

Performance Benchmarking for Electricity Distribution Utilities



Ashutosh Sharma,

11th Capacity Building Programme for Officers of Electricity Regulatory Commissions

13 November 2017

AGENDA

- | | |
|----------|---|
| 1 | INTRODUCTION |
| 2 | IMPORTANCE OF BENCHMARKING |
| 3 | DBF - A RUNNING SHOW CASE |
| 4 | BENCHMARKING and PERFORMANCE ANALYTICS across the ENERGY VALUE CHAIN |
| 5 | DISCUSSIONS |

Ashutosh Sharma

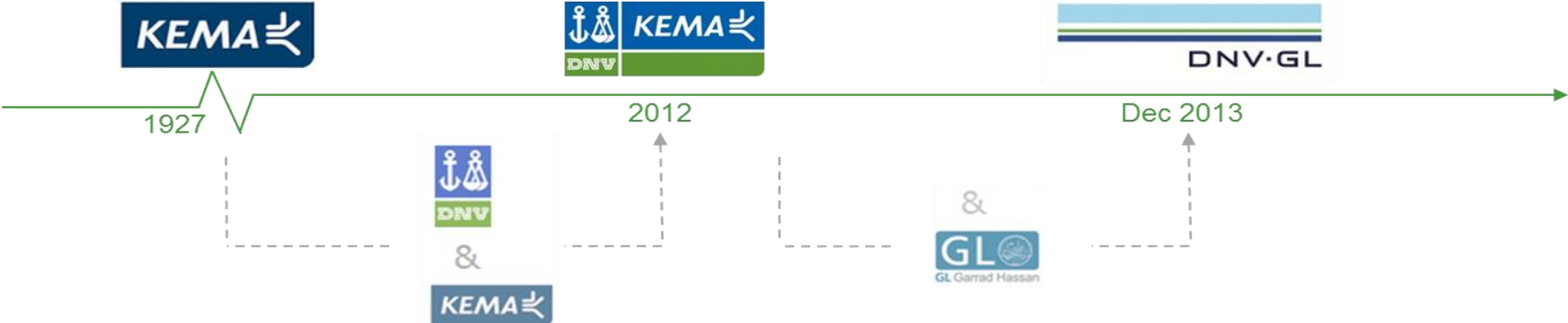
- Presently -Principal Consultant and Head of Section (Asset Management and Power System Planning) ; Joined KEMA/DNV GL in 2007,
- Working in the power industry since 1985
- Maintenance manager with NTPC India till 1998
- Worked at ALBA in Bahrain till 2007 responsible for the High, Medium and Low Voltage electrical assets maintenance
- Area of Expertise:
 - Asset Management, Electrical Engineering, Asset Risk Management, Power Failure Investigation(asset / HSE)
- General Expertise:
 - Project Management, Training



DNV GL Company Introduction

DNV GL Combining the strength of well-known brands

2,500 energy expert help customers throughout the electrical power industry realize efficient, reliable and clean energy for today and the future





- DNV GL is the world's largest independent energy and renewables advisory firm.
- We have over 2500 energy experts.
More than 1000 are focused on renewables.
- DNV GL has advised on over 3000 solar projects, 150 GW of wind projects
- Extensive experience in microgrid and storage technologies and applications



- *Our overall goal is to help governments, **regulators**, energy providers and other stakeholders manage the world's growing demand for energy, while balancing costs, reliability and the environment... the so-called energy trilemma.*



Energy Transition Outlook - Now available as a report
here: <https://eto.dnvgl.com/2017/>

Purpose, vision and values of DNV GL

Purpose

- To safeguard life, property and the environment

Values

- We build trust and confidence
- We never compromise on quality or integrity
- We are committed to teamwork and innovation
- We care for our customers and each other
- We embrace change and deliver results

Vision

- Global impact for a safe and sustainable future

Assisting companies in solving the energy trilemma



DNV GL service lines

Energy Advisory

- Asset Management (AM)
- Power System Planning (PSP)
- Market and Policy Development
- Project Management & Technical services
- Operational Excellence



Key deliverables:

- Business strategy across all markets
- Power system design and modelling
- Technology implementation services
- Operations and systems optimization

Key deliverables:

- Business strategy across all markets
- Power system design and modelling
- Technology implementation services
- Operations and systems optimization

...requires our comprehensive approach

We give clear answers and confidence

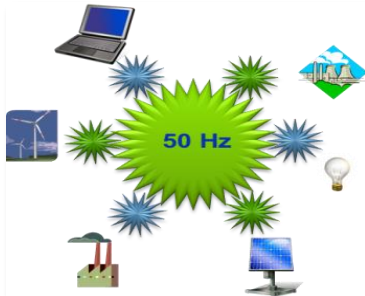
Strengthening the Grid

We enable customers to transform their grid and to comply with regulatory requirements and international standards using innovative solutions.



Balancing Supply & Demand

We deliver certainty about reliability and stability in diverse operational modes for the different generation scenarios with high RES in-feed.



Advanced Asset Management

We provide scenario's to optimize the asset fleet performance and related risks and costs, resulting in sustainable world class asset management processes.



Offshore T&D Technology

We provide confidence in defined solutions and enable customers to demonstrate the value of investments in offshore and.



Integration of Renewables

We deliver innovative concepts to enable the integration of renewables in the grid, and to control the risks associated with large scale presence of distributed sources.



Strengthening the GRID



To enable grid extension in a changing environment while maintaining security of supply and compliance with regulatory requirements and international standards.

Associated DNV GL Services

- **Grid Development Planning**
(e.g. **grid reliability assessment**, power system studies, NERC compliance)
- **Grid Technology Solutions**
(e.g. basic design and specification for power lines, cables and substations, **solutions for the integration of energy storage system integration**)
- **Grid Projects Support**
(e.g. Owner's engineer, **vendor selection**, tender evaluation, project risk assessment, **design verification & quality assurance**)

Balancing Supply & Demand



To deliver certainty about reliability and stability in diverse operational modes for the different generation scenarios with high RES in-feed.

We provide transparency on system limits and give answers to all stakeholders including regulators and connected clients

Associated DNV GL Services

- **Electricity Balancing**
(e.g. advanced algorithms for Electricity Balancing, development of unit commitment and economic dispatch, storage facilities, incentives on operation flexibility)
- **Load Freq. Control & Reserve Management**
(e.g. stability and controllability assessment, optimization of reserve management)
- **Congestion Management**
(assessment of congestion management framework and developing of operational measures)

Advanced Asset Management



To deliver system optimization and improved reliability. We help to enhance the quality of the AM process and organization, optimize planning against aging assets but are also well-equipped to do power failure investigations.

Associated DNV GL Services

- **Process Review & Optimisation**
(e.g. Auditing PAS55 / ISO55000, Integrated risk-based AM)
- **Asset Fleet Management**
(e.g. Decision support & data utilization, CASCADE)
- **Condition and Remaining Life**
(Cable & Substation diagnostics, Oil lab services, Smart Cable Guard)
- **Power Failure Investigations**
(Independent root-cause analysis of power failures)
- **Competence Development**
(DNV GL Academy training courses, Asset competence development)

Asset Management

Power Failure Investigations

Service description

- In depth analysis cause of failure
- Taking into account design, production, installation, service conditions
- With all possible laboratory services at hand
- With experts per component type
- Investigation at DNV GL or any other location

Customer benefits

- Independent report on the cause of failure
- Based on worldwide experience
- With recommendations to prevent future failures
- Often work can be done on short notice



B. Sustainable Energy Use

Advice, analysis and implementation assistance for energy efficiency programmes and measures

Service lines:

1. Policy advisory and research
2. Programme development and implementation
3. Sustainable buildings and communities
4. Industrial energy management



- Design and deliver turnkey energy efficiency programmes that produce verifiable savings and meet utility goals
- Develop innovative approaches for data collection and analysis that extract more value and support policy decisions
- Reduce building operating costs, increase property values, manage risks and meet expectations of investors and customers

Capacity Building



दूरभाष (का.) Telephone (O) : 080-22287205
फैक्स Fax : 080-22259343 / 22352616
ई-मेल E-mail: mssrpc@yahoo.com

सदस्य सचिव
भारत सरकार
केंद्रीय विद्युत प्राधिकरण
दक्षिण क्षेत्रीय विद्युत समिति
29, रेस कोर्स क्रॉस रोड, बंगलूर - 560009
Member Secretary
Government of India
Central Electricity Authority
Southern Regional Power Committee
29, Race Course Cross Road, Bangalore - 560 009

Date: 27th September 2017

Sub: Completion of “Capacity Building Programme on Integration of Renewable Energy Resources (RES) into the Grid” for Power Utilities operating in Southern Region against tender no. NIT 01/2017 floated by Southern Regional Power Committee (SRPC), Bangalore.

This letter is to confirm that between May 2017 and August 2017, Garrad Hassan India Pvt. Ltd. (a DNV GL Company) with support of the other DNV GL companies (KEMA-IEV GmbH & Garrad Hassan Iberica SL) completed the “Capacity Building Programme on Integration of Renewable Energy Resources (RES) into the Grid” for Power Utilities operating in Southern Region.

- Southern Regional Power Committee (SRPC)
- Central Electricity Authority (CEA)
- Ministry of Power (MoP)
- Central Electricity Regulatory Commission (CERC)
- Power System Operation Corporation Limited (POSOCO)
- Tamil Nadu Transmission Corporation Limited
- Power grid Corporation & India Ltd. (PGCIL)
- Karnataka Power Transmission Corporation Limited
- Transmission Corporation of Telangana Ltd
- Transmission Corporation of Andhra Pradesh Ltd
- National Thermal Power Corporation (NTPC)
- NLC India Ltd.
- Kerala State Electricity Board Ltd.
- Electricity Department (Govt. of Puducherry)

The programme was executed in India, Germany and Spain and contained visits to Power plant, Wind plant, SCADA system, Grid Lab besides class room and online training. The total contract price was INR 4,18,87,032/- as per agreed contract.

The focus of programme was on policy framework and regulatory aspects to promote integration of Renewable Energy Supply (RES) into the Grid. Participants were made

familiar with challenges posed by RES for the grid and possible technological solution and following topics were emphasized during the training.

- Trends and Innovations in Green Power.
- Challenges posed by RES for the grid and technological solutions
- Policy Framework for Renewables energies in India and Renewable energy rich countries
- Regulatory Provisions for Renewable Energy in India and Renewable energy rich countries
- RE Management best practices in RE rich countries.
- Visits to Energy Self-sufficient Village Feldheim.
- Experience of flexing of Coal based generating stations to take care of variable RE generation including visit to such Coal based plant.
- Interactions with Transmission Operators dealing with large scale RES penetration.
- Assessment of balancing capacity and RE purchase
- Forecasting tools for wind and solar generation (plant wise and area wise).
- Technical solutions for integrating large scale RE capacity- such as Low-Voltage - Ride-Through capability, Active Power Control, Dynamic Reactive power support.

The capacity building program was concluded within agreed timelines.

(S R BHAT)
Member Secretary
Southern Regional Power Committee
Bangalore

Importance of Benchmarking



What is your BMI?

Body Mass Index Calculator



Overweight

Your BMI is 27.3

This means your weight is within the overweight range.
Your current BMI is greater than the recommended range of 18.5 to 24.9.

Being overweight is a chronic condition and therefore needs a long-term plan aimed at weight reduction. Your doctor or registered dietician is the ideal person to initiate and monitor an organized treatment plan for you.

This treatment plan should center on behavior modification.

Important Note

Aim to keep within the healthy weight range by enjoying a healthy, well-balanced diet and exercising regularly. Most adults should get at least 30 minutes of moderate-intensity physical activity on most, if not all, days.

