KEY PERFORMANCE INDICATORS (KPI) MANUAL FOR MONITORING PERFORMANCE OF ELECTRIC UTILITY

ELECTRICITY REGULATORY COMMISSION

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ABBREVIATIONS

AT&C	Aggregate Technical and Commercial
CAIDI	Consumer Average Interruption Duration Index
CDP	Corporate Development Plan
CSF	Critical Success Factors
DSCR	Debt Service Coverage Ratio
EBIT	Earnings before Interest and Tax
EBITDA	Earnings before Interest, Tax, Depreciation and Amortization
ERC	Electricity Regulatory Commission
F/Y	Fiscal Year
GoN	Government of Nepal
GWh	Gigawatt Hour
KPA	Key Performance Indicators
KPI	Key Performance Indicators
kWh	Kilowatt Hour
MW	Megawatt
MWh	Megawatt Hour
NEA	Nepal Electricity Authority
NPR	Nepalese Rupees
PBR	Performance Based Regulation
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SLF	System Load Factor
TBD	To Be Determined
T&D	Transmission and Distribution

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UTILITY PERFORMANCE MEASUREMENT

The basic expectations on performance from electric utilities are safe, reliable, and affordable services in its area.[1] Over the years, the expectations of electric utilities have evolved beyond these basic requirements and now include the need to be a consumer centered, sustainable, and resilient system. There is a renewed focus on improving the performance of electric utilities in order to enhance economic performance, improve network performance, and increase consumer satisfaction.

To ensure that a utility is effectively fulfilling its purpose, it is necessary to measure its performance. Tracking the performance of the utility will not only ensure accountability but will also allow them to identify areas of improvement. The process of utility performance measurement includes defining organizational goals and objectives, identifying key performance areas, and defining key performance indicators. By compiling and benchmarking these indicators, utility can gain valuable insights and make data-driven decisions to optimize their performance.

MONITORING PERFORMANCE BY REGULATOR

Regulators have a mandate to ensure utilities are performing well–technically and financially–while also being responsive to consumer needs. The involvement of an independent regulator in the performance measurement process can help to ensure that the interests of both utilities and consumers are served. Moreover, independent regulators can incentivize utilities to improve their performance by offering rewards, while also imposing penalties when necessary. This balance of incentives and penalties, overseen by independent regulators, can help to drive improvements in utility performance and benefit all stakeholders involved.

In many countries around the world, regulators set tariffs that allow utilities to recover costs and earn a return on their investment. In some countries regulators incentivize utilities to improve performance by tying tariff rates to efficient performance by rewarding good performance and penalizing poor performance; This is the concept of Performance Based Regulation (PBR). Therefore, for PBR, it is necessary to identify relevant metrics/indicators to track performance of utilities along key performance areas (KPAs). By continuously monitoring the performance of utilities and offering incentives for improvement, regulators can play a key role in promoting the long-term sustainability of the power sector.

Performance measurement by the regulator, the Electricity Regulatory Commission (ERC), is essential to ensure that electric utilities in Nepal are performing effectively and efficiently.[2] By establishing Key Performance Indicators (KPIs) and monitoring them over time, the ERC can identify areas for improvement, set targets and get a better understanding of performance of the utilities across different functions and priority areas.[3] Examples of relevant KPIs for electric utilities include system losses, profit margin, number of outages, and consumer satisfaction. By tracking these metrics, utilities can make informed decisions to improve their overall performance across its various key performance areas.

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[1] Phillips, Charles F. (1993). *The Regulation of Public Utilities: Theory and Practice.* Arlington, Virginia: Public Utilities Reports, Inc.; p.136.

[2] See Section 12 of the ERC Act of 2074 (2017 A.D.).

[3] While this document directs requirements to NEA, these requirements shall be applicable to all of Nepal's electricity utilities and successor companies of the NEA.

KEY PERFORMANCE AREAS (KPAs) AND KEY PERFORMANCE INDICATORS (KPIs)

Key Performance Areas (KPAs) are the specific areas or functions of an organization that are important for its success and that need to be monitored and measured in order to assess the organization's overall performance.[4] These areas include day-to-day areas of utility functions such as technical, operational, and financial performance. Additional KPAs may also include consumer satisfaction, socio-economic factors, safety, and innovation, among others. The specific KPAs for an organization will depend on its industry, business model, and goals. By identifying and tracking KPAs, an organization can better understand its strengths and weaknesses, identify opportunities for improvement, and make informed decisions about how to optimize its performance. It is not uncommon to see the KPAs as being referred to as Critical Success Factors (CSF).

Based on the ERC's and electric utility's mission, and strategic goals, this manual recommends and identifies KPAs, and Key Performance Indicators (KPIs) which represent and measure the performance areas.

