BHUTAN POWER CORPORATION LIMITED

(An ISO 9001:2015, ISO 14001:2015 & OHSAS 18001:2007 Certified Company)

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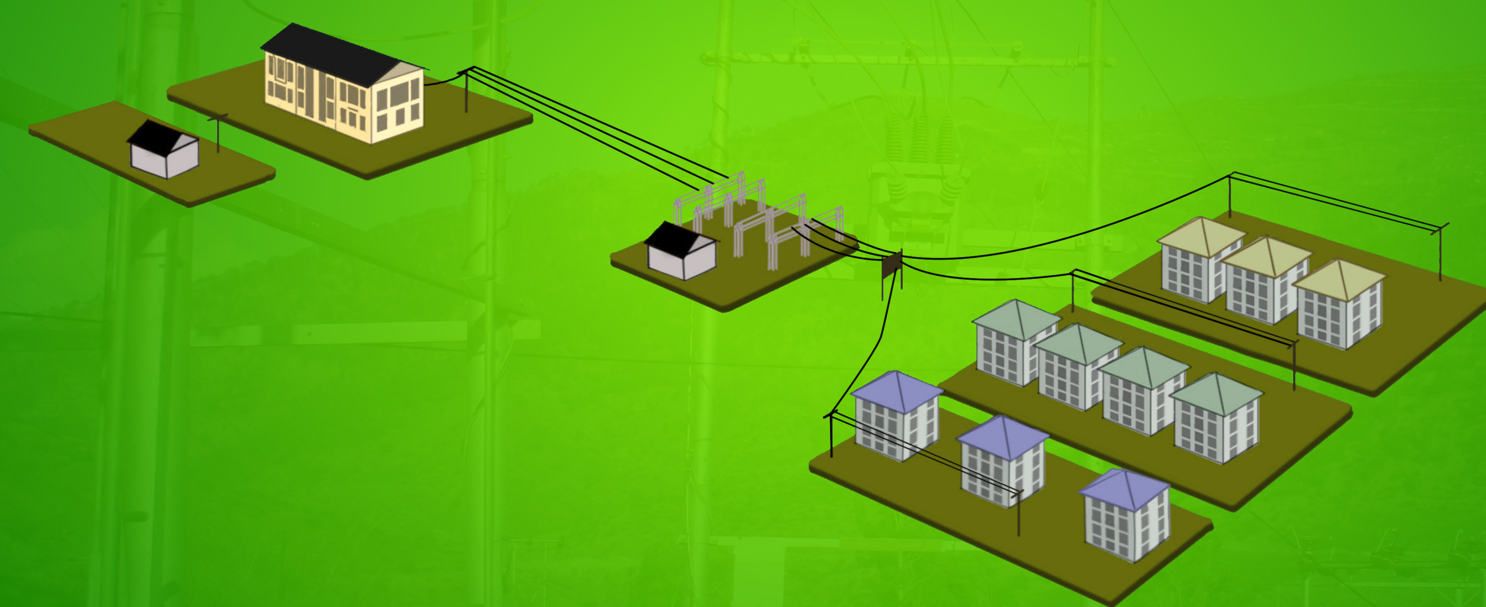
DISTRIBUTION SYSTEM MASTER PLAN (2020-2030)

TSIRANG DZONGKHAG



Distribution and Customer Services Department
Distribution Services
Bhutan Power Corporation Limited

2019

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FOREWORD

The Distribution System Master Plan (DSMP) identifies, prioritizes and opts for adequate and optimal distribution system expansion and augmentation programs to meet the expected electricity growth and demand development in the Country. This timely formulation of DSMP is in line with the stated corporate strategic objective of providing affordable, reliable and quality services to customers and will enable to traverse the changing technological, regulatory and social constraints for the time horizons considered.

The DSMP has been finalized after a series of consultative discussions with all the relevant stakeholders to obtain a shared outcome. In particular, adequate efforts have been taken to ensure that the DSMP aligns and integrates with the stated plans and programs of the Royal Government of Bhutan (RGoB) for the energy sector.

Based on the expected demand development for the time horizons considered, the DSMP outlines the road map for the implementation of optimized distribution network expansion programs and projects in stages with the expected investment required and financial commitments. The DSMP will be updated on a regular basis to incorporate changing business imperatives and contexts to ensure its relevance.

Appreciation goes to all the officials of the Distribution Services for formulating and coming out a comprehensive document that is timely which will serve as a blueprint for the Distribution Services to build a robust distribution system that will go a long way in contributing towards realization of BPC's objectives of providing a reliable electricity supply to its valued customers.

(Sonam Tobjey)
Chief Executive Officer

Preparation, Review & Approval of the Document

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Reviewed& Vetted by:	Management, Bhutan Power Corporation Limited, Thimphu. (18th September, 2020 – Meeting No. 584)	**CEO, BPC**
Approved by:	Board Tender & Technical Committee (BTTC), Bhutan Power Corporation Limited, Thimphu. (8th October, 2020 – 23rdBTTC Meeting)	**Chairman, BTCC**

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Abbreviations

BPC: Bhutan Power Corporation Limited

ESD: Electricity Services Division

DSMP: Distribution System Master Plan

GIS: Geographical Information System

SLD: Single Line Diagram

ETAP: Electrical Transient and Analysis Program

IS: Indian Standard on Transformers

IEC: International Electro-technical Commission

IP: Industrial Park

DT: Distribution Transformer

TSA: Time Series Analysis

LRM: Linear Regression Method

MV: Medium voltage (33kV, 11kV and 6.6kV)

DDCS: Distribution Design and Construction Standards

kVA: Kilo Volt Ampere

W: Watt

kWh: Kilo Watt Hour

RMU: Ring Main Unit

ARCB: Auto Recloser Circuit Breaker
ISD: Intelligent Switching Device

FPI: Fault Passage Indicator

Definitions

Asset Life: The period of time (or total amount of activity) for which the asset will be economically feasible for use in a business.

Balanced system: A system is said to be balanced when all phase conductors carry approximately the same current. For delta systems, this applies to two-phase conductors, and for three-phase star systems, this applies to three-phase conductors.

Contingency plan: Power that is needed when regularly used electric generating units are not in service, such as during short-term emergencies or longer unplanned outages, and during periods of scheduled maintenance when the units must be shut sown. Short-term backup power is generally called emergency power. Long-range backup power is often provided for in reserve sharing agreements.

Capacity: Also known as the power or capability of an electric generating plant. 1) Facilities and place to serve electric customers. 2) The total amount of electrical energy a power line is able to transport at any given time (Measured in kVA).

Clearance: The clear distance between two objects measured surface to surface. For safety reasons, proper clearance must be maintained between power lines and the ground, buildings, trees, etc.

Critical Value: The value of the random variable at the boundary between the acceptance region and the rejection region in the testing of a hypothesis.

Distribution line: That part of the electrical supply system that distributes electricity at medium voltage (33kV, 11kV & 6.6kV) from a transformer substation to transformers or other step-down devices service customer premises, which finally supply power at the voltage required for customer use.

Distribution loss: Energy losses in the process of supplying electricity to the consumers due to commercial and technical losses.

Distribution system: The portion of the transmission and facilities of an electric system that is dedicated to delivering electric energy to an end-user.

Energy: Delivered power measured in kilowatt-hours (kWh).

Generating station: A plant wherein electric energy is produced by conversion from some other forms of energy.

Grid: A system of high-voltage transmission and power-generating facilities that is interconnected with a number of other bulk power supply agencies on a regional basis. A grid enables power to be transmitted from areas having a surplus to areas experiencing a shortage. A grid also eliminates some duplication of costly facilities in a given region.

Investment: the action or process of investing money for certain activities with return and profit.

Lines (electrical supply) - Those conductors used to transmit or deliver electric energy and their necessary support or containing structures.

Linear Regression Method: In **statistical modeling**, regression analysis is a set of statistical processes for **estimating** the relationships between a **dependent variable** (often called the 'outcome variable') and one or more **independent variables.**

Load: 1) A device, or resistance of a device, to which power is delivered in a circuit. 2) The measure of electrical demand placed on an electric system at any given time.

Load forecasting: The methods used in determining a system's short and long-term growth in peak load and kilowatt-hour sales by consumers.

Load Growth: The increase in the demand of power required over time.

Marginal Value: Just barely adequate or within a lower Limit.

On line - Term generally used to indicate when a generating plant and transmission line is scheduled to be in operation. When an operational plant and line is not on line, it is said to be "down."

Outage - Interruption of service to an electric consumer.

Overload - Operation of equipment in excess of normal, full-load rating, or of a conductor in excess of rated ampacity that, when it persists for a sufficient length of time, would cause damage or dangerous overheating. A fault, such as a short circuit or ground fault, is not an overload.

Optimization: the action of making the best or most effective use of a situation or resource.

Pad-mounted equipment- General term describing enclosed equipment, the exterior of which enclosure is at ground potential, positioned on a surface-mounted pad. Example: underground transformers and junction boxes.

Peak demand - The maximum amounts of electricity used by a utility customer at any given time during the year. The peak is used to measure the amount of electric transmission, distribution, and generating capacity required to meet that maximum demand, even if it occurs infrequently and only for very short durations.

Peak load - The greatest amount of electricity used during a time period by the consumers in a utility's system.

Power - The time rate of electric energy in a device or circuit, measured in watts.

Power factor - A measurement of efficiency in the use of electricity. For example: a 100% power factor would be like a horse pulling a wagon on rails directly forward with no resistance. If the horse turns and pulls at a right angle to the rails, he may pull just as hard, but his efforts will not move the car. This would be a zero percent power factor. Now, if he pulls at a 45-degree angle to the rails, he will pull the car, but not with as high efficiency as if he were pulling straight down the rails. In the use of electricity, not every kilowatt generated translates into equivalent horsepower efficiency.

Power grid - A network of generation, transmission and distribution system that are interconnected

Power quality - The extent to which a utility system is able to maintain its delivery of electric energy within the tolerable limits of voltage and without outages or other problems with affect a customer's equipment use.

Power supply - Source of current and voltage.

Reliability - A measure of a utility's ability to deliver uninterrupted electric service to its customers.

Substation - An electrical facility containing switches, circuit breakers, buses, and transformers for switching power circuits and transforming power from one voltage to another, or from one system to another.

Time Series Analysis: The statistical techniques used when several years' data are available to forecast the load growth.

1. Executive Summary

Bhutan Power Corporation Limited is mandated to provide affordable, adequate, reliable and quality electricity services to the customers through transmission and distribution network established across the country. Towards realizing the mission, vision and destination statement of BPC as outlined in the Corporate Strategic Plan (2019-2030), there is a need to carry out comprehensive studies of the distribution system to address the system deficiencies as the ground realities are different triggered by technological advancement and economic growth.

The existing distribution networks were modeled and accordingly, the technical evaluation is carried out adopting the generally accepted load forecasting framework i.e. Time Series Analysis in conjunction to Linear Regression Method, the power requirement for next ten (10) years are forecasted. Subsequently, the network capability and the system gaps are identified with proposed distribution system planning. The investments are proposed (based on the priority matrix) to address the system inadequacies with the intent to improve the Customer Services Excellence, Operational and Resource Optimization Excellence, Innovation and Technology Excellence and Business Growth Excellence.

The single to three phase distribution network conversion across the country is reproduced in this report based on the studies carried out by BPC "Technical and Financial Proposal on Converting Single Phase to Three Phase Power Supply in Rural Areas".

The details on the distribution grid modernization are outlined in Smart Grid Road Map 2019 including the investment (2020-2027). The identification of the system deficiencies and qualitative remedial measures which would require system automation and remote control as per the existing and projected load are only outlined in this report. Similarly, the system study beyond the Distribution Transformers had to be captured during the annual rolling investment and budget approval.

The ETAP tool is used to carry out the technical evaluation and validate the system performances. Finally, necessary contingency plans, up gradation and reinforcement plans are proposed as annual investment plans based on the outcome of the simulation result.

2. Introduction

The system study is intended to improve the power distribution system in Bhutan by formulating a comprehensive, national level and district wise DSMP (2020-2030) till 2030 that provides measures for renewing and reinforcing power distribution facilities. BPC's distribution system has grown in size and complexities over the years. While many network additions and alterations carried out so far were as per the recommendations of the Druk Care Consultancy Study Report (2006), the ground realities are evermore different now than anticipated during the study. There is a need to explore opportunities for optimizing the available resources and develop a master plan for future investments.

Some of the prominent driving factors required for the development of the master plan includes but not limited to reliable power supply to the customers, reduction of distribution losses, network capability with the anticipated load growth, optimization of the resources and to develop annual investment plan.

BPC has never carried out comprehensive system studies to improve the distribution system and optimize the available resources. The recurring investment plans (annual) is based on the on-site and field proposals without any technical evaluation being carried out which could have resulted in preventable and excessive investments. Therefore, proper planning is necessary to improve the system for optimal usage of resources.

It is also intended that this master plan is to provide general guidance in preparing long-range system planning. The analysis indicates where up-grades are most likely to be economical and provides insight into the development of a practical transition from the existing system to the proposed long-range system. Based on this analysis, recommendations are made for improving system performance and increasing system capacity for expansion. Periodic reviews of the master plan will be required to examine the applicability of the preferred plan considering actual system developments.

3. Objectives of the Master Plan

The objective(s) of the DSMP (are):

3.1 To carry out the system study of the existing distribution network, forecast and come out with the comprehensive ten (10) years strategic distribution plan;

3.2 To provide affordable and adequate electricity, reduce losses, improve power quality, reliability, optimize the resources and gear towards excellent customer services; and

3.3 To come out with annual investment plans.

4. Scope of the Distribution System Master Plan

Formulation of detailed DSMP (2020-2030) of the Dzongkhag for renewal, reinforcement, and extension of the power distribution system up to DT.

5. Methodology and Approach

In order to better understand the existing distribution system and postulate the credible investment plans; standard framework and procedures had been adopted. However, in the absence of any standardized procedures in BPC for planning of distribution system, the following customized procedures detailed in **Section 5.1** through **Section 5.5**and as shown in **Figure 1** are considered to suit BPC's requirement for developing the DSMP.

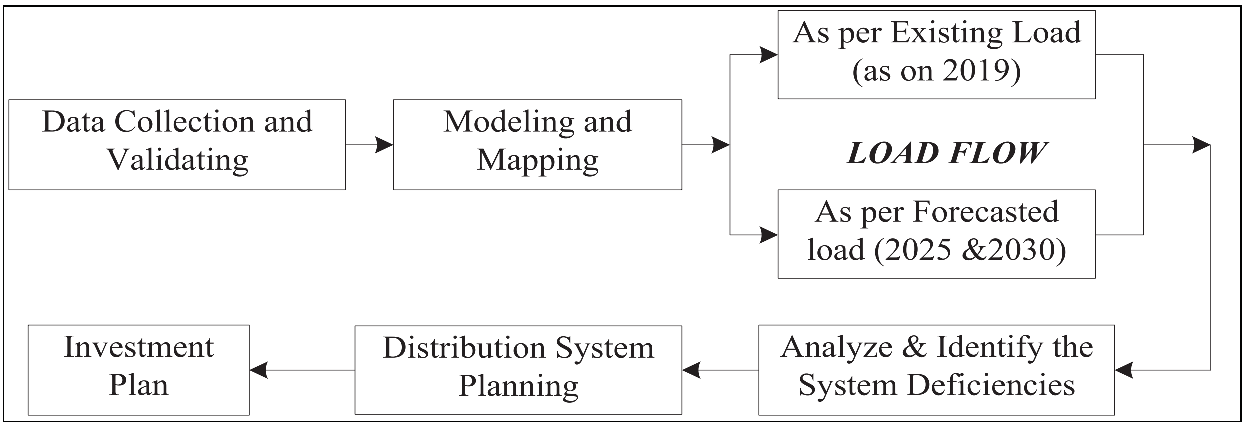


Figure 1: Block diagram for distribution system planning for thematic studies

5.1 Data Collection and Validation

In order to carry out the detailed studies with greater accuracy, complete and reliable data for the existing distribution infrastructure is required. Therefore, intensive field investigation was carried out during the months of April and May (2020) to validate the information that was collected. The information required for the studies does not confine to the BPC's internal distribution network but also the developmental activities of the cross-governmental sectors. The power arrangement requirements from these developmental activities were also used to forecast the power demand. The data validation on the distribution system includes the review of all the power sources, medium voltage lines and transformers with that of GIS data of Environment and GIS Division and SLD submitted by respective ESDs which is attached as **Annexure-1.**

5.2 Modeling and Mapping

The feeder wise distribution lines and transformers were modeled and mapped in ETAP tool and the base case was developed for the existing distribution network. The technical parameters for the lines and transformers were considered based on IS 2026, IEC 60076 (Detailed parameters attached as**Annexure-2)** to develop the base model. Modeling and Mapping detail is attached as **Annexure-1.**

5.3 Analysis and Identification of System Deficiencies

The existing distribution system model was analyzed in the ETAP involving balanced load flow to figure out the network capabilities against the set distribution standards. The load growth was projected using the commonly adopted methodology that is LRM in conjunction to TSA which is based on the historical data and accordingly the behavior of the distribution system was analyzed, and the system deficiencies were identified. The details on load forecast methodology is attached as **Annexure-3.**

5.4 Distribution System Planning

Necessary deterministic and probable distribution system planning methods are proposed to address the system gaps focusing on reduction of losses, improving the reliability and power quality. Accordingly, any contingency plans, up gradation and reinforcement plans are proposed along with the investment plans incorporating best fit technology.

5.5 Investment Plan

The approved investment plans (from 2020-2024) have been validated based on the outcome of the system studies and accordingly, the yearly investment plans are outlined as per the priority matrix as detailed in **Section 9.**

6. Existing Electricity Distribution Network

6.1 Overview of Power supply sources

The power supply to 12 Gewogs (Barshong, Dunglagang, Goseling, Kilkhorthang, Mendrelgang, Patshaling, Phuentenchu, Rangthangling, Semjong, Sergithang, Tsholingkhar and Tsirangtoe) of Tsirang Dzongkhag is fed from 220/66/33kV (220/66kV- 2x10 MVA and 66/33kV- 2x5 MVA) Dharjey substation. The power supply to Dharjey substation is from 126 MW Dagachhu and 64 MW Basochu hydropower plant, transmitted through 220 kV transmission line. The substation also has access to the eastern transmission grid via 220 kV Jigmeling substation thus strengthening the energy security scenario. Additionally, the Dzongkhag has 2x100 kW Micro Hydel at Changchay and its generation is synchronized and injected into the grid. Further, part of Tsirang (Sergithang Gewog) is catered by 11 kV Jala Ula feeder (2x63 MW) emanating from 2x5 MVA, 33/11 kV Basochu substation. The overall power distribution network of the Dzongkhag is illustrated in the schematic diagram shown in **Figure 2**.

The Dharjey substation has six (6) number of 33kV outgoing feeders (i.e. 33kV Damphu, 33kV Rangthangling & Mendrelgang, 33kV Dunglagang & Semjong, 33kV Tsholingkhar, 33kV Dagapela I and 33kV Dagapela II). Out of 6 feeders, the 33 kV Dagapela Feeder-I is exclusively for Dgana Dzongkhag.

The power supply to Relangthang, Waklaytar & Kereyni villages under Sergithang Gewog is fed from 11kV Jala Ula feeder of Wangdue Dzongkhag which is being tapped from Taksha.

The power generated from 200kW Changchay Micro-Hydel is supplied to Changchay town under Goseling Gewog and is further interconnected to 33kV Damphu feeder via 6.6/33kV, 250kVA Inter-Connecting Transformer (ICT).