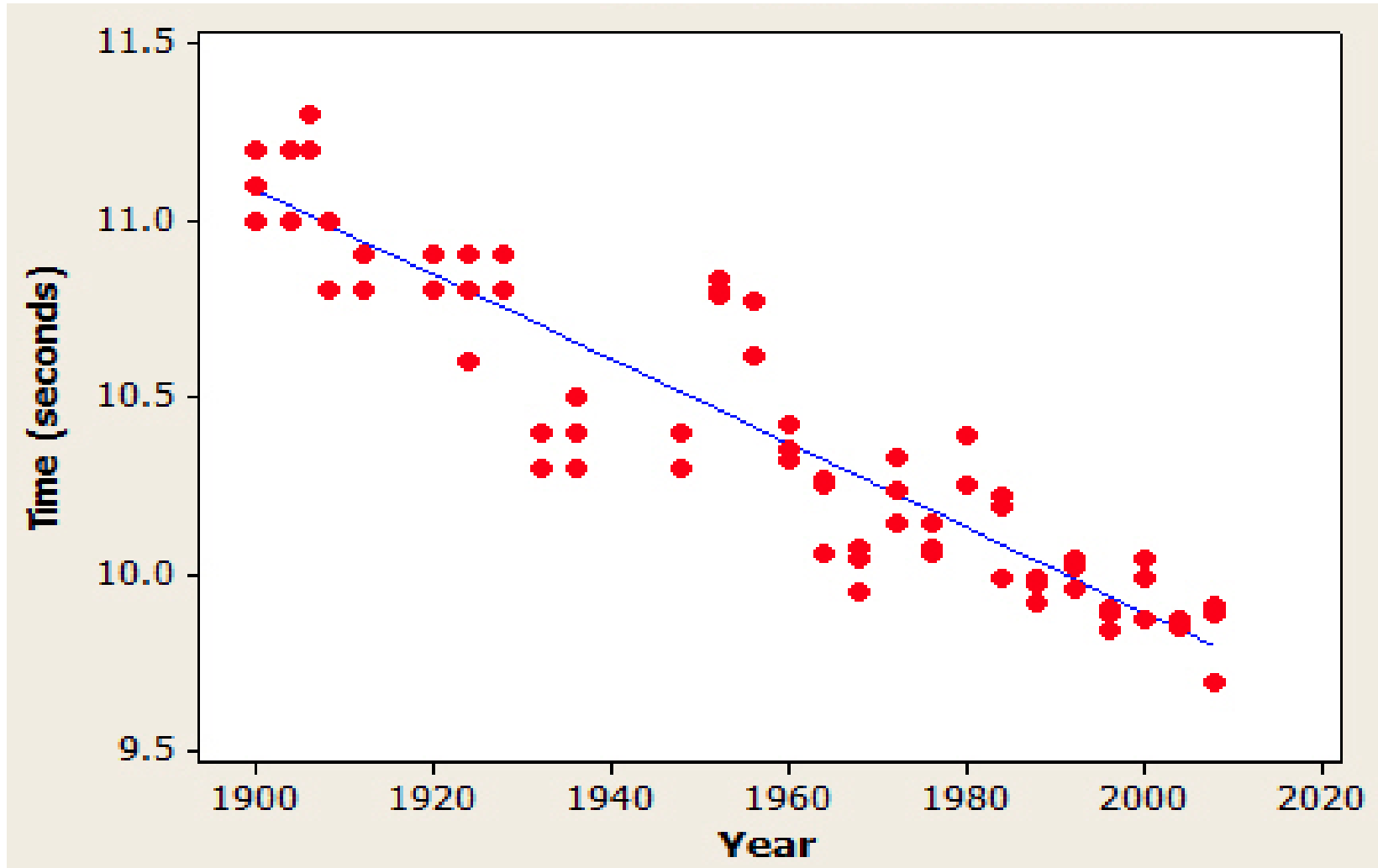
- ✓ Underweight = Less than 18.5
- ✓ Normal weight = 18.5–24.9
- ✓ Overweight = 25–29.9
- ✓ Obesity = BMI of 30 or greater

I know I need to benchmark
but
I am too busy.

Well if you don't benchmark now, and then implement improvements based on it, you will find yourself out of control.

Then you'll have plenty of time to benchmark, but it won't matter.

A Question



Benchmarking

- Numbers
 - What to do with numbers?
 - Interpret the numbers
 - What is behind the numbers?
 - Find the gaps
 - Bridge the gaps / Fill the gaps
-
- Benchmarking is a process
 - Process of continually searching for the best methods, practices and processes
 - To become the “best of the best.”

Types of Benchmarking

- Internal
- External

- Competitive Benchmarking
- Product Benchmarking
- Process Benchmarking
- Practices Benchmarking
- Strategic Benchmarking
- Parameter Benchmarking

Benchmarking – As a competitive process

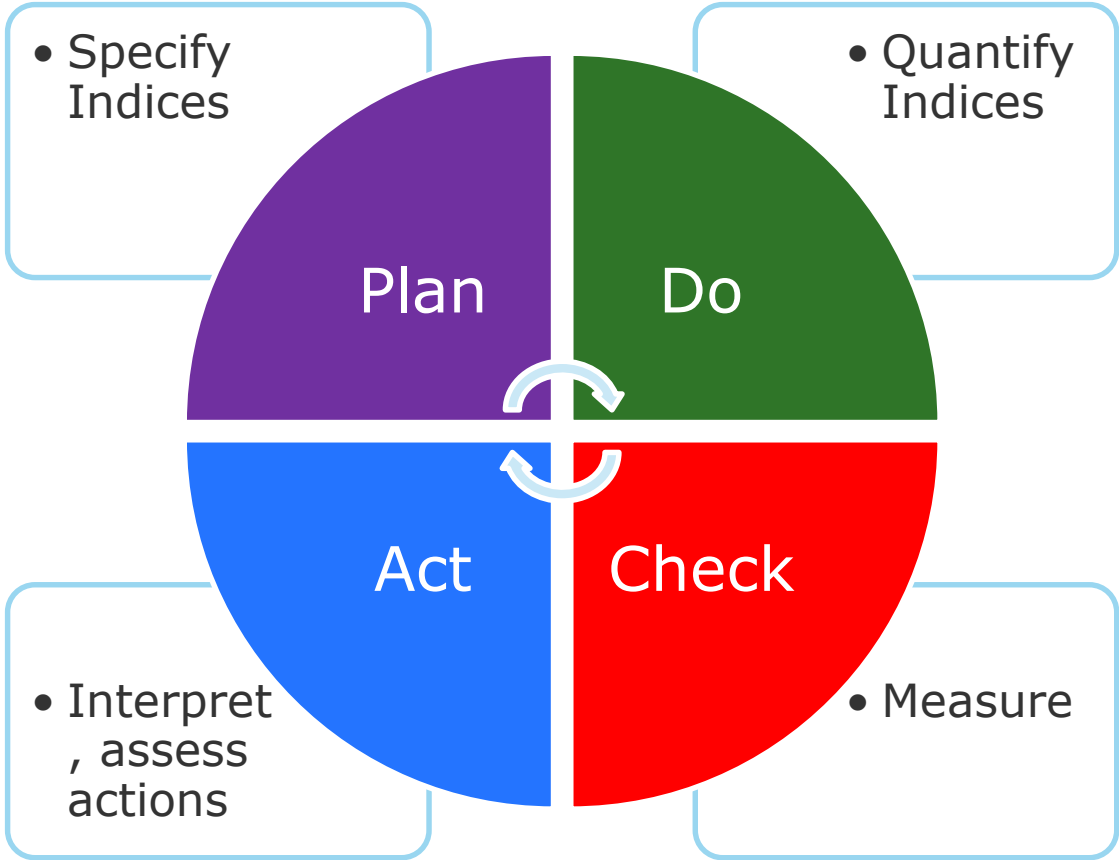
- Improves Efficiency
- Improves Performance
- Improves >>>>>>>>>>

- **Reduce Costs**

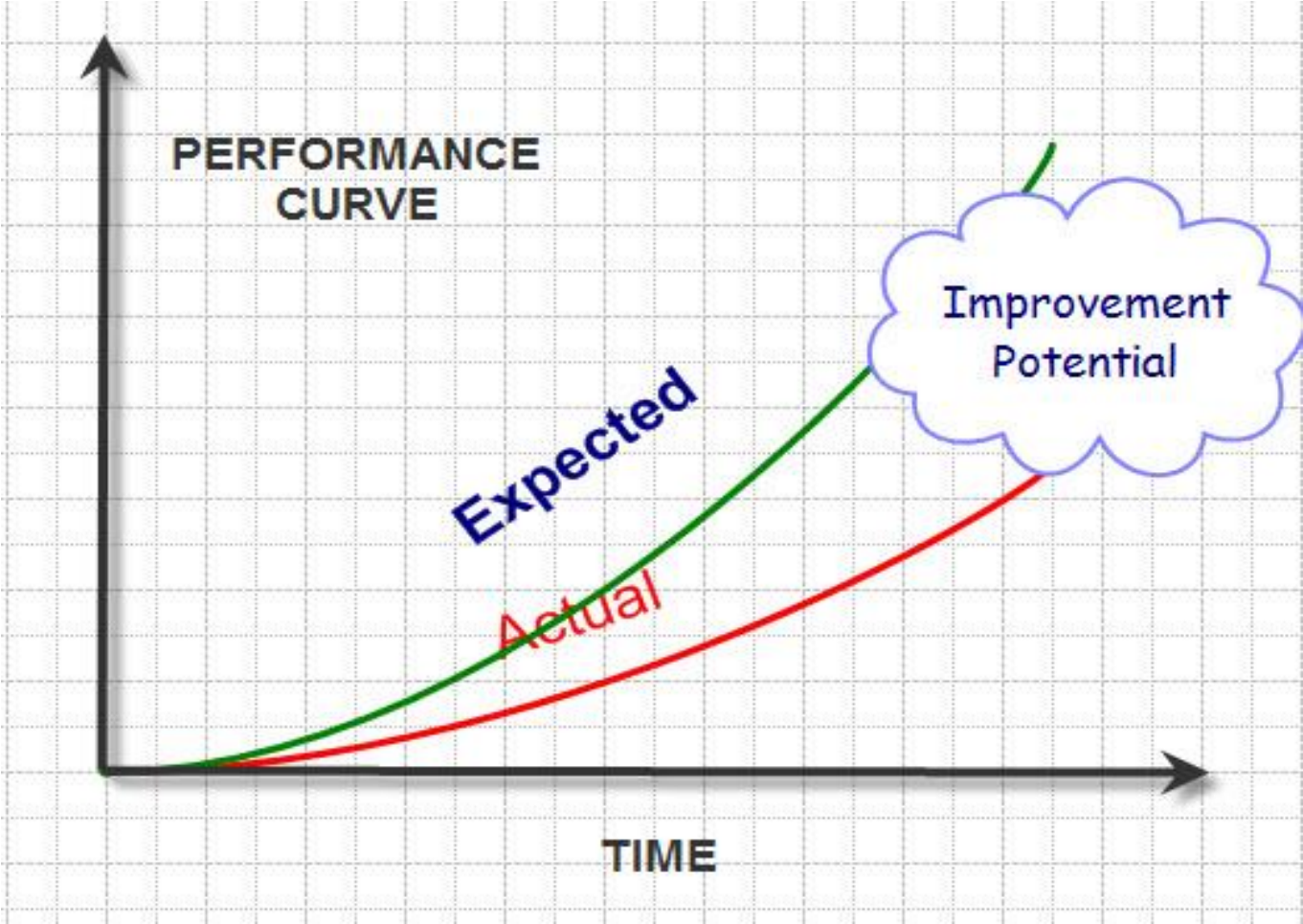
Benchmarking

- Continuous process
- Investigation process
- Learning process
- Innovative process - a pragmatic search for ideas
- Requires discipline
- Resource - consuming
- A vital tool that provides useful information for improving virtually any business process

Benchmarking



Benchmarking



DBF – A Running Show Case of Distribution Utilities Benchmarking



VISION OF DBF

“To be a forum for participants to share experiences and learn from each other and improve performance through benchmarking”



OBJECTIVES

IMPROVEMENT
is part of
business process

MEASURE
performance to
improve

BENCHMARK
to identify gaps

LEARN
from peer group

DBF MEMBERS



شركة مسقط لتوزيع الكهرباء.
Muscat Electricity Distribution Co.



MAJAN
ELECTRICITY CO. (SAOC)



شركة ظفار للطاقة ش.م.ع.ع
Dhofar Power Company S.A.O.G



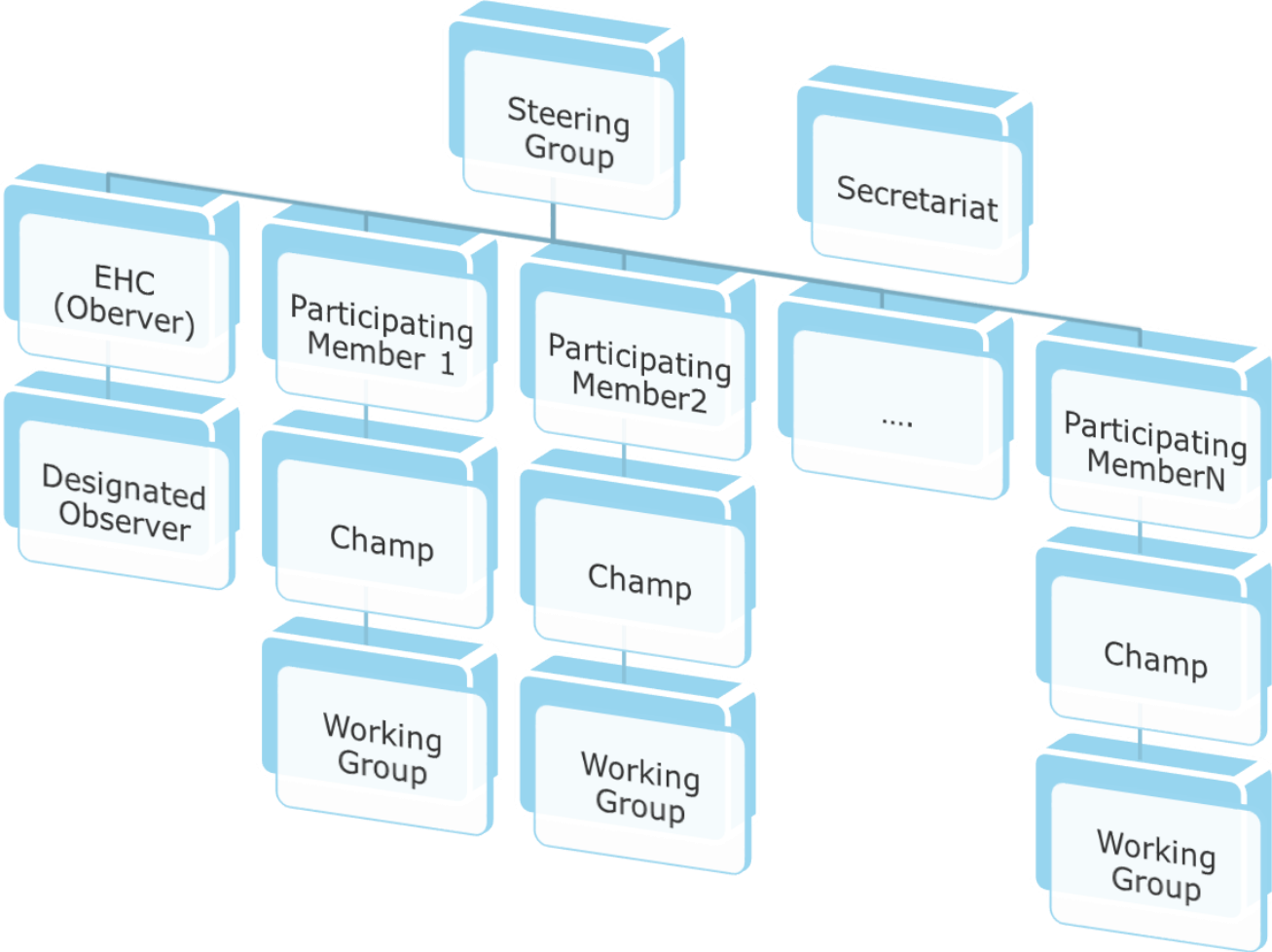
شركة كهرباء مزون ش.م.ع.ع
Mazoon Electricity Company S.A.O.C

Rural Area Electricity Company
S.A.O.C



كهرباء إربد
Irbid Electricity

DBF ORGANISATION



DBF BENCHMARKING AREAS

1

NETWORK PERFORMANCE

What is the quality of the network system?