1. **Technical and operational** indicators provide a clear and measurable way to track progress and a greater understanding of the utility's performance. This KPA focuses on the utility's ability to deliver reliable and uninterrupted electricity supply to consumers.
2. It is crucial to be aware of the **safety performance** in order to reduce risks to the employees and consumers. This KPA measures the utility's commitment to maintaining a safe working environment for employees and consumers. The utility may track safety performance through the number of accidents that occur within the company's facilities and operations, safety training conducted for employees and safety measure awareness for third parties.
3. Tracking and benchmarking **financial** key performance indicators provide insight into the overall financial health of the utility. By regularly monitoring financial KPIs, utilities can identify trends and provide data driven approach for informed decisions.
4. It is vital for the ERC to propose a KPI-driven approach to regulate the utilities, in order to enhance **reliability and quality** on a large scale, where it is most needed. Performance measurement is a standard practice followed by utilities worldwide; however, data accumulation can pose a significant challenge. This approach will help identify areas where power reliability needs improvement and ensure that consumers receive consistent and reliable power supply.
5. **Consumer Service** indicators help identify and address any issue which will impact on consumer experience to provide seamless service to the consumers. This KPA measures the utility's ability to meet consumer needs and expectations.
6. **Socio-Economic** indicators are essential to track access to electricity which ensures households can meet their basic needs. Similarly, it will also help to understand the self-reliance of the country in terms of electricity generation. These indicators are critical to operate in a sustainable and responsible manner.

The selected six KPAs with relevant KPIs for utilities are listed in Table 1 and each performance indicator is defined in Table 2.

[4] Asih, Ia & Purba, Humiras & Sitorus, Tosty. (2020). Key Performance Indicators: A Systematic Literature Review. 8. 142-155.

Table 1 Key Performance Areas with identified Key Performance Indicators

Key Performance Areas	Key Performance Indicators
1. Technical and Operational	i. % of dispatched Energy[5] ii. System Loss iii. System Load Factor (SLF) iv. Peak Demand/ Installed Capacity
2. Safety	i. Fatalities and Accidents – Public & Employees ii. Mandatory Safety Training Employee Days iii. Awareness Initiatives for Consumers
3. Service Quality and System Reliability	i. SAIDI ii. SAIFI iii. CAIDI
4. Financial	i. Cost Recovery Ratio ii. Profit/Loss Margin iii. Return on Capital Employed iv. Return on Equity v. Debt Service Coverage Ratio
5. Consumer Service	i. Number of Consumer Complaints ii. Complaint Resolution Rate
6. Socio-Economic	i. % of electricity available from different sources ii. Per capita consumption iii. Household access to electricity

[5] In this document, the term "energy" is interchangeably used with the term "electricity supply" or "electricity" and mean the latter.

KEY PERFORMANCE INDICATORS (KPIS)

Table 2. Details of KPIs

Indicator Name	Unit	Definition	Importance of the KPI	Limitations	Formula	Report Timeframe
1. Technical and Operational						
% Of Dispatched Energy	%	The percentage provides the proportion of dispatched energy to the total available energy.	Depicts utility's efficiency in planning the system requirement and resources. If the % is less than 100, it indicates the inability of the utility to sell the entire energy produced and/ or purchased. A higher % indicates utility's higher efficiency and lower spilled energy.	N/A	$\frac{\text{Energy } Dispatched(MWh)}{Energy\ Available\ (MWh)}$ *where,* *Energy Dispatched (MWh) = Energy Available (MWh) -Energy not Dispatched (MWh)* *Energy available =Total energy available from [Own Plants+ Domestic PPAs+ Committed Cross Border Purchases] The following details to be provided along with % of energy dispatched: Total Available Energy in MWh: Total Dispatched Energy in MWh: Total Sold Energy in MWh:	Annually (Report by utility quarterly/ half yearly)
System Loss	%	Total system loss measures all losses that occur during the transmission and distribution of electricity from points of purchase to end-use consumers. Total system losses equal the difference between the power (GWh) supplied for consumption within the country and the power (GWh) billed to end users. i. **Transmission Loss-** Loss occurred during the transmission of electricity from point of purchase to	Operationalizes overall distribution performance of utility (including technical and non-technical aspects). System losses can be divided into technical and non-technical losses, the latter including theft, commercial and metering losses. They do not account for non-payment by end users.	It does not provide the source of loss – equipment or theft. It is a rough estimate due to the difference in timing of when injection and consumption meters are read.	$\frac{Electricity\ supplied\ to\ grid - Total\ electricity\ billed}{Eletricity\ supplied\ to\ grid}$ The following details to be provided along with losses in %: Total System Loss in MWh: (a) Technical: (b) Non-Technical:	Annually