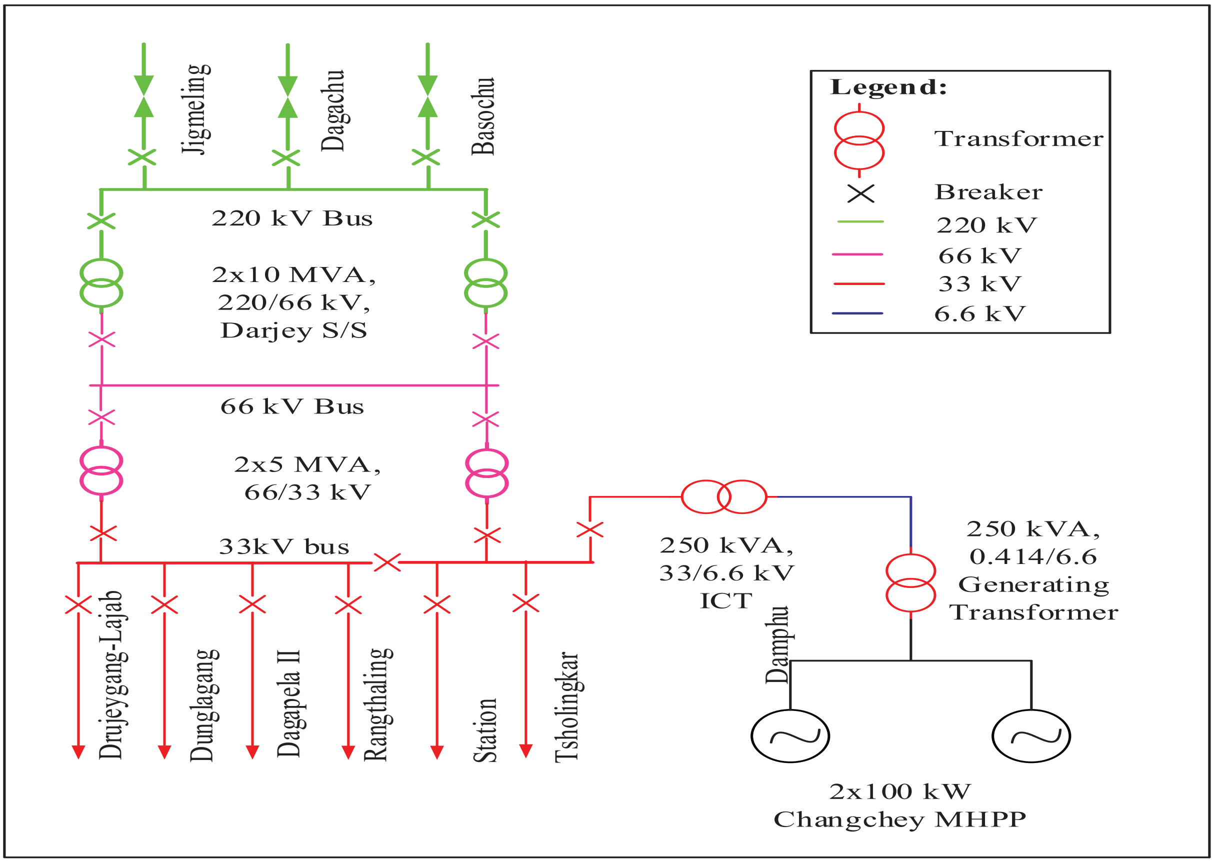


Figure 2: Electricity distribution schematic diagram

6.2 Electricity Distribution Lines

The quantity of MV and LV lines infrastructure operated and maintained by the Division is summarized in **Table 1**.

Table1: MV and LV line infrastructure details

Sl. No.	33 kV (km)		11 kV (km)		6.6kV (km)		Total MV line (km)	LV lines (km)		Total LV length (km)
	OH	UG	OH	UG	OH	UG		OH	UG	
1	185.29	0.14	5.58	-	3.71		**194.72**	519.72	-	**519.72**

The total MV line length is 194.72km and the total LV line length is 519.72km. The ratio of LV to MV line length is 2.67:1 which reflects a high proportion of power distribution through LV distribution network. While the ratio of LV to MV line length would vary according to the site conditions, as a general thumb rule, network ratio of 1.2:1 (LV to MV) should be maintained for optimum initial capex and the running and maintenance costs. The MV distribution network is through 33 kV, 11 kV, and 6.6 kV overhead lines.

6.3 Distribution Transformers

The number of distribution transformers at various kVA rating levels operated and maintained by the Division is tabulated in **Table 2**.

Table 2: Total numbers of transformers, installed capacity& customers

Source	Capacity (MVA)	Feeder	Feeder Length (km)	DTs (Nos.)	Connected (kVA)	Customers (Nos.)
220/66/33kV Dharjey SS	2x5	33kV Damphu	8.696	19	4466	1272
		33kV Rangthangling & Mendrelgang	52.743	64	2648	1597
		33kV Dagapela II	15.764	15	1509	455
		33kV Dunglagang & Semjong	31.240	44	2196	1273
		33kV Tsholingkhar	76.980	88	3802	2090
		Station Transformer (2x250kVA)	0.000	2	500	19
66/11kV, Basochu SS	5	11kV Taksha Feeder	5.579	3	113	53
200kW Changchay Micro-Hydel	0.25	6.6kV Changchay Feeder	3.714	1	50	32
Total			**194.716**	**236**	**15,284.00**	**6,791.00**

As of June 2020, there were 236 distribution transformers with a total capacity of 15, 284kVA. As can be inferred from the **Table 2,** the installed capacity of the transformer per customer is 2.25kVA.

7. Analysis of Distribution System

Based on the model developed in ETAP for the existing feeder wise distribution network, analysis of the system was carried out by considering the forecasted load growth from 2020-2030. The quality of power, reliability and energy loss of the existing network were assessed and accordingly the augmentation and reinforcement works are proposed which shall be the integral part of the investment plan. The assessment of MV lines, DTs, power sources, reliability of the power supply and energy & power consumption pattern are presented from **Section 7.1** through **Section 7.4**.

7.1 Assessment of Power Sources

The assessments of the capabilities of the power sources were exclusively done based on the peak load (2019-2020) and forecasted load. The source capability assessment had been carried out bifurcating HV and MV substations as detailed below.

7.1.1 HV Substation (220/66/33kV)

Dharjey substation is the primary power source for the Dzongkhag. The substation has a transformation capacity of 2x10MVA at 220/66kV voltage level and 2x5MVA at 66/33kV voltage level. To assess the capacity of the substation, the peak power consumed has been compiled based on the historical data. The daily and monthly peak demand has been consolidated to annual peak demand as shown in **Table 3**.

Table 3: Peak load of Dharjey substation

Sl. No.	Name of Source	Voltage Level (kV)	Installed Capacity		Peak Load (MW)	Forecasted Load (MW)	
			MVA	MW*	2019	2025	2030
1	Dharjey Substation	220/66	2x10	17	5.76	6.294	7.56
		66/33	2x5	8.5	5.76	6.294	7.56
2	Basochu SS	66/11	2x5	8.5	1.64	2.58	3.37

** Pf of 0.85 is considered for study purpose*

a) 220/66/33kV Dharjey Substation

As seen from **Table 3**, the recorded peak load at the Dharjey substation in the year 2019 is 5.76MW at 33 kV voltage level. The time series forecast projected a load of 7.56 MW in the year 2030 against its installed capacity of 8.5 MW (@ 0.85 pf). Therefore, the Dharjey substation would be adequate to cater the present and forecasted power demand.

b) 66/11kV Basochu Substation

Similarly, the Basochu substation recorded a peak load of 1.64 MW as of 2019 which is around 19.3 % of the total installed capacity. There is only one 11kV feeder under the Dzongkhag and is fed from 66/11kV Basochu substation. Even considering the combined loads of Tsirang and Wangdue Dzongkhags, the substation would be adequate to meet the power requirement of the Dzonkhags.

7.1.2 MV Substation (33/11 kV)

There are no MV substations under the administration of the Dzongkhag.

7.2 Assessment of MV Feeders

Feeder wise planning is necessary to ensure that the power delivery capacity, power quality and reliability requirements of the customers are met. In distribution system, capacity assessment of existing MV feeders is important to ensure that feeders are adequate to transmit the peak demand of the load connected to the feeders. Particularly, the capacity assessment of the feeders enables identification of feeders that require reinforcement and reconfiguration works.

The behavior of the MV feeders are assessed based on the existing and forecasted load, feeder wise energy loss, reliability, and single to three-phase line conversions which are outlined vividly in **Section 7.2.1** through **Section 7.2.4**. Further, recognizing that the asset life of the distribution system is thirty years (30), our system should be able to handle the load growth (peak demand) for next 30 years. Therefore, it is equally important to consider the asset life of the system in addition to the assessment of the system in different time horizons.

As per the feeder details shown in **Table 2,** the 33kV Tsholingkhar Feeder has the longest circuit line length (76.980km) with maximum number of DTs (88) and customers (2090) connected to the feeder when compared to other feeders.

7.2.1 Assessment of MV Feeder Capacity with Load

The feeder wise peak power consumption was compiled based on the historical data. The array of daily and monthly peak demand was sorted to obtain the annual peak demand. The feeder-wise historical peak demand recorded at the source is presented in **Table 4** and the corresponding feeder-wise annual load curve is presented in **Figure 3.**

Table 4: Historical feeder wise peak power demand

Power Source	Feeder Name	Peak Load (MW)					
		2014	2015	2016	2017	2018	2019
220/66/33kV, 2x5MVA, Dharjey SS & 0.415/6.6kV, 250kVA, Changchay Micro-Hydel	33kV Damphu Feeder & 6.6kV Changchay Feeder	0.91	0.93	1.05	1.06	1.06	1.09
	33kV Tsholingkhar Feeder	0.72	0.73	0.79	0.80	0.93	1.11
	33kV Rangthangling Feeder	0.58	0.62	0.60	0.69	0.73	0.73
	33kV Dagapela Feeder-II	0.22	0.24	0.31	0.32	0.29	0.40
	33kV Dunglagang Feeder	0.51	0.41	0.56	0.66	0.48	0.53
	2x250kVA Station Transformer	0.03	0.02	0.03	0.03	0.03	0.04
66/33kV,2x5MVA, Basochu Substation	11kV Taksha Feeder (tapped from 11kV Jala Ula Feeder of ESD Wangdue)	A detailed study has been done in the DSMP of ESD Wangdue. Hence, the feeder is disregarded.					

As can be inferred from **Figure 3,** there is sudden rise in the peak load of a 33 kV Dunglagang feeder from the year 2015-17 which is attributed because of the installation of a temporary bitumen mixing power plant for black topping the Gewog Centre (GC) road which was scheduled to be completed between 2016-217. However, the peak load data has been normalized to forecast power requirement for the Dzongkhag.

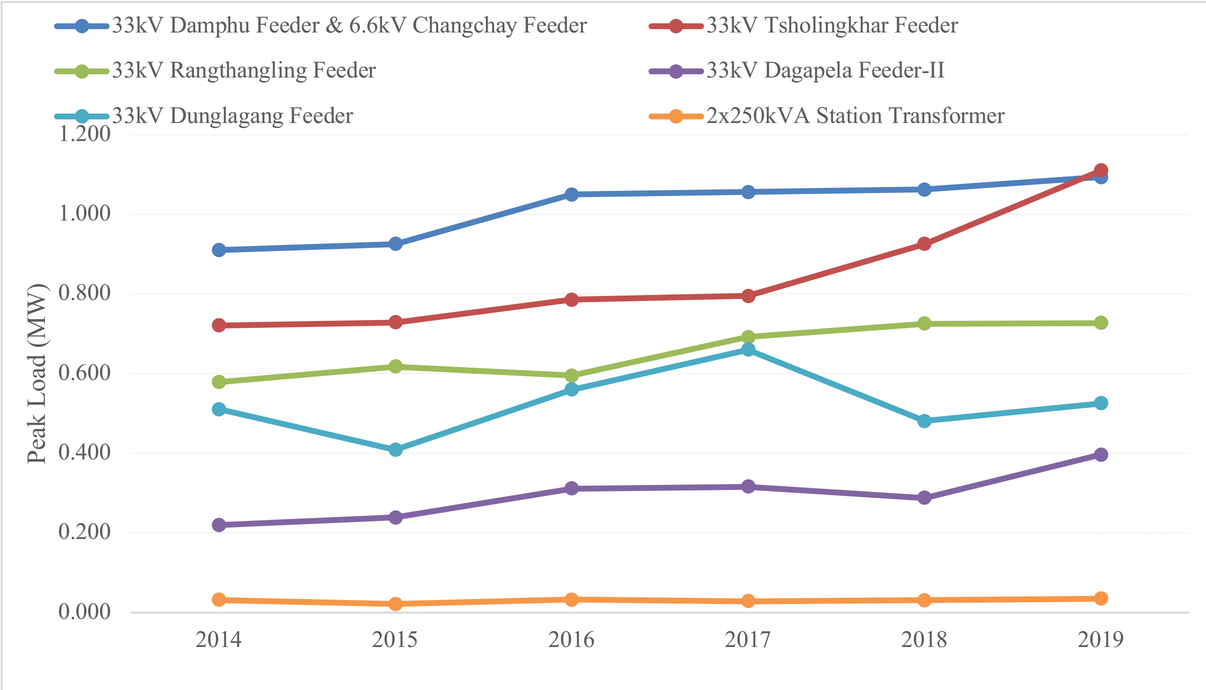


Figure 3: Peak load (MW) of Dharjey substation outgoing feeders

The assessment of the feeder is carried out based on the following aspects:

a) System study: Existing load

b) System study based on forecasted load: 2025 & 2030 scenario

c) System study based on when the Changchey Micro Hydel is non-operational

a) System Study (Existing Load)

Based on the peak load (2019-2020) and the thermal capacity of the line, the load flow and accordingly the assessment of the feeder was carried out. The simulation result shows no abnormality and the ampacity capability of the feeders will be within the range with the existing as well as with the forecasted load as the maximum forecasted feeder is less than 2MW. The thermal capacity of the different conductor sizes is as shown in **Table 5.**

Table 5: Thermal loading of ACSR conductor at different voltage levels

Sl. No.	ACSR Conductor Type	Ampacity of Conductor	MVA rating corresponding to the Ampacity
33 kV Voltage Level			
1	RABBIT	193	11.031
2	DOG	300	17.146
3	WOLF	398	22.748
11 kV Voltage Level			
1	RABBIT	193	3.677
2	DOG	300	5.715
3	WOLF	398	7.582

Ampacity (thermal loading) of the lines have been calculated based on IS 398 (Part-II): 1996 for maximum conductor temperature 85°C for ACSR conductors considering an ambient temperature of 40°C.

b) System Study with Forecasted Load (2025 and 2030)

The peak power demand from 2014-2019 has been considered to forecast the peak power demand for the next 10 years (2020-2030) as shown in **Table 6** and **Figure 4** adopting the commonly practiced methodology of LRM and TSA with the help of ETAP. The detailed simulation result is attached as **Annexure-4.**

Table 6: Feeder wise Load forecast

Feeder Name	Forecasted Load (MW)										
	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Dharjey Substation											
33kV Damphu & 6.6kV Changchay Feeders (Changchay Hydel)	1.24	1.27	1.31	1.35	1.39	1.43	1.46	1.50	1.54	1.58	1.62

Feeder Name	Forecasted Load (MW)										
	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
33kV Tsholingkhar Feeder	1.07	1.15	1.22	1.29	1.36	1.44	1.51	1.58	1.66	1.73	1.80
33kV Rangthangling Feeder	0.83	0.86	0.90	0.93	0.96	1.00	1.03	1.06	1.10	1.13	1.16
33kV Dagapela Feeder-II	0.40	0.43	0.46	0.49	0.52	0.55	0.58	0.61	0.64	0.67	0.70
33kV Dunglagang Feeder	0.62	0.63	0.64	0.65	0.67	0.68	0.69	0.70	0.71	0.72	0.73
2x250kVA Station Transformer	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07

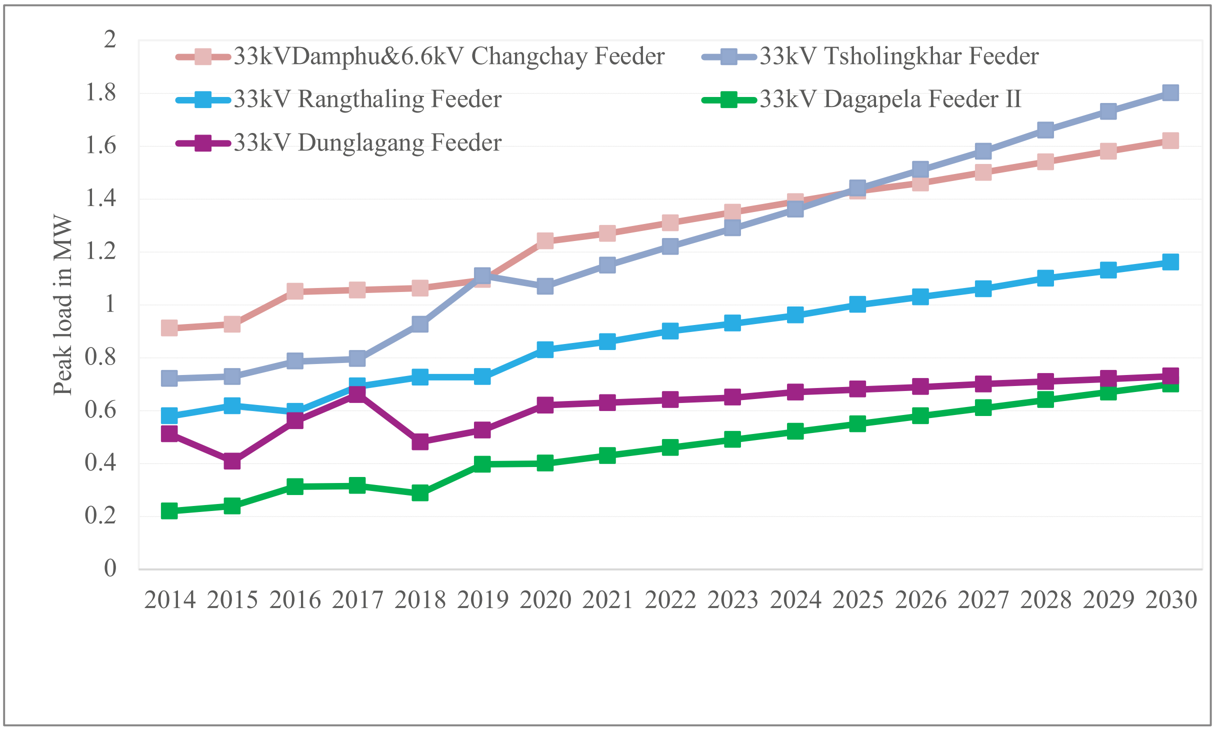


Figure 4: Plot of feeder wise peak power demand forecast

The simulation results for the feeders along with the voltage profile are tabulated in **Table 7** which is based on 2025 & 2030 forecasted load. From the simulation result, no abnormality was observed for the both the scenarios and therefore, the distribution lines would be adequate to cater the load though there is marginal voltage drop and will be within the accepted range.

Table 7: Voltage profile of the feeders

Feeder Name	2025 Load (MW) and Voltage (%)			2030 Load (MW) and Voltage		
	Load	Bus	End	Load	Bus	End
66/33kV Dharjey SS Bus	**4.79**	**100**	**98.08**	**5.89**	**100**	**97.58**
33kV Tsholingkhar	1.37	98.08	97.37	**1.69**	97.58	96.69
33kV Rangthaling	0.95	98.08	97.73	**1.09**	97.58	97.17
33kV Dagapela Feeder-II	0.53	98.08	97.97	**0.66**	97.58	97.45
33kV Dunglagang	0.65	98.08	97.83	**0.97**	97.58	97.21
33kV Damphu	1.210*	98.08	97.87	1.357 **	97.58	97.36
6.6kV Changchay	0.007	99.03	98.74	0.008	98.80	98.44
Changchey Plant(200kW)	0.061	100	99.03	0.074	100	98.80

**1.21MW-1.157MW from Dharjey & 0.053MW from Changchey*

***1.357MW- 1.292MW from Dharjey& 0.065MW from Changchey*

c) System study (2025 and 2030 scenario) without Changchey Micro Hydel

The system study was also carried out to find out the behavior of feeders when the Changchey Micro Hydel is non-operational. The power flow analysis shows that there is marginal voltage drop without the Changchey Micro Hydel. However, the voltage profile would be within the permissible range of ((±10%).

