Benchmarking Workshop

RECAP OF DAY 1 WORKSHOP

Purpose for Performance Benchmarking

Involves find best practices and then being able to apply that experience and knowledge in a meaningful context to improve performance.

Benchmarking is a valuable instrument for comparing performance of a utility over time as well as performance between similar organizations and between regions

It allows better understanding of performance gaps and allow one to derive reasons for underperformance, improved decision making within power utilities and increases efficiency, and improved performance of participating power utilities.

Purpose for Utility Power Benchmarking

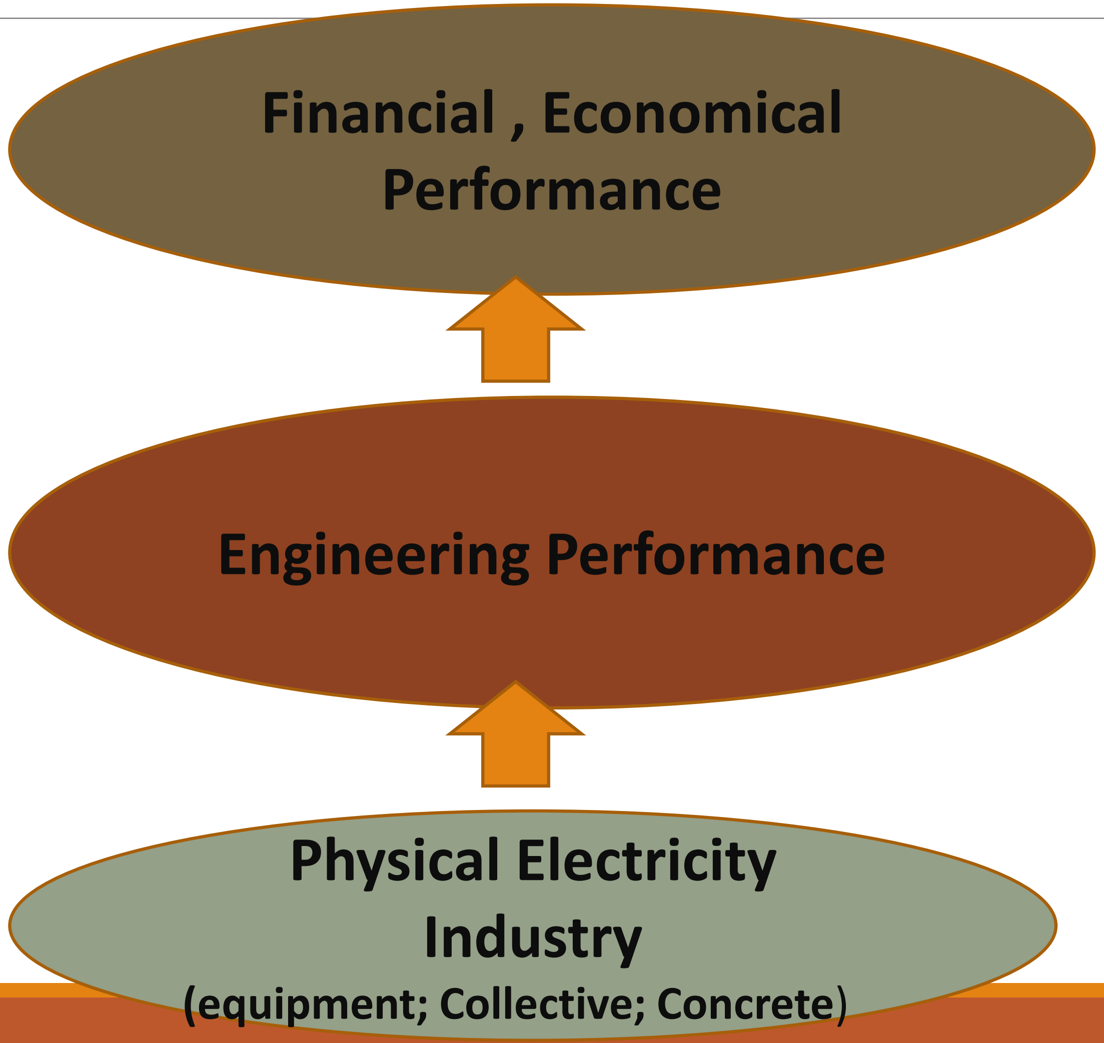
Key Performance Indicators (KPI’s) provide a means for utilities to monitor, assess and improve their performance over time by performance with other similar utilities

Transparent and reliable information is useful to a wide range of decision makers, including own utility, financial analysts, investors, policymakers and consumers.