2

CUSTOMER SERVICE PERFORMANCE

How satisfied are customers?

3

FINANCIAL PERFORMANCE

How financially secure is the company?

4

HSE PERFORMANCE

How safe is the company's environment?

5

HR PERFORMANCE

How satisfied are the employees?

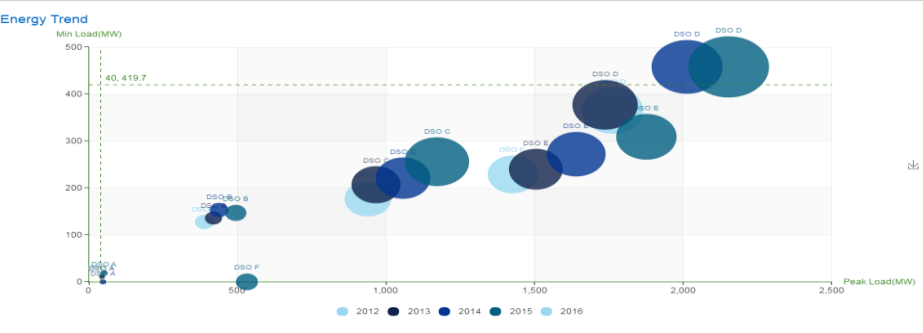
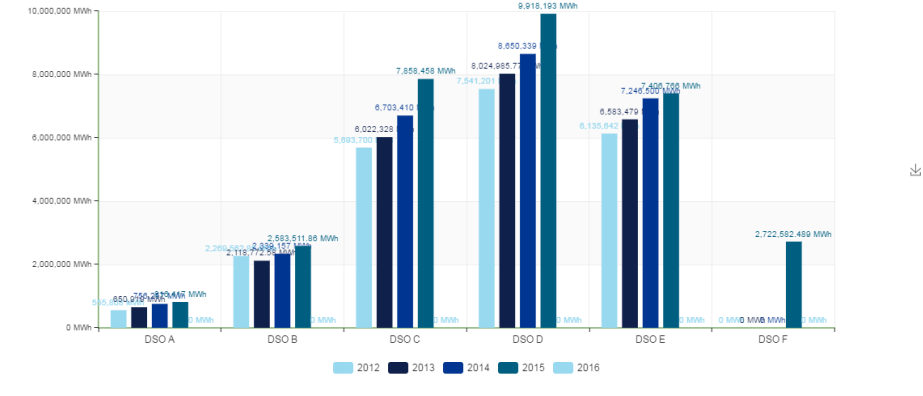
CONFIDENTIALITY

- There shall be strict confidentiality in the treatment and disclosure of any data or information within the DBF.
- Participating Members can disclose benchmarking results of other Participating Members only in an anonymous manner.
- Each participating member shall enter into a confidentiality agreement with DNV as a secretariat for the duration of the participation. Confidentiality agreement format will be developed by DNV GL.



KPI'S OVERVIEW

Total energy Served during the reporting period
Unit in MWh



3. FINANCIAL PERFORMANCE

3.1	Return on Capital (ROC)	%
3.2	Cost Effectiveness (CE)	RO/MWh
3.3	Days Sales Outstanding (DSO)	days

4. HUMAN RESOURCES PERFORMANCE

4.1	Customer served per employee (CSPE)	Number
4.2	Employee Satisfaction Index (ESI)	Index

5. SAFETY HEALTH ENVIRONMENT PERFORMANCE

5.1	Lost Time Injury Frequency Rate (LTIFR)	LT/million hours
5.2	Near Miss Reported (NMR)	Reports/staff

DBF – Tool



INTRODUCTION

- DNV GL has developed an online tool, to enter the Distribution Benchmarking data and instantly get benchmarking results.
- This tool allows users to either directly enter data online or to upload excel sheets with filled data.
- The tool is designed to ensure data security and all the company's are anonymised.

The logo consists of the letters 'D', 'B', and 'F' in a bold, sans-serif font. The 'D' and 'F' are green, and the 'B' is blue.

Performance Benchmark

Sign In

Log in

Powered By

The logo features three horizontal bars of increasing length from top to bottom, colored light blue, dark blue, and black. Below the bars, the text 'DNV-GL' is written in a bold, black, sans-serif font.

FEATURES OF DBF TOOL

All data on one platform



Welcome,
dbfonline9d37086d
[Logout](#)



Benchmark ▾ Manage ▾ Options ▾

Compose	Get Format	Import	Export
2012	2012	2012	2012
2013	2013	2013	2013
2014	2014	2014	2014
2015	2015	2015	2015
2016	2016	2016	2016

DBF

Performance Benchmark

Sign In



Log in

Powered By



FEATURES OF DBF TOOL

Benchmark Graphs

DNV·GL

Welcome,
raecooman

Benchmark ▾ Manage ▾ Options ▾

Summary	Network & Operations	Customer Service	Financial	HR & HSE
2012		Customer Service	Financial Related	HR & HSE Related
2013	Energy Load	Related		
2014	Customers & Connections			
2015	Total Loss & NSL			
Completeness	Indexes			
	HV & LV Lines			

Benchmark ▾ Manage ▾ Options ▾

Fill in 2015 KPI(s)

Compose datasheet with corresponding KPI and value

Completion Rate

86.11%

Network Operations & Performance

Save Cancel

NETWORK OPERATIONS RELATED INFORMATION

Key Indicator	Unit	Values
Total energy Served during the reporting period	MWh	816417.00
Peak Load experienced during the reporting Period	MW	51.70
Date and time of peak load	yyyy/mm/dd hh:mm	2015/07/24 14:00
Minimum load experienced during the reporting Period	MW	19.60
Date and time of minimum load	yyyy/mm/dd hh:mm	2015/07/05 13:00
Total served area	Square kilometres	184460.07
Total Length of HV Overhead lines (33kV)	kilometres	2000.73
Total Length of HV Cable service lines (33kV)	kilometres	361.73
Total Length of HV Overhead lines (11kV)	kilometres	3297.12



Typical Show case of Network Operations KPIs

SAIDI Definition

- The System Average Interruption Duration Index (SAIDI) measures the average of the total long duration of interruptions affecting the average delivery point for a given year. Long interruptions are those that last longer than 5 minutes.
- This indicator is defined as the total time that customers were interrupted divided by the total number of customers.

Where:

$$SAIDI = \frac{\sum_i (N_i \cdot d_i)}{CA}$$

i: Index of interruptions for the year

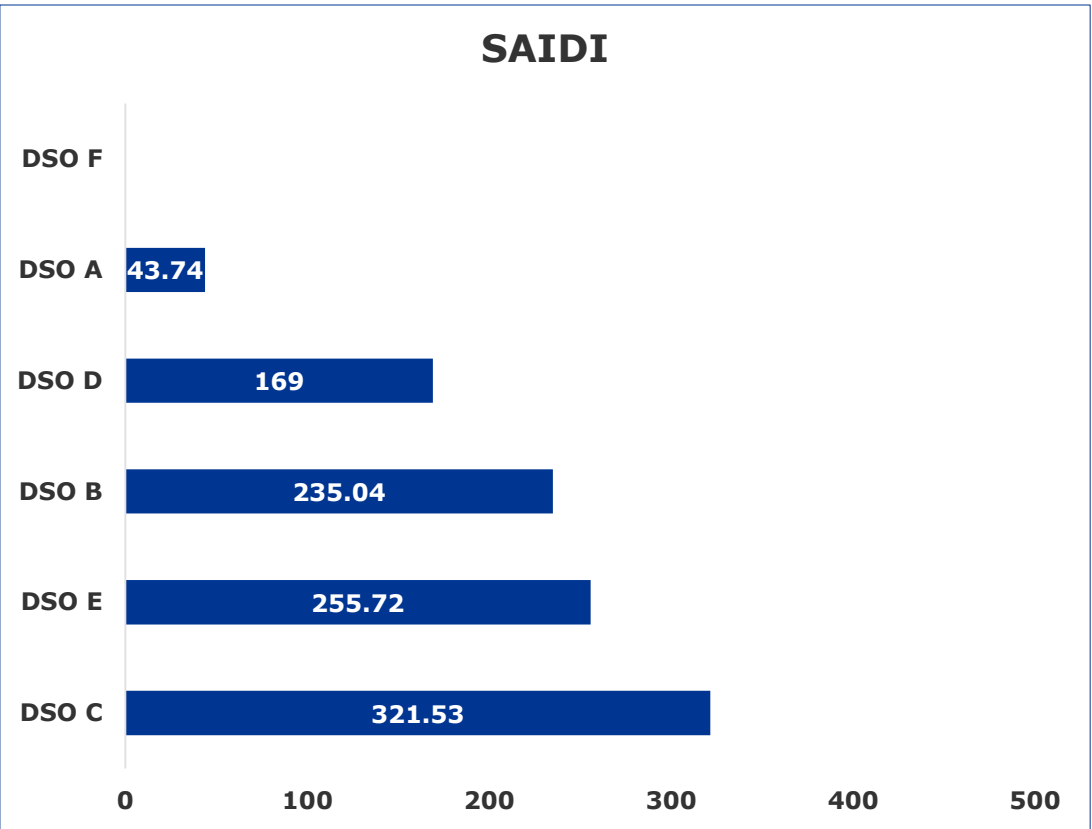
di: Duration of interruption "i", in minutes

Ni: Number of customers for which the supply was interrupted by interruption "i"

CA: Customer Accounts

* **Interruption:** An event where one or more customers experience loss of electricity supply for a period longer than 5 minutes.