Table 8: Voltage profile of the feeders when Changchey Hydel is non-operational

Feeder Name	2025 Load (MW) and Voltage (%)			2030 Load (MW) and Voltage		
	Load	Bus	End	Load	Bus	End
66/33kV Dharjey SS Bus	**4.847**	**100**	**98.05**	**5.959**	**100**	**97.55**
33kV Tsholingkhar	1.365	98.05	97.35	1.688	97.55	96.66
33kV Rangthaling	0.946	98.05	97.70	1.091	97.55	97.14
33kV Dagapela Feeder-II	0.529	98.05	97.95	0.664	97.55	97.42
33kV Dunglagang	0.651	98.05	97.81	0.966	97.55	97.18
33kV Damphu & 6.6kV Changchay	1.216	98.05	97.71	1.364	97.55	97.17

7.2.2 Energy Loss Assessment of MV Feeders

Energy losses in the distribution network are inherent as the power transmission and distribution system are associated with the transformers and lines. However, it is crucial to maintain the energy loss at an optimal level by engaging in timely improvement of the distribution infrastructures and not reacting to the localized system deficiencies. The objective of the energy loss assessment is to single out the feeder (s) with maximum loss (es) and put in additional corrective measures to minimize to the acceptable range. To carry out the assessment, the energy sales, purchase and loss is as tabulated in **Table 9** and as shown in **Figure 5.**

Table 9: Energy sales, purchase and loss trend

Sl. No.	Particulars	2015	2016	2017	2018	2019	Average
1	**Energy Requirement (MU)**						
i)	Purchase from GenCos as per TD bill	7.25	7.82	8.02	7.89	8.24	
ii)	Mini/Micro Hydel Generation	0.05	0.25	0.21	0.38	0.42	
iii)	Diesel Generation	0.00	0.00	0.00	0.00	0.00	
iv)	Import from Wangdue	0.10	0.11	0.11	0.12	0.50	
v)	Export	0.00	0.00	0.00	0.00	0.00	
	Total	**7.40**	**8.19**	**8.35**	**8.39**	**9.15**	
	% growth over previous year	-	10.72%	1.95%	0.50%	9.11%	5.57%
2	**Energy Sales (MU)**						
i)	**LV Total**	**6.72**	**7.29**	**7.75**	**8.10**	**8.60**	
ii)	Medium Voltage	0.00	0.00	0.00	0.00	0.00	
iii)	High Voltage	0.00	0.00	0.00	0.00	0.00	
	Total Energy Sales	**6.72**	**7.29**	**7.75**	**8.10**	**8.60**	
	% growth over previous year	-	8.51%	6.37%	4.56%	6.15%	6.40%
	Energy Loss (1-2)	**0.68**	**0.90**	**0.60**	**0.28**	**0.55**	
	Total Loss (%)	**9.20%**	**11.00%**	**7.15%**	**3.39%**	**6.01%**	**7.35%**

Source: Adapted from Power Data Book 2019, BPC

Note: LV Customer: Domestic (Rural & Urban), Rural Cooperatives, Rural Micro-Trades, Rural Community Lhakhangs, Religious Institutions, Commercial, Industrial, Agriculture, Institutions, Street Lighting, Powerhouse auxiliaries, and Temporary connections.

As evident, the energy requirement has increased steadily over the year @ 5.57 % and so is the energy consumed @ 6.40 % on the average from 2015-2019. The average energy loss of the distribution network in the Dzongkhag is 7.35 % (0.602 MU on average). The loss profile seems to be fluctuating and may not be able to explicitly ascertain the reason for such fluctuations. The drastic reduction of energy loss may be attributed to replacement of the entire analog to digital meters of the town areas and other improvement works carried out. Further, it could be also due to data anomalous. The feeder wise energy loss for 2019 is as tabulated in **Table 10.**

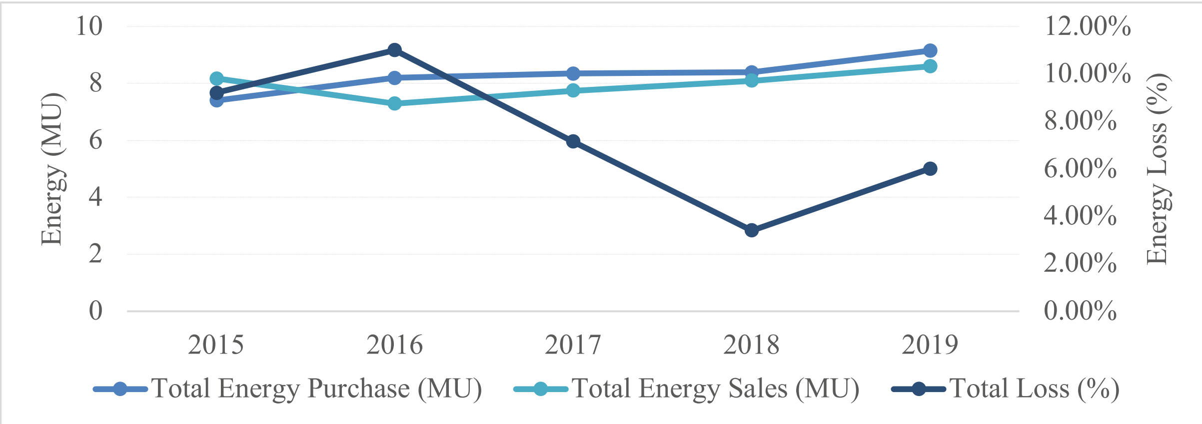


Figure 5: Energy requirement trend

Table 10: Feeder Wise Energy Loss

Sl. No.	Feeder Name	2019		
		Energy Purchase (MU)	Energy Sales (MU)	Energy Loss (%)
1	33kV Damphu Feeder & 6.6kV Changchay Feeder (Changchay Micro-Hydel)	2.80	3.05	-8.74%
2	33kV Rangthangling Feeder	1.90	1.69	10.95%
3	33kV Dagapela Feeder II	0.52	0.44	14.71%
4	33kV Dunglagang Feeder	1.26	1.09	13.61%
5	33kV Tsholingkhar Feeder	2.44	2.11	13.76%
6	11kV Taksha Feeder	0.11	0.10	4.41%
7	2x250kVA Station Transformer	0.13	0.13	0.00%
	Total	**9.15**	**8.60**	**6.01%**

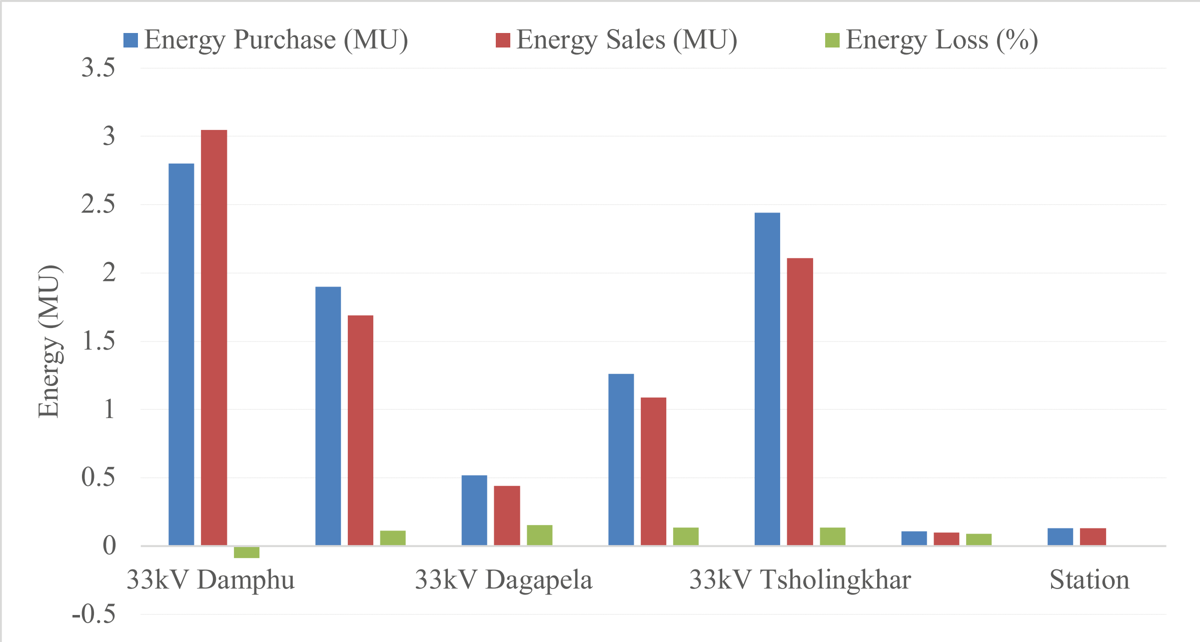


Figure 6: Feeder wise energy loss

It is evident from **Figure 6,** the 33kV Dagapela feeder has contributed the highest energy loss followed by 33kV Tsholingkhar and 33kV Dunglagang feeders. The high losses can be attribute to longer circuit line length. On the other hand, the 33 kV Damphu feeder has negative energy loss which could have resulted from anomalous energy accounting. Therefore, it is recommended to carry out the detailed study on the negative energy losses recorded for the feeder.

As the system study is till DT, the technical loss obtained through the ETAP software tool is for MV lines including the DT and doesn't account the loss due to LV network and transmission system. The simulation result shows only 1.27 % loss out of 7.35% as technical loss due to MV lines, DT and rest (6.08%) is due to LV and commercial loss. The feeder wise MV and DT technical loss is as shown in **Table 11.**

Table 11: Technical loss from ETAP simulation

Sl. No.	Feeder Name	Power Demand (MW)	Apparent Loss (MW)	Loss (%)
1	33kV Damphu Feeder & 6.6kV Changchay Feeder (Changchay Micro-	1.054	0.018	1.71%

Sl. No.	Feeder Name	Power Demand (MW)	Apparent Loss (MW)	Loss (%)
	Hydel)			
2	33kV Rangthangling Feeder	0.57	0.006	1.05%
3	33kV Dagapela Feeder II	0.436	0.005	1.15%
4	33kV Dunglagang Feeder	0.472	0.005	1.06%
5	33kV Tsholingkhar Feeder	0.751	0.008	1.07%
6	2x250kVA Station Transformer	0.015	0	0.00%
	Total	**3.298**	**0.042**	**1.27%**

7.2.3 Reliability Assessment of the MV Feeders

Today's emphasis in the power sector has shifted to providing reliable power supply as electricity itself is positioned as one of the essential needs. However, improving reliability comes with its inherent costs as it involves embracing additional preventive and corrective measures leading to substantial up-front capital investment. Any major reliability improvement strategies need to be adopted only after carefully understanding the costs involved and the benefits that will be accrued from implementing such strategies. Failure rate, repair time and restoration time are some important parameters defining reliability. Reducing the values of one or more of the above parameters can improve reliability considerably.

In addition to ensuring that the MV feeders have the required capacity, it is also very important to ensure that the MV feeders are reliable. In order to assess the reliability of the distribution system, the historical data was referred. The yearly (2017-2019) feeder reliability indices summary is compiled as tabulated in **Table 12** and details used to derive such summary is attached as **Annexure-5**. The interruptions with less than five minutes were omitted from the computation. The actual records (both within and beyond ESDs control) were considered for actual representation to compute the reliability indices. The average reliability indices viz a viz SAIFI &SAIDI compiled from 2017-2019 are 8.17 & 16.69 respectively which indicates that the power supply to the Dzongkhag is commendable.

Table 12: Feeder wise reliability indices (2017-2019)

Name of Feeder	2017		2018		2019		Average	
	SAIFI	SAIDI	SAIFI	SAIDI	SAIFI	SAIDI	SAIFI	SAIDI
33kV Damphu Feeder & 6.6kV Changchay Feeder	0.68	0.68	0.38	0.23	0.19	0.36	**0.42**	**0.42**
33kV Rangthangling Feeder	2.97	6.09	3.41	8.29	3.33	5.23	**3.24**	**6.54**
33kV Dagapela Feeder II	0.58	0.96	0.06	0.21	0.27	1.46	**0.30**	**0.88**
33kV Dunglagang Feeder	2.11	2.07	0.75	1.93	0.37	1.19	**1.08**	**1.73**
33kV Tsholingkhar Feeder	3.47	8.53	1.85	4.47	4.08	8.36	**3.13**	**7.12**
	9.81	**18.33**	**6.45**	**15.13**	**8.24**	**16.60**	**8.17**	**16.69**

Source: Adapted from monthly system performance report of DCSD, BPC

Notes :(a) SAIFI (System Average Interruption Frequency Index) = (Total no. of customer interruption per year)/ (Total no. of customers served)

(b) SAIDI (System Average Interruption Duration Index) = Σ (Total interruption duration per year)/ (Total no. number of customers served)

(c) The interruption due to scheduled outages, momentary outages less than five minutes and outages due to failure of the grid are not taken into account.

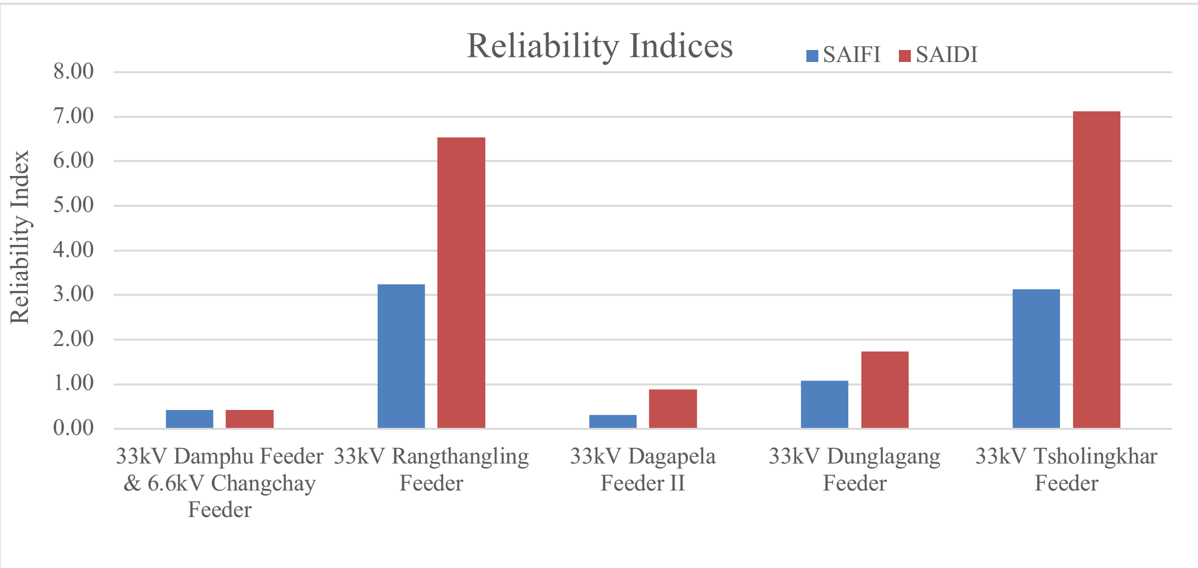


Figure 7: Graphical representation of reliability indices

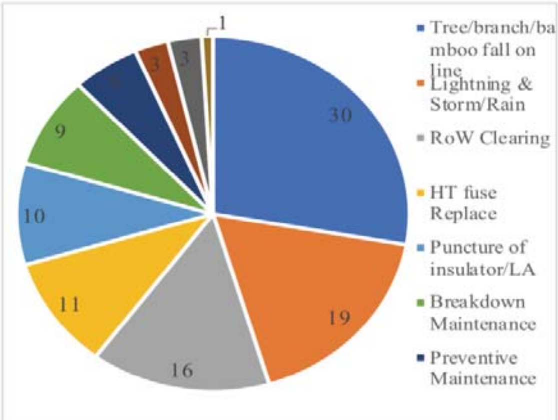
As can be inferred from **Table 12**, the average interruption per customer is 8.17 times in a year (SAIFI) and the duration of the average outages per customer is 16.69 hours (SAIDI) for last three years (2017-2019). The table also indicates that the 33 kV Rangthangling and Tsholingkhar feeders have the highest value of both the indices and thus more vulnerable to the interruptions compared to the other feeders as the feeders pass through dense forests and tough terrains. Further, there are multiple spur lines tapped form these feeders and therefore had sustained more faults especially monsoon season. Therefore, it is recommended that the Division need to strategize in improving the reliability of these two feeders.

To get a better understanding of the reliability index, the detailed root cause outages of the individual feeder had been computed in **Table 13.**

Table 13: The root causes (2017-2019)

Cause of Outages	Frequency (Nos.)	Interruption (%)
Tree/branch/bamboo fall on line	30	28%
Lightning & Storm/Rain	19	18%
RoW Clearing	16	15%
HT fuse Replace	11	10%
Puncture of insulator/LA	10	9%
Breakdown Maintenance	9	8%
Preventive Maintenance	6	6%
Momentary/Transient fault	3	3%
Others	3	3%
Line Jumpering/Snap	1	1%
Total	**108**	**100%**

Others: Conductor snapping, birds/animals fall on line



It is noted that while exploring the tripping data of the previous years, most of the causes are due to tree/branch/bamboo shoot touching the line followed by Lightening & storm and HT fuse replacement. Since Tsirang falls in the tropical region with heavy rainfall; the growth of trees, bamboo, and bushes is fast thus requiring to clear the RoW frequently. Further, trees and branches are blown in by the heavy wind on the lines and poles leading to the snapping of conductor and damaging the structures. This is directly related to the RoW clearing along the line. Therefore, as mandated in the O&M manual, it is recommended to increase the frequency of RoW clearing, non-working ARCBs to be made functional, installation of FPIs in order to easily locate the fault and thus faster restoration. Additional line lightning arrestors (LA) could also be installed at critical locations where maximum faults occur due to lightning and storm.

The reliability of the lines and substations can also be enhanced through training of linemen to equip them with the knowledge, skills, and the confidence to operate and maintain the distribution infrastructure. For instance, the linemen of the ESDs need to develop the confidence to change DO fuses online using hot sticks instead of the usual practice of taking shut down of the whole feeder. However, having the right tools, equipment, and especially spares (of appropriate specifications) is a prerequisite.

Although it is not possible to quantify the reliability indices that can be achieved with preventive and corrective measures in place, the proposed plans would significantly improve the power quality to the customers.

7.2.4 Single Phase to Three Phase Conversion

BPC during the RE expansion programs considered for low-load remote and rural homes with two of the three phases of the MV designed with single phase transformers. However, with the adoption of mechanized agricultural machineries, the requirement of three phase power to cater these loads is gaining an importance even in the rural areas. Therefore, R&DD, BPC in 2017 has carried out the “Technical and Financial Proposal on Converting Single Phase to Three Phase Supply” to come out with the alternatives for providing three-phase power supply where there are single phase power supplies. It was reported that while all the alternatives required the third conductor of the MV system to be extended on the existing poles following three proposals along with the financial impact were proposed:

i. Alternative -I

It was proposed to replace all the single-phase with three-phase transformers and this option as contemplated as not feasible as replacement by three phase transformers and distribution boards will lead to idle storage of single phase transformers of BPC.

ii. Alternative -II

It was proposed to utilize the existing single-phase transformers to form three-phase transformations along with additional purchase of three-phase transformers and additional pole structures. Further, single phase transformers of identical make, type and rating can be only used to make three phase power available.

iii. Alternative -III

Option 3 is found to be techno-commercially viable alternative as the lines can be easily upgraded to three phase by constructing third conductor on existing pole structures. The transformer can be up- graded from single to three-phase as and when the demand for 3-phase supply comes. The line up-gradation across the country would amount to Nu. 96.67 million (Detail in **Annexure-6**) excluding the cost of three-phase transformers which have to be procured on need-basis, rather than one-time conversion in general.

The total single phase line length required to be converted to three-phase in the Dzongkhag is 21.76km and the estimate for such conversion would require Nu. 2.65 Million.

As the single to three-phase network conversions is a demand driven planning, conversions works shall be carried out based on the demand from the customers which would be more techno-commercially viable alternatives. Therefore, considering the anticipatory conversion requirement, the conversion of networks is proposed in the later stage of the DSMP.

7.3 Assessment of Distribution Transformers

7.3.1 Distribution Transformer Loading

The DTs are one of the most critical equipment of the distribution network and assessment of loading pattern along with the remaining asset life are crucial to ascertain the adequacy and performance of the transformer. The capability evaluation is based on historical peak load loading pattern and forecasted peak load growth of the feeder.