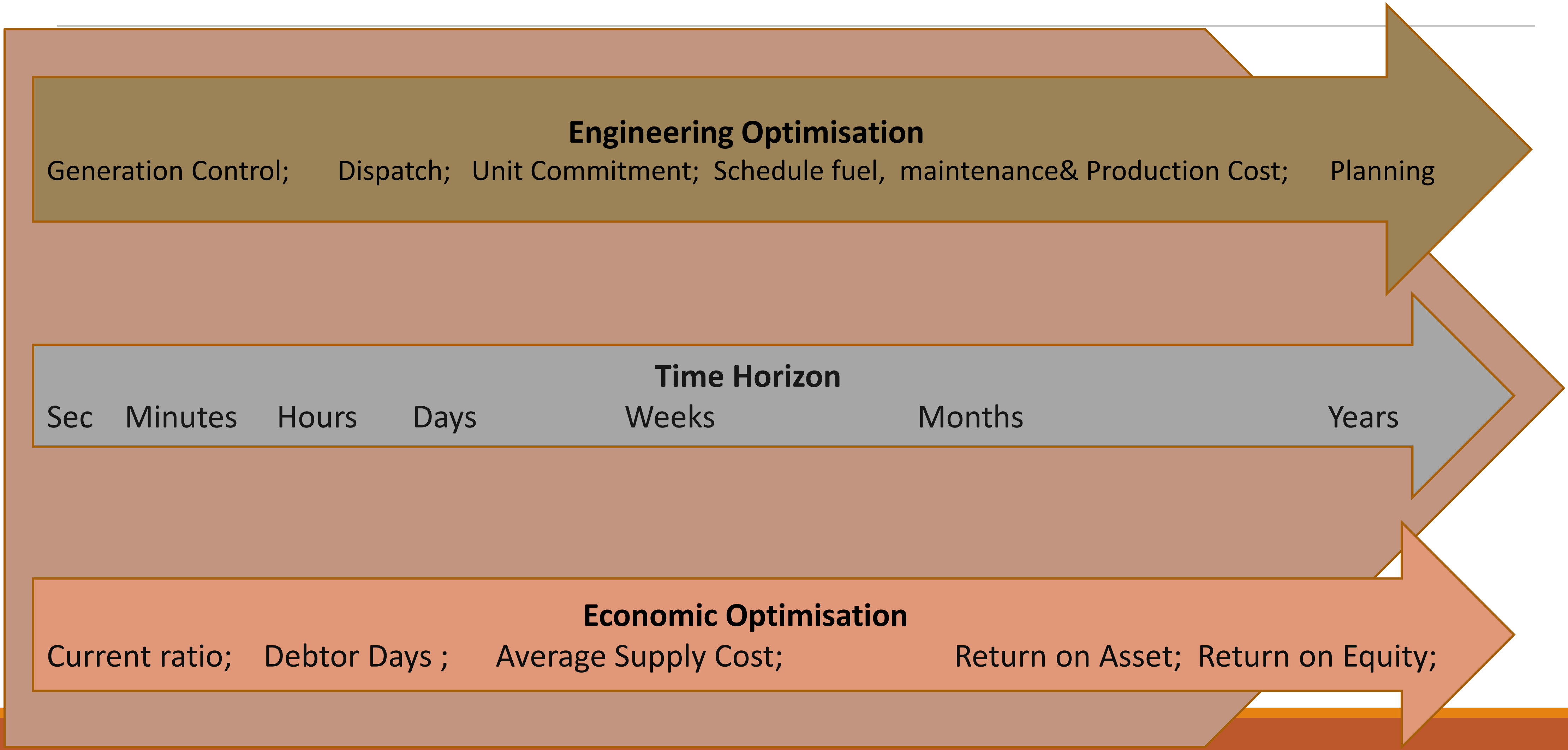
Promotes improvement – provides a way to learn from better performers.

Maximize efficiencies and knowledge sharing

Monitoring Performance Level



Benchmarking- a decision making Tool for Utilities



Security of Supply – availability, quality of Supply

Electricity industry is a flow industry

- Lack of cost-effective storage of electrical energy
- Social expectations of uninterrupted energy service

Key measures of ‘health’ of the flow industry

- (un) availability of supply at the point of end-use:
  - Frequency & duration of Supply outages

Quality of Supply at the end–use

- Voltage and Frequency
- Voltage surges, waveform purity, phase balance

Ever-present threats to availability and quality

Nature & purpose of Production Costing

Nature of Production costing:

- Simulation of future operation of the existing power system for a specified time period (e.g. 7 to 365 days)

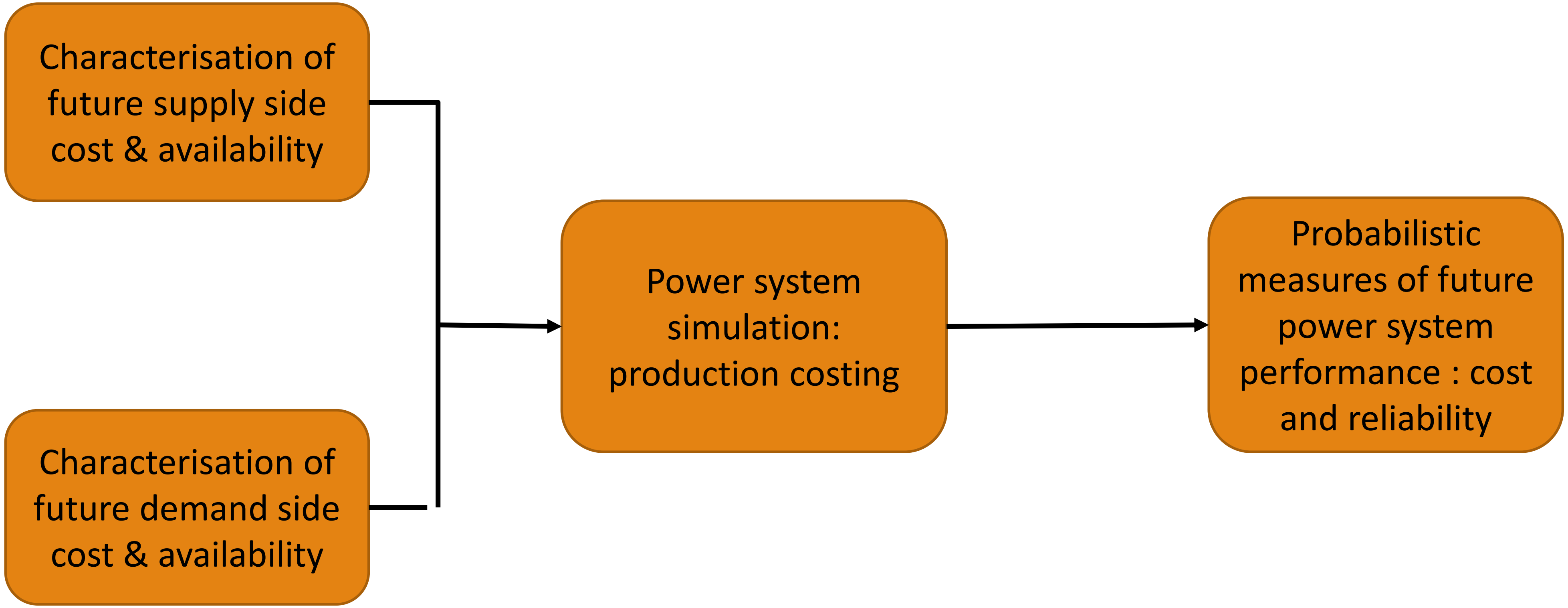
Purpose of production costing:

- Estimating future system operating cost & reliability
- Informing energy constraint management
- Simulating system operation in expansion planning

Key challenges in production costing :

- Specifying supply & demand side uncertainty
- Characterising supply and demand uncertainty
- Simulating operation and characterising performance

Implementation of Production costing



Supply & Demand Side Costs & uncertainties

Supply side cost, such as :

- Start up & shut down cost, fixed and variable cost while operating , maintenance cost, network losses.

Demand side cost, such as:

- Cost of un met demand (lost load)

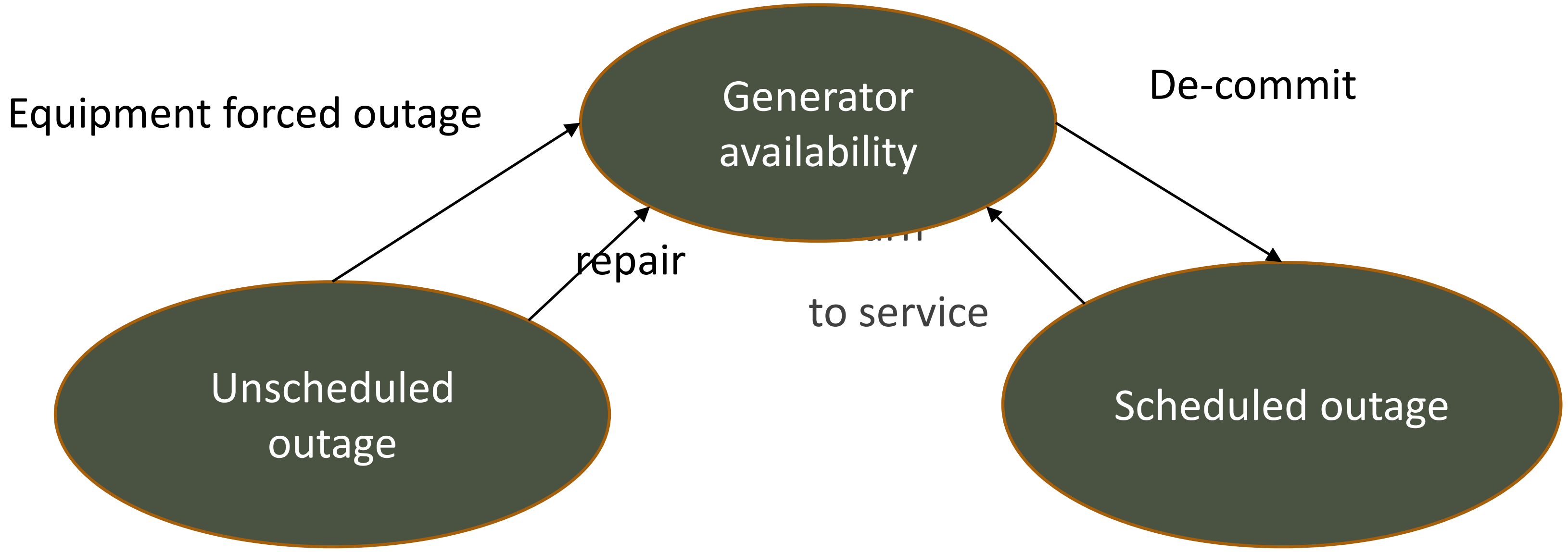
Supply side uncertainties, such as :

- Forced full and partial outages of generator and network
- Generator failure to start

Demand side uncertainty, such as;

- Demand forecast uncertainty (eg weather dependence)

Modelling generator uncertainty



Forced outages rate (q_n): $\frac{\{hours\ of\ unscheduled\ outages\ in\ period\}}{\{total\ hours\ in\ period}$

Probability that generator is available : $p_n = 1 - q_n$

Frequency and duration of outages

Modell of failure and repair processes:

- Mean (average) time between failures (MTBF)
- Mean (average) time to repair (MTTR)
- Estimated forced outage rate:

  - $q_n = {}^{MTTR}/_{(MTTR+MTBF)}$

- Issues in application:
  - Derive estimates of MTBF &MTTR from historical data but that future does not repeat the past

KEY ELEMENTS

Benchmarking has four key elements:

- Systematic – needs to be part of an on-going disciplined program in order to maximise results;
- Comparative – involves evaluating relative performance;
- Focussed on best practice – looks towards examples set by best performers;
- About achieving quantum breakthrough or incremental continuous improvements.