KPI COMPARISON GRAPH: SAIDI



KPI Description:

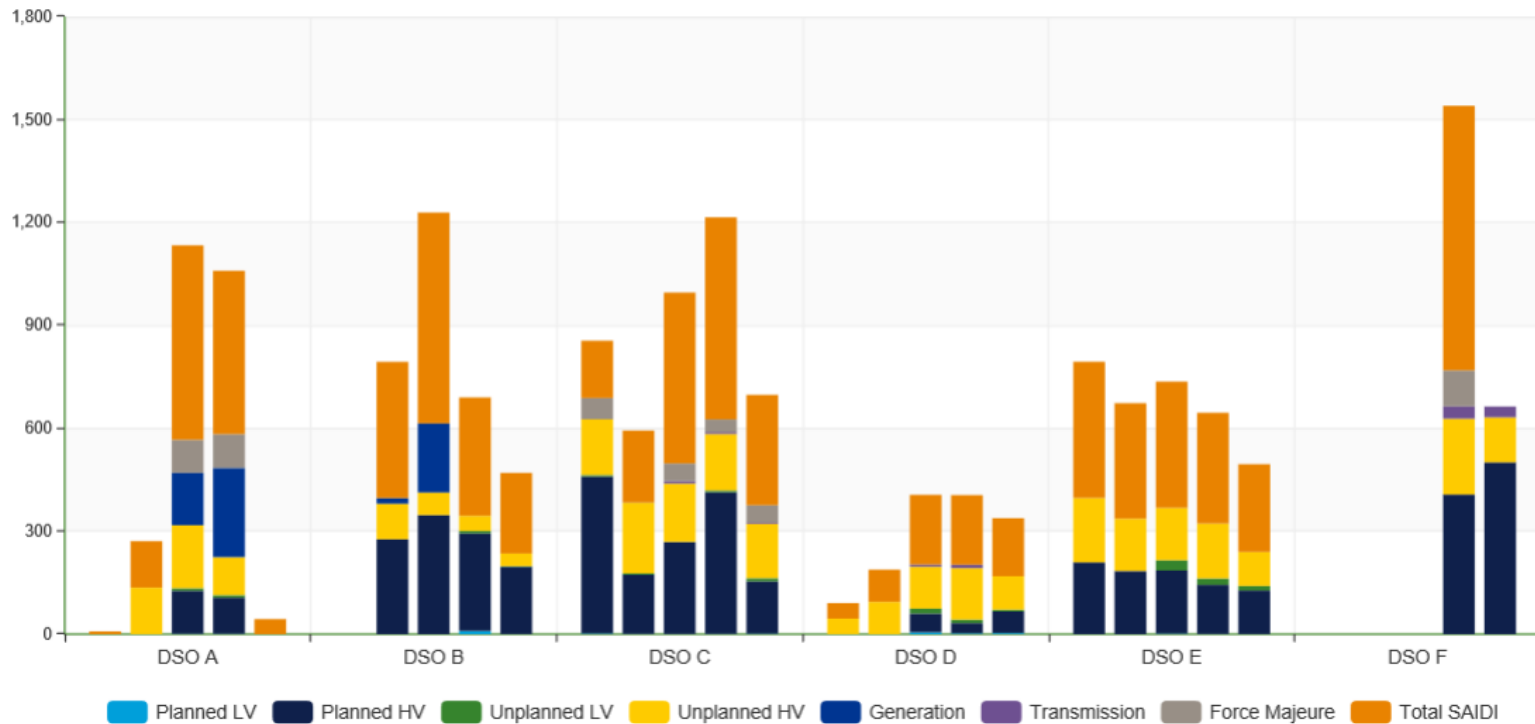
The System Average Interruption Duration Index (SAIDI) measures the average of the total long duration of interruptions affecting the average delivery point for a given year. Long interruptions are those that last longer than 5 minutes.

Participants should strive to **decrease** SAIDI.

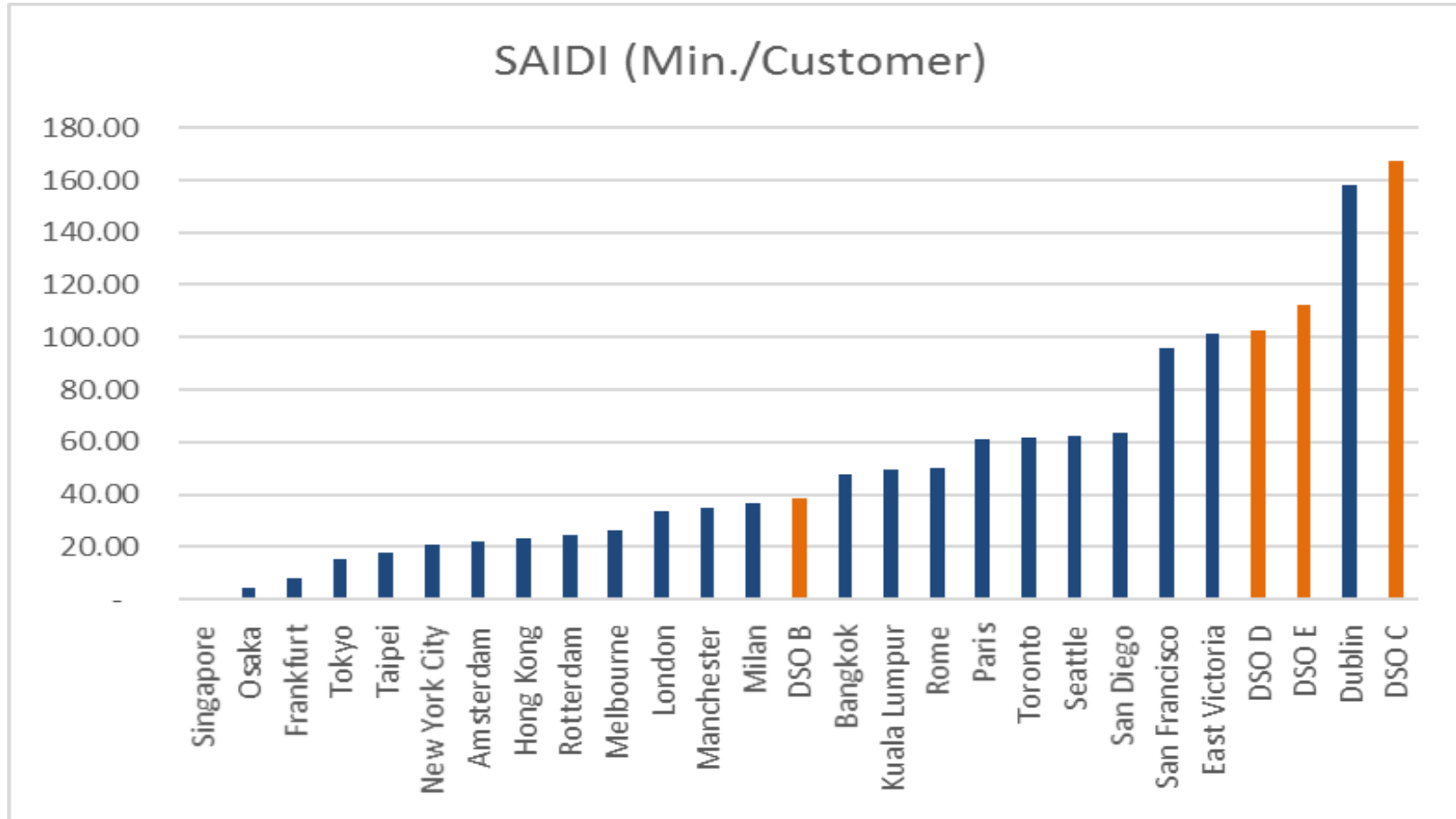
NETWORK OPERATIONS KPIs: SAIDI

SAIDI Index

Unit in (Min./Customer)



INTERNATIONAL BEST-PRACTICE: SAIDI



Note: Unplanned HV and LV only

SAIFI Definition

- The System Average Interruption Frequency Index (SAIFI) measures the average number of long interruptions experienced per customer. The System Average Interruption Frequency Index (SAIFI) indicates how often the average customer
- experiences a sustained interruption over a predefined period of time.
- Long interruptions are those that last longer than 5 minutes.
- This indicator is defined as the total number of customer interruptions divided by the total number of customers.

Where:

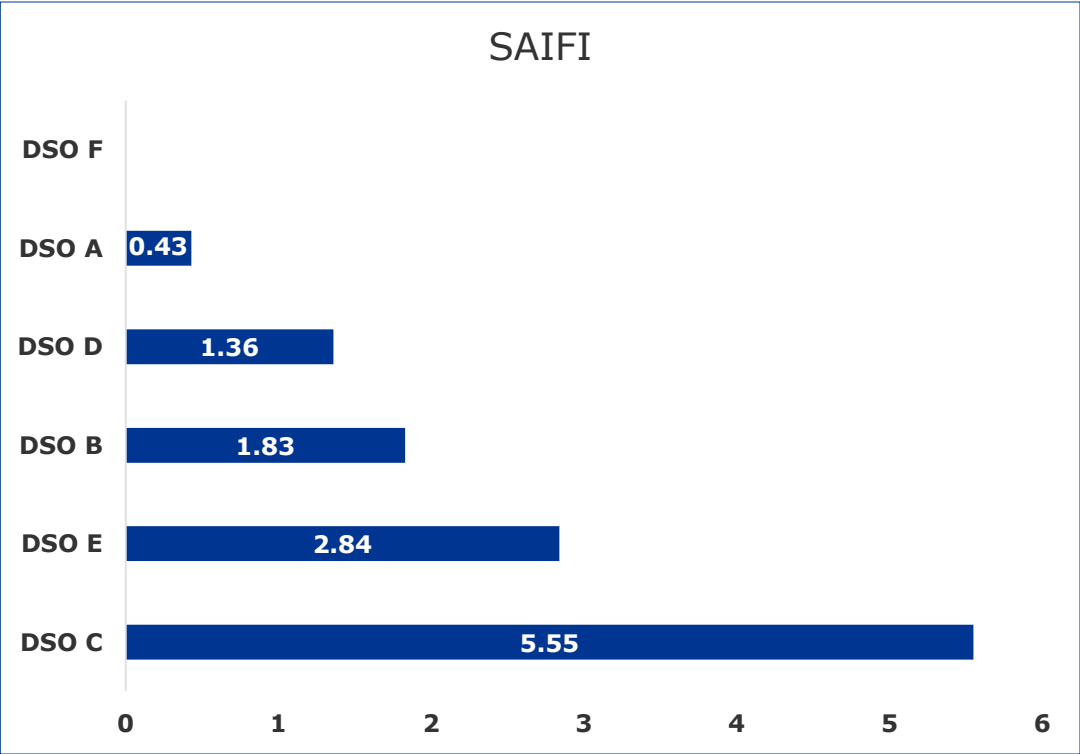
i: Index of interruptions for the year

N_i: Number of customers for which the supply was interrupted by interruption "i"

CA: Customer Accounts

$$SAIFI = \frac{\sum_i (N_i)}{CA}$$

KPI COMPARISON GRAPH: SAIFI



KPI Description:

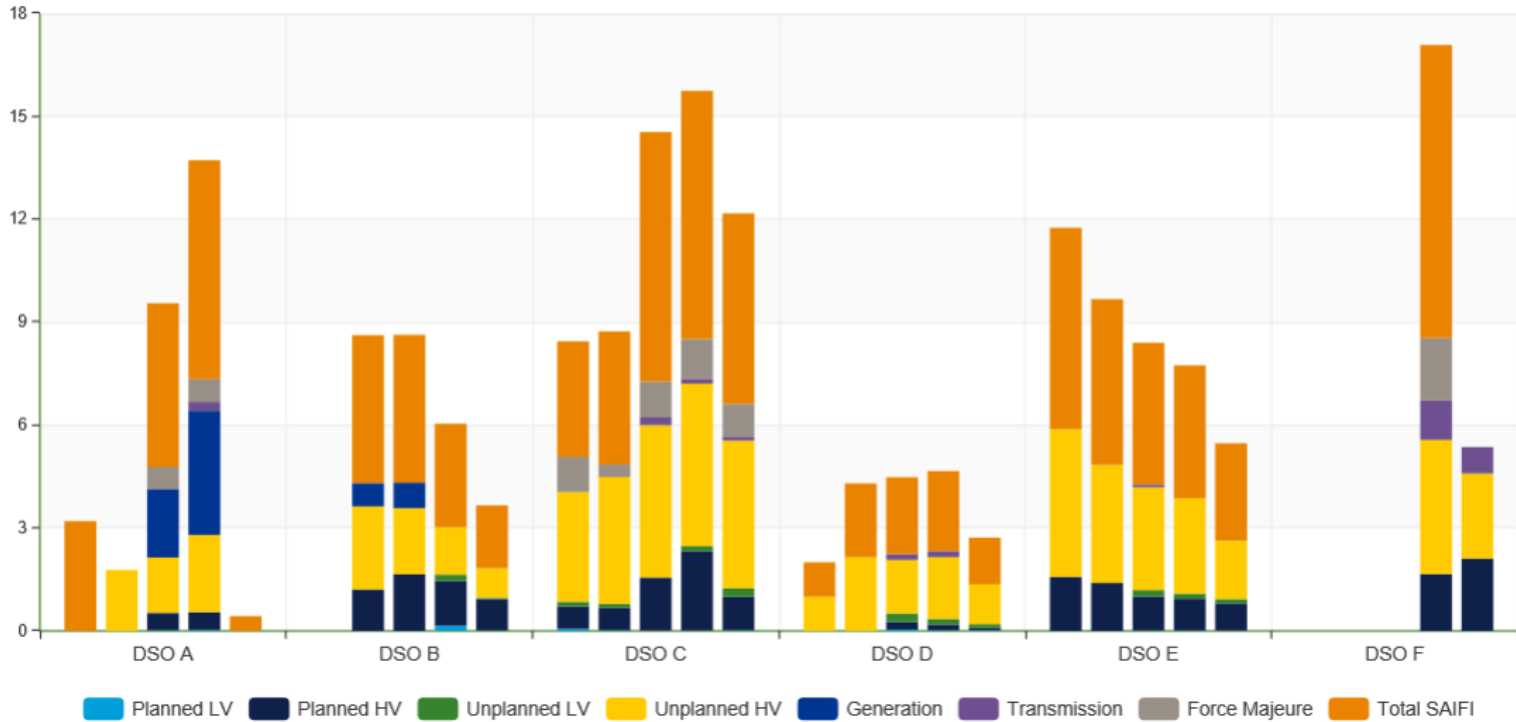
The System Average Interruption Frequency Index (SAIFI) measures the average number of long interruptions experienced per customer.

Participants should strive to **decrease** SAIFI.