As per the peak loading pattern, some of the existing transformer capacities would not be adequate to cater the forecasted load growth for next ten (10) years. Accordingly, the capacities of the transformers need to be up-graded and such proposal is tabulated in **Table 14**. The individual DT loading details used to derive the summary is attached as **Annexure-7**.

Table 14: List of overloaded distribution transformers

Sl.No.	Name of substation location	Capacity (kVA)	Existing Loading 2019		Loading (%)		Remarks
			(kVA)	%	2025	2030	
33kV Damphu & 6.6kV Changchay Feeder							
1	MENCHUNA	125	105.10	84.08%	100.01%	113.36%	New 125kVA SS at Dharjey top within 2025.
2	NEAR OLD COURT	63	53.12	84.32%	100.29%	113.68%	Up-grade to 125kVA within 2025 and will also cater additional load to LAP III. (Replace with 125kVA Below Vet. Hospital X'mer)
3	LOWER MARKET	315	264.98	84.12%	100.06%	113.42%	Additional 250kVA within 2025 and will also cater additional load to LAP II. Proposed in IP 2020-2024 too.
4	BELOW VET. HOSPITAL	125	105.12	84.10%	100.03%	113.39%	Up-grade to 250kVA within 2025 and will also cater additional load to LAP II.
33kV Rangthangling Feeder							
5	DHARJEY	125	66.83	53.46%	92.25%	107.63%	Up-grade to 250kVA between 2025 & 2030. Additional 125kVA.
6	RESERBU, B	63	32.76	52.00%	89.72%	104.68%	Up-grade to 125kVA between 2025 & 2030.
7	MENDRELGANG	63	31.38	49.81%	85.94%	100.27%	Up-grade to 125kVA between 2025 & 2030.
8	SAMZHINGGADEN, B	16	9.57	59.81%	103.20%	120.41%	Up-grade to 25kVA within 2025 (replace with 25kVA Darachu X'mer)
9	UPPER PEMASHONG	63	38.21	60.65%	104.65%	122.09%	Up-grade to 125kVA within 2025. Proposed in IP 2020-2024 too. Replace with 125kVA Vet Hospital DT.
10	DARACHU	25	14.57	58.28%	100.56%	117.32%	Up-grade to 63kVA within

Sl.No.	Name of substation location	Capacity (kVA)	Existing Loading 2019		Loading (%)		Remarks
			(kVA)	%	2025	2030	
							2025. Approved in IP 2021 and PR already submitted.
11	LOWER GAIRIGAON, II	25	12.69	50.76%	87.58%	102.18%	Up-grade to 63kVA between 2025 & 2030 (replace with 63kVA Tashithang I X'mer)
12	PHIRPHIRAY, I	25	12.90	51.60%	89.03%	103.87%	Up-grade to 63kVA between 2025 & 2030. Replace with 63kVA of Reserbu B DT.
13	DARAGAON, I	25	15.70	62.80%	108.36%	126.42%	Up-grade to 63kVA between 2025 & 2030. Replace with 63kVA of Mendrelgang DT.
33kV Dagapela Feeder II							
14	SUNKOSH, A	16	12.81	80.06%	100.47%	127.66%	Up-grade to 25kVA within 2025 (replace with 25kVA Ranahung II X'mer)
33kV Dunglagang Feeder							
15	UPPER BOCKREY	125	89.70	71.76%	102.40%	154.58%	New 125kVA SS within 2025 and will also cater additional load to LAP III. Proposed in IP 2020-2024 too.
16	KHORSANEY GUP OFFICE	25	11.84	47.36%	67.58%	102.02%	Up-grade to 63kVA between 2025 & 2030. New
33kV Tsholingkhar Feeder							
17	RANAHUNG II	25	13.88	55.52%	104.89%	131.41%	Up-grade to 63kVA within 2025.
18	KAPASING TOP	25	13.52	54.08%	102.17%	128.00%	Up-grade to 63kVA between 2025 & 2030.
19	TASHITHANG I	63	33.98	53.94%	101.90%	127.66%	Up-grade to 125kVA between 2025 & 2030.
11kV Taksha Feeder							
20	WAKLAYTAR	25	7.42	55.68%	115.00%	121.59%	Up-grade to 63kVA between 2025 & 2030.

Assuming that the load growth of the rural homes is not expected to grow similar to that of urban dwellings, it is strongly recommended to closely monitor the actual load growth and accordingly plan remedial measures for those transformers although some of the transformers would get overloaded as per the forecasted load. Nevertheless, considering the actual site-specific growth rate and judgment of the field offices, it is recommended that arrangements be made for the up-gradation of twenty (20) transformers as tabulated in **Table 14**. However, cross-swapping the existing transformers prior to procurement of new transformers would mean that, fourteen (14) transformers would require procurement.

7.3.2 Asset life of Distribution Transformers

The life cycle of the transformer has to be known and mapped as it gives us the clear information on the optimal usage and development of asset replacement framework so that investment required on transformer replacement in future will not be exorbitant as a huge investment might be required without having proper replacement guidelines for outlived transformers.

Although, as listed in **Table 15**, the DTs had already outlived the asset life, proper evaluation and testing should be required to find out the actual performance of the DTs and informed decisions can be made on the continuous use of the transformers. The life of the asset has been calculated from the year transformer is put into use.

Table 15: List of outlived distribution transformers

Asset Code	DT Location Name	Transformer Ratio	Capacity	MFD	2019	2025	2030
1501851	Changchay Bazar	6.6/0.415kV	50	1990	29	35	40

7.3.3 Replacement of Single Phase Transformer

As discussed in the "Single Phase to Three Phase Conversion" of the distribution network it will be more economical and technically feasible to convert the single to three phase transformers on need basis. Total of Nu. 283.00 million is estimated for replacing all single phase transformers including the distribution board. The detailed work out is produced as **Annexure-8.**

There are 39 single phase transformers in the Dzongkhag and the estimate for up-grading all the single to three-phase transformers would require Nu. 8.32 Million. As the conversion from single to three-phase transformer is demand base, the plan has been distributed in ten year-span.

7.4 Power Requirement for Urban Areas by 2030

Tsirang Dzongkhag Thromde stretches down from Namgyal Choling Dratshang till Damphu Central School and is divided into three LAPs. Planning of LAP-I is yet to be taken up and as informed by Damphu Municipal Office, the plan may get approved after 2030 only. Therefore, only LAP-II & III are considered in this study.

Planning of LAP-II is under progress and is anticipated to be approved by 2021 or 2022. The areas under LAP-II are core town area, Dzongkhag administration, corporate offices, hospital, RBP office & colony, Royal Guest House, vegetable market and workshops. Other commercial and sports complex development plans are also proposed in the Draft LAP-II plan.

Table 16: LAP II Plan

LAP-II			
Sl. No.	**Proposed Facilities**	**No. of Plots**	**No. of Floor**
1	Total Private Plots	218	3
2	Total Private Buildings/Plot in Core Area	49	4
3	Sport complex/Sport Hub	1	3 to 4
4	Garage	1	1
5	Proposed public library	1	2 to 3
6	Proposed town hall	1	2 to 3
7	Proposed Club House	1	2 to 3
8	Vegetable market	1	1 to 2
9	Commercial center	1	4
10	Service apartment	1	3 to 4
11	Logging facility for sport complex	1	3
12	Bus Terminal	1	3
13	Mix used center	1	3 to 4
14	Museum	1	1 to 2
15	Exhibition area	1	1 to 2
	Total Plots	**280**	

LAP-III has been approved and some developmental activities have been already initiated. The areas under LAP-III are Namgyal Choling Dratshang, Dzongkhag Court, RAA Regional Office, DoR office & colony, and Residence. The LAPs are as shown in **Figure 8.**

Table 17: LAP III Plan

LAP-III			
Sl. No.	**Proposed Facilities**	**No. of Plots**	**No. of Floor**
1	Core Area	16	4
2	Remaining Plots	100	3
	Total Plots	**116**	

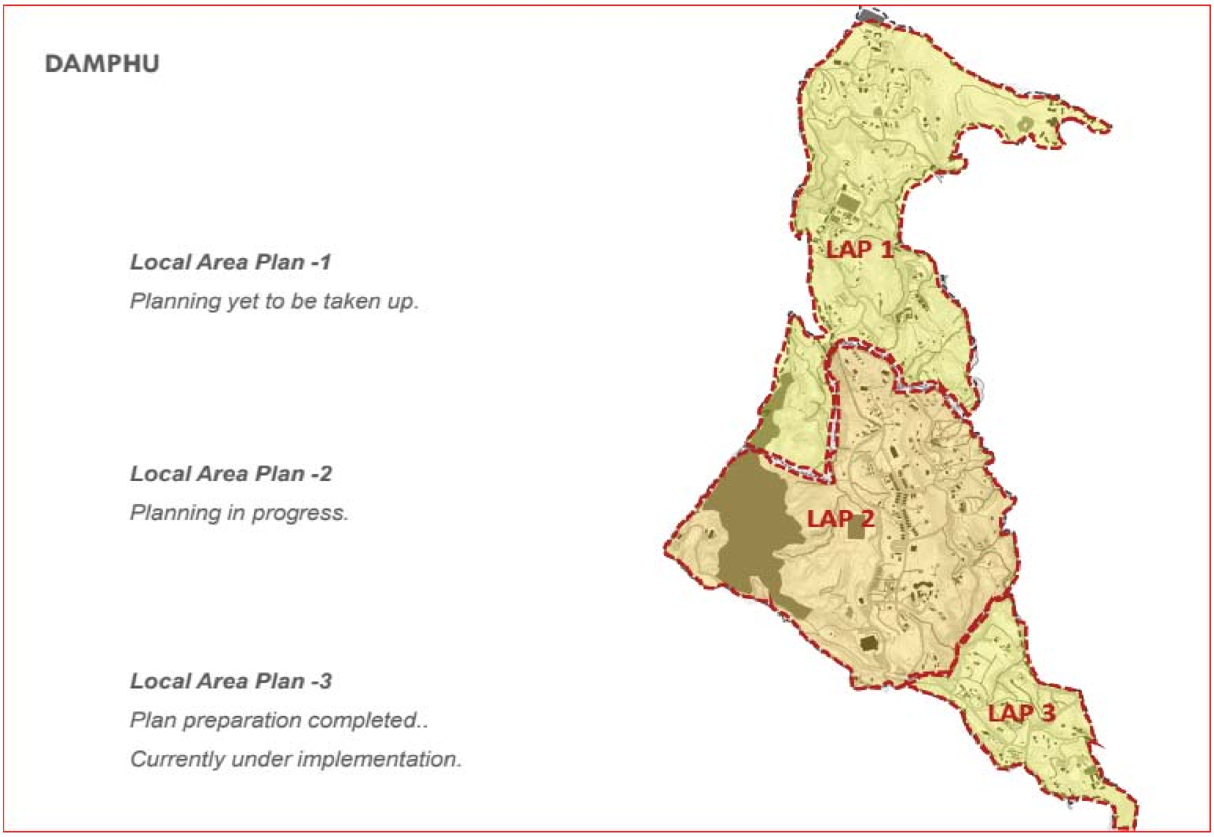


Figure 8: LAPs of the Dzongkhag

The power supply to the Tsirang Thromde (LAP-II & LAP-III) are catered from existing 33 kV Damphu feeder which are on ACSR DOG and RABBIT conductors. Considering the ampacity of the RABBIT conductor (193 A at ambient temperature), it can cater a load of 3.125 MW. The feeder recorded a peak load of 1.121 MW (as of February 2020) and is forecasted to reach 1.62MW by 2030 indicating that the feeder would be adequate to cater additional load of other LAPs. However, to have a reliable power supply, an interconnecting MV line of 3km to connect 33kV Tsholingkhar and 33kV Dunglagang feeder is recommended.

Presently, the Damphu feeder has ten DTs connected, with a total installed capacity of 2,691 kVA catering to the power requirement of 849 customers as detailed in **Table 18.** However, to cater to the future power requirement of the LAPs, the up-gradation of some of the existing DTs is a prerequisite while in some areas the construction of a new substation is proposed.

Table 18: Existing DTs under LAP II & III

Distribution Transformers under LAP II & III				
Sl.No.	**Transformer Location**	**Installed Capacity (kVA)**	**Customers Connected**	**Remarks**
1	Near Dratshang	250	156	
2	Near Old Court	63	52	
3	Near Telecom	250	30	
4	Upper Market	500	277	
5	VIP Guest House	63	5	
6	Lower Market	315	183	
7	Near Forest Colony	125	64	
8	Below Hospital	125	77	
9	New Court	250	4	
10	Damphu Hospital	750	1	Private CSS
	Total	**2691**	**849**	

Construction of new substations along with the substation that required up-gradation to cater to the future LAP load is listed in **Table 19** and **Figure 9** shows the existing distribution network in LAPs.

Table 19: List of new substations

Substation Location	Capacity (kVA)	Existing Loading 2019		Loading (%)		Remarks
		(kVA)	%	2025	2030	
NEAR OLD COURT	63	53.12	84.32%	100.29%	113.68%	Up-grade to 125kVA to cater to the additional load of LAP III. (2025)
BELOW VET. HOSPITAL	125	105.12	84.10%	100.03%	113.39%	Up-grade to 250 kVA to cater to the additional load of LAP II. (2025
UPPER BOCKREY	125	89.70	71.76%	102.40%	154.58%	Installation of an Additional 250kVA to cater to a load of LAP III. (2025)
LOWER MARKET	315	264.98	84.12%	100.06%	113.42%	Installation of an Additional 250kVA to cater to a load of LAP II. (2025)

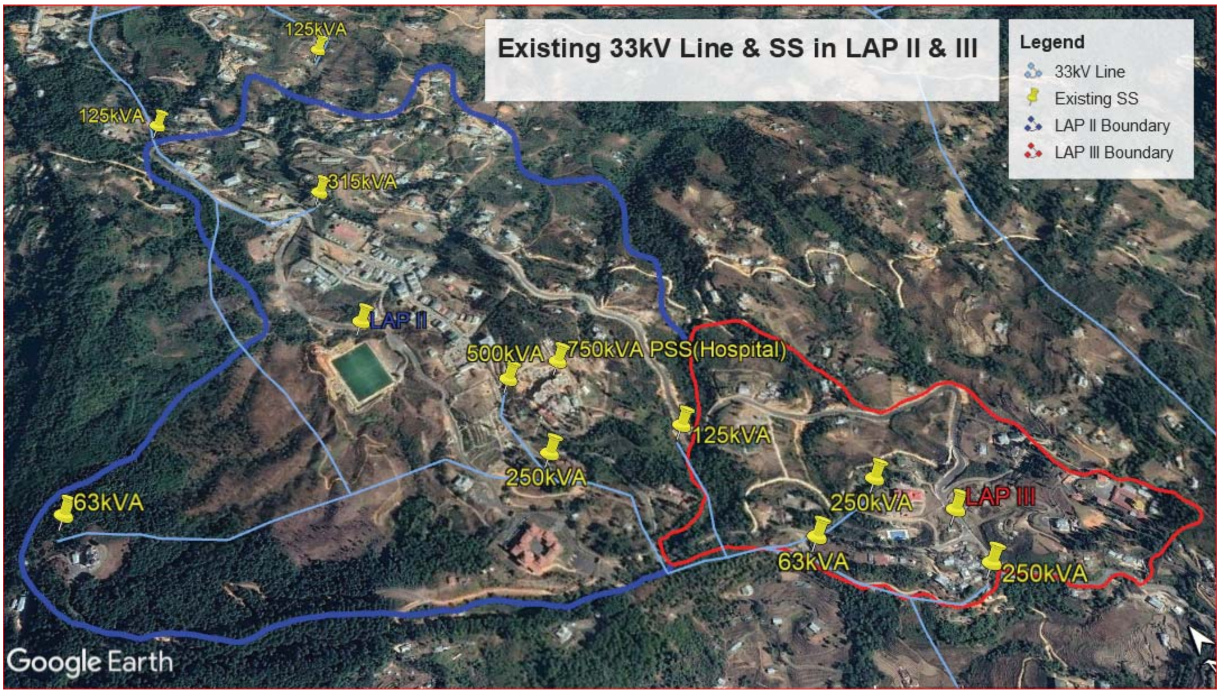


Figure 9: Existing 33kV line and SS in LAP II & III

As a transitional phase, in urban areas of the Dzongkhag, it would be prudent to opt for HV ABC lines/UG for MV lines considering that ACSR conductors pose serious RoW and safety constraints instead.

8. Distribution System Planning until 2030

The distribution network of Dzongkhag has a radial topology with significant risk of high interruptions (fault in one location would mean that the entire customer in the network would experience the outage). Having alternate routes, sources or any contingency plan would significantly improve the reliability and power quality. In order to have robust and hard-lined distribution network, there is a need for good contingency plans with adequate sources to reduce the downtime. However, any provision to improve the power system would incur additional capital cost in addition to recurring additional preventive and corrective costs.

Therefore, to meet the system shortfalls against the set standard and to keep abreast with the forecasted load growth, proper distribution system planning is required which are detailed from **Section 8.1** through **Section 8.4.**

8.1 Power Supply Source

8.1.1 HV substation

As per power source assessment made in **section 7.1.1**, the 220/66/33kV, 2x5 MVA Dharjey substation would be adequate to cater the existing and forecasted power requirement.

8.1.2 MV Substations

There are no MV substations under the jurisdiction of the Dzongkhag.

8.2 MV Lines

The detailed MV line assessment made in **Section 7.2** shows that the existing MV distribution lines would be adequate to cater the existing as well as future load growth. However, for a reliable power supply to the core areas (LPA I, II & III), interconnecting 33kV MV line of 3km has to be constructed to connect 33kV Tsholingkhar and 33kV Dunglagang feeders.

8.3 Distribution Transformers

As detailed in **Section 7.3.1,** the DTs of urban areas might get overloaded as forecasted and considering the plans of the LAPs, following are the list of DTs which would require either up-gradation or installation of new substations.

a) Up-grade 33/0.415kV, 125kVA transformer Below Veterinary Hospital to 250kVA.

b) Up-grade 33/0.415kV, 63kVA transformer at Upper Pemashong to 125kVA.

c) Up-grade 33/0.415kV, 25kVA transformer at Lower Gairigaon, II to 63kVA.

d) Up-grade 33/0.415kV, 25kVA transformer at Lower Phirphiray, I to 63kVA.

e) Up-grade 33/0.415kV, 25kVA transformer at Daragaon, I to 63kVA.

f) Up-grade 33/0.415kV, 25kVA transformer at Khorsaney Gup Office to 63kVA.

g) Up-grade 33/0.415kV, 25kVA transformer at Ranahung II to 63kVA.

h) Up-grade 33/0.415kV, 25kVA transformer at Kapasing Top to 63kVA.

i) Up-grade 33/0.415kV, 63kVA transformer at Tashithang I to 125kVA.

j) Up-grade 11/0.415kV, 25kVA transformer at Waklaytar to 63kVA.

k) Up-grade 33/0.415kV, 125kVA transformer at Dharjey to 250kVA.

l) Up-grade 33/0.415kV, 63kVA transformer at Reserbu B to 125kVA.

m) Up-grade 33/0.415kV, 63kVA transformer at Mendrelgang to 125kVA.

n) Construction of new 33/0.415kV, 125kVA substation at Dharjey Top to share load from 125kVA SS at Menchuna.

o) Installation of additional 33/0.415kV, 250kVA transformer at existing 33/0.415kV, 315kVA substation (Lower Market)

p) Construction of new 33/0.415kV, 125kVA substation at Upper Bockrey through the extension of 0.5km MV line to share load from existing 125kVA SS.

q) Construction of 33/0.415kV, 500kVA transformer below Public Ground (LAP II)

r) Construction of additional 33/0.415kV, 25kVA substation at Naybasay Village under Rangthangling Gewog through Extension of 1.2 km, 33kV Rabbit conductor line (for improvement of LV voltage drop)

s) Upgradation of 25kVA, 33/0.415kV pole-mounted distribution substation to 63kVA at Darachu.