Types of Benchmarking

1) Statistical Benchmarking

2) Management Benchmarking

- Overview
- Detailed

Disadvantage

- Focused on one KPI at a time provide partial overview.

Compensation to current benchmarking process

1) Balance Scorecard

2) Performance Quadrant

Current Benchmarking Processed (@PPA Secretariat)

Challenges

- Validation labour intensive
- In complete submission
- Incorrect data
- Change of BLO
- Difficult to generate special report for individual utilities

KPI Exercise

DISCUSS PERFORMANCE GAP AND IMPROVEMENT

KPI 1: Load Factor

The 'Load Factor' indicates a key characteristic of demand.

A high load factor low variation in demand with respect to time.

A low load factor may indicate generators are more frequently start and stop, resulting in low efficiency.

Therefore higher load factor is better to minimise system operating cost

Influenced by lower off peak tariffs/high peak demand tariff, DSM activities such as peak shift, peak clipping etc.

Target: 50% to 80%

Generation Indicators

1) KPI 1: Load Factor

$$Load\ Factor\ (\%) = \frac{[Gross\ Generation\ (MWh) \times 100}{Maximum\ Demand\ (MW) \times 8{,}760\ h}$$

Gross Generation (MWh) = [Total Utility Generation Capacity(MWh) + Total IPP Generation Purchased (MWh)

Exerise1: Calculate Load Factor

Use your utilities 2017 Questionnaire data to answer for example see sample exercise.

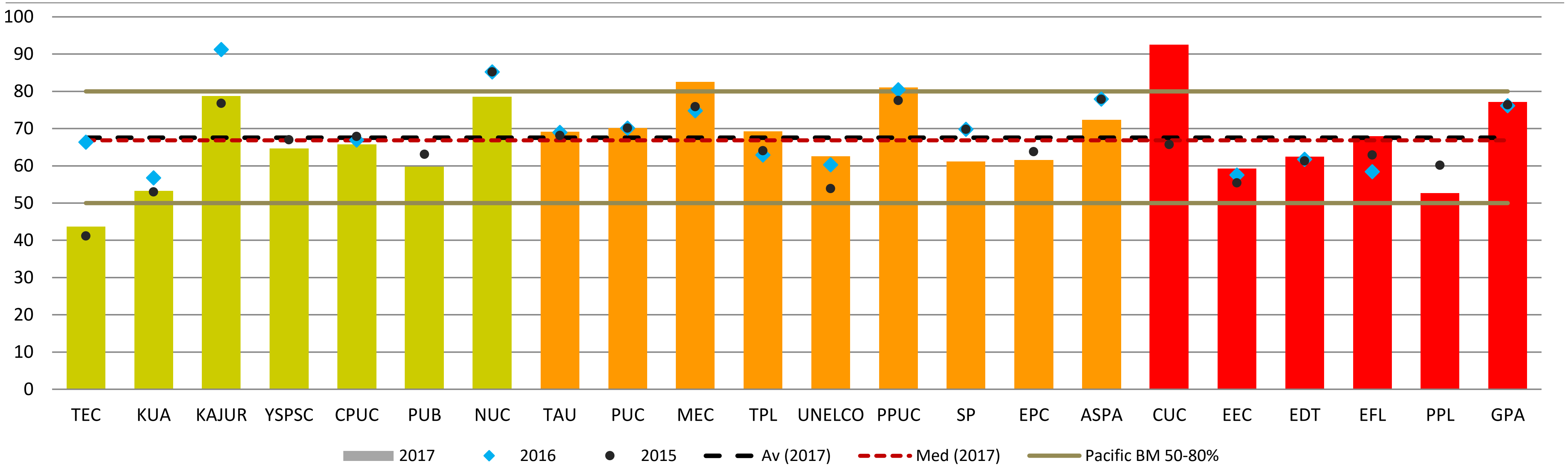
Example: ASPA

				Main Grid 1
1	Name of the Grid		Brief name or description of each grid	Tutuila
2	Total Utility Generation	MWh	Total utility generation for each grid	156,557
3	Total IPP Generation Purchased	MWh	Purchases from IPPs for each grid	0
4	Maximum Demand / Peak Generation	MW	Maximum demand for each grid	22.950
5	Minimum Demand Generation	MW	Minimum demand for the each grid	14.600
6	Guaranteed/Contracted IPP Generation Capacity	MW	The capacity guaranteed by an IPP under contract	0.000

Internal Benchmarking: Analysis and Trend

2017	2016	2015
72.35	77.93	77.87

External Evaluation of Load Factor



External Benchmarking: Evaluate Performance against same size utilities. From the graph MEC & PPUC are high performers. PPUC has maintained performance in the last 3 years whereas MEC has gradually improved their Load Factor,

Task: Discuss best practice and develop Improvement Plan

KPI 2: Capacity Factor

The investment in generation capacity is determined by several factors:

- Maximum demand
- Redundant capacity to enable outages for planned maintenance
- Spinning reserve policy
- Capacity required for standby purposes
- Transmission capacities and risks

Capacity factor indicates capacity utilisation and the risk of insufficient capacity. Higher capacity factor is desirable – it indicates better use of generating capacity to produce energy.