Indicator Name	Unit	Definition	Importance of the KPI	Limitations	Formula	Report Timeframe
		the point of distribution input. ii. **Distribution Loss:** The loss occurred during the distribution of electricity from the distribution input to the end-use consumers. Distribution input is from distribution substation.			$\frac{Electricity\ supplied\ to\ grid - Total\ electricity\ input\ at\ distributior}{Eletricity\ supplied\ to\ grid}$ $\frac{Total\ Electricity\ input\ at\ distribution - Total\ Electricity\ billed}{Total\ electricity\ input\ at\ distribution}$	
System Load Factor (SLF)	%	System Load Factor (SLF) is a ratio of the average annual load to the maximum/peak load. It measures how much power is supplied (on average) per unit of peak demand.	SLF provides information on how efficiently the power system is being utilized and to a certain extent on how close the power system is to being overloaded. A high SLF indicates the power system efficiency is high but if SLF approaches 100% then it indicates system is nearing its capacity limits and may be at risk of collapsing.	N/A	$\frac{(Annual\ electricity\ consumption(MWh))/(24\ hours * 365days)}{Peak\ Annual\ load\ (MW)}$	Annually
Peak Demand/ Installed Capacity	%	Ratio of peak demand to installed capacity.	Indicates whether the existing system is capable of handling peak system demand. It is an important tool in system planning.	In Nepal's hydro context, installed capacity does not necessarily always indicate available capacity, this metric will need to be measured on a monthly basis with installed capacity replaced by available capacity. The ratio depends on the type of generation mix and readiness to rely on CBET.	$\frac{Peak\ demand\ (MW)}{Installed\ capacity\ (MW)}$	Monthly

Indicator Name	Unit	Definition	Importance of the KPI	Limitations	Formula	Report Timeframe
II. Safety						
Fatalities and Accidents	Number	Total number of fatalities and accidents per year involving public and employees.	Helps track number of fatalities and accidents under both group: i. utility employees ii. public.	Not every accident might be reported and logged in the utility. The indicator might not always reflect true number. The magnitude of the accident will also determine the indicator. If only human life loss or irreparable damage is considered as an accident, then the indicator will not reflect other logged accidents with different magnitude. Also, the indicator does not cover the damage to infrastructure including utility assets.	--	Quarterly and Annually
Mandatory Safety Training Employee Days	Employee days	Safety training employee-days provide total training days attended in a given period. It is calculated by multiplying the number of training days with the number of attendees. Training two people for two days is four-man days. Assuming, it as one full day training. If two people attend half day training, then it is 1 man day.	Indicates the total number of training days in a given period. Higher man days indicate greater number of trainings days or higher attendees in the trainings. The indicator takes into consideration both the number of training days and number of attendees all together. Such trainings help in reducing workplace accidents and fatalities.	Higher number does not mean better effectiveness of the trainings.	Number of training days* Number of trainees 1 training day is assumed to be 8 hour working day.	Annually

Indicator Name	Unit	Definition	Importance of the KPI	Limitations	Formula	Report Timeframe
Awareness Initiatives for Consumers	Number	Number of awareness campaigns conducted for consumers on electrical safety indoors and outdoors, prevention of fires, death and injuries caused by electrical faults, use of safe electrical appliances to name a few. These can either be done through digital mass awareness campaigns or through physical campaigns.	It is imperative for utilities to raise awareness amongst the general public to not take any risk of interacting with the risky electricity infrastructure.	N/A	--	Annually
III. Service Quality and System Reliability						
SAIDI	Time (minutes/ hours)	The System Average Interruption Duration Index (SAIDI) is defined as the average interruption duration (in minutes) for consumers served by the utility system during a specific period. SAIDI will be measured at 11/33 kV feeder level [6] which can be aggregated to provide Distribution Centre and Province Level SAIDI.	Continuity of supply is an important metric for reliability of service and SAIDI is a key measure.	Measuring SAIDI accurately requires consumer's network link to be maintained and measured to reflect supply disruptions. Current network configuration will likely limit the ability to measure SAIDI accurately.	$\frac{Sum\ of\ duration\ of\ all\ outages\ in\ a\ year}{Number\ of\ Customers}$ [7]	Annually
SAIFI	No.	The System Average Interruption Frequency Index (SAIFI) is defined as	Continuity of supply is an important metric for reliability of service and SAIFI is a key	Measuring SAIFI accurately requires consumer's network	$\frac{Sum\ of\ all\ consumer\ interruptions\ in\ a\ year}{Number\ of\ Consumers}$	Annually

[6] ERC, Electricity Consumer Right Protection Directive 2080 (Draft)