8.1.3 Switching and Control

Switching and control system is required to take care of the system during faulty situations which ultimately is going to take care of the failure rate, repair and restoration time. This in turn would improve the reliability, safety of the equipment and online staff, optimizes the resource usage and more importantly the revenue generation will be enhanced. In order to capture the real time data and information, it is inevitable to have automated and smart distribution system. The feeders which are more susceptible to faults are identified with proposed restorative measures through the studies. With the exception of tripping of breakers in the sending end substations, existing distribution network is neither automated nor smart to detect the faults and respond in real-time manner. The automation and smart grid components are detailed in Smart Grid Master Plan 2019.

8.4.1 Intelligent Switching Devices

As per the detailed reliability assessment of individual feeders in **Section 7.2.3**, the 33 kV Rangthangling and 33kV Tsholingkhar feeders seem to be more susceptible. In order to improve reliability and power quality of the above mentioned feeders which are more susceptible to power outages (including other feeders), it is proposed to have technology in place to respond to fault and clear it accordingly rather than through ex-post facto approach. Therefore, it is proposed to enhance the existing switching and control system by having latest suitable and user-friendly technology (automatic). The coordinated arrangement of Intelligent Switching Devices (ISD) like ARCBs, Sectionalizers and FPIs would significantly improve the control and operation mechanism of the network. **Table 20** shows the list of proposed switching devices for easing operation and maintenance and for improving the reliability of the power supply for the Dzongkhag.

However, the quantum and location of the devices to be installed shall be based on the Smart Grid Master Plan 2019.

Table 20: List of switching equipment

Sl. No.	Name of Feeder	ARCBs		FPIs			LBS	
		Existing (nos.)	Proposed (Nos.)	Existing (nos.)	Proposed (Nos.)	Proposed Location	Existing (nos.)	Proposed (Nos.)
1	33kV Damphu Feeder & 6.6kV Changchay Feeder	0	1	0	2	Menchuna & Below DLSS	2	1
2	33kV Rangthangling Feeder	1	0	0	4	Rakshidangra, Dupi, Upper Pemashong, Samzhinggaden	9	1
3	33kV Dagapela Feeder II	0	1	0	2	Upper Tsholingkhar & Sunkosh	4	0
4	33kV Dunglagang Feeder	1	0	0	3	Upper Menchuna, Bichgaon & Khorsaney	3	2
5	33kV Tsholingkhar Feeder	1	0	0	6	Batasey, Pemathang, Chokpur, Jingay, Manithang & Dauthrey	6	2
6	11kV Taksha feeder	0	0	0	1	Waklaytar	1	0
	Total	**3**	**2**	**0**	**18**		**25**	**6**

8.4.2 Distribution System Smart Grid

The distribution grid modernization is outlined in Smart Grid Master Plan 2019 including the investment (2020-2027). The DMS, ADMS, SCADA features along with their components and functionalities, the timeline for the programs and the cost estimates of the smart grid are lucidly reflected. Therefore, this report exclusively entails the identification of the system deficiencies and qualitative remedial measures which would require system augmentation and reinforcement as per the existing and projected load.

9. Investment Plan

In accordance to the above mentioned contingency plans targeted to improve the power quality, reduce losses and improve reliability indices of the Dzongkhag, investment proposal is developed. The investment plan has been confined to power supply sources, MV lines, DTs, switching and control equipment and RoW. The proposed/approved (2020-2024) investment plan and any new investment plans have been validated and synced with the system studies carried out. The annual investment plan (2020-2030) has been worked out based on the priority parameters set out as shown in **Figure 10.**

The matrix gives us the basis on the prioritization of the investments to be made in the ten-year schedule as every activity cannot be carried out at a time. The activities which have to be carried out due to load growth, developmental activities and retrofitting of obsolete/defective switchgears and equipment will have the highest level of importance and urgency. These activities have to be prioritized and invested in the initial years which are grouped in the first quadrant (Do First).

Similarly, there are certain activities although might be very important but not so urgent can be planned in the later stage of the year (Do Next). These activities can be but not limited to improving the reliability, reducing losses and reconfiguration of lines and substations to reduce the losses and improving the power quality. The activities which are not so important but are highly urgent have to be also planned in later stage of the period.

How important is the task?			
	Highly Important	Action: Do First **I**	Action: Do Next **II**
	Important	**Action:** **Do Later** **III**	No Action: Don't Do **IV**
		More Urgent	**Urgent**
How urgent is the task?			

Figure 10: Priority Matrix

According to the investment prioritization matrix framework, the yearly investment plan along with the cost estimation is derived and is consolidated in **Table 21** as an investment plan. The cost estimates have been worked out based on the BPC ESR-2015 and annual inflation is cumulatively applied to arrive the actual investment cost for the following years.

In the span of next 10 years (2020-2030), the total projected investment required to build adequate infrastructure and deliver the quality power to the customers of Tsirang Dzongkhag is Nu. 27.49 million (Nu. 2.75 million per year).

Table21: Investment Plan until 2030

Sl.No.	Activities	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
1	**MV Lines**												
1.1	Interconnection of 33kV Damphu feeder with Tsholingkhar and Dunglagang feeder (New 3km, 33kV DOG Conductor line) to improve power reliability.				2.82								2.82
1.2	Single phase to three-phase line conversion		0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	2.60
2	**Distribution Transformers**												
2.1	Up-grade 33/0.415kV, 125kVA transformer Below Veterinary Hospital to 250kVA.			0.89									0.89
2.2	Up-grade 33/0.415kV, 63kVA transformer at Upper Pemashong to 125kVA.			0.43									0.43
2.3	Up-grade 33/0.415kV, 25kVA transformer at Lower Gairigaon, II to 63kVA.								0.32				0.32
2.4	Up-grade 33/0.415kV, 25kVA transformer at Lower Phirphiray, I to 63kVA.								0.32				0.32
2.5	Up-grade 33/0.415kV, 25kVA transformer at Daragaon, I to 63kVA.									0.32			0.32
2.6	Up-grade 33/0.415kV, 25kVA transformer at Khorsaney Gup Office to 63kVA.									0.32			0.32
2.7	Up-grade 33/0.415kV, 25kVA transformer at						0.32						0.32

Sl.No.	Activities	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
	Ranahung II to 63kVA.												
2.8	Up-grade 33/0.415kV, 25kVA transformer at Kapasing Top to 63kVA.							0.32					0.32
2.9	Up-grade 33/0.415kV, 63kVA transformer at Tashithang I to 125kVA.							0.43					0.43
2.1	Up-grade 33/0.415kV, 125kVA transformer at Dharjey to 250kVA.										0.89		0.89
2.11	Up-grade 33/0.415kV, 63kVA transformer at Reserbu B to 125kVA.									0.43			0.43
2.12	Up-grade 33/0.415kV, 63kVA transformer at Mendrelgang to 125kVA.								0.43				0.43
2.13	Up-grade 11/0.415kV, 25kVA transformer at Waklaytar to 63kVA.							0.29					0.29
2.14	Construction of new 33/0.415kV, 125kVA substation at Dharjey Top to share load from 125kVA SS at Menchuna.					0.53							0.53
2.15	Installation of additional 33/0.415kV, 250kVA transformer at existing 33/0.415kV, 315kVA substation (Lower Market)			0.72									0.72
2.16	Construction of new 33/0.415kV, 125kVA substation at Upper Bockrey through extension of 0.5km MV line to share load from existing				0.95								0.95

Sl.No.	Activities	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
	125kVA SS.												
2.17	Construction of 33/0.415kV, 500kVA transformer below Public Ground (LAP II)											1.46	1.46
2.18	Construction of additional 33/0.415kV, 25kVA substation at Naybasay Village under Rangthangling Gewog through Extension of 1.2 km, 33kV Rabbit conductor line (for improvement of LV voltage drop)		1.37										1.37
2.19	Upgradation of 25kVA, 33/0.415kV pole mounted distribution substation to 63kVA at Darachu.		0.32										0.32
2.20	Construction of additional 33/0.415kV, 25kVA substation at Dingay through extension of 1km 33kV Rabbit line and Construction of chain link fencing around 33/0.415kV, 250kVA substation below Dratshang, Damphu town (6X6).	1.19											1.19
2.21	Replacement of single by three-phase transformers		0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	8.30
3	**Switching and Control**												
3.2	Installation of 33kV LBS		0.59			0.46	0.46						1.51
	Total	**1.19**	**3.37**	**3.13**	**4.86**	**2.08**	**1.87**	**2.14**	**2.17**	**2.17**	**1.98**	**2.55**	**27.49**

10. Conclusion

Based on the inputs from Divisional office, validated data, assessment of the existing distribution network, and the reliability analysis, recommendations are made for system modifications and improvements. Costs associated with each recommendation are presented in several phases so that work may continue at a pace that is determined by fund availability and the capacity of the office to execute the work. An attempt is made to prioritize the recommendations; however, there will undoubtedly be adjustments in the order and priority by which the investments will be actually implemented.

The third option which would be the least-cost alternatives for converting the single to three-phase distribution network where all the MV lines will have to be converted to three-phase and replacing the single phase by three-phase transformers on need basis.

Although the report entails the identification of system deficiencies and reinforcement required, for automation and smart operation of the distribution network, the smart grid infrastructure development with functionalities are detailed in “Smart Grid Master Plan 2019”. Therefore, the DSMP-Smart Grid Master Plan-Hybrid is necessary which can be amalgamated during the rolling out of annual investment and budget approvals.

Proportion of LV is higher in comparison to MV line length; accordingly, the independent study carried out by BPC in 2017 showed that large portion of loss is due to LV and DT. Therefore, similar system study beyond DT has to be carried out in order to capture the entire network and strategize to develop the blue print.

11. Recommendation

Sl. No.	Parameters	Recommendations
A. Power Supply Sources		
1	HV Substations	The Dharjey substation would be adequate to meet the power requirement.
2	MV Substations	There are no MV substations under the jurisdiction of the Dzongkhag.
B. MV Lines		
1	MV lines	As reflected in **Section 8.2,** it is recommended to implement the interconnecting and extension lines to improve the reliability of the power supply to the Dzongkhag.
C. Distribution Transformers		
1	Distribution Transformers	As reflected in **Section 7.3.1** of this report, it is proposed to regularly monitor the loading pattern especially of the urban transformers. It is desired to load the transformers less than 85% so as to ensure that transformer is operated at maximum efficiency. As the system study is restricted to DTs, the loads need to be uniformly distributed amongst the LV feeders to balance the load.
2	Single to Three-phase Transformers	As reported in the "Technical and Financial Proposal on Converting Single Phase Power Supply to Three-phase in Rural Areas", it is recommended to replace the single to three-phase transformers on need basis.
D. Switching and Control Equipment		
1	Switching and Control Equipment	It is recommended to install Intelligent Switching Devices (ISD) like ARCBs, Sectionalizers and FPIs as proposed which would reduce the downtime for clearing faults. 1) Install FPI, Sectionalizes and ARCBs at various identified locations. 2) Installation of 11kV& 33kV RMUs at various identified locations.
E. others		
1	Investment Plan	As reflected in **Section 9** of this report, overall investment plan as proposed is recommended.
2	Review of the DSMP	Practically the projections will hold only true in the nearest future therefore, it is strongly recommended to review the DSMP in 2025 (after five years) or if need be as and when situation demands.
3	System Studies	It is observed that distribution of electricity is more through LV than MV & HV

Sl. No.	Parameters	Recommendations
	beyond DT	and the scope of DSMP terminates at DT. However, it is equally important to carry out similar system studies for LV networks till meter point. Due to time constraint and non-availability of required LV data, it is recommended to carry out the studies on LV network including the DTs. Nevertheless, with the entire distribution network captured in the GIS and ISU, the system studies should be carried out including the LV network in the future.
4	Customer Mapping	One of the important parameters required especially for reaffirming the capability of the DTs is by examining customer growth patterns. Therefore, it is recommended to consistently update the customers via customer mapping process carried out annually.
5	Right of Way	RoW should be maintained as per the DDCS 2016. However, increased frequency of RoW clearing in the problematic sections of the line and in fast growth sub-tropical forest is recommended.
7	Asset life of DTs	The asset life of DTs needs to be gathered to enable development of asset replacement framework. However, it is recommended to regularly monitor the health of the transformers which have already outlived their lives.
8	Overloading of DTs	As per the load forecast, some of the rural DTs might overload. While the probability of realizing such an event is quite low. It is, however, recommended that the DTs that have already exhausted its statutory life (25 years and above) be regularly monitored.
9	New extension through 33kV network	The power carrying capacity of 33kV system is almost 3-fold compared to that of 11kV system. Therefore, any new extension of lines may be done through 33kV system (based on fund availability and practical convenience).
10	Reliability	In order to improve the reliability of the feeder/network, it is recommended that fault should be located within short period of time there by reducing the restoration time and the number of customers affected. In this regard, the following initiatives are recommended: 1) To install ISDs (communicable FPIs, Sectionalizers & ARCBs); 2) To explore with construction of feeders with customized 11kV & 33kV towers; and 3) To increase the frequency of Row clearing in a year.

12. Annexure

Annexure-1: MV Line Details and Single Line Diagram

Annexure-2: IS 2026, IEC 60076 (Technical parameters for Distribution Lines and Transformers)

Annexure-3: The details on load forecast methodology.

Annexure-4: Detailed Simulation Results

Annexure 5: Feeder Wise Reliability Indices

Annexure-6: Material Cost for Upgrading single phase (11 kV and 33 kV) Lines to three-phase

Annexure 7: Distribution Transformer loading

Annexure-8: Material Cost of three phase (3Φ) Transformers

13. References

1. The FWPL and CPL from TD, BPC as of 2018.
2. BPC Power Data Book 2018.
3. BPC Distribution Design and Construction Standards (DDCS)-2016.
4. BPC Smart Grid Master Plan (2019-2027).
5. BPC National Transmission Grid Master Plan (2020 & 2030).
6. BPC Operation and Maintenance Manual for Distribution System (2012).
7. BPC Corporate Strategic Plan (2019-2030).
8. Population and Housing Census of Bhutan 2019.
9. The Structural Plan (2004-2027) for every Dzongkhag.
10. Tsirang City Development Strategy (2008).
11. Industrial Parks (Department of Industry).
12. BPC Electrical Schedule of Rates 2015.

14. Assumptions

1. All the distribution network was considered as Balanced System (Restriction with the existing ETAP Key);

2. All DTs considered as lump load and depending upon the type of load connected to the feeder, ratio of 80% (static load) to 20% (industrial feeders) were assumed;
3. The voltage level of ±10% is given as critical value which is indicated by red color while simulating and voltage level of ±5% is given as marginal value which is indicated by pink color while simulating.
4. The typical inbuilt value of X/R ratio of ETAP tool was considered for all the transformers;
5. Dimensions and parameters of some cables/UG cables are customized in the library as per the requirement;
6. The technical parameters which are required for analysis of the distribution network have been considered as per the set standard of DDCS.

15. Challenges

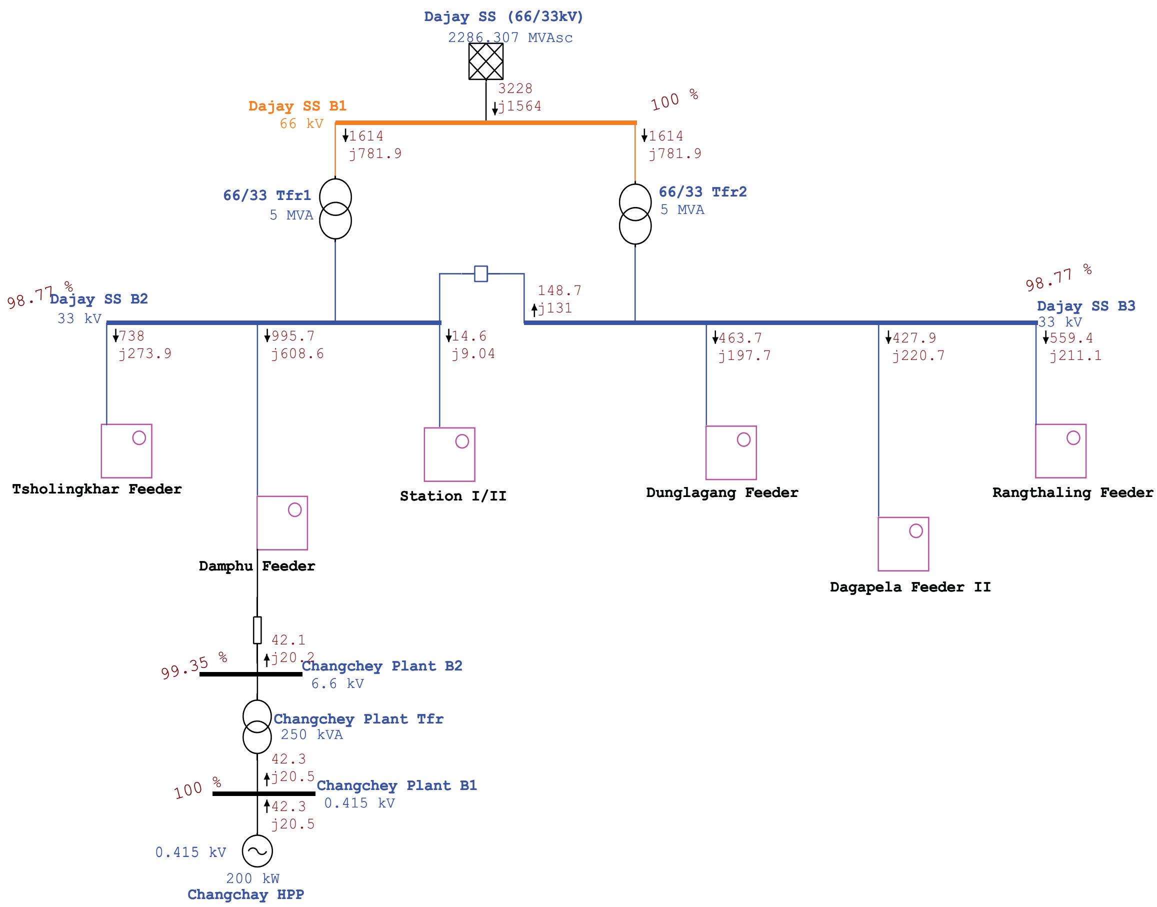
Sl. No.	Parameters	Challenges	Opportunities/Proposals
1	Software Tool (ETAP)	a) Only one key & off-line Key	a) Can opt for on line key with fewer more modules especially to carry out the technical evaluation of un-balanced load flow system. This would be more applicable and accrue good result for LV networks.
		b) Balanced Load Flow	
		c) Limitations of No. of buses (1000)	
2	Data	a) No recorded data (reliability & energy) on the out-going feeders of MV SS	a) Feeder Meters could be install for outgoing feeders of MV substations to record actual data (reliability & energy)
		b) Peak Load data of DTs which were recorded manually may	b) In order to get the accurate Transformer Load Management (TLM)/loading, it is proposed to install DT

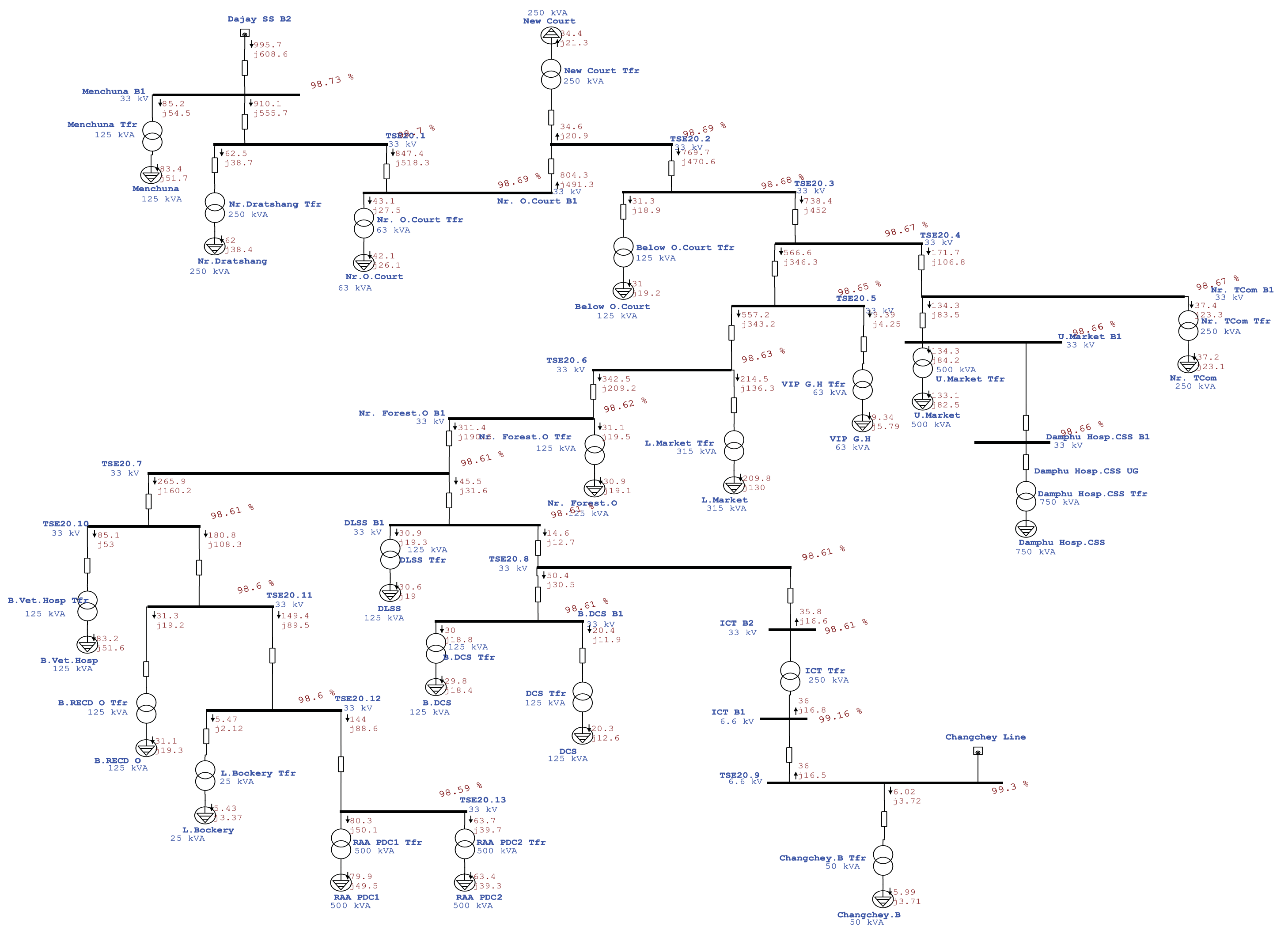
Sl. No.	Parameters	Challenges	Opportunities/Proposals
		be inaccurate due to timing and number of DTs.	meters which could also have additional features to capture other required information.
		c) No proper feeder and DT wise Customer Mapping recorded	c) Customer Information System (CIS) of the feeder/DT would enable to have proper TLM and replacement framework.
3	Manpower	a) Resource gap in terms of trained (ETAP) and adequate engineers (numbers)	a) Due to lesser number of trained engineers in the relevant fields (software), engineers from other areas were involved.