Capacity Factor

$$Capacity\ Factor\ (\%) = \frac{Gross\ Generation\ (MWh) \times 100}{Total\ Installed\ Generation\ Capacity\ (MW) \times 8760\ h}$$

Total Installed Generation Capacity (MW)

= Total Utility Generation (MW) + Total Guaranteed/Contracted IPP Generation Capacity (MW)

Availability Factor

Generation capacity may become unavailable for operation due to various reasons, such as:

- Forced outages: due to faults on the generator, connecting equipment or transmission network, breakdowns of the diesel engine and instability that may require the generator to be taken out for repairs.
- Planned outages: due to routine maintenance of the generator and engine, connecting equipment or transmission network.
- De-rating of the generator or connection equipment. Here the generator is available to supply the network however due to temporary limitations it cannot generate up to full capacity. The capacity by which the generator is de-rated becomes unavailable for generation until such time as it is restored to full capacity generation.

Higher Availability Factor is desired

Note: Target is 80% to 90%

Availability Factor

$$Availability\ Factor\ (\%) =$$

$$\frac{[Total\ Installed\ Generation\ Capacity\ (MW) \times 8760\ h - Total\ Capacity\ Hours\ Out\ of\ Service (MWh)] \times 100}{Total\ Installed\ Generation\ Capacity\ (MW) \times 8{,}760\ h}$$

Total Capacity Hours Out of Services (MWh) = Total Utility Capacity Hours Out of Service (MWh) + Total IPP Capacity Hours Our of Services (MWh)

KPI 4: Generation Labour Productivity (GWh/generation employee)

“Full Time Equivalent (FTE)” is defined as the total number of hours paid for over a period divided by the normal hours of work for one person over that same period.

To derive the FTE Generation Employees, add the number of hours paid for generation employees. Overtime is to be included as the equation is based on hours paid for. For example, if a person works 1 hour of overtime and is paid double-time, the FTE Generation is calculated using 2 hours.

Paid hours data can be sourced from payroll records.

Generation Labour Productivity

$$Generation\ Labour\ Productivity\ \left(GWh \middle/ generation\ employee\right) = \frac{{[Total\ Utility\ Generation (MWh)]}/{1000}}{Number\ of\ FTE\ Generation\ Employee}$$

Number of Full Time Equivalent (FTE) Generation Employee = $\frac{Paid\ Hours\ Utility\ Generation\ Labour\ (h)}{2000\ (h)}$

KPI 5:Specific Fuel Consumption

Specific Fuel Oil consumption monitors the efficiency of generating units using hydrocarbon based fuels such as Heavy Fuel Oil (HFO), Industrial Diesel Oil (IDO), biodiesel

Specific fuel consumption is normally given in grams per kWh or (kg/kWh or Tonne/MWH) as this includes the impact of the specific gravity of fuel and more closely relates to the energy content of the fuel.

This exercise uses kWh per Litre as it is the definition used for the previous two benchmarking exercises.

HFO despite having a lower heating has a higher specific gravity and thus will produce up to 10% more kWh per litre of fuel

Utilities are to provide fuel oil usage data at the standard 15 ˚C.

KPI 5:Specific Fuel Consumption

Specific Fuel Consumption (kWh/L) = $\frac{Total\ Fuel\ Oil\ Generation\ (kWh)}{Total\ Fuel\ Usage\ (L)}$

Total Fuel Oil Generation (MWh) = $\sum_{n=distilated}^{distilate,HFO,biofuel,mixed\ fuel} Generation\ by\ n(MWh)$

Total Fuel Usage (L) = $\sum_{n=distilated}^{distilate,HFO,biofuel,mixed\ fuel} Fuel\ Usage\ by\ n(L)$

Benchmark: > 4 kWh/L

KPI 6: Lube Oil Consumption

This indicator is also best limited to carbon-based fuel oil generating units, which are the major 'consumers' of lubricating oil.

This indicator is only useful over a long period such as a year. On a monthly basis it can have large variation as servicing may occur every several months depending on hours of operations.

On an annual basis, the lubricating oil consumption figure indicates the quality of maintenance done on a generating unit.

Benchmark:500 to 700 kWh/Litre for units up to 1 MW capacity 1,000 to 1,300 kWh/ Liter for units of 4-5 MW capacity

KPI 6: Lube Oil Consumption

$$Lubbricating\ Oil\ Consumption(kWh/L) = \frac{Total\ Fuel\ Oil\ Generation\ (MWh) \times 1000}{Total\ Lubricants\ Used\ in\ Generation\ (L)}$$

Forced Outage (%)

- Forced outages are:
  - Outages due to unplanned events such as faults on the generating unit or connecting equipment to the grid;
  - Outages as a result of human or operator error
  - De-rated capacity due to temporary limitation on the gen. unit.
  - To determine Unavailable Capacity Forced, a record of every fault event needs to be kept.

Forced Outage (%)

- This would extend from the time of the fault to the time the unit is restored and made available for operations, or for de-rating events, from the time the
unit was de-rated to the time it was restored to full capacity.
- The Unavailable Capacity Forced for a generator is the capacity of the generator multiplied by the hours unavailable.
- The sum of unavailable capacity in MWh for all events during the period is the
'Unavailable Capacity Forced' used to determine this indicator.
- Benchmark: less than 5%

Forced Outage (%)

Forced Outage(%) =

$$\frac{\sum_{n=utility}^{Utility,IPP} (\boldsymbol{n\ Capacity\ of\ hours\ out\ of\ Service\ Due\ to\ Generation\ Froced\ Outage\ Event(MWh)} + \boldsymbol{n\ Capacity\ Hours\ Out\ of\ Service\ Due\ to\ Generation\ Derated\ Outage\ Event(MWh))]} \times \mathbf{100}}{\boldsymbol{Total\ Installed\ System\ Generation\ Capacity\ (MW)} \times \mathbf{8760}\ \boldsymbol{h}}$$

Planned Outage (%)

A planned outage is the time a generator is down as a result of planned maintenance such as servicing and overhauls on the generating unit or equipment connecting it to the grid.

$$\frac{\sum_{n=utility}^{Utility,IPP} (n\ Capacity\ of\ hours\ out\ of\ Service\ Due\ to\ Generation\ Planned\ Outage\ Event(MWh)) \times 100}{Total\ Installed\ System\ Generation\ Capacity\ (MW) \times 8760\ h}$$

To calculate the numerator for this indicator, determine and sum the unavailable capacity hours out of service for each outage event.