NETWORK OPERATIONS KPIs: SAIFI

SAIFI Index

Unit in (Interruptions / Customer)

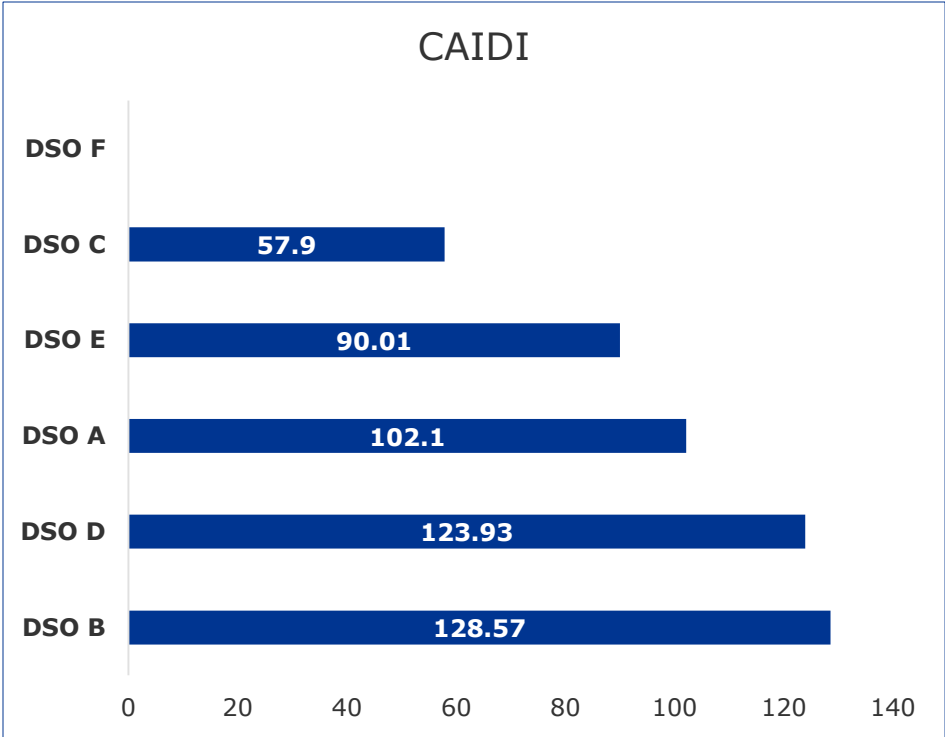


CAIDI Definition

- The Customer Average Interruption Duration Index (CAIDI) measures the average time of long interruptions. This indicator is defined as the total time that customers were interrupted divided by the total number of customer interruptions.
- Alternatively this indicator can be defined as SAIDI divided by SAIFI.

$$CAIDI = \frac{SAIDI}{SAIFI}$$

KPI COMPARISON GRAPH: CAIDI

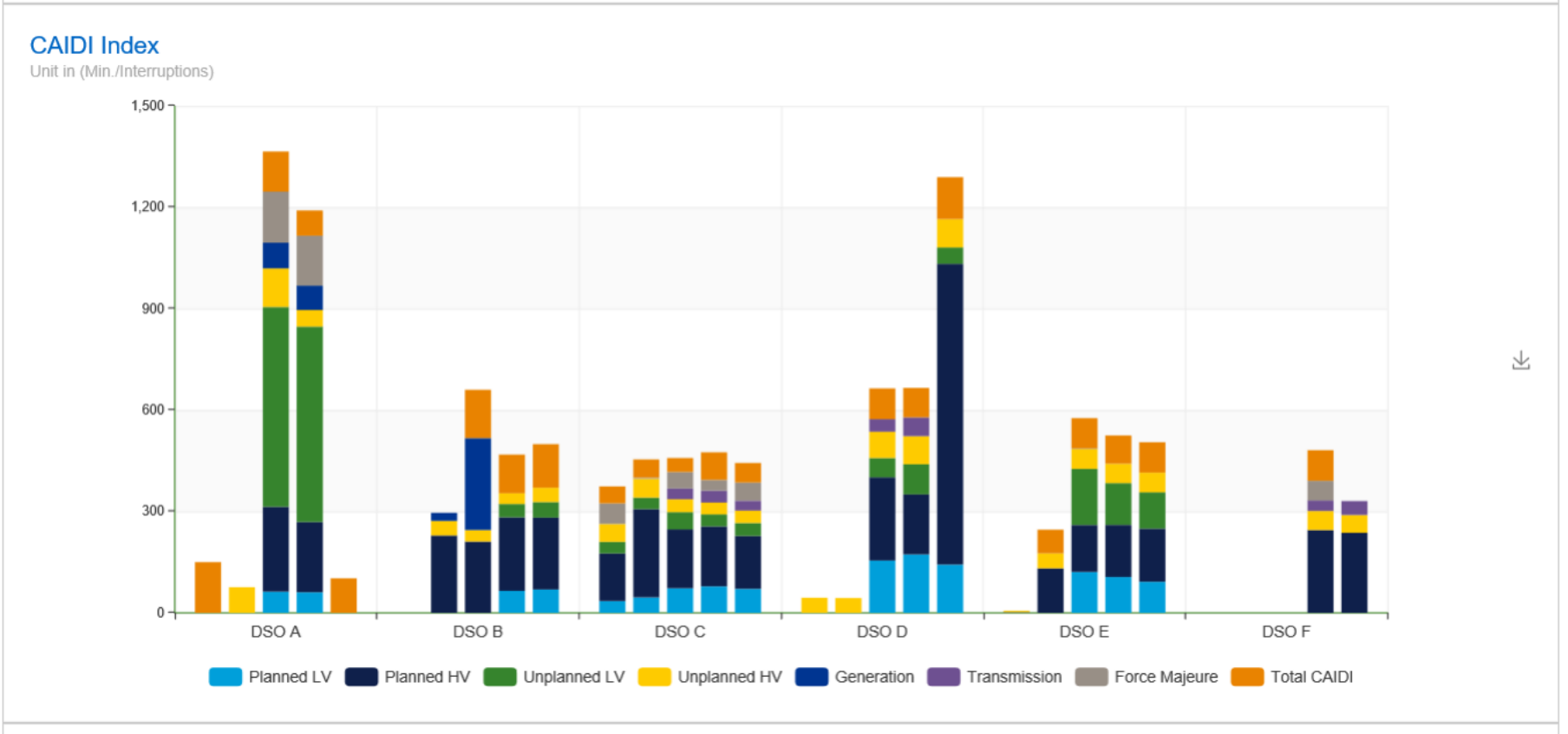


KPI Description:

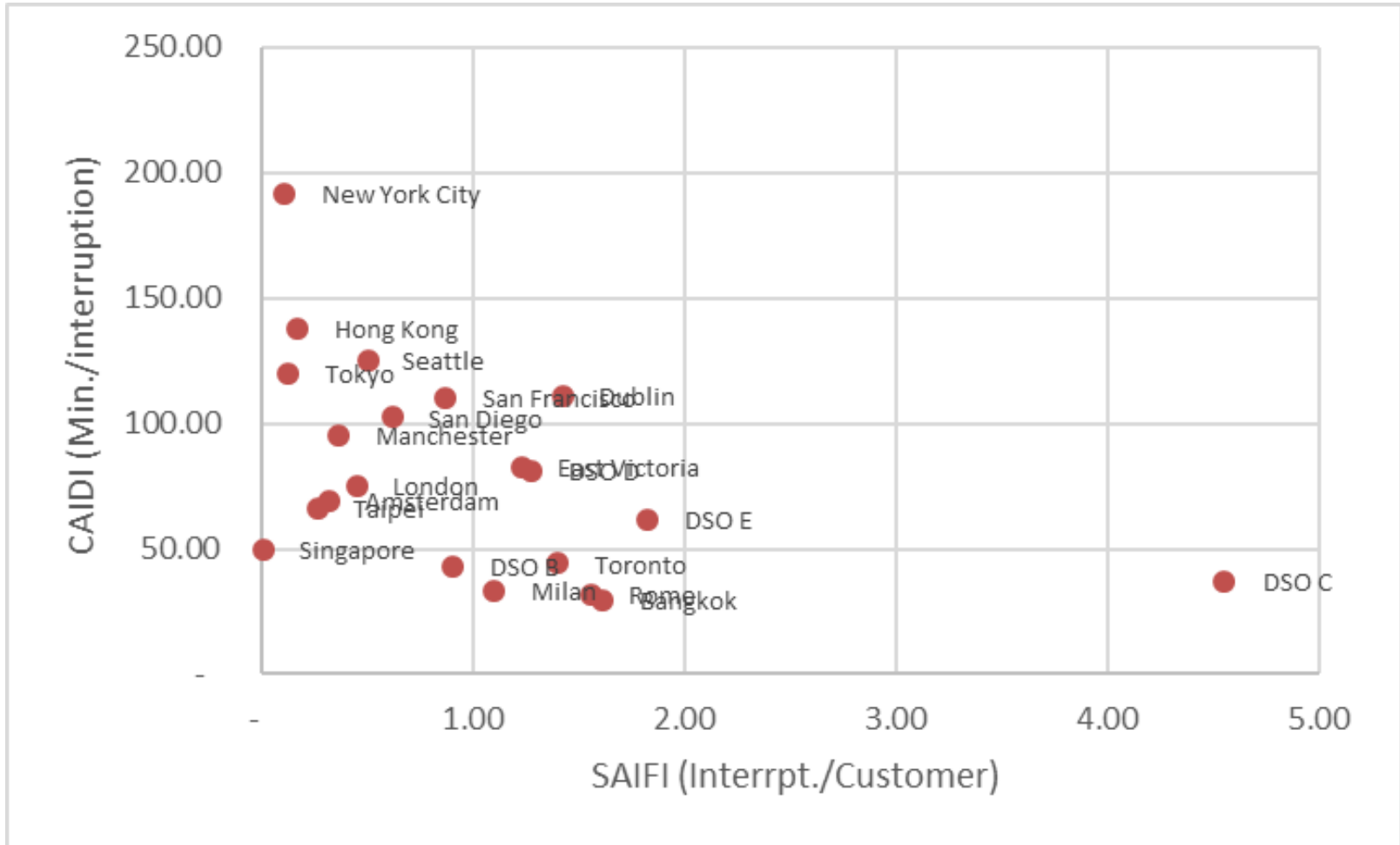
The Customer Average Interruption Duration Index (CAIDI) measures the average time of long interruptions. CAIDI is provided as a total CAIDI = total SAIDI/total SAIFI

Participants should strive to **decrease** CAIDI.

NETWORK OPERATIONS KPIs: CAIDI



INTERNATIONAL BEST-PRACTICE: RELIABILITY

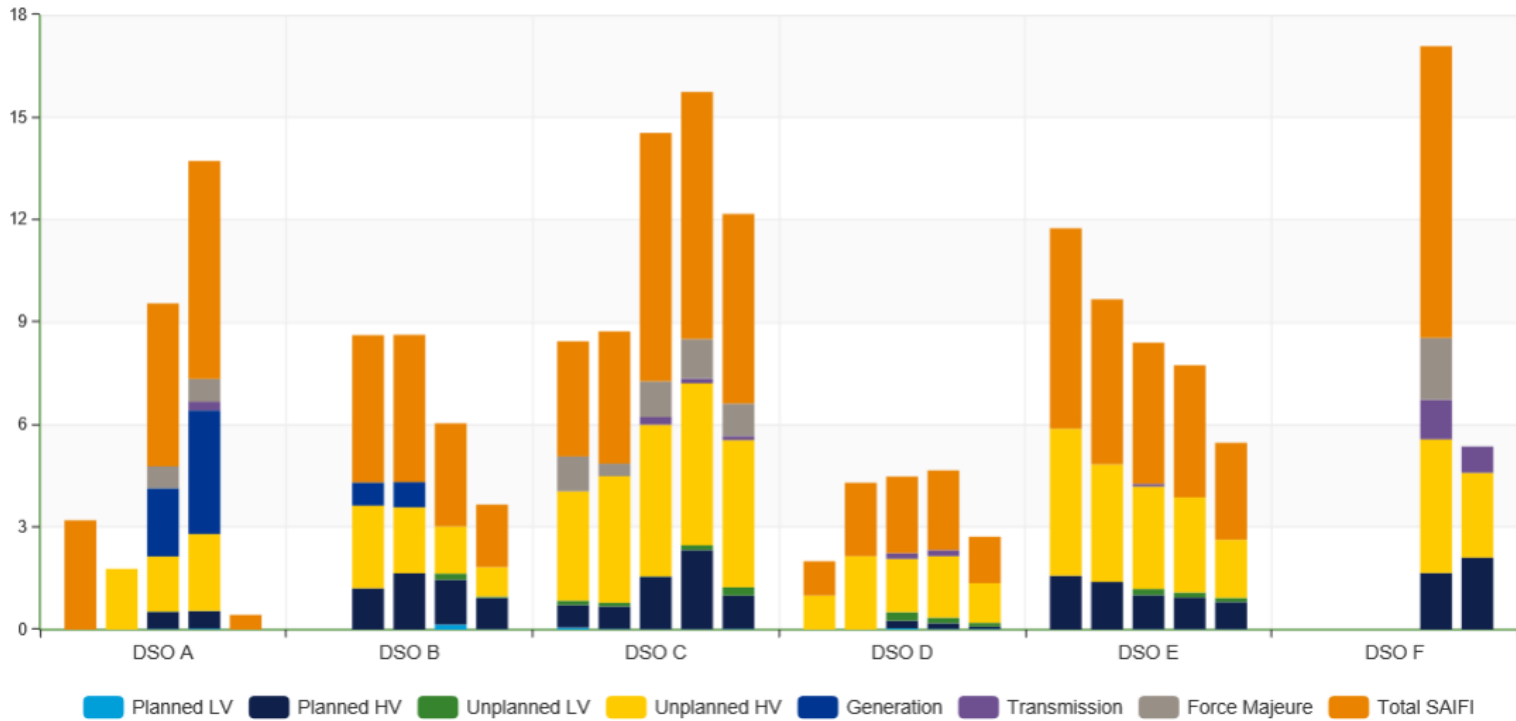


Note: Unplanned HV and LV only

NETWORK OPERATIONS KPIs: ENERGY NOT SUPPLIED

SAIFI Index

Unit in (Interruptions / Customer)