12. Annexures

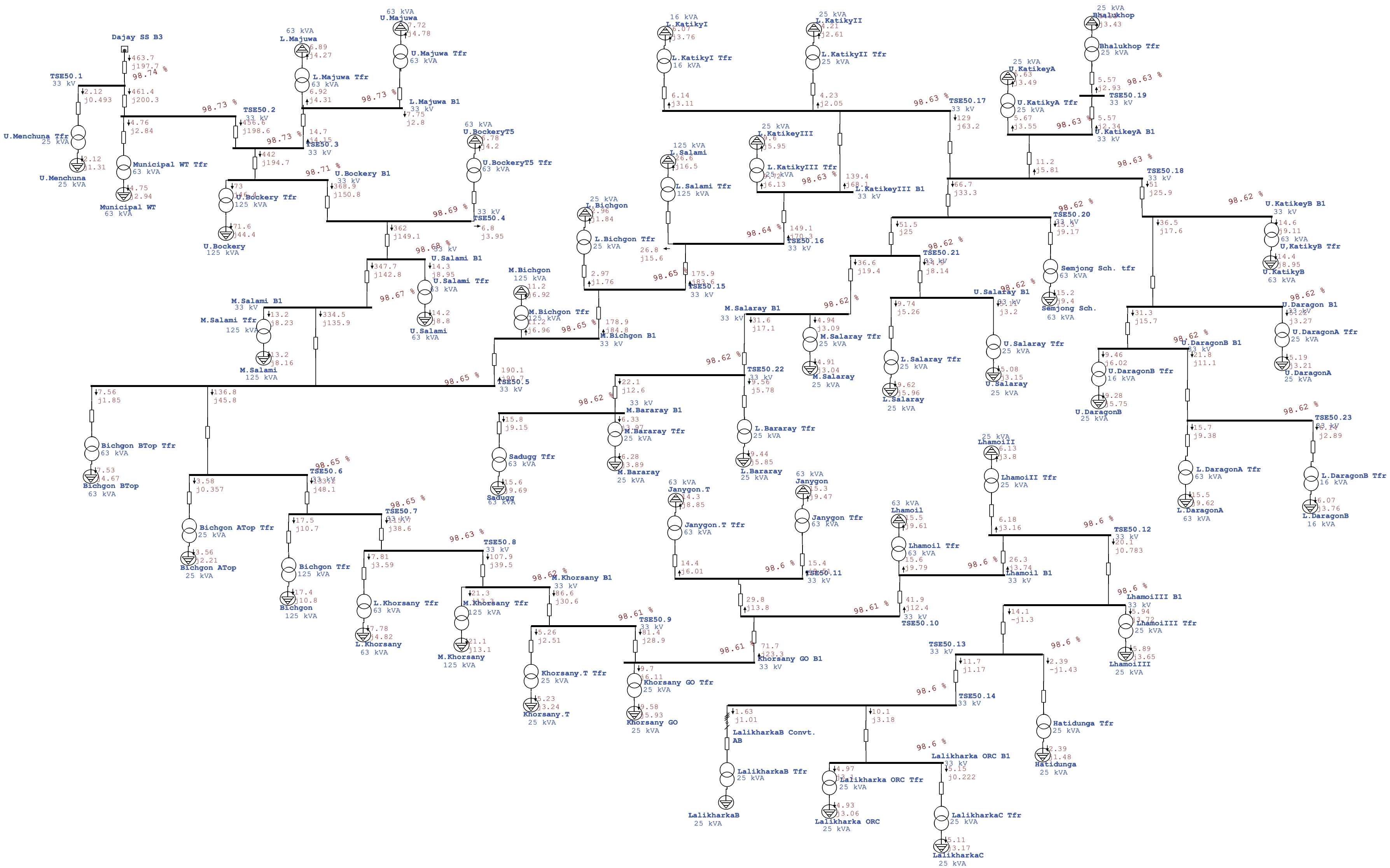
Annexure-1: MV Line Details and Single Line Diagram

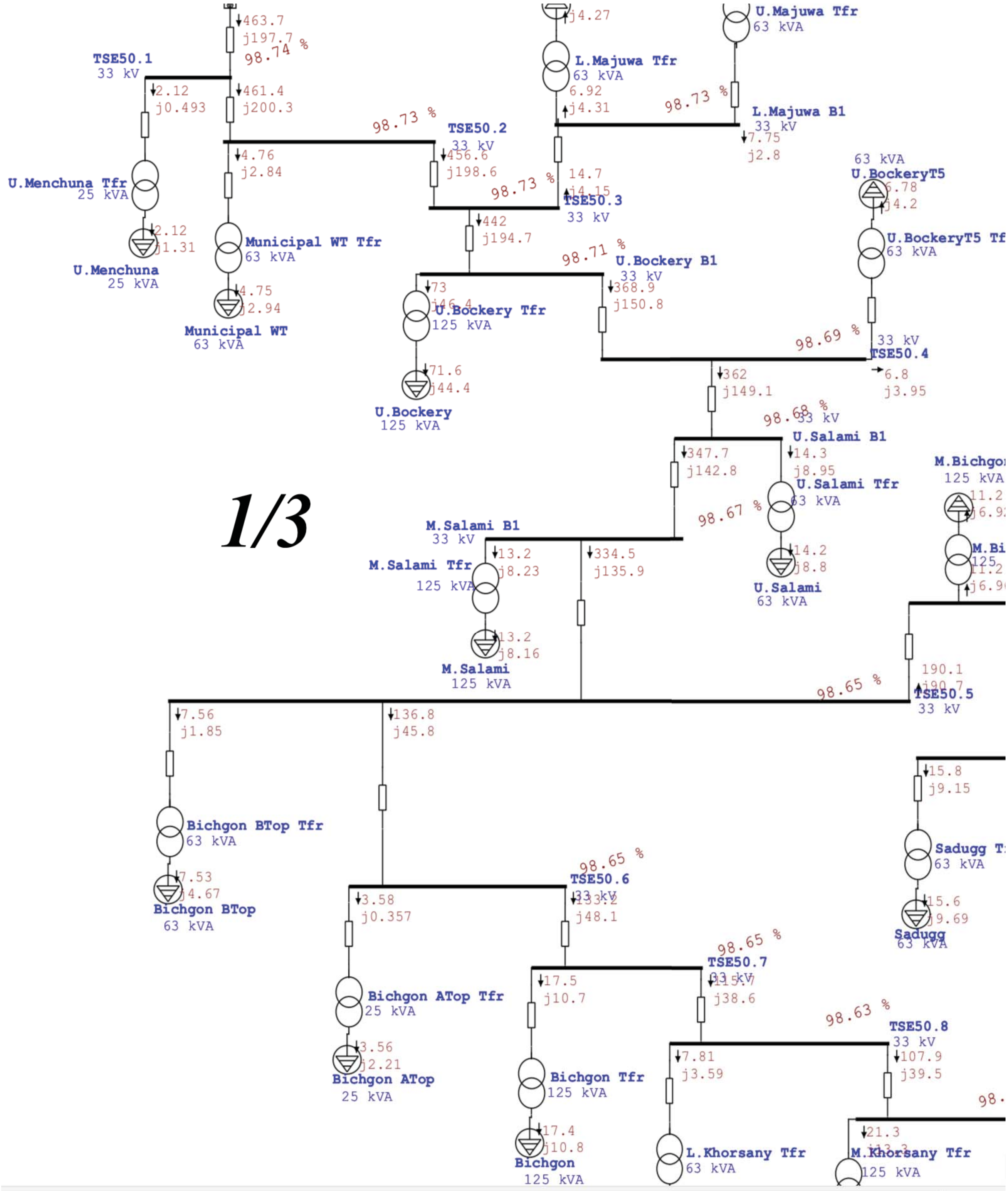
One-Line Diagram - OLV1 (Load Flow Analysis)




Dajay SS B2
Menchuna B1
33 kV
Menchuna Tfr
125 kVA
Menchuna
125 kVA
TSE20.1
33 kV
Nr.Dratshang Tfr
250 kVA
Nr.Dratshang
250 kVA
Nr. O.Court B1
33 kV
Nr. O.Court Tfr
63 kVA
Nr.O.Court
63 kVA
New Court
250 kVA
New Court Tfr
250 kVA
TSE20.2
33 kV
TSE20.3
33 kV
Below O.Court Tfr
125 kVA
Below O.Court
125 kVA
TSE20.4
33 kV
TSE20.5
VIP G.H Tfr
63 kVA
VIP G.H
63 kVA
Nr. TCom B1
33 kV
Nr. TCom Tfr
250 kVA
Nr. TCom
250 kVA
U.Market B1
33 kV
U.Market Tfr
500 kVA
U.Market
500 kVA
Damphu Hosp.CSS B1
33 kV
Damphu Hosp.CSS UG
Damphu Hosp.CSS Tfr
750 kVA
Damphu Hosp.CSS
750 kVA
TSE20.6
33 kV
L.Market Tfr
315 kVA
L.Market
315 kVA
Nr. Forest.O B1
33 kV
Nr. Forest.O Tfr
125 kVA
Nr. Forest.O
125 kVA
TSE20.7
33 kV
TSE20.10
33 kV
B.Vet.Hosp Tfr
125 kVA
B.Vet.Hosp
125 kVA
TSE20.11
33 kV
B.RECD O Tfr
125 kVA
B.RECD O
125 kVA
TSE20.12
33 kV
L.Bockery Tfr
25 kVA
L.Bockery
25 kVA
TSE20.13
33 kV
RAA PDC1 Tfr
500 kVA
RAA PDC1
500 kVA
RAA PDC2 Tfr
500 kVA
RAA PDC2
500 kVA
DLSS B1
33 kV
DLSS Tfr
125 kVA
DLSS
125 kVA
TSE20.8
33 kV
B.DCS B1
33 kV
B.DCS Tfr
125 kVA
B.DCS
125 kVA
DCS Tfr
125 kVA
DCS
125 kVA
ICT B2
33 kV
ICT Tfr
250 kVA
ICT B1
6.6 kV
TSE20.9
6.6 kV
Changchey Line
Changchey.B Tfr
50 kVA
Changchey.B
50 kVA

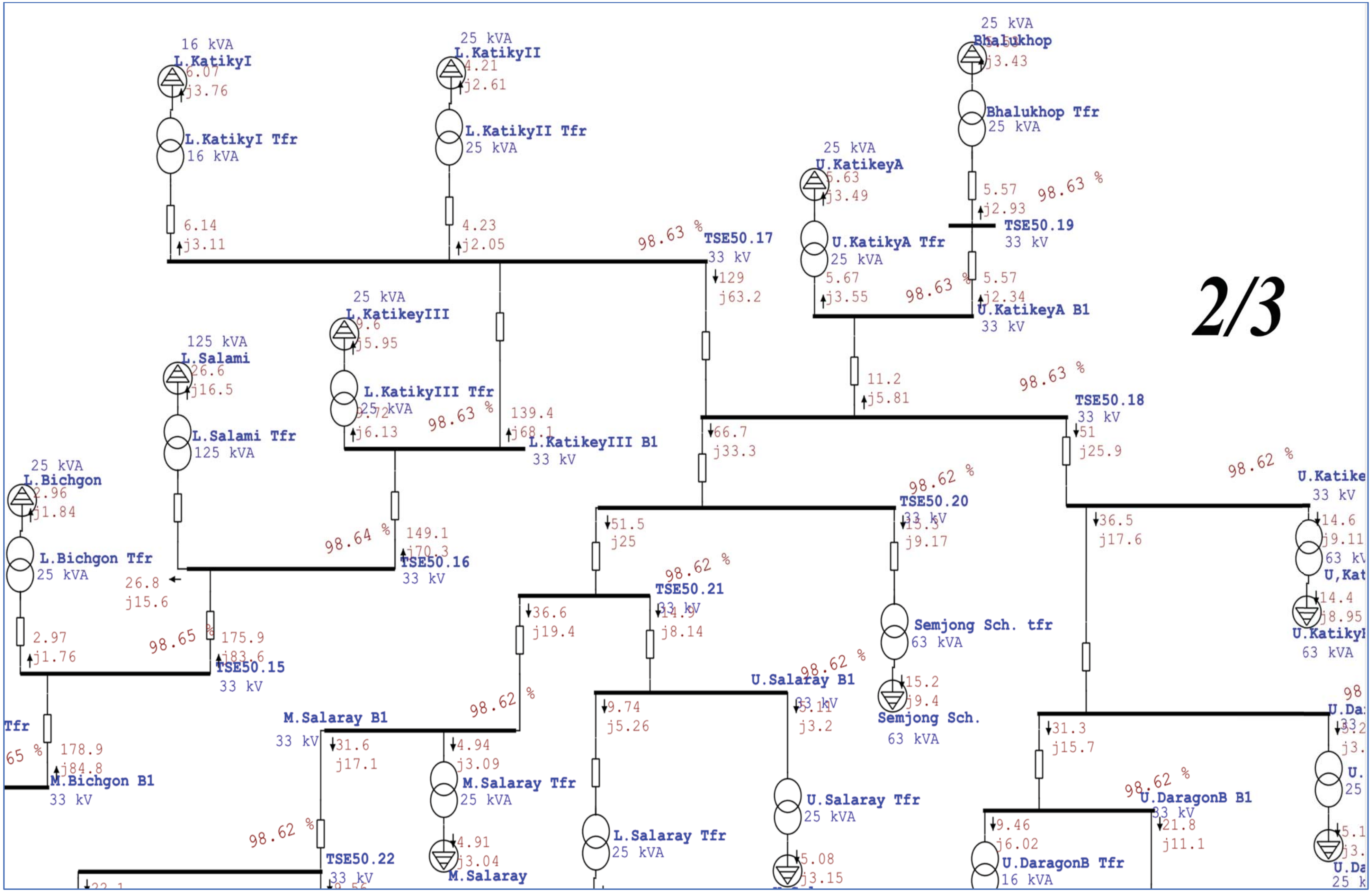
One-Line Diagram - OLV1=>Dunglagang Feeder (Load Flow Analysis)



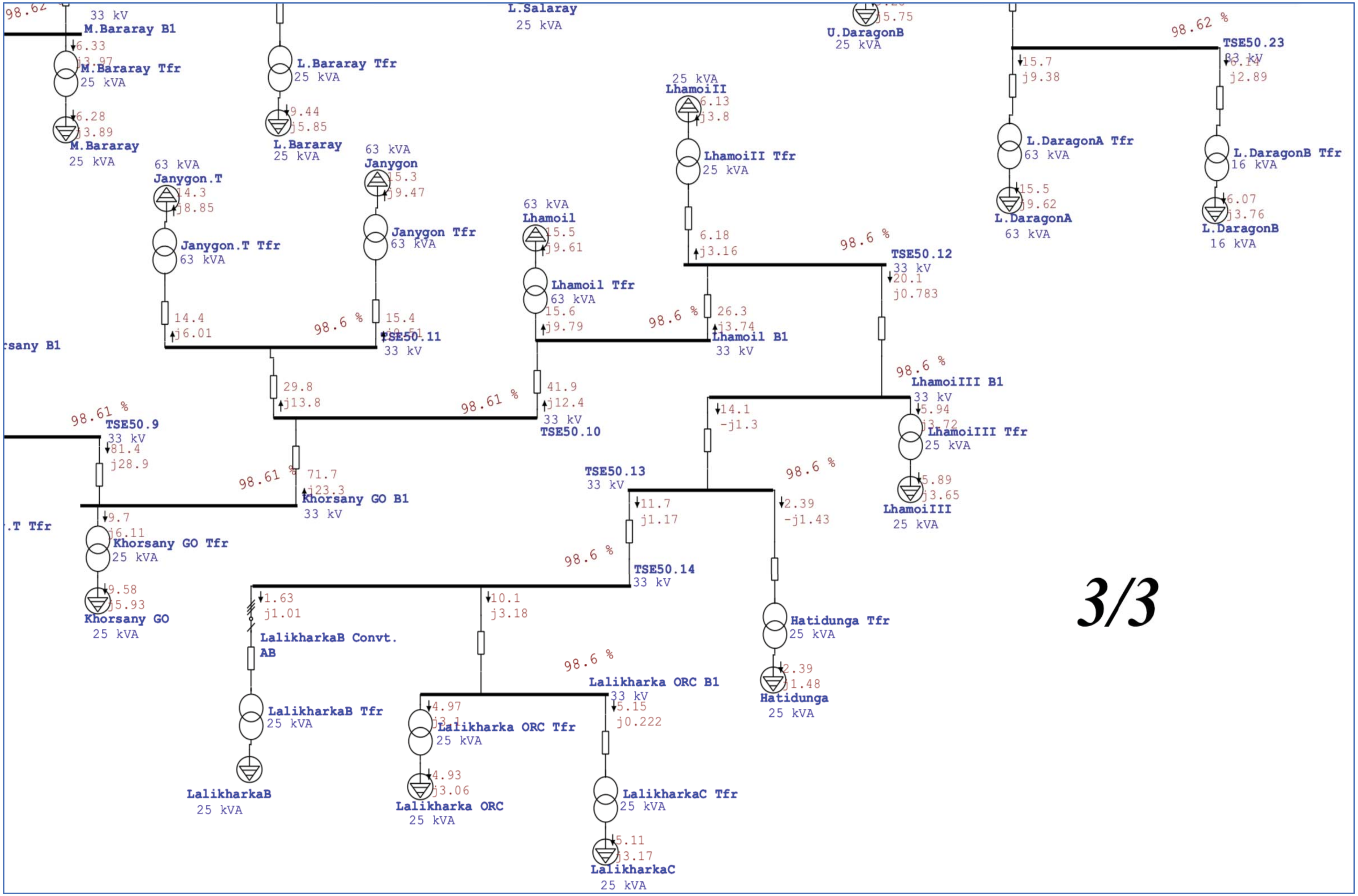


TSE50.1
33 kV
463.7
j197.7
98.74 %
2.12
j0.493
461.4
j200.3
U.Menchuna Tfr
25 kVA
4.76
j2.84
Municipal WT Tfr
63 kVA
2.12
j1.31
U.Menchuna
25 kVA
4.75
j2.94
Municipal WT
63 kVA
98.73 %
TSE50.2
33 kV
456.6
j198.6
j4.27
L.Majuwa Tfr
63 kVA
6.92
j4.31
U.Majuwa Tfr
63 kVA
98.73 %
L.Majuwa B1
33 kV
7.75
j2.8
14.7
j4.15
98.73 %
TSE50.3
33 kV
442
j194.7
63 kVA
U.BockeryT5
6.78
j4.2
U.BockeryT5 Tfr
63 kVA
98.71 %
U.Bockery B1
33 kV
368.9
j150.8
73
j46.4
U.Bockery Tfr
125 kVA
71.6
j44.4
U.Bockery
125 kVA
98.69 %
33 kV
TSE50.4
6.8
j3.95
362
j149.1
98.68 %
33 kV
U.Salami B1
347.7
j142.8
14.3
j8.95
U.Salami Tfr
63 kVA
98.67 %
14.2
j8.8
U.Salami
63 kVA
M.Bichgon
125 kVA
11.2
j6.92
M.Bi
125
11.2
j6.9
1/3
M.Salami B1
33 kV
13.2
j8.23
334.5
j135.9
M.Salami Tfr
125 kVA
13.2
j8.16
M.Salami
125 kVA
190.1
j90.7
98.65 %
TSE50.5
33 kV
7.56
j1.85
136.8
j45.8
15.8
j9.15
Bichgon BTop Tfr
63 kVA
Sadugg T
63 kVA
7.53
j4.67
Bichgon BTop
63 kVA
98.65 %
TSE50.6
33 kV
133.2
j48.1
3.58
j0.357
15.6
j9.69
Sadugg
63 kVA
98.65 %
TSE50.7
33 kV
115.7
j38.6
17.5
j10.7
Bichgon ATop Tfr
25 kVA
3.56
j2.21
Bichgon ATop
25 kVA
98.63 %
TSE50.8
33 kV
107.9
j39.5
7.81
j3.59
Bichgon Tfr
125 kVA
17.4
j10.8
Bichgon
125 kVA
98.
21.3
j13.3
L.Khorsany Tfr
63 kVA
M.Khorsany Tfr
125 kVA