Benchmark: less than 5%

KPI 9: Generation O&M Costs

Costs are to be provided in the local currency. Conversion to USD will be performed by the Benchmarking Team who will prepare the final benchmarking report.

Generation Expenditure includes all costs related to generation such as labour/staffing, repairs, parts, etc.

This cost does not include fuel, oil and IPP purchases as other indicators capture these costs . This indicator may be used to monitor all other generation costs.

Benchmark: $18.00 per MWh

KPI 9: Generation O&M Costs

Generation O&M (USD/MWh)= $\frac{Total\ Generation\ O\&M\ Cost\ (USD)}{Total\ Utility\ Generation\ (MWh)}$

KPI 10: Power Station Usage

This indicator looks at the energy consumed in utility operated power stations (including auxiliaries) as a percentage of Total Utility Generation.

Where the power station is supplied from the power station bus through a separate circuit breaker from the generator main circuit breaker, the meter (if available) on the power station supply circuit breaker would provide the Power Station-Auxiliary Power.

This indicator may be used to monitor the energy used in power stations to generate the energy for customers.

Benchmark: Less than 5%

KPI 10: Power Station Usage

$$Power\ Station\ Usage(\%) = \frac{{Power\ Station\ Usage}/{Station\ Auxiliaries(MWh)}}{Total\ Utility\ Generation\ (MWh)}$$

Benchmark: <5%

KPI 11: Renewable Energy to Grid (%)

Renewable Energy Generated is the total energy generated from renewable sources such a hydro, wind, solar, bio-mass, bio-fuels, etc.

This includes all utility generated and IPP generated renewable energy. The unit of measure is MWh.

Benchmark specific to each utility.

$$Renewable\ Energy\ to\ Grid(\%) = \frac{Total\ Renewable\ Energy\ Generation\ (MWh)}{Gross\ Generation\ (MWh)}$$

KPI 12: IPP Energy Generation (%)

IPP Energy Generation is the total energy purchased from IPPs.

Indicates the level of participation of the private sector in energy generation for the utilities.

$$IPP\ Energy\ Generation\ (\%)$$

$$= \frac{Total\ IPP\ Generation\ Purchased\ (MWh) \times 100}{Gross\ Generation\ (MWh)}$$

Benchmark specific to each utility.

KPI 13: Generation by Source

Distillate Generation (%) = $\frac{Distillate\ Energy\ Generation\ (MWh)\times 100}{Gross\ Generation\ (MWh)}$

Benchmark: Individually set by each utility. In general desire to reduce Distillate and HFO Generation to reduce fuel cost.

Similar Calculation for other generation source.

Transmission

KPI 15: Transmission Losses(%)

This indicator looks at the energy losses resulting from the delivery of electricity across the transmission network.

Net Generation is the total energy delivered to the transmission network from the generating stations and IPPs.

Electricity Delivered to the Distribution Network is the total energy measured at the demarcation points between transmission and distribution networks flowing in the direction of the distribution network from the transmission network.

World Bank study on Transmission loss : http://data.worldbank.org/indicator/EG.ELC.LOSS.ZS

KPI 16: Transmission Reliability

This indicator looks at the reliability of the transmission network in terms of unplanned or forced outages as a result of faults on the transmission network.

$$Transmission\ Relaibility(outage\ event\ km) = \frac{Number\ of\ Unplanned\ Transmission\ Outage\ Events\ (events) \times 100}{Length\ of\ Transmission\ Line\ (km)}$$

Benchmark: <2%

KPI17: Average Transmission Outage Duration (hrs per event)

$$Average\ Transmission\ Outage\ Duration\ (hr\ per\ envent)$$

$$= \frac{Total\ Duration\ of\ Unplanned\ Transmission\ Outage\ Events\ (events)}{Number\ of\ Unplanned\ Transmission\ Outage\ Events\ (events)}$$

Distribution

KPI 18: Network Delivery Losses(%)

Where a utility cannot separate transmission and distribution losses, the combined losses can be determined by this indicator.

$$Network\ Delivery\ Losses(\%)$$

$$= \frac{[Net\ Generation(MWh) - Electricity\ Sold(MWh)] \times 100}{Net\ Generation\ (MWh)}$$

KPI 19: Distribution Losses (%)

This indicator looks at the energy losses resulting from the delivery of electricity across the distribution network. Include energy consumed in the utilities substations if it is not metered and accounted for.