KPI : LOSSES

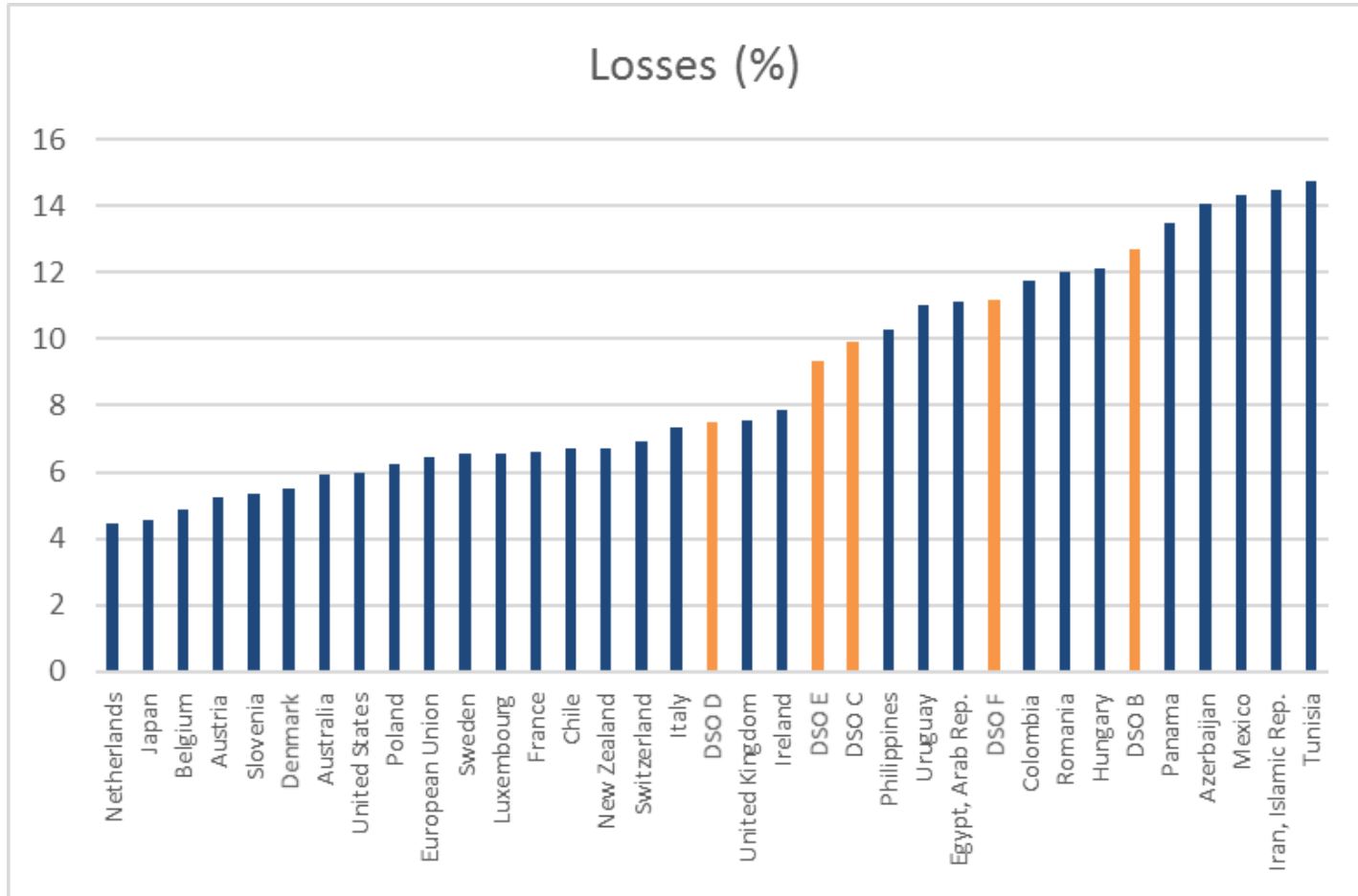
KPI Description:


- Normally Technical Losses comprises energy losses caused by the physical transport of energy, e.g. line losses, transformer losses; and
- Technical Losses are normally determined using specific studies.

Best Practices have losses at around 4% - 5%.

Participants should strive to **decrease** total losses.

INTERNATIONAL BEST PRACTICE: TOTAL LOSSES





Typical Show case of Financial KPIs

RETURN ON CAPITAL

- The Return on Capital (ROC) is a measure of the return that the company is earning on its invested capital.

$$ROC = \frac{PFO}{Capital} \times 100\%$$

Where:

PFO: Profit from operations

Capital: Average of the Net Regulatory Asset values on start date i.e. 1st January and end date i.e. 31st December of reporting period

- Additionally, please kindly check **DBF Manual** for further definitions.

COST EFFECTIVENESS

- The Cost Effectiveness (CE) is a measure of the cost level for the company relative to the number of units it distributes.

$$CE = \frac{OC}{RUD}$$

Where:

OC: Operating Costs during reporting period

RUD: Regulated Units Distributed during reporting period

- Additionally, please kindly check **DBF Manual** for further definitions.

Safety, Health and Environment KPIs

Lost Time Injury Frequency Rate

- Lost Time Injury Frequency Rate (LTIFR) measures how many Lost Time Injuries (LTI) occurred over a specified period per million staff working hours.

$$LTIFR = \frac{LTI}{\text{Working Hours}} \times 1,000,000$$

Where:

LTI: Number of Loss Time Injuries occurred during the given period

Working Hours: Total number of working hours for all staff in the given period including contractor staff

- Additionally, please kindly check **DBF Manual** for further definitions.



DBF Best Practices Workshop Presentation

Workshop of learning, sharing practices



Management **Daily**
Performance Monitoring
through BI

1- Complaints Recovery Time

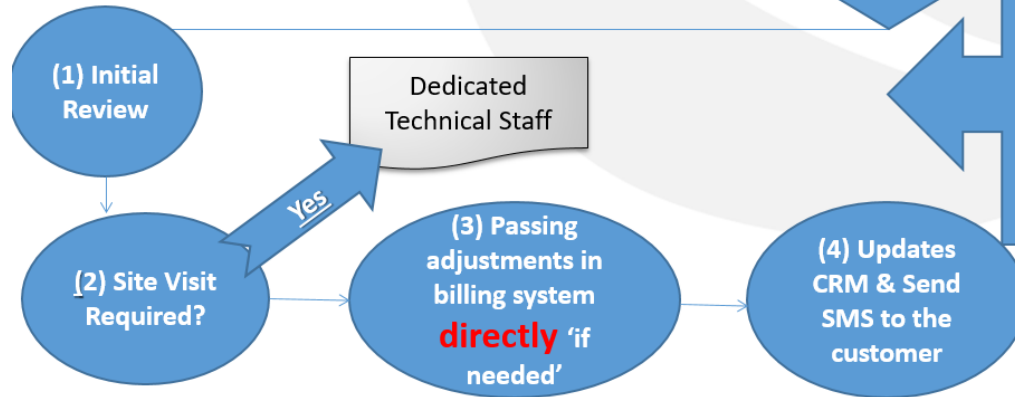
2013	2014	2015
63%	98.4%	100%
10WD	10WD	7WD

Created on	No of Complaints	Solved In 10Days	Solved In 40Days	Solved In Above 40Days	Not Solved	Solved In 10Days %	Solved In 40Days %	Solved In Above 40Days %	Not Solved %
10/1/2015	37	33	0	0	4	89.189	18919	0	10.811
10/2/2015	3	0	0	0	3	0	0	0	100
10/3/2015	3	0	0	0	3	0	0	0	100
10/4/2015	29	0	0	0	29	0	0	0	100
	72	33	0	0	39				

Registering
Complaints in
CRM
by CC &
branches

Back
Office
Team

Monitoring
Progress and
Follow up
the team &
writing official
response to the
customers



DBF Welcomes Utilities across the Globe to Join the Forum



ELECTRICITY DISTRIBUTION BENCHMARKING

Assessing and improving service performance for electricity distribution network operators
How can power utilities meet the rapidly growing demand for electricity while managing ageing assets effectively and fulfilling regulatory requirements? The DNV GL-facilitated Distribution Benchmarking Forum helps you to answer that question. Through annual in-depth benchmarking studies, it enables electricity distribution network operators (DNOs) to achieve and maintain world-class performance.

Electricity consumption in the Cooperation Council for the Arab states of the Gulf (GCC) region is growing fast. For example, in Oman both peak and average demand are predicted to approximately double between 2013 and 2020. For the region as a whole, demand is estimated to grow at around 5-10% per year over the coming five years. And demand per capita is increasing at around 2.5% – four times faster than in the USA.

In meeting this growth, DNOs must efficiently manage their ageing assets, increase efficiency and comply with all regulations. Benchmarking your operations against the peer group allows you to understand how well your company is performing and identify where and how you can improve effectiveness and efficiency even further.

The Distribution Benchmarking Forum gives you that opportunity – facilitated and supported by DNV GL, one of the most trusted and experienced independent consultant name in the energy industry.

The Distribution Benchmarking Forum

The Distribution Benchmarking Forum (DBF) was historically established in 2012 on the initiatives of Electricity Holding Company (EHC) owned by the Omani government with the goal of "measuring performance to improve". To enable that goal, the EHC appointed DNV GL to act as the DBF's independent benchmarking expert and secretary. DBF members can draw on DNV GL's extensive global experience of benchmarking projects and analyses. The vision of the DBF is "To be a forum for participants to share experiences, learn from each other, and improve performance through benchmarking."



The forum is now open for other DNOs to join as participating member and share the benefit of it.

Why to benchmark?

Benchmarking is essential for any electricity distribution network operator who has a desire to excel so needs to thorough review of:

- Asset performance
- Planned and unplanned service interruptions
- Reliability indicators
- Customer satisfaction
- Financial performance
- Employee satisfaction

Benchmarking within the DBF

With the DBF, benchmarking focuses on five strategic themes:

- Network operation
- Customer services
- Financial performance
- Human resource management
- Health and safety

The forum uses standardised reporting practices and common metrics to simplify comparison with your peers, whilst accounting for specific differences between distribution companies. It promotes practical solutions that are easy to understand and easy to implement, helping to improve performance more quickly.

How it works

Each member DNO submits its yearly data on key indicators on standard templates released by DNV GL related to the five strategic themes. DNV GL checks the data from all members, and carries out detailed benchmarking calculations. The outcome of these calculations is shared via an annual report. This shows how your performance compares to other participating members and how the top performers achieve their results.

After the report is published, all DBF members are invited to an annual workshop to discuss the results and share best practices. The workshop is hosted by workshop is hosted by one of the participating member and therefore can take place in various locations. This makes it possible to get an insight in the company of the host as well. All participating member DNOs sign the 'confidentiality-agreement' and make sure that the data and information is kept within their companies.

How to join

Membership of the DBF is now open to all electricity distribution companies in the region and the globe. To take advantage of the benefits of membership, please contact:

Mr. Ashutosh Sharma
Tel: +971 4 352 6626
Fax: +971 4 352 3335
Email: dubai@dnvgl.com
Or go to www.dnvgl.com/dbf



Benefits of DBF membership

- Receive an annual overview of where your company stands
- Gain an understanding of where you can improve
- Learn best practices from the peer group leading performers

A TRUSTED AND EXPERIENCED PARTNER

DNV GL has a heritage stretching back 150 years. We unite the strengths, know-how and resources of respected brands including KEMA, Garrad Hassan, DNV and GL.

As a leading business and technical consulting partner to the global energy industry, we have established a strong reputation for international benchmarking. We have been active in transmission benchmarking analyses since 1998 covering 18 countries, and have delivered distribution benchmarking studies for companies around the globe.

DBF Welcomes Utilities across the Globe to Join the Forum

SAFER, SMARTER, GREENER

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DNV GL

Driven by our purpose of safeguarding life, property and the environment, DNV GL enables organisations to advance the safety and sustainability of their business. We provide classification and technical assurance along with software and independent expert advisory services to the maritime, oil and gas, and energy industries. We also provide certification services to customers across a wide range of industries. Operating in more than 100 countries, our 16,000 professionals are dedicated to helping our customers make the world safer, smarter and greener.