[7] *Pacific Power Association & Asian Development Bank Manual of ...* (2002) *Manual of Performance Benchmarking*. Available at: https://www.ppa.org.fj/wp-content/uploads2/2013/03/01-Manual-of-Performance-Benchmarking-July-2002.pdf

Indicator Name	Unit	Definition	Importance of the KPI	Limitations	Formula	Report Timeframe
		the average number of instances a consumer on the utility system will experience an interruption during a specific period. SAIFI will be measured at 11/33 kV feeder level [8] which can be aggregated to provide Distribution Centre and Province Level SAIFI.	metric that measures the number of interruptions per consumer.	link to be maintained and measured to reflect supply disruptions. Current network configuration will likely limit the ability to measure SAIDI accurately.	*Since SAIFI is a sustained interruption index, only outages lasting longer than five*(TBD) minutes are included in the calculations.	
CAIDI	Hrs.	Consumer Average Interruption Duration Index (CAIDI) is defined as the average duration (in minutes) of an interruption experienced by consumers. CAIDI will be measured at 11/33 kV feeder level which can be aggregated to provide Distribution Centre and Province Level CAIDI.	It indicates the average time required to restore service during a pre-defined period.		$\frac{SAIDI}{SAIFI}$ [9] *Since CAIDI is a sustained interruption index, only outages lasting longer than five*(TBD) minutes are included in the calculations. It can also be calculated by dividing the sum of all consumer minutes of interruption during that period by the number of consumers that experienced one or more interruptions during that time period.	Annually
IV. Financial						
Cost Recovery Ratio	%	It is a financial ratio that measures the extent to which the utility is recovering its costs of providing service to its consumers. The calculation of this ratio involves dividing the total revenue received by the utility by its total cost of service.	This ratio expresses the percentage of total costs that are being recovered through revenue. A high-cost recovery indicator is generally desirable, as it indicates that the utility is generating sufficient revenue to cover its expenses and invest in infrastructure improvements.	The cost recovery ratio is based on the total revenue and total cost of service for the entire consumer base. It does not account for differences in consumer usage patterns or the cost of serving consumers	$\frac{Total\ Revenue\ Generated}{Total\ cost\ of\ service}$ *Total Revenue Generated =Revenue generated from sale of energy in the country + Revenue generated from export of energy in cross border market + Revenue from other income *Total Cost of service= Cost of generation, transmission, distribution, and corporate overheads. *Corporate overheads also include interest on working	Annually

[8] ERC, Electricity Consumer Right Protection Directive 2080 (Draft)
[9] ERC, Electricity Consumer Right Protection Directive 2080 (Draft)

Indicator Name	Unit	Definition	Importance of the KPI	Limitations	Formula	Report Timeframe
			For example, if the ratio is 0.90, it means that the electric utility is recovering 90% of its costs through revenue.	with different usage profiles.	*capital*	
Profit / Loss Margin	%	Profit margin indicates what percentage of sales has turned into profit. It is calculated by finding the profit as a percentage of the revenue.	It indicates a utility's profitability.		$\frac{Profit\ (Loss)}{Revenue}$	Annually
Return on Capital Employed	%	The financial ratio to assess a company's profitability and capital efficiency.	Indicates of how well a company is using its capital to generate returns or measures the company's profitability versus the investments it has made in itself.		$\frac{Earnings\ Before\ Interest\ and\ Tax\ (EBIT)}{Capital\ Employed}$ *Capital Employed= Total Assets- Total Current Liabilities or, = Shareholder's equity +Long Term Liabilities	Annually
Return on Equity	%	The return on equity is a measure of the profitability of a utility in relation to the equity	It measures the utility's overall profitability for the investors.		$\frac{Net\ Income}{Shareholder's\ Equity}$ *Shareholder's equity= Total assets -Total Liabilities	Annually
Debt Service Coverage Ratio (DSCR)	Ratio	DSCR is the ratio of net revenues available for debt service to total debt service for the year. This ratio measures the utility's ability to meet its annual debt obligation.	It indicates the utility's ability to repay its debt (principal and interest). A DSCR of 0.90 indicates the company's operating income only covers 90% of its debt obligations. A DSCR calculation greater than 1.0 indicates there is barely enough operating income to cover annual debt obligations, while a calculation less than one indicates potential solvency problems.	Net Revenue does not consider tax expenses. Not the entire amount of Net Revenue is available to debt holders; A certain portion will be used for taxation purposes.	$\frac{Earnings\ Before\ Interest\ Tax,\ Depreciation\ and\ Amortization\ (EBITDA)}{Total\ Debt\ Service\ (Principal + Interest)}$ *Debt service includes principal and interest payments on short term and long-term debt.	Annually
V. Consumer Service						
Number of consumer complaints	Number	Total number of complaints filed in a year.	It is an important indicator which measures consumer service effectiveness. Also helps to identify frequent service failure and areas of improvement.	Does not provide insights into the nature or severity of complaints other than the ones stated.	Number of consumer complaints under different categories in a given period. Number of Complaints under: 1. Outages 2. Voltage 3. Billing 4. Safety	Quarterly/ Annually