Electricity Delivered to the Distribution Network is the total energy measured at the demarcation points between transmission and distribution.

$$Distribution\ Lossess(\%) =$$

$$\frac{[Electricity\ Delivered\ to\ Distribution\ Network(MWh) - Electricity\ Sold\ (MWh)] \times 100}{Electricty\ Delivered\ to\ Distribution\ Network\ (MWh)}$$

Benchmark: Less than 5%

KPI 20: Customers per Distribution Employee

The greater the customers per distribution employee, the better labour is utilized and more efficient the operation.

$$Customers\ Per\ Distribution\ Employee\ (customers\ per\ distribution\ employee) = \frac{Average\ number\ of\ Customers (connections)}{Average\ number\ of\ Distribution\ and\ Customer\ Service\ Employees\ (employees)}$$

Average number of Customers (connections) =

$$\frac{Total\ number\ of\ customers\ at\ start\ of\ Period + TotalNumber\ of\ Customers\ at\ the\ end\ of\ Period\ (connection)}{2}$$

KPI 21: Distribution Reliability

This indicator looks at forced outage events per 100 km of distribution lines and cables.

$$Distribution\ Reliability\ (event\ per\ 100\ km\ of\ line) = \frac{Number\ of\ Distribution\ Forced\ OutageEvents\ (events) \times 100}{Length\ of\ Distribution\ Line\ (km)}$$

KPI 22: Distribution Transformer Utilization

This indicator looks at the total energy delivered to consumers on the low voltage network through distribution transformers. It indicates the effectiveness of distribution planning in matching transformer capacity with demand.

Total Distribution Transformer Capacity is calculated by adding up the capacity (nameplate rating) of all distribution transformers installed on the distribution network.

A low utilisation implies a greater investment in distribution transformers. A higher utilisation implies higher efficiency in capital outlay on the distribution network (or on the other side of the scale, deferred capacity upgrade and erosion of security margins)

Benchmark: Greater than 30%.

KPI 22: Distribution Transformer Utilization

$$Distribution\ Transformer\ Utilisation(\%)$$

$$= \frac{Electricity\ Sold(MWh) \times 100}{Total\ Distribution\ Transformer\ Capacity\ (MVA) \times 8760hrs}$$

Benchmark: >30%

KPI 23: Transmission/Distribution Operations and Maintenance Costs($ per km)

The total cost of operating and maintaining the distribution network on a per km line (overhead line and underground cable).

$$T\&D\ Operations\&Maintenance\ Cost\left(\frac{USD}{km}\right) =$$

$$\frac{T\&D\ O\&M\ Cost}{Lenght\ of\ distrubution\ Line\ (km)}$$

KPI 24: System Average Interruption Duration Index (SAIDI)(mins per Customer)

SAIDI indicates the average power outage duration experienced by a customer during the benchmarking period

Total Customer Interruptions Duration Index is found by summing the customer interruptions duration for each customer interruption event. This includes both planned and forced events.

For example, if a forced outage causes 10 customers to experience a power cut of 2 hours, the Customer Interruptions Duration for this event is 10 x 2 = 20 customer hours. If another outage affects 20 customers for 3 hours, Customer Interruptions Duration is 60 customer hours.

- The total Customer Interruptions Duration Interrupted for these two events is 20 + 60 = 80 customer hours.

KPI 24: System Average Interruption Duration Index (SAIDI)(mins per Customer)

When determining SAIDI and SAIFI the following internationally accepted convention applies:

Only outages **caused by faults and planned outages on the high voltage distribution network, transmission lines and generators** that result in interruption to power supplied to a customer is to be taken into consideration. Outages on the low voltage network are to be excluded.

Only outages of more than a minute are to be considered. Momentary outages such as those caused by an auto-recloser which has successfully reclosed should be excluded. However, where the recloser has locked out, then the outage should be included.

Benchmark: 200 customer minutes

KPI 24: System Average Interruption Duration Index (SAIDI)(mins per Customer)

$$SAIDI(minutes) = \frac{Total\ Customer\ Interruoted\ (cust\ hr) \times 60}{Average\ Number\ of\ Customers\ (connections)}$$

Benchmark: 200 customer minutes

KPI 25: System Average Frequency Index (SAIFI)

The ‘Total Customer Interruptions’ is the sum of the customer interruptions for each outage including both forced and planned interruptions.

A customer interruption for a power outage is the total customers interrupted for the event. For example, if two power outages affect 300 and 500 customers respectively, the total customer interruption is 300 + 500 = 800.

SAIFI indicates the average number of outages a customer experienced for the period.

KPI 25: System Average Frequency Index (SAIFI)

$$SAIFI(\%) = \frac{Total\ Customer\ Interruptions}{Average\ Number\ of\ Customers\ (connections}$$

Demand Side Management

KPI 26: DSM Initiatives

A utility's engagement in Demand Side Management (DSM) initiatives indicates a proactive approach to changing consumer behaviour and reducing electricity demand.

When applied to unbilled electricity consumption, such as power station auxiliary usage and the consumption in head office or government buildings, this will have a positive affect reducing Power Station Usage (KPI 10) and reducing Customer Unbilled Electricity Usage (KPI 37)

Subsequent reduction in fuel usage translating to an increased profit margin.

When applied to domestic, commercial or industrial consumers, behavior can be changed to result in a lower demand being placed on overloaded generator resources and to change the demand profile to achieve a demand that can be met with more efficient operation

KPI 27: DSM Budget

A utility’s DSM budget is reflective of the focus being placed on DSM activities.

Goals for changing consumer behavior to reduce demand or change consumption patterns require resourcing and adequate budgeting.

KPI 28: Full Time Equivalent Employees Involved in DSM Initiatives

Like the DSM budget, a utility’s number of FTE employees involved in DSM activities indicates the focus being placed on DSM activities. Goals for changing consumer behavior require adequate human resourcing.

KPI 29:Recorded Saving By Consumers Through DSM Initiatives

A successful DSM Program will be shown through a reduction of power usage and recorded savings.

KPI 30: Power Quality Standards

Power quality standards are important in determining the degree that power reflects the ideal electricity signal with constant magnitude and frequency sinusoid voltage wavelength.