In the energy industry

DNV GL delivers world-renowned testing and advisory services to the energy value chain including renewables and energy efficiency. Our expertise spans onshore and offshore wind power, solar, conventional generation, transmission and distribution, smart grids, and sustainable energy use, as well as energy markets and regulations. Our 2,500 energy experts support clients around the globe in delivering a safe, reliable, efficient, and sustainable energy supply.

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ENERGY

ELECTRICITY DISTRIBUTION BENCHMARKING

SAFER, SMARTER, GREENER

DBF Welcomes Utilities across the Globe to Join the Forum

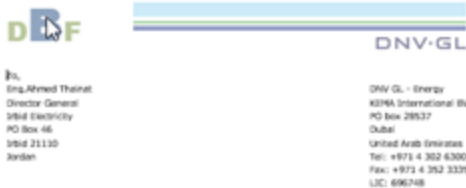
www.dnvgl.com/dbf

Contact at-

dbf@dnvgl.com

or at

Dubai@dnvgl.com



Date: 20th Sept 2015
Our reference: DBF-AS
Your reference: Email dated 20th September 2015

Subject: Invitation to join Distribution Benchmarking Forum (DBF)

Dear Sir,

You hereby receive an invitation letter and information on the DBF (Distribution Benchmarking Forum), the forum in which Electricity Distribution Network Operators (DNOs) compare their Network Operation practices against mutually agreed and established key performance indicators.

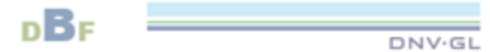
The vision of the DBF is "to be a forum for participants to share experiences, learn from each other, and improve performance through benchmarking."

The DBF has defined objectives where as the main objective is to satisfy the yearning to learn from peer groups, isolated by the restructuring process in many electricity markets. The need for learning from each other was firstly identified by Electricity Holding Company of Oman with five electricity distribution companies, who took the initiative and commissioned KEMA (now known as DNV GL) to facilitate and establish the DBF in 2012. The forum has successfully operated by DNV GL for last two years and all participating members. Today, a database with more than 15 Performance Measures is available for the participating members of the forum and is updated annually. This data is used in detailed multidimensional Benchmarking Models, which enable a sound comparison of five different performance areas namely are network performance, customer service, financial performance, human resources and HSE. The results provide the members with a detailed insight in possibilities for improving their performance.

All members meet once in a year for a workshop where the results and differences are discussed and lead to a better understanding of 'best-practice' in Systems Operation and performance areas. This workshop is hosted by one of the participating member and therefore can take place in various locations. This makes it possible to get an insight in the company of the host as well.

Furthermore, all participating member DNOs are very much aware of the confidential character of the data and information shared. They all sign the 'confidentiality-agreement' and make sure that the data and information is kept within their companies.

The one time registration fee to join the DBF during the year 2016 is USD 3,445.00, whereas annual membership fee of the DBF for the year 2015 is 5,800 USD, these shall be payable by the member
KEMA International BV, LAF Peer Burjuman Business Tower, Bur Dubai, PO box 28537, Dubai, United Arab Emirates
Tel: +971 4 302 6026, Fax: +971 4 302 3335, email: dbf@dnvgl.com, www.dnvgl.com



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directly to KEMA International BV (Dubai Branch). The fee excludes any travel and hotel expenses of your people attending the workshop.

The attached brochure contains additional information. The 2015 project of the DBF has been finalized for the data of 2014 and workshop is planned in coming month in Muscat, with completion of that DBF will be ready for 2016 project. We will release the DBF 2016 manual and 2015 data request by start of year 2016 so we motivate you to express the interest to join the DBF and join with start of the year 2016.

Optional additional support service for Preparation for Benchmark

In order to prepare DNOs for benchmarking and data collection DNV GL can also offer support service, where in we not only support in data collection but can also analyze the available data 'on-the-spot' and include them in the existing benchmark models, comprising the information of all member DNOs from available data base. This will enable you to have your first results available within a week after you submit the collected historical data, if historical data is available, same can be used for self-assessment over the years. The gaps in data can be notified during preparation stage.

This service is offered separately at site or virtually by DNV GL as per the need of the DNO and is not mandatory for DBF and is normally offered on time and material basis.

We look forward to welcoming your company as a member in the DBF.

Please do not hesitate to contact me for any additional information or Ms Viktorja Nemevira, Facilitating consultant DBF at email E-mail address: Viktorja.Nemevira@dnvgl.com or dbf@dnvgl.com

Meanwhile we remain,

With kind regards,




Ashutosh Sharma
Project Manager DBF
Principal Consultant, Operational Excellence
KEMA International BV

KEMA International BV, LAF Peer Burjuman Business Tower, Bur Dubai, PO box 28537, Dubai, United Arab Emirates
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BENCHMARKING and PERFORMANCE ANALYTICS across the ENERGY VALUE CHAIN



DNV GL Global Team of Experts in Benchmarking

Name	Key Qualification and Experience
<p>Tom McInally</p> 	<p>Tom is a Senior Principal Consultant with DNV GL. Tom's areas of expertise include Benchmarking, Electricity and Gas Market Design, Modelling and forecasting; Grid operations and codes; Micro grids; Governance and Operation; Electricity Trading; Retail pricing and billing. He has extensive work experience with utilities in Singapore, Switzerland, Germany, Austria, Australia, Czech Republic, Slovenia, Taiwan, Vietnam, Philippines, Malaysia, Thailand, and UK. Tom has recently been involved in benchmarking of SP Services, and separately on three occasions, in benchmarking of SPPG performance and cost to serve. In Malaysia (as part of IPP audits) Tom participated in benchmark of 8 IPPs in Malaysia.</p>
<p>Dr. Viren Ajodhia</p> 	<p>Dr. Viren Ajodhia, was closely involved in the benchmarking projects previously conducted for SPPA as well as for SP Services. He has extensive international benchmarking project of network tariffs, end-user tariffs, and quality performance. In addition, as part of this project he developed proposals for quality incentive schemes and conducted the international benchmarking of network tariffs. Dr. Ajodhia is a benchmarking expert with a mixed engineering and economics background. He was previously regulatory economist with the Dutch Energy Regulator. As a consultant, he has advised on regulatory policy design, price and quality control implementation, and (DEA and econometric) benchmarking analysis in the areas of electricity, gas, and water. He is a part-time lecturer at Delft University of Technology. He is also an invited lecturer at the Florence School of Regulation where he teaches advanced courses in economic regulation to staff from various European energy regulators. He has published extensively on the issue of quality regulation and benchmarking.</p>
<p>Karthik Arunachalam</p> 	<p>Karthik is a Consultant with DNV GL. In DNV GL he has worked on a range of projects including knowledge transfer assignments sponsored by international bodies such as the Asian Development Bank. He leads the center of excellence in benchmarking within D&V GL CTC Singapore and has led the development of a benchmarking portal. He has worked on and project managed a wide range of benchmarking projects with utilities in Asia Pacific. He has extensive experience in benchmarking, data analytics and data visualisation for utilities. He specialises in network regulation regimes, utility performance and retail operations. Karthik holds B.Eng (Hons.) and a MSc degree in Chemical Engineering from the National University of Singapore (NUS).</p>

Benchmarking and Performance Analytics across the energy value chain

The Energy Value Chain



Policy, Strategy & Energy Trading



Energy Production



Transmission Management



Energy Distribution



Energy End Use



Efficiency Analysis



Power Plant Performance Audits



TSO/DSO Benchmarking

- Grid Reliability – SAIDI / SAIFI
- Grid Capex / Opex
- Power Quality



Retail Benchmarking

- Cost-to-serve
- End-user tariffs
- Customer Service Levels

T&D and Retail Benchmarking

Increasing cost pressure in utilities to keep electricity and gas at affordable and competitive tariffs.

Ageing T&D assets make high reliability a key focus of operation and maintenance regimes.

Limitation in capital and resources require new approaches to strategic and operational asset management and investment allocation.

In order to identify new approaches to business issues, many companies are turning to benchmarking against their peer groups to identify utilities with better practices and areas of improvement.

Utility (T&D and Retail) Benchmarking

Business drivers of Benchmarking

Stakeholders	Key business drivers
Regulators	<ul style="list-style-type: none">• Support efforts with electricity sector reforms and unbundling of utilities.• Support efforts in development of incentive regulation and price-cap regulation policies.• Measure financial and technical performance of the utilities.• Develop energy sector performance database.
Utilities	<ul style="list-style-type: none">• Understand their relative cost position with reference to the others and identify opportunities for improvement.• Enhance reliability and minimize operational downtime of ageing assets.• Renewal of PPAs, subsidies, incentives from the regulator.
Retailers	<ul style="list-style-type: none">• Help determine the ideal cost to serve for future cost projection and planning.• Help compare tariff levels and customer service levels to ensure reliability and quality of service to end users.

Utility (T&D and Retail) Benchmarking

Methodology



Utility (T&D and Retail) Benchmarking

KPIs used for Utility Benchmarking

- Operating Efficiency
 - Unit operational costs per unit delivered
 - Substation OPEX
 - Lines OPEX per unit transported
 - Labor Costs / Operational costs
- System Reliability
 - System availability
 - Forced and Fault Outages,
 - SAIFI, SAIDI, CAIDI
 - System Average Restoration Index
- Customer Service & Others
 - Service Standards and Performances
 - Cost-to-serve per Customer
 - Unit Cost of Meter Reading
 - Metering cost per customer
- Grid Charges and End-user tariffs
 - Low tension – Small
 - Low tension – Large
 - High tension
 - Extra high tension
- Power Quality
 - Voltage and Frequency Deviation Indices
 - Volt-var optimisation practices
 - Comparison against industry stds such as SEMI F47 and ITIC for voltage sag
- Cross-comparison:
 - Cost-to-serve vs customer service standards
 - End-user tariffs vs customer service standards
 - Grid charges vs SAIDI

DNV GL Benchmarking and Performance Analytics Services

Comparison with Typical Benchmarking Approach

Typical Benchmarking Approach



One off exercise

Lack of in-depth industry exposure

Generic Approach

DNV GL's Solution



Performance benchmarking as the first step

Concrete follow-up actions items with an implementation roadmap

Customized solution due to familiarity with global energy markets and regulations

DNV GL experience in Energy Benchmarking

S/No	Project Title	Customer	Country	Period
1	Cost to Serve and Service Levels Benchmarking	SP Services	Singapore	Feb 2017 – June 2017
2	Benchmarking Study of Grid Price and Performance	SP PowerAssets	Singapore	Aug 2016 – Nov 2016
3	HSE Benchmarking of SP Group	SP Ltd	Singapore	Mar 2016 – Jul 2016
4	Upgrade of Grid price and Performance Benchmarking	SP PowerAssets	Singapore	Jul 2014 – Oct 2014
5	Conducting Benchmarking Study of District Cooling System	Singapore District Cooling	Singapore	May 2014 – Jul 2014
6	Consultancy Service for Grid Price and Performance Benchmarking Study	SP PowerAssets	Singapore	Jun 2010 – Oct 2010
7	Benchmarking of environmental parameters of electricity generation in Europe	Essent Energie and Nuon	the Netherlands	Sep 2007 – Dec 2007
8	Grid Price and Performance Benchmarking Study	SP PowerAssets	Singapore	May 2006 – Dec 2006
9	Carilec Multi-Dimensional Benchmarking	Carilec	the Caribbean	Nov 2005 – Apr 2006
10	Benchmarking Study of Caribbean Utilities	Carilec	the Caribbean	Oct 2004 – Oct 2004
11	Implementation of Cap Regulation and Benchmarking for Electricity Networks	Suruhanjaya Tenaga	Malaysia	Oct 2003 – Jun 2004

BENCHMARKING and PERFORMANCE ANALYTICS

- A Quick Look

When looked from Benchmarking view ?



S. No.	Name of Distribution Company	Total No. of 11 K.V. Feeders.	Metered 11 K. V. Feeders	Remaining Feeders
1	Jaipur VVNL	6642	6598	44
2	Ajmer VVNL	7442	7230	212
3	Jodhpur VVNL	8442	7623	819
	Total	22526	21451	1075

When looked from Benchmarking view ?

S. No.	Particulars	Jaipur Discom	Ajmer Discom	Jodhpur Discom	Total
2.	Area	72474 Sq. KM	87256 Sq. KM	182509 Sq. KM.	342239 Sq. KM.
3.	Population	256 Lakh	229 Lakh	203 Lakh	688 Lakh*
4.	Consumers	45.85 Lakh	43.27 Lakh	37.32 Lakh	126.44 Lakh
5	Total Villages	15145	15279	14248	44672
6	Electrified villages (as per old definition) (upto31.12.15)	14458 (95.46%)	14969 (97.97%)	13837 (97.11%)	43264 (96.84%)
7	Electrified village, (as per new definition) (upto31.12.15)	14722 (97.20%)	15071 (98.63%)	13838 (97.12%)	43631 (97.67%)

When looked from Benchmarking view ?

