity	MVA					421,173				11,938					15375.55
Network Length	km		3,101	2,424		170,685			7,212	3,434					5964.11
Regulated Asset Base	M$		578			16,965.33				356.71					
Number of Substations	#		22			250			347	93					59
Number of Transformers	#					1429									92
Operating Expenses:	M$	0	33	14.45		1,591	0		1,136,708,000	29.07		-	-		- 96.77
Human Resource Expenses				6		493			113,670,800	9.46					
Operation and Maintenance Expenses			2	8.08		1,098				20					
Administrative and General Expenses			31	0.10											
Number of Employees	#		739	552		9,258			2,719	1,469					792
Transmission Losses	%		4.1	18		20.66			1.7	1.92					3.32
Operating Expenses As A Percentage of RAB	%		5.7%			9.4%				8.1%					
Operating Expenses (Less HR Expense) As Percentage of RAB	%														
Distribution:															
System Peak Demand	MW		736.68	1,882											
Electricity Sales	GWh		3201	8,769			43,572			4,380					21556
Network Length			15564	227,773						47265		263,035			5,548

Number of Substations	#		69	4480						93					357
Regulated Asset Base:	M$		730.062	4,425		79,498.00						18,080.17			
Operating Expenses:	M$	0	60.6	364.68		8,900.00	1,316,938.78		-	213		-	957.91		-	173.3
Human Resource Expenses	M$		27.16	158		3,466.67									
Operation & Maintenance Expenses	M$		12.28	81.30		5,433.33							593.86		
Administrative & General Expenses	M$		21.16	125.53									689.86		
Distribution Losses:	%	23	17.5	23.70%		19	6.08		8	5.1		6	3.87		7	
Technical Losses	%															6.87
Non-Technical Losses	%															5.91
Customer Strength	No.		1,696,520	7,067,861						1,847,988			5,302,563		1,963,156	5,368,493
Number of Meters			1,500,000													5,361,621
Metering Ratio			97%													100
Number of Employees	#		1619	10,914									10,842			5,930
Interruptions																
SAIFI			86	1.98			1.5			13.15			2.15			
SAIDI			191	11.5 (Nairobi)			163			23.67			5.12			
CAIDI				4.37												
O&M Cost per Customer	#												324			
Operating Expenses As %age of RAB	%		8.30%	8.24%		11.20%							5.30%			

Operating Expenses (Less HR Expense) As %age of RAB	%															

4.2 Water Benchmark Indicators

Table 6: Water Benchmark Indicators across the Water Industry Value Chain

			Africa				Europe			North America			South America		Asia/Pacific	
Water Industry Value Chain By Parameter	Unit		Ghana Benchmark	Uganda	Kenya		Denmark	Georgia		USA	Canada		Brazil	Argentina	Mongolia	Australia
Water Coverage																
Water Coverage Ratio	%			84	57		100	100					97	97	74.96	100
O & M Cost Coverage	%			1.06	103		2.84						0.96	0.49	0.84	1.87
Non-Revenue Water (NRW)	%		45	37.68	47		7.49	66					60.5	41.99	14.44	5.27
Metering Ratio	%		95	100	96			47					52.39	21.35	100	100
Collection Ratio	%		98	100	89		100						83.21			
Capacity Utilization	%		85													
Water Quality:	%															
Treated Water Quality																
Distribution Water Quality	Ratio			93	92											
Physical & Chemical Compliance	%		95	96.7				6.5								
E-Coli compliance	%		100	99.6	60			34								
Sampling Compliance Index	%		0.95	84.1	33		98.6	0.97								
Water Production:																
Operating Expenses	MUSD															
Regulated Asset Base	MUSD															
Operating Efficiency Benchmark Percentage	%															
Percentage of Water Production Assets Dedicated to Operating Expenses	%															

Water Transmission:																
Operating Expenses	**MUSD**															
Regulated Asset Base	**MUSD**															
Operating Efficiency Benchmark Percentage	%															
Percentage of Water Production Assets Dedicated to Operating Expenses	%															
Water Distribution & Supply:																
Operating Expenses	**MUSD**															
Regulated Asset Base	**MUSD**															
Operating Efficiency Benchmark Percentage	%															
Percentage of Water Production Assets Dedicated to Operating Expenses	%															

5.0 LIMITATIONS

The findings reported in this study, should be considered in light of limitations pertaining to availability, accessibility, and interpretation of data relevant to the object of study. The duration assigned for study completion also hindered the timely submission of a complete report. These limitations are explained below.

5.1 Data *Availability*

The methodology included collecting data based on some key indicators from multiple sources to enable uniformity in the comparisons of selected countries. Data for some indicators, however, were not available from the relevant data sources and databases. This limited the scope of key benchmarks and performance indicators to be analyzed; creating gaps in the data compiled, and inhibiting a thorough analysis of the results.

5.2 Language Barrier

Country documents and data reported in languages apart from English, presented a challenge in data compilation and interpretation. This meant that some countries that the study could have considered (i.e countries with similar electricity and water industry structure as Ghana) were dropped due to the difficulty in indicator identification and data interpretation.

5.3 Benchmarking Targets and Reporting

The study reviewing process revealed that no specific benchmark target has been identified in each of these countries for electricity and water. Country reporting standards and terminologies of benchmark indicators also differed. This tends to undermine the rigorous identification and interpretation of indicators, leading to limited and difficulty in comparison across countries.

5.4 Time Constraint

The time allotted to undertake this comprehensive benchmarking exercise and reporting, was well limited to approximately 10 working days. Considering the intensive nature of data collection, compilation, and reporting, in addition to other demanding work-related tasks of team members, submission of a final report within the stipulated time becomes an uphill task. The limited time, therefore, affected the timely submission of a complete draft report and subsequent data publication on the PURC website.

6. RECOMMENDATIONS

The following key points are recommended for similar future studies that would be undertaken by the Commission;

- The deficiency in collection of data necessitates a revision of the method of future data

collection for similar studies. This can be done by complementing the current approach with data periodically received from/shared with other regulatory authorities and utilities. For instance, the Commission can leverage its relationship with sister regulatory bodies and utilities to periodically undertake study visits, and share data and technical reports.

- Subscription to paid databases and peer-reviewed journals would also offer the Commission access to a wide range of search tools and data sources to facilitate data collection efforts.

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