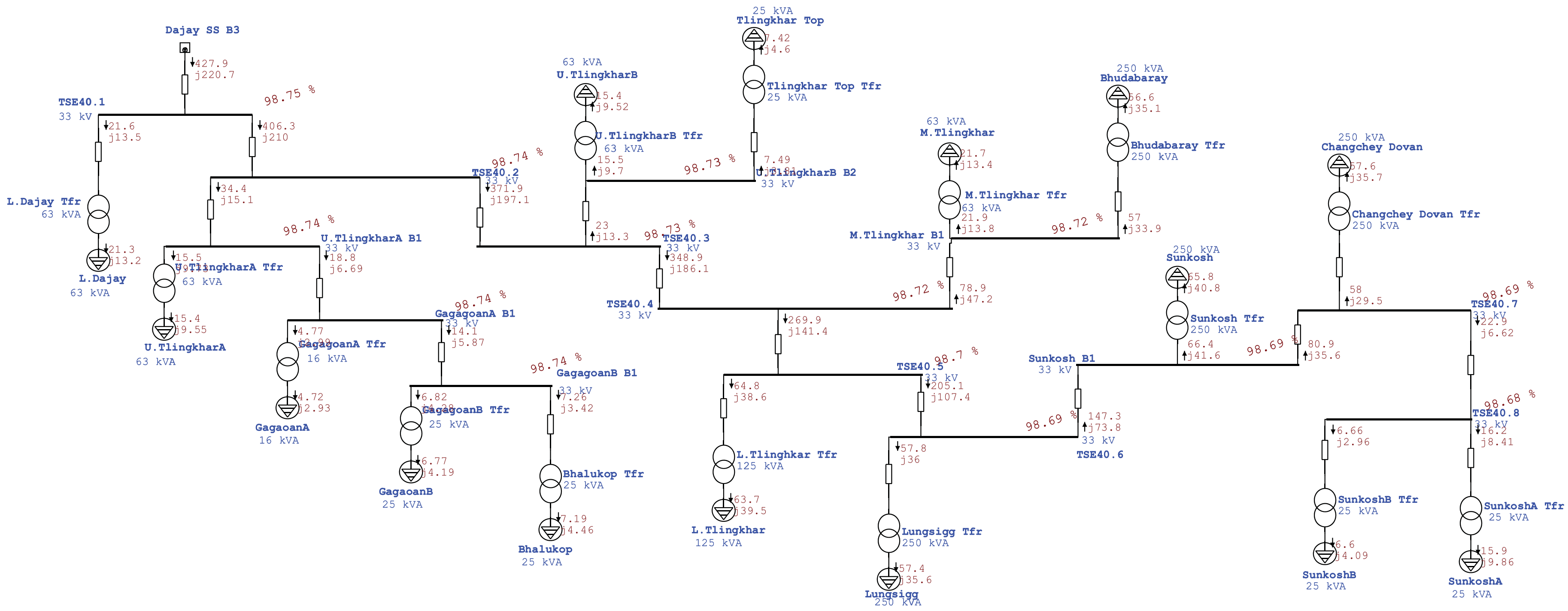
2/3



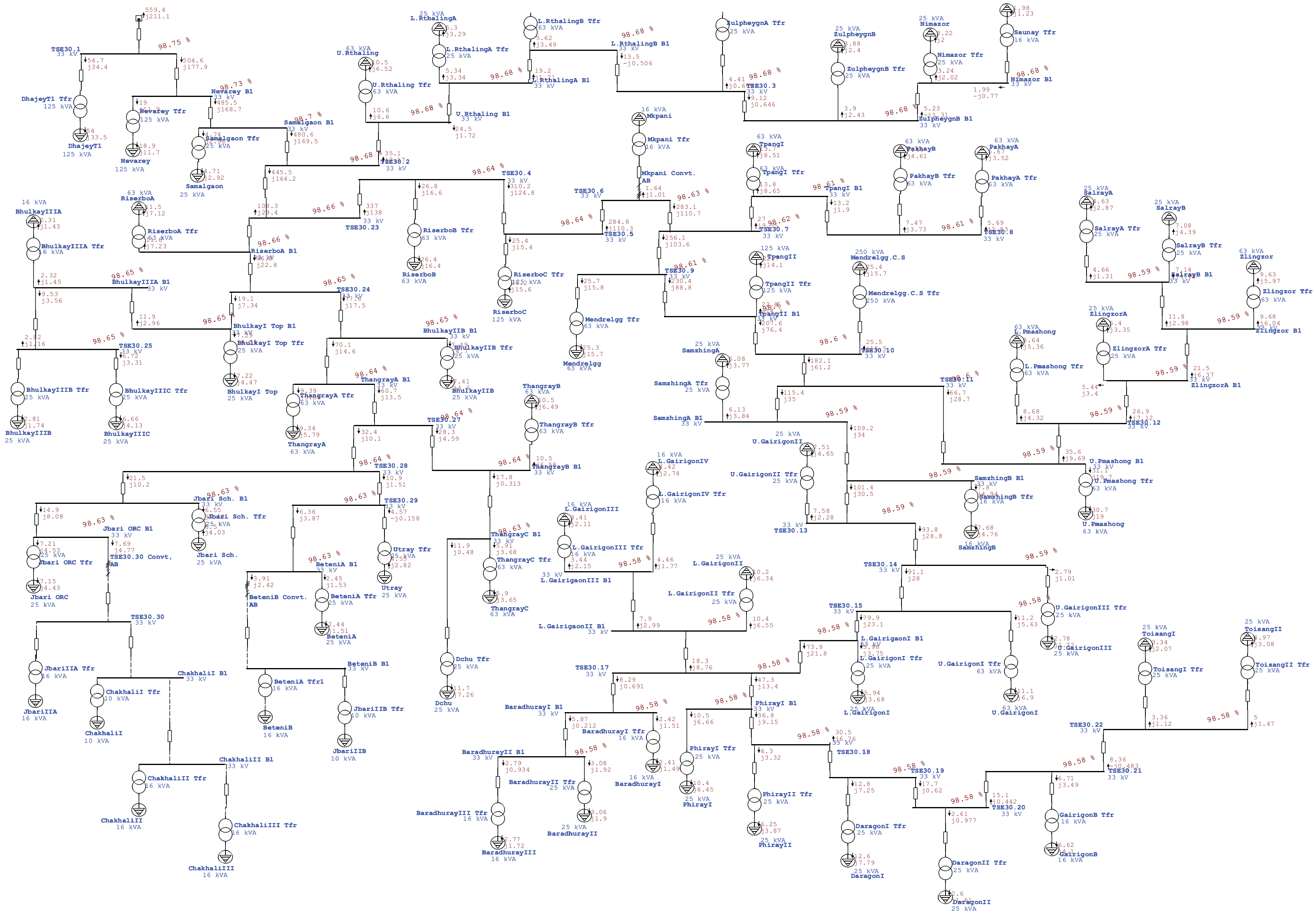
L.KatikyI
16 kVA
L.KatikyI Tfr
L.KatikyII
25 kVA
L.KatikyII Tfr
TSE50.17
33 kV
98.63 %
Bhalukhop
Bhalukhop Tfr
TSE50.19
U.KatikeyA
U.KatikyA Tfr
U.KatikeyA B1
L.KatikeyIII
L.KatikyIII Tfr
L.KatikeyIII B1
L.Salami
125 kVA
L.Salami Tfr
TSE50.18
L.Bichgon
L.Bichgon Tfr
TSE50.16
98.64 %
TSE50.15
98.65 %
M.Bichgon B1
TSE50.20
98.62 %
TSE50.21
Semjong Sch. tfr
63 kVA
Semjong Sch.
U.Salaray B1
U.Salaray Tfr
L.Salaray Tfr
M.Salaray B1
M.Salaray Tfr
M.Salaray
TSE50.22
U.DaragonB B1
U.DaragonB Tfr

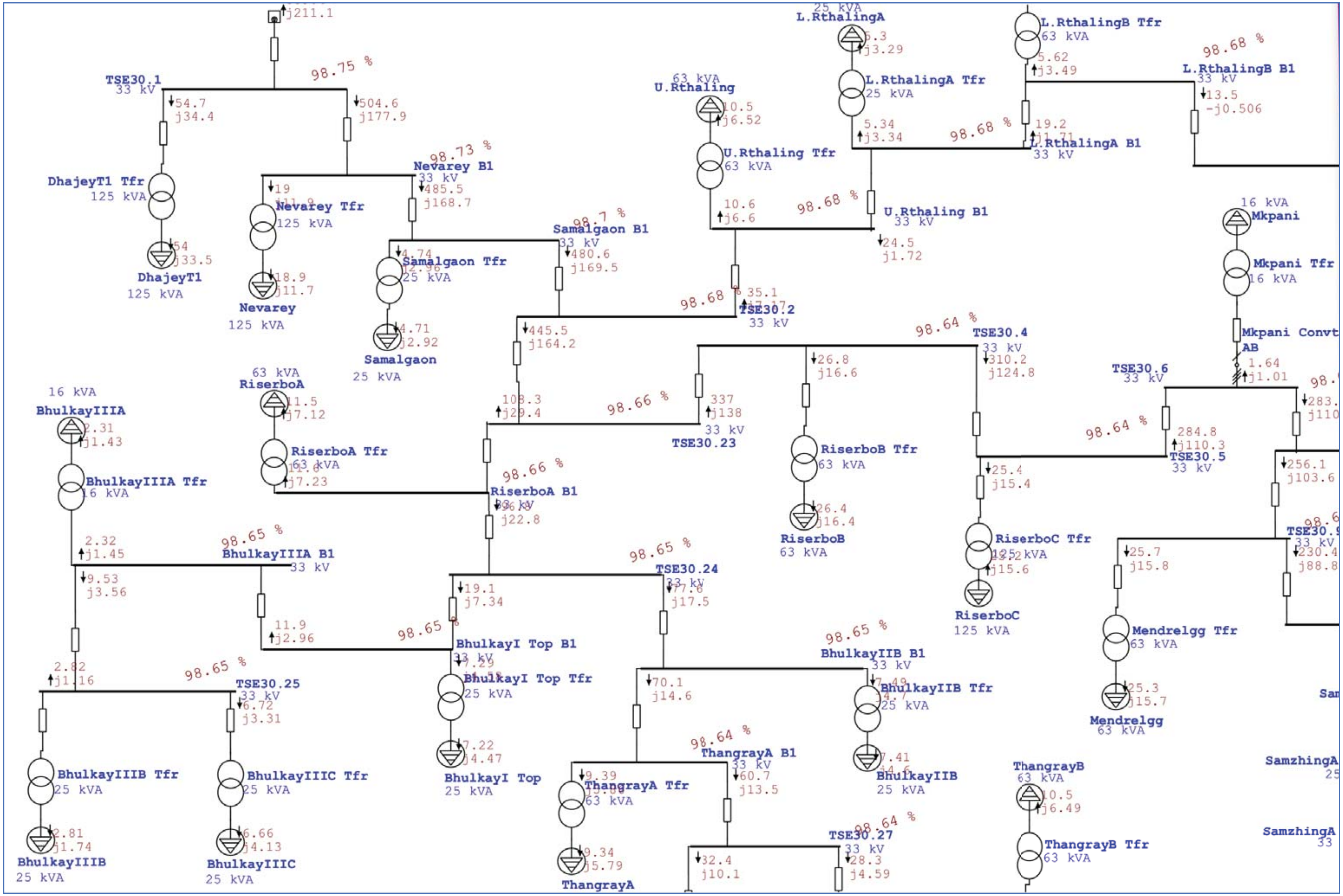

M.Bararay B1
33 kV
M.Bararay Tfr
25 kVA
M.Bararay
25 kVA
L.Bararay Tfr
25 kVA
L.Bararay
25 kVA
L.Salaray
25 kVA
U.DaragonB
25 kVA
TSE50.23
L.DaragonA Tfr
63 kVA
L.DaragonA
63 kVA
L.DaragonB Tfr
16 kVA
L.DaragonB
16 kVA
Janygon.T
63 kVA
Janygon.T Tfr
63 kVA
Janygon
63 kVA
Janygon Tfr
63 kVA
TSE50.11
33 kV
Lhamoil
63 kVA
Lhamoil Tfr
63 kVA
Lhamoil B1
33 kV
LhamoiII
25 kVA
LhamoiII Tfr
25 kVA
TSE50.12
33 kV
LhamoiIII B1
33 kV
LhamoiIII Tfr
25 kVA
LhamoiIII
25 kVA
TSE50.10
33 kV
TSE50.9
33 kV
Khorsany GO B1
33 kV
Khorsany GO Tfr
25 kVA
Khorsany GO
25 kVA
TSE50.13
33 kV
TSE50.14
33 kV
Hatidunga Tfr
25 kVA
Hatidunga
25 kVA
LalikharkaB Convt.
AB
LalikharkaB Tfr
25 kVA
LalikharkaB
25 kVA
Lalikharka ORC B1
33 kV
Lalikharka ORC Tfr
25 kVA
Lalikharka ORC
25 kVA
LalikharkaC Tfr
25 kVA
LalikharkaC
25 kVA
98.62 %
98.61 %
98.6 %
3/3

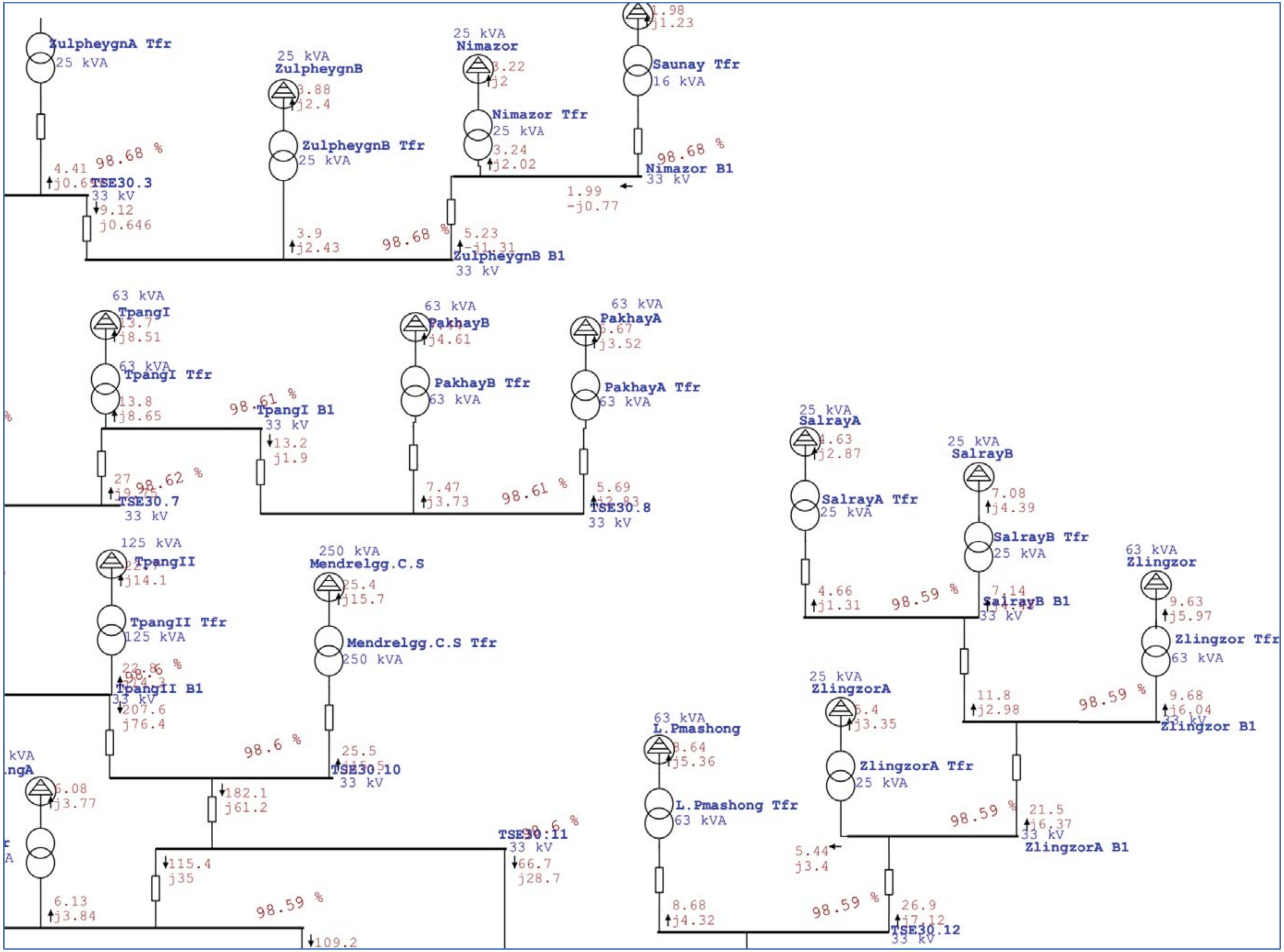
One-Line Diagram - OLV1=>Dagapela Feeder II (Load Flow Analysis)