System Average Interruption Frequency Index (SAIFI)

Name of Licensee: JODHPUR DISCOM

SOP-4
For the 1st Half of FY 2017-18

S.No.	Name of Circle	Total number of consumers served	Total number of sustained interruptions to consumers	SAIFI = (2)/(1) (Number of Interruptions/ consumer)	Target specified by the Commission
		1	2		
1	JODHPUR, CC	265090	2688663	10.14	
2	JODHPUR, DC	409820	7349972	17.93	
3	PALI	482355	4928119	10.22	
4	SIROHI	206239	3521766	17.08	
5	BARMER	346844	14996350	43.24	
6	JALORE	301231	9759209	32.40	
7	JAISALMER	93039	2482177	26.68	
8	BKESL(BIKANER CC)	148996	1549648	10.40	
9	BIKANER, DC	213884	12091446	56.53	
10	HANUMANGARH	341247	6577655	19.28	
11	GANGANAGAR	355830	6387853	17.95	
12	CHURU	348905	19261963	55.21	
TOTAL		3513480	91594821	26.07	

When looked from Benchmarking view ?

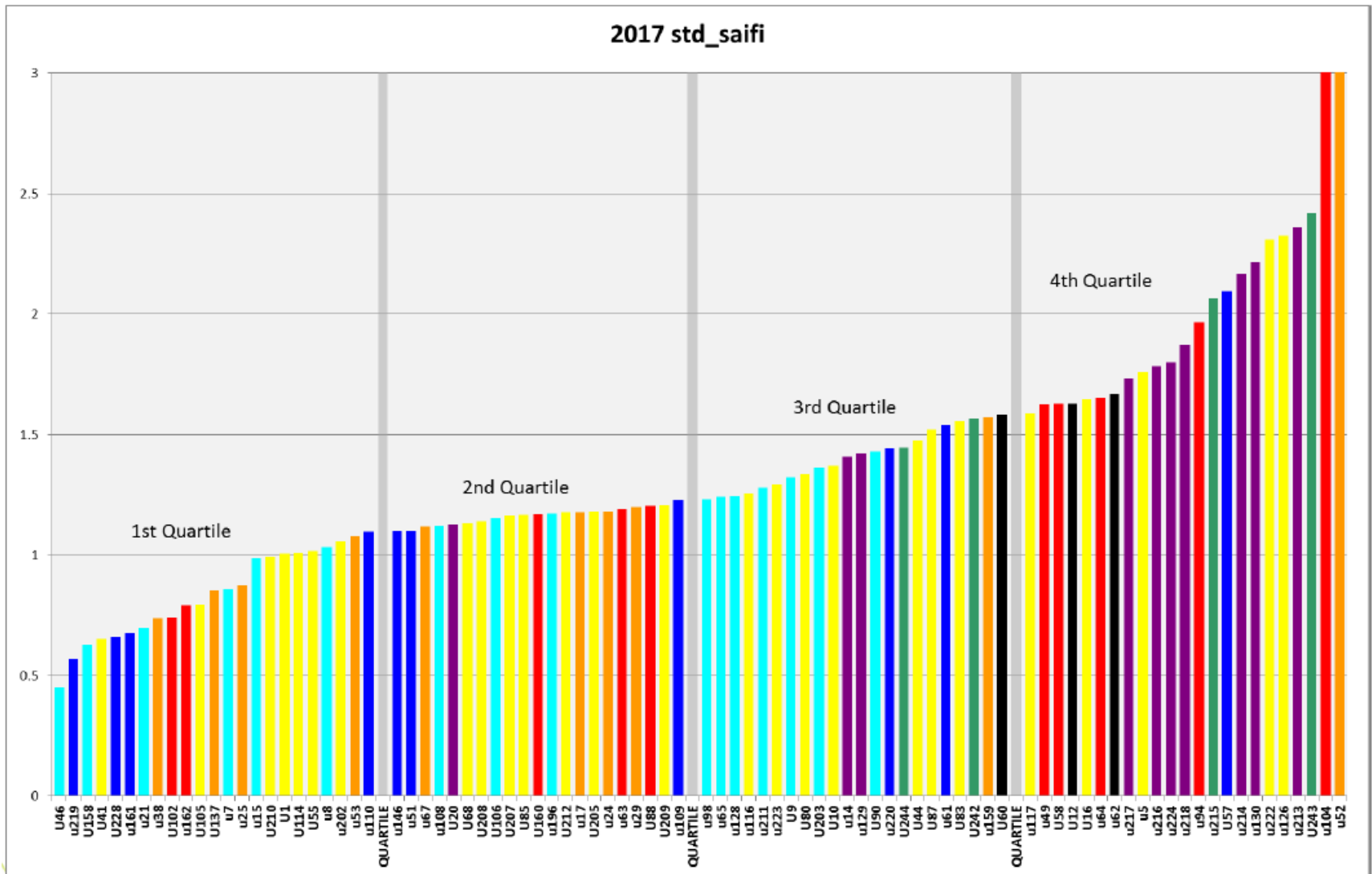
SOP-4

Name of Licensee : Jaipur Discom

For the 1st Half Year ending :2017-18

S.NO.	Name of Circle	Total no of consumer served (1)	Total numbers of sustained interruptions to consumers (2)	SAIFI=(2)/(1) (No. of interruptions/Consumers)	Target specified by the commission
1	JCC	805432	60375	0.0750	
2	JPDC	685912	31569	0.0460	
3	DAUSA	286933	19413	0.0677	
4	ALWAR	639540	22462	0.0351	
5	TONK	219366	12131	0.0553	
6	BHARATPUR	277192	264788	0.9553	
7	SAWAI MADHOPUR	195329	6735	0.0345	
8	DHOLPUR	107568		-	
9	KARAU LI	168368	44136	0.2621	
10	KOTA	337521	35698	0.1058	
11	BARAN	205131	5912	0.0288	
12	BUNDI	170542	9870	0.0579	
13	JHALAWAR	217586	2643	0.0121	
	TOTAL	4316420	515732	0.1195	

When looked from Benchmarking view ?



When looked from Benchmarking view ?

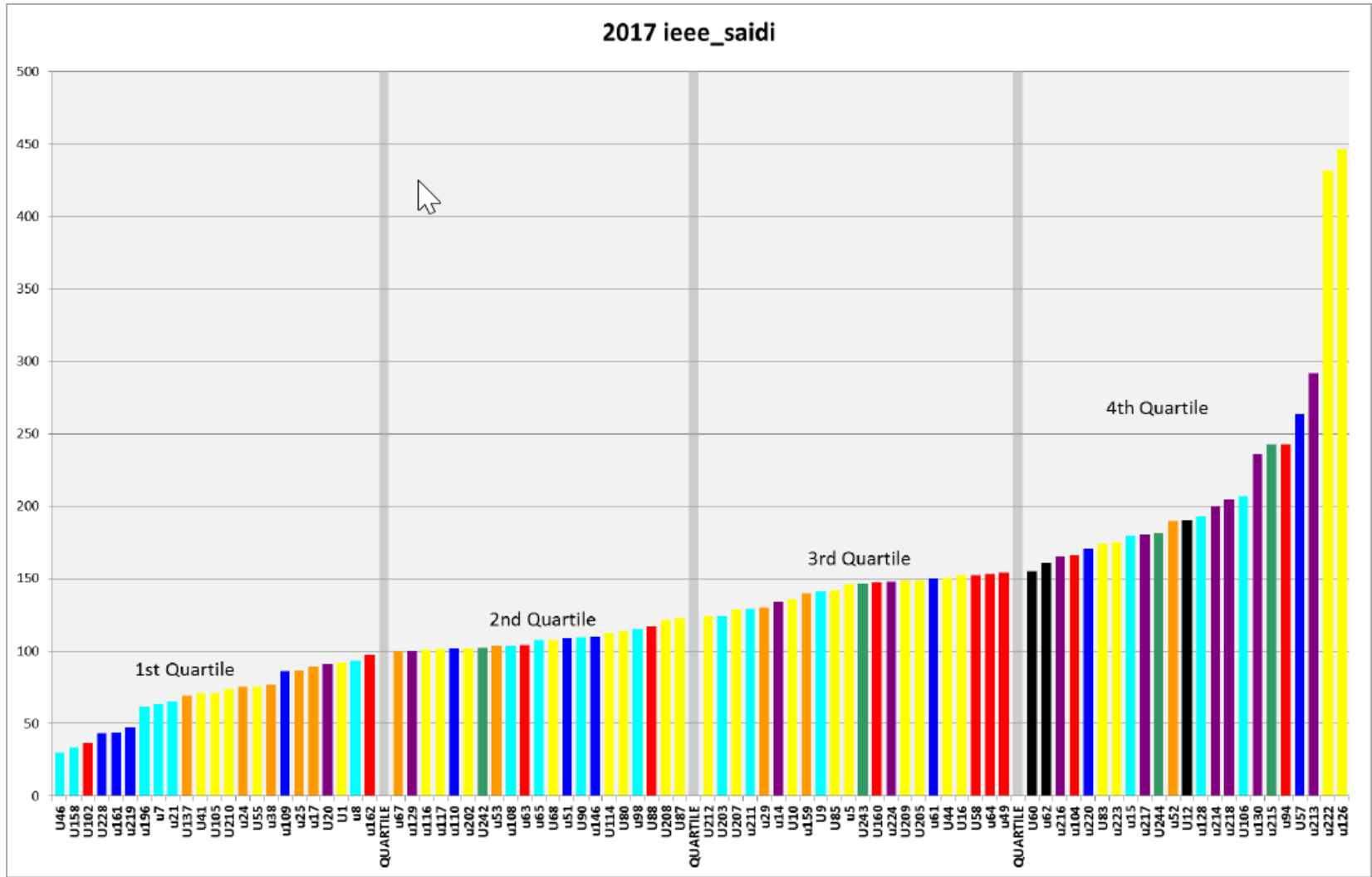
SOP-5

Name of Licensee : Jaipur Discom

For the 1st Half Year ending :2017-18

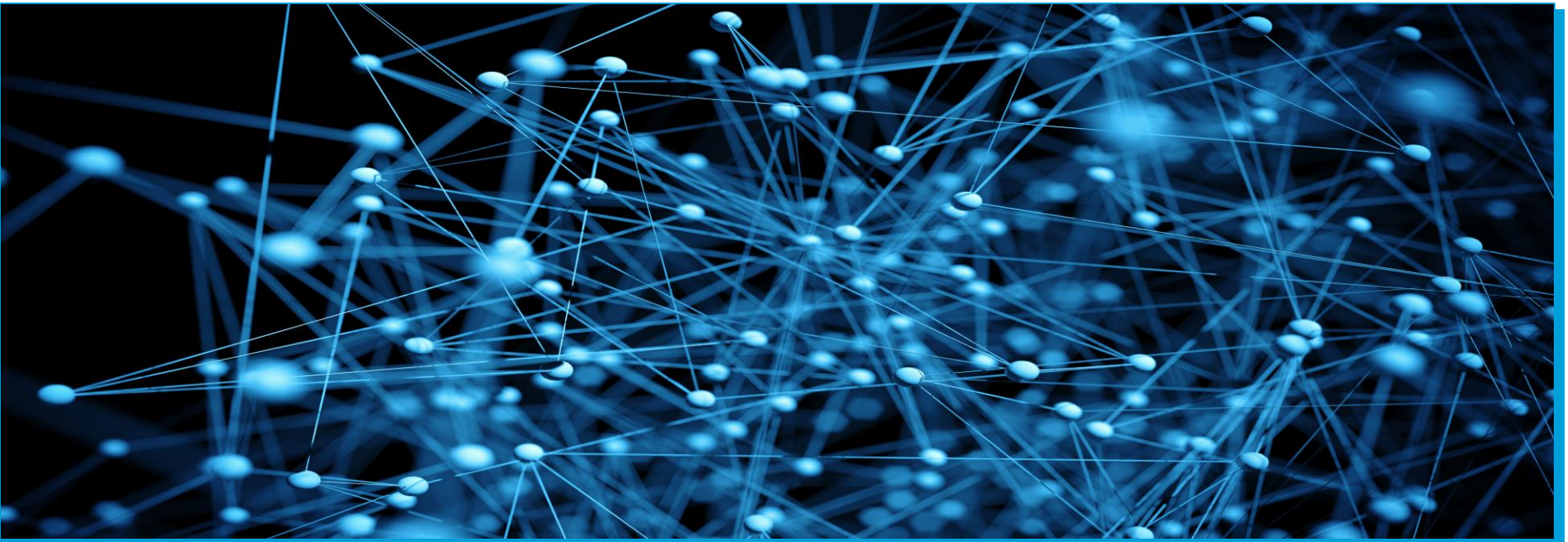
S.NO.	Name of Circle	Toatal no of consumer served (1)	Total minutes of sustained interruptions to consumers (2)	SAIDI=(2)/(1) (Minutes/Consumers)	Target specified by the commission
1	JCC	805432	-226860	0.282	
2	JPDC	685912	483954	0.706	
3	DAUSA	286933	324728	1.132	
4	ALWAR	639540	35560	0.056	
5	TONK	219366	108533	0.495	
6	BHARATPUR	277192	1325258	4.781	
7	SAWAI MADHOPUR	195329	71219	0.365	
8	DHOLPUR	107568	0	0.000	
9	KARAU LI	168368	5479	0.033	
10	KOTA	337521	71396	0.212	
11	BARAN	205131	14300	0.070	
12	BUNDI	170542	23199	0.136	
13	JHALAWAR	217586	11283	0.052	
	TOTAL	4316420	2701769	0.626	

When looked from Benchmarking view ?



Discussion





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