Indicator Name	Unit	Definition	Importance of the KPI	Limitations	Formula	Report Timeframe
			Major types of Complaints: 1. Outages 2. Voltage 3. Billing 4. Safety 5. Others		5. Others	
Complaint Resolution Rate	%	Complaint Resolution Rate measures the percentage of solved complaints from overall problems raised by consumers.	It is used to track how well the consumer problems are being solved and to determine the overall efficacy of the consumer service department. An effective resolution of complaints increases consumer confidence while assuring them that the utility is consumer focused. In addition, high-resolution rates help manage consumer issues, while identifying possible solutions for improvement.	The indicator will not provide information on the response time for complaint resolution. ERC can provide guidance to utilities to begin tracking resolution time by key complaint categories	$\frac{Total\ number\ of\ complaints\ resolved}{Total\ number\ of\ complaints}$	Monthly
VI. Socio-Economic						
% of electricity available from different sources	%	The ratio of electricity generation from different sources including domestic and imports to total electricity available.	It provides our nation's self-reliance on electricity supply and dependence on the imports from different sources. This indicator will provide domestic generation		1. Domestic Generation $\frac{Own\ generation + NEA\ subsidiary\ generation + Purchase\ from\ IPPs\ (GWh)}{Total\ electricity\ available\ (GWh)}$ i. $\frac{NEA\ generation\ (GWh)}{Total\ electricity\ available\ (GWh)}$ ii. $\frac{NEA\ subsidiary\ generation\ (GWh)}{Total\ electricity\ available\ (GWh)}$ iii. $\frac{IPPS\ generation\ (GWh)}{Total\ electricity\ available\ (GWh)}$ 2. Imports $\frac{Total\ Imports\ (GWh)}{Total\ electricity\ available\ (GWh)}$ i. $\frac{Solar\ energy\ sourced\ Imports\ (GWh)}{Total\ imports\ (GWh)}$ ii. $\frac{Coal\ energy\ sourced\ Imports\ (GWh)}{Total\ imports\ (GWh)}$ iii. $\frac{Renewable\ energy\ sourced\ Imports\ (GWh)}{Total\ imports\ (GWh)}$	Annually reported domestic generation including NEA, NEA Subsidiary and IPPs

Indicator Name	Unit	Definition	Importance of the KPI	Limitations	Formula	Report Timeframe
Per capita consumption	kWh	The energy consumption per capita is when the total energy consumption is divided by the total population.	It is an important metric to determine the level of domestic electricity consumption. The indicator of per capita consumption of electricity reflects the level and potential of the country's economic condition. Monitoring of per capita consumption level important for demand stimulation and ensuring efficient use of electricity.		$\frac{Total\ population\ electricity\ consumption\ (kWh)}{Total\ population}$	Annually province wise
Household access to electricity	%	Access to electricity is the percentage of the population with access to electricity. Household access to electricity is measured as percentage of households that are connected to an electric power source (grid or off-grid).	Household access to electricity is an important tool to monitor national electrification rate. It is also one of the indicators of power sector performance. It shows how advanced the sector is in achieving its developmental goal of connecting households and businesses.		$\frac{Total\ households\ with\ electricity\ access}{Total\ number\ of\ households}$	Annually province wise

BENCHMARKING MAJOR KPIS

Benchmarking is a valuable tool to compare the performance of the utility with that of other utilities or to the industry standards. This can be done to identify areas where the utility is performing well and areas where it could improve.[10] However, identifying appropriate utilities to benchmark against and collecting data for benchmarking key performance indicators (KPIs) can be a significant challenge. Utilities operate in vastly different regions, with different consumer demographics, climates, and regulatory environments. These differences can impact the cost of producing and delivering electricity, making direct comparisons difficult. Electric utilities may generate power from various sources, such as coal, natural gas, hydroelectricity, solar, or wind. This diversity can make it challenging to find comparable utilities that generate electricity in the same way. As a result, identifying appropriate utilities to benchmark against can be a complex and time-consuming process.

Another major challenge for benchmarking is the vast amount of data that must be collected and analyzed. Utilities will need to gather data from various sources, including their own internal systems, external vendors, and other stakeholders. Additionally, data collection can be time-consuming and resource-intensive, requiring significant human resources and investment. There may also be challenges associated with data quality, accuracy, and consistency, as data may be sourced from different systems or may have been collected using different methodologies. Furthermore, there may be challenges associated with defining and standardizing metrics, making it difficult to measure performance accurately. Despite these challenges, benchmarking KPIs remains a critical activity for utilities to assess their performance, identify areas for improvement, and drive positive change across the industry.