Having a power quality standard provides a method to monitor power quality.

Good network power quality will result in efficient distribution. Poor network power quality will ultimately result in financial loss through increased distribution losses, damage to equipment and unplanned outages

Human Resource/Safety Indicators

KPI 31: Lost Time Injury Duration Rate (Days per employee)

A Lost Time Injury (LTI) is defined as an incident where an employee is absent from work for one day/shift due to injury.

Australian Standards AS18851 provides guidelines for this indicator.

$$Lost\ Time\ Injury\ Duration\ Rate(days) = \frac{Total\ Days\ Lost\ Due\ to\ Work\ Injury\ During\ Period\ (days)}{Total\ Number\ of\ Employees\ (employees)}$$

Benchmark: less than 5 days

KPI 32: Lost Time Injury Frequency Rate (Injuries per million hours)

The frequency rate is the number of injuries resulting in lost time, for each one million hours worked.

$$Lost\ Time\ Injury\ Frequency\ Rate$$

$$= \frac{Number\ of\ Lost\ Time\ Injuries\ During\ Period\ (LTIs) \times 1{,}000{,}000h}{Total\ Hours\ Worked\ (h)}$$

Benchmark: less than 2 per million hours

KPI 33: Labour Productivity (customers per employee)

Labour Productivity looks at the number of customers per FTE Utility.

$Labour\ Productivity(\%) =$

$$\frac{Average\ Number\ of\ Customers\ (customers) \times 100}{FTE\ Utility}$$

$$FTE\ Utility = \frac{Total\ Paid\ Hours\ Employees\ including\ contractors}{FTE\ Annual\ Hours(2000)}$$

KPI 33: Labour Productivity (customers per employee)

Paid hours is the total hours paid for labour and includes contractors engaged in the operations and maintenance of the system.

FTE is the full time equivalent determined by the total paid normal hours for one person for one year (2000 hours). The total paid hours divided by FTE gives the FTE Utility.

The total paid hours does not include the labour hours engaged for capital expenditure projects.

Customer Indicators

KPI 34: Service Coverage(%)

This indicator looks at the electricity coverage with respect to the country served by the utility.

It also indicates the potential market yet to be served by the utility

$$Service\ Coverage(\%) = $$

$$\frac{Number\ of\ Households\ Supplied(Domestic\ Connections)(households) \times 100}{Total\ Number\ of\ Housholds\ in\ Country(households)}$$

KPI 35: Productive Electricity Usage

It is assumed that the electricity billed to commercial and industrial customers is productive for the economy.

Based on this assumption, this indicator captures the productive economic impact of electricity supply. It ignores the economic impact of domestic supply and other categories

$$Productive\ Electricity\ Usage(\%) = \frac{\begin{array}{c}Total\ Commercial\ Electricity\ Billed\ + \\ Total\ Industrial\ Electricity\ Billed\ + \\ Total\ Other\ (Productive)\ Electricity\ Billed\end{array}}{Electricity\ Sold}$$

KPI 35: Productive Electricity Usage

Exercise using Sample Data

$$Productive\ Electricity\ Usage = \frac{[10{,}000 + 23{,}000]}{100{,}000} = 33\%$$

KPI 36: Customer Usage

a) Lifeline Tariff Usage(%)

Lifeline tariff is usually a lower price to assist low income household customers. Lifeline tariff is applied differently by utilities that offer this category.

This indicator looks at the percentage (%) of electricity sold under the lifeline tariff.

Lifeline Tariff Usage(%)

$$Lifeline\ Tariff\ Usage(\%) = \frac{Total\ Electricity\ Billed\ Under\ Lifeline\ Tariff\ \times 100}{Electricity\ Sold}$$

Customer Usage

Domestic, Industrial, Commercial and Other Usage are similar to Lifeline tariff indicating portion of electricity sold under each category of customers.

KPI 37: Customer Unbilled Electricity Usage (%)

This represents the electricity that is metered but is not billed to any consumer.

$$= \frac{Total\ Unbilled\ Electricity\ Usage}{Electricity\ Sold + Total\ Unbilled\ Electricity\ Usage}$$

KPI 38: Self Regulated or Externally Regulated

External regulation is usually indicative of higher quality standards being imposed on a utility than when a utility is self regulated

Financial Indicators

Price Setting

Cost – what it actually costs to make

Price – What you can sell it for

Objective – decision making frameworks for maximising electricity industry IBOT

KPI 39: Operating Ratio (%)

A measure of how much income is consumed by the business to produce and supply electricity.

$$Operating\ Ratio = \frac{Total\ Operating\ Expenses\ (local\ currency) + Depreciation \times 100}{Total\ Operating\ Revenue\ (local\ currency)}$$

KPI 40: Debt to Equity Ratio

This looks at the gearing of the business. Gearing is a measure of financial leverage, demonstrating the degree to which a firm's activities are funded by the owner's funds versus creditor's funds. The higher the gearing, the greater the risk.

When the business is performing well higher returns are generated for the owners. When losses are incurred the impact on the owner is increased.

The optimum gearing ratio is specific for each industry. For the utility business in the Pacific a Benchmark of 50% is deemed suitable.

KPI 40: Debt to Equity Ratio

$$Debt\ to\ Equity\ Ratio(\%) = \frac{Long\ Term\ Debt/\ Non\ Cuurent\ Liability \times 100}{Equity/Net\ Assets/Capital\ Reserves + Long\ Term\ Debt/\ Non\ Current\ Liability}$$

Benchmark: 50%