In order to initiate the benchmarking process effectively, it is vital for the utilities to maintain a comprehensive record of the indicators and diligently track and monitor them. This proactive approach will streamline and expedite the benchmarking procedure during the second phase of implementation. Therefore, realizing the importance and challenges of benchmarking, this manual proposes 2 phases for implementation of performance measurement of utility where benchmarking will be undertaken only at the end of Phase 2.

IMPLEMENTATION PLAN

For utilities to manage resources, build momentum and support for implementing the performance measurement system, this manual divides the implementation plan into 2 phases. The first phase of implementation includes monitoring KPIs that the utility is already measuring and for which data is available. The second phase will include data collection, identification of appropriate benchmarks and identification of additional and relevant KPIs for the utility. The phasing of the implementation plan will lead to better and sustainable outcomes.

Details of the proposed implementation plan are as follows:

PHASE 1: PROPOSED IMPLEMENTATION PERIOD (FY 2080/81) (FY 2023/24)

1. ***Establish targets for KPIs which are already recorded.***
   The Nepal Electricity Authority (NEA) currently tracks and monitors several key performance indicators (KPIs) on a periodic basis, including technical, operational, and financial performance indicators. However, these KPIs are not benchmarked, and targeted for performance evaluation

[10] Mugisha, Silver (2011). *Utility Benchmarking and Regulation in Developing Countries: Practical Application of Performance Monitoring and Incentives.* International Water Association.

and improvement. To address this, NEA should establish clear targets for all relevant KPIs; many are already outlined in the NEA's Corporate Development Plan (CDP 2019/20-2023/24).[11]

Some of the KPIs that NEA is currently tracking include:

Table 3 KPIs which are currently being tracked by the NEA.

KPI	Baseline (2021/22)	ERC's Target (2022/23)	NEA's Achieved (2022/23)	Remarks
System Load Factor (SLF)	65%[12]	75%	70%	NEA CDP
System Loss	15.38%	14.4%	14.12%	NEA CDP
% of Electricity Available from Domestic Generation	86%[13]	100% Long-term target	86%	The government has a goal of adding 5000 MW to the national grid by 2023/24, which will likely lead to a significant decrease in the need for imports. In fact, there has already been a 45.01% decrease in imports from 2020/21 to 2021/22. As domestic generation increases, imports will be replaced accordingly.
Household Access to Electricity	93%[14]	100% (2023/24)	96%	NEA CDP
Per Capita Consumption	295.91[15]	496	362	NEA Distribution and Consumer Services Directorate FY 2021/22

2. *Track and establish goals for indicators that are not regularly recorded.*

Financial performance KPIs are annually recorded however there is a need for tracking, monitoring, and setting targets for each of them. Similarly, safety KPIs including safety training employee days, number of awareness initiatives can easily be measured and monitored with relevant data. Financial and Safety KPIs mentioned in Table 1 can be tracked and monitored in Phase 1.

3. *Reporting indicators*

There is a need to analyze the collected data and compare the utility's performance against its past data until appropriate utility/s are identified to benchmark against. A report should be developed that highlights areas of strength and weakness and identifies opportunities for improvement. This report should be shared with stakeholders, including management, regulators, and consumers.

During Phase 1, utilities will record, track, and establish targets for the following KPIs:

[11] NEA Corporate Development Plan 2018/19-2022/23
[12] NEA Annual Report FY 2021/22
[13] NEA Annual Report FY 2021/22
[14] NEA Annual Report FY 2021/22
[15] NEA Annual Distribution and Consumer Services Directorate Report FY 2021/22

Table 4 KPIs to be recorded, tracked and with established targets in Phase I

KPIs[16]	Targets			Remarks
	Short Term (1 year) (FY 2080/81) (FY 2023/24)	**Medium Term** (2-3 years) (FY 2081/82-FY 2083/84) (FY 2024/25-2026/27)	**Long Term** (4-5 years) (FY 2083/84-FY 2085/86) (FY 2026/27-2028/29)	
Technical and Operational				
i. % of dispatched Energy	N/A	N/A	N/A	The indicator will be tracked, hence no target set. If the % is less than 100, it indicates the inability of the utility to sell the entire energy produced and/ or purchased. A higher % indicates utility's higher efficiency and lower spilled energy.
ii. System Loss	13.75%	12.25%	12%	Historical Trend NEA System Loss reduced from 17.18% in FY 20/21to 15.38% in FY 21/22. [17](Historical trend shows average decrease in 7% per annum for the last 5 years) CDP AT&C losses14.4% (22/23) India's T&D losses =20.66% (2018/19)[18] AT&C losses = 17% (2021/22) Bangladesh T&D Loss =10.41% (2021/22)[19]
	Transmission loss= 4.3%	4.1%	4%	Historical Trend Transmission loss reduced to 4.49% in FY 21/22. (Average decline by 3%) Transmission loss (Bangladesh)=2.89% (2021/22)
	Distribution loss= 9.45%	8.15%	8%	Historical Trend Distribution loss reduced to 10.86% in FY 21/22 from 11.69% in FY 20/21. (Average decline by 7%) Distribution loss (Assam)= 17.75% (2021) (Bangladesh) = 8.10% (2021/22)
iii. System Load Factor (SLF)	70%	70%	70%	65% (NEA Annual Report 21/22) All India = 83% (2021)[20] Assam= 56% Uttarakhand =66% Bihar = 59% Bangladesh = 64.82% (2021/22)

[16] KPI: Key Performance Indicators
[17] NEA annual Report 2021/22
[18] Central Electricity Authority Report, India 2018/19
[19] Annual Report 2021/22, Bangladesh Power Development Board
[20] Seasonality analysis of load factor in Indian Power System, June 2021

KPIs[16]	Targets			Remarks
iv. Peak Demand/ Installed Capacity	75%	65%	60%	Peak Demand FY 21/22= 1747.53 MW[21] Installed Capacity FY 21/22=2190 MW Peak Demand/ Installed Capacity (21/22) = 79% India - 207/416=49.7% Bangladesh - 15.8/22.5=70% Pakistan - 22.5/43.7= 51%
Safety				
i. Fatalities and Accidents – Public & Employees	0	0	0	Recorded separate for Public and Utility employees
ii. Mandatory Safety Training Employee Days	*TBD			Contract, Norms and Specifications Departments at NEA will be responsible for developing standards and protocols for NEA operations. *Chaitra 26th marks as Electrical Safety days at NEA: interaction program with employees, displaying safety related banners, posters, pamphlets etc. to express NEA commitment on electrical safety as well as to create awareness.
iii. Awareness Initiatives for Consumers	*TBD			Develop and Implement Consumer Safety Awareness Campaign (CDP). Safety Management Division will be created as an arm of the Energy Efficiency and Loss Reduction Department (EELRD). It will be responsible for increasing public awareness of safety standards. (CDP).
Service Quality and System Reliability				
i. SAIDI	*TBD	*TBD	*TBD	Initiate data gathering process. (Requires Baseline Study Data)
ii. SAIFI	*TBD	*TBD	*TBD	Initiate data gathering process. (Requires Baseline Study Data)
iii.CAIDI	*TBD	*TBD	*TBD	Initiate data gathering process. (Requires Baseline Study Data)
Financial				
i. Cost Recovery Ratio	>100%	>100%	>100%	
ii. Profit/Loss Margin	*TBD	*TBD	*TBD	23% FY 21/22 (NEA financial statement)
iii. Return on Capital Employed	*TBD	*TBD	*TBD	5.43% FY 21/22 (NEA Financial Statement)
iv. Return on Equity	*TBD	*TBD	*TBD	

[21] NEA annual report 21/22

KPIs[16]	Targets			Remarks
v. Debt Service Coverage Ratio	>1.2	>1.3	>1.4	Lender's requirement, Industry Norm Average projected DSCR for FY 23-27 is 2.12. 4.82* (NEA Annual Report 2021/22) * The ratio only covers interest payments
Consumer Service				
i. Number of Consumer Complaints	*TBD	*TBD	*TBD	Data to be collected and tracked for major categories of complaints: • Outages • Voltage • Billing • Safety • Others
ii. Complaint Resolution Rate	100%	100%	100%	
Socio-Economic				
i. % of electricity available from different sources (Domestic generation and imports)				The indicator will be tracked, hence no target set. With government plan to add 5000 MW in national grid by 2023/24, imports can be significantly expected to be replaced by domestic generation. The contribution of the total internal generation to the total available energy has increased from 68% in FY 2020/21 to 86% in FY 2021/22.
ii. Per capita consumption	362	550	700	Per capita consumption for FY 21/22 is 295.91(NEA Annual Distribution report FY21/22) Budget FY 2080/81 (450kWh by FY 2081/82)
iii. Household access to electricity	96%	100%	100%	92.51% in FY 21/22 (National electrification by household in FY 21/22- NEA Distribution and Consumer Service Directorate) The GoN has set a target to provide electricity access to the entire population by FY 2023/24.

PHASE 2: PROPOSED IMPLEMENTATION PERIOD (FY 2081/82) (FY 2024/25)

During Phase 2, utilities will develop and implement a system for consistently collecting, tracking, monitoring, and benchmarking KPIs along with adding a range of relevant indicators.

1. **Data Collection:** It is critical to establish a clear plan for collecting the data required for identified and new KPIs. This may involve integrating data from different sources or establishing new data collection processes by the utilities. It is also essential to ensure the accuracy and reliability of the data collected.
2. **Additional KPIs:** Utilities can get a better picture of their performance across various areas by using a range of KPIs. Additional KPIs should be specific, measurable, and aligned with utility's vision and goals and that are most relevant across its different functions. Furthermore, tracking and benchmarking additional KPIs will require planning, system, and data in order to be effectively monitored. **Additional KPIs may also be included in the reporting.** Some of the additional KPIs which may be tracked and benchmarked in the second phase are included in Annexure 1. It is not an exhaustive list and other indicators may be included as required.
3. **Benchmarking:** Benchmarking KPIs for a utility will involve identifying relevant KPIs and appropriate utility or indexes of a group of utilities in terms of demographic and geographic differences, diverse generation mix, size, and structure of the utility. It will be followed by gathering and analyzing data, setting targets, and monitoring progress over time. Benchmarking will require planning, development of performance measurement systems, and data in order to be effectively monitored. In addition to that, utilities should monitor and update the benchmarking process regularly and make updates as necessary to ensure that it remains relevant and effective.

   By the end of Phase 2, all the KPIs mentioned in Table 1 will have adequate, reliable, and relevant data for benchmarking including service quality and system reliability KPIs- SAIDI, SAIFI and CAIDI. Benchmarking will be done after Phase 2 ends.

Table 5. Key Indicators from Table 2 to be recorded and tracked in Phase 2

Key Performance Indicators	Targets	Remarks
Service Quality and System Reliability		
i.SAIDI	N/A	Date to be recorded and tracked.
ii.SAIFI	N/A	Date to be recorded and tracked.
iii.CAIDI	N/A	Date to be recorded and tracked.

CONCLUSION

Performance measurement by ERC can help utilities improve their operational efficiency and financial performance. By tracking key performance indicators and setting targets for improvement, the utilities can identify areas for improvement and take necessary actions to enhance its performance. In addition, performance measurement can help utilities align their activities and efforts with their strategic goals, such as improving consumer service, access to electricity, and reliability of the power grid.

It is important for ERC and the electric utilities to regularly review and update the KPIs to ensure that they are still relevant and accurately reflect the performance of the utility. The review process should involve stakeholders such as consumers, employees, and other industry experts to ensure that all relevant perspectives are considered. In addition to tracking the KPIs, it is also important to analyze the data and use it for decision making and to identify areas for improvement. By regularly measuring and analyzing performance, the utilities and ERC can work towards continuous improvement and ensure that the power sector in Nepal is providing reliable, affordable, and sustainable services to its citizens. Overall, performance measurement can play a vital role in the development and success of Nepal's power sector by helping to ensure that all stakeholders are working towards common goals and objectives.

ANNEXURE I

Key Performance Areas	Key Performance Indicators
1. Technical and Operational	i. Revenue per employee (NPR) ii. Operations And Maintenance Expense Per Consumer (Transmission and Distribution) (NPR/consumer) iii. Operation And Maintenance Expense Per MWh[22] (Generation) iv. Technical and commercial losses (%) in distribution (compare energy sold to energy supplied to distribution)
2. Safety	i. Lost Work-day Rate (Lost work incident hour per work hours of month) ii. Non-fatal public contact incidents rate
3. Service Quality and System Reliability	i. Scheduled outage duration (Minutes) ii. Supply restoration after sudden outage affecting one consumer or group of consumers (Minutes) iii. % of unplanned outages/ total outages iv. Variation in voltage magnitude
4. Financial	i. Operating Expenditure/ Revenue (Cost Efficiency) (%) ii. Revenue per kWh (under different consumer category)[23] iii. Revenue per Connection – Category (NPR) iv. Per unit cost by consumer category (NPR/kWh) v. Gearing Ratio (%)
5. Consumer Service	i. Average Response time for complaints (category wise) ii. Service Restoration Time (% within different time slots) iii. Lead time to provide new connection (based on nature of request) (Days) iv. Average Response time to permanently disconnect the supply (Days) v. Number of consumer care personnel /100 consumers[24]

[22] *Pacific Power Association & Asian Development Bank Manual of ...* (2002) *Manual of Performance Benchmarking*. Available at: https://www.ppa.org.fj/wp-content/uploads2/2013/03/01-Manual-of-Performance-Benchmarking-July-2002.pdf

[23] *Financial and operating ratios of Public Power Utilities, American Public Power Association on financial and operating ratios*

[24] *Concept Paper: Performance Benchmarks for Electricity Distribution Companies in South Asia*

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