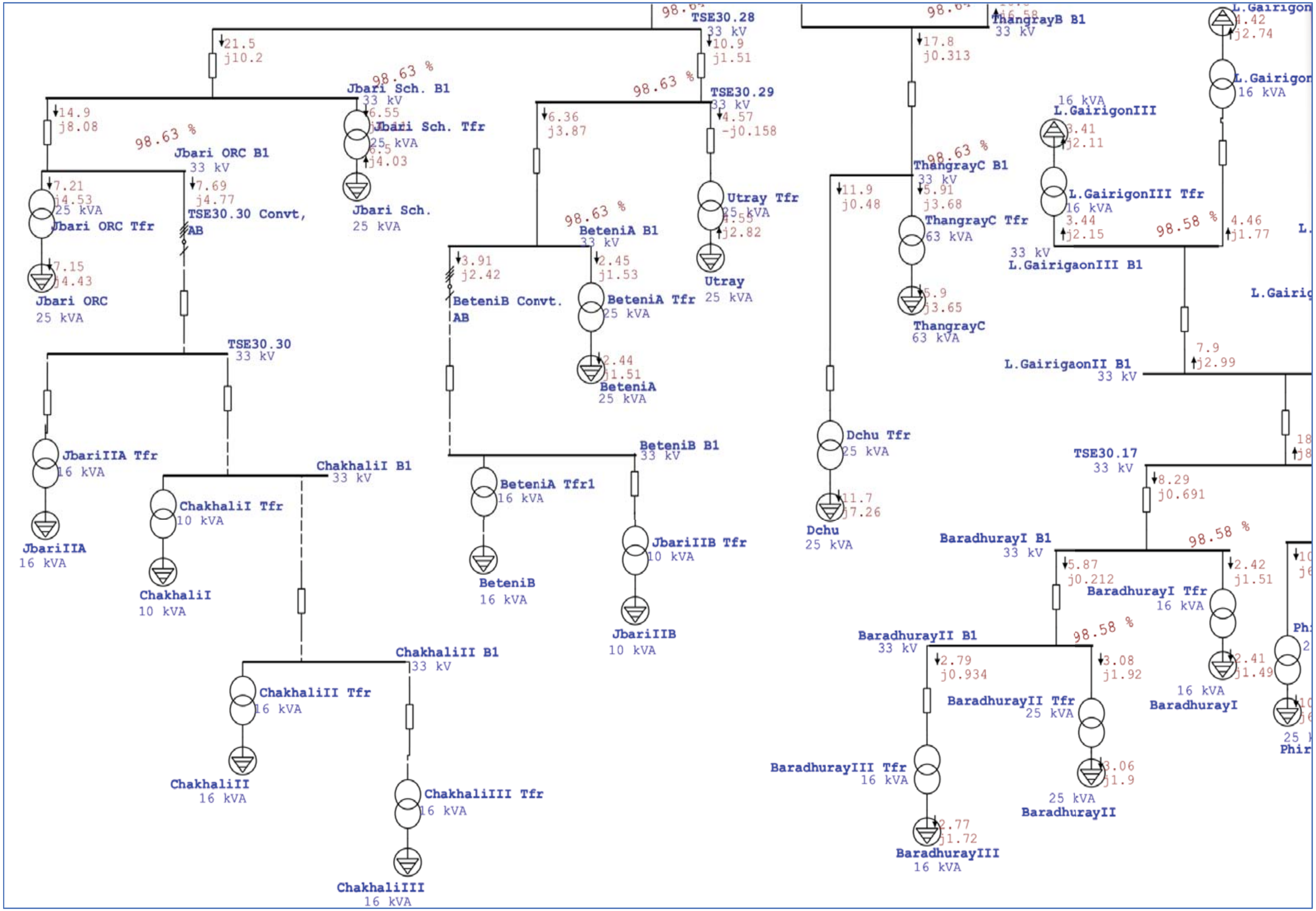


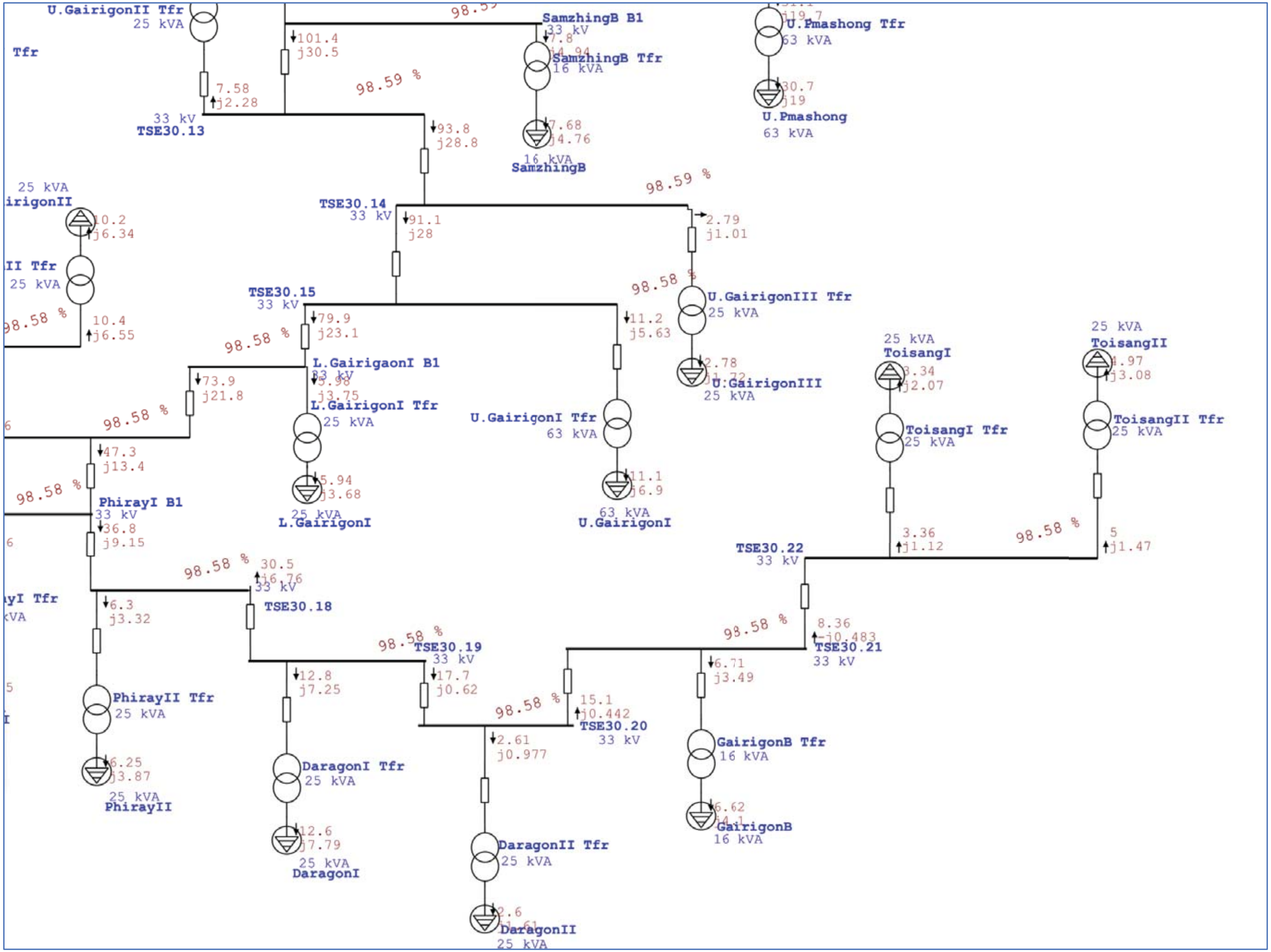
One-Line Diagram - OLV1=>Rangthaling Feeder (Load Flow Analysis)




TSE30.1
33 kV
DhajeyT1 Tfr
125 kVA
DhajeyT1
125 kVA
Nevarey B1
Nevarey Tfr
125 kVA
Nevarey
125 kVA
Samalgaon B1
Samalgaon Tfr
25 kVA
Samalgaon
25 kVA
RiserboA
RiserboA Tfr
RiserboA B1
BhulkayIIIA
16 kVA
BhulkayIIIA Tfr
BhulkayIIIA B1
TSE30.25
BhulkayIIIB Tfr
BhulkayIIIB
BhulkayIIIC Tfr
BhulkayIIIC
BhulkayI Top B1
BhulkayI Top Tfr
BhulkayI Top
TSE30.24
TSE30.23
TSE30.2
U.Rthaling
U.Rthaling Tfr
U.Rthaling B1
L.RthalingA
L.RthalingA Tfr
L.RthalingA B1
L.RthalingB Tfr
L.RthalingB B1
TSE30.4
RiserboB Tfr
RiserboB
RiserboC Tfr
RiserboC
125 kVA
TSE30.5
TSE30.6
Mkpani
Mkpani Tfr
Mkpani Convt
AB
Mendrelgg Tfr
Mendrelgg
BhulkayIIB B1
BhulkayIIB Tfr
BhulkayIIB
ThangrayA B1
ThangrayA Tfr
ThangrayA
TSE30.27
ThangrayB
ThangrayB Tfr
SamzhingA

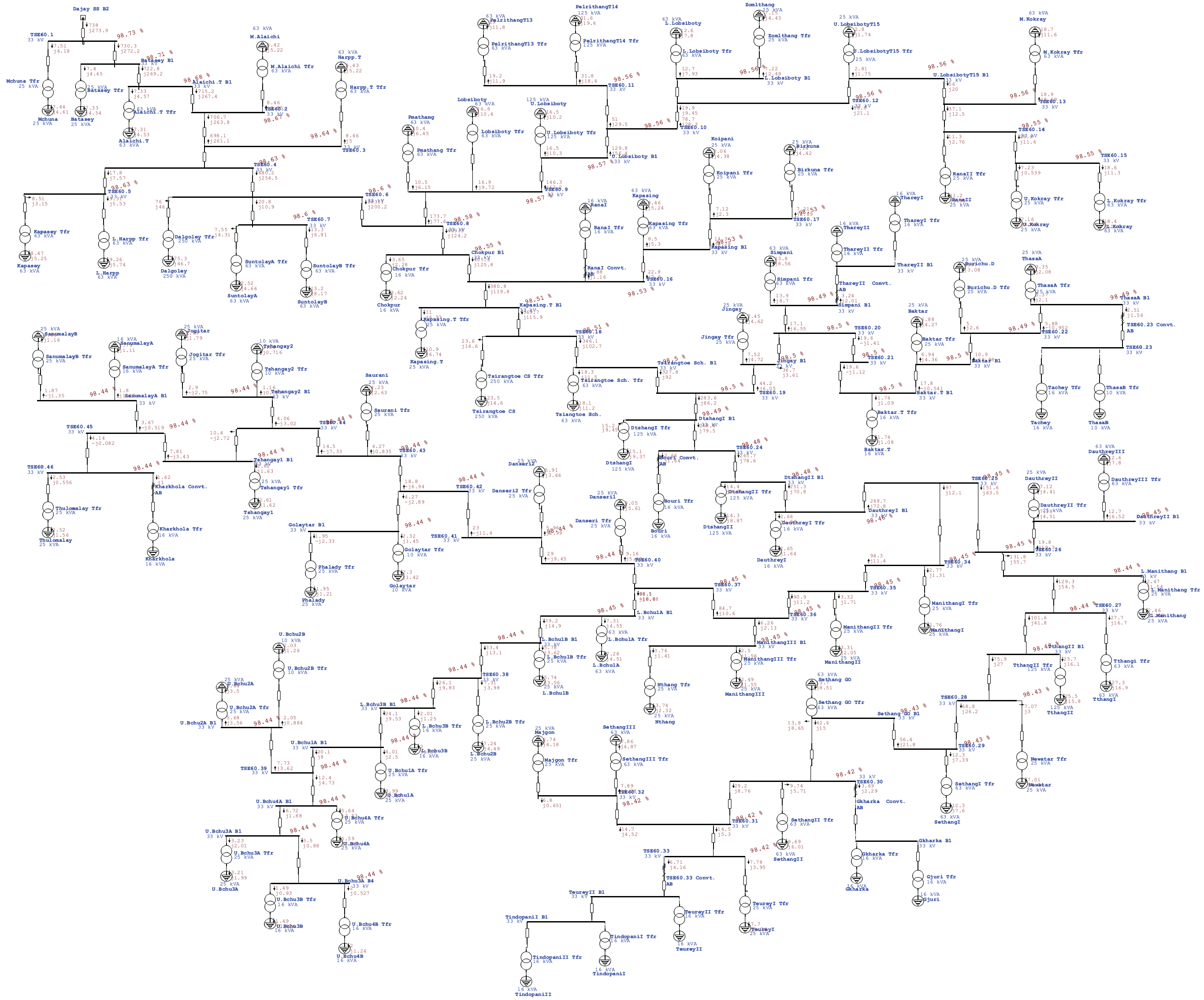

ZulpheygnA Tfr
25 kVA
4.41
98.68 %
TSE30.3
33 kV
9.12
j0.646
25 kVA
ZulpheygnB
3.88
j2.4
ZulpheygnB Tfr
25 kVA
3.9
j2.43
98.68 %
5.23
ZulpheygnB B1
33 kV
25 kVA
Nimazor
3.22
j2
Nimazor Tfr
25 kVA
3.24
j2.02
1.99
-j0.77
1.98
j1.23
Saunay Tfr
16 kVA
98.68 %
Nimazor B1
33 kV
63 kVA
TpangI
j8.51
63 kVA
TpangI Tfr
13.8
j8.65
27
98.62 %
TSE30.7
33 kV
98.61 %
TpangI B1
33 kV
13.2
j1.9
63 kVA
PakhayB
j4.61
PakhayB Tfr
63 kVA
7.47
j3.73
98.61 %
63 kVA
PakhayA
j3.52
PakhayA Tfr
63 kVA
5.69
TSE30.8
33 kV
125 kVA
TpangII
j14.1
TpangII Tfr
125 kVA
TpangII B1
33 kV
207.6
j76.4
250 kVA
Mendrelgg.C.S
25.4
j15.7
Mendrelgg.C.S Tfr
250 kVA
98.6 %
25.5
TSE30.10
33 kV
182.1
j61.2
6.08
j3.77
6.13
j3.84
115.4
j35
98.59 %
109.2
TSE30.11
33 kV
66.7
j28.7
25 kVA
SalrayA
j2.87
SalrayA Tfr
25 kVA
4.66
j1.31
98.59 %
25 kVA
SalrayB
7.08
j4.39
SalrayB Tfr
25 kVA
7.14
SalrayB B1
33 kV
63 kVA
Zlingzor
9.63
j5.97
Zlingzor Tfr
63 kVA
11.8
j2.98
98.59 %
9.68
j6.04
Zlingzor B1
63 kVA
L.Pmashong
j5.36
L.Pmashong Tfr
63 kVA
8.68
j4.32
25 kVA
ZlingzorA
j3.35
ZlingzorA Tfr
25 kVA
5.44
j3.4
98.59 %
21.5
j6.37
33 kV
ZlingzorA B1
98.59 %
26.9
TSE30.12
33 kV

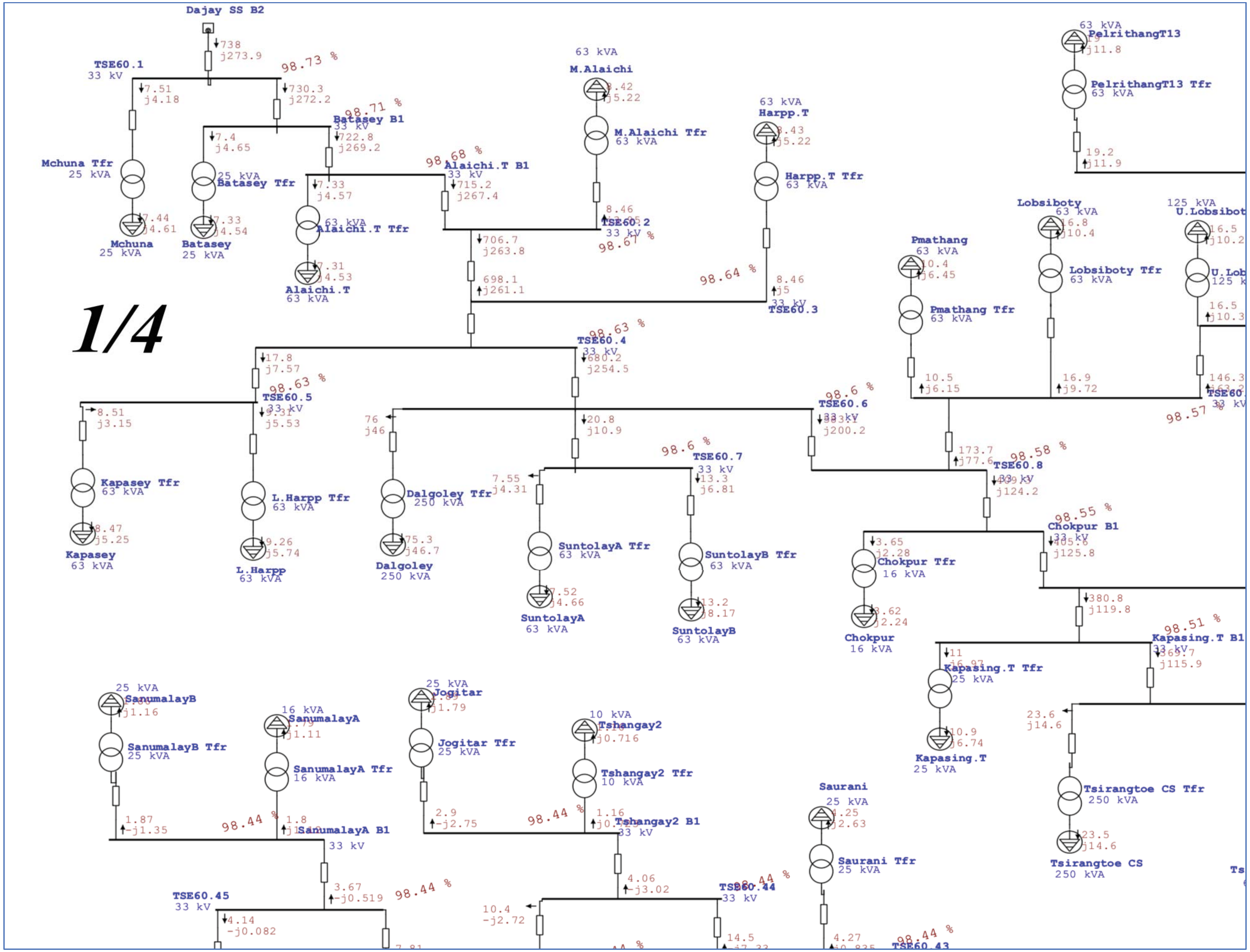

TSE30.28
33 kV
TSE30.29
33 kV
Jbari Sch. B1
Jbari Sch. Tfr
Jbari Sch.
25 kVA
Jbari ORC B1
33 kV
Jbari ORC Tfr
Jbari ORC
25 kVA
TSE30.30 Convt, AB
TSE30.30
33 kV
JbariIIA Tfr
16 kVA
JbariIIA
16 kVA
ChakhaliI B1
33 kV
ChakhaliI Tfr
10 kVA
ChakhaliI
10 kVA
ChakhaliII B1
33 kV
ChakhaliII Tfr
16 kVA
ChakhaliII
16 kVA
ChakhaliIII Tfr
16 kVA
ChakhaliIII
16 kVA
BeteniA B1
33 kV
BeteniA Tfr
25 kVA
BeteniA
25 kVA
BeteniB Convt. AB
BeteniB B1
33 kV
BeteniA Tfr1
16 kVA
BeteniB
16 kVA
JbariIIB Tfr
10 kVA
JbariIIB
10 kVA
Utray Tfr
25 kVA
Utray
25 kVA
ThangrayB B1
33 kV
ThangrayC B1
33 kV
ThangrayC Tfr
63 kVA
ThangrayC
63 kVA
Dchu Tfr
25 kVA
Dchu
25 kVA
L.GairigonIII
16 kVA
L.GairigonIII Tfr
16 kVA
L.GairigaonIII B1
33 kV
L.GairigaonII B1
33 kV
TSE30.17
33 kV
BaradhurayI B1
33 kV
BaradhurayI Tfr
16 kVA
BaradhurayI
16 kVA
BaradhurayII B1
33 kV
BaradhurayII Tfr
25 kVA
BaradhurayII
25 kVA
BaradhurayIII Tfr
16 kVA
BaradhurayIII
16 kVA
98.63 %
98.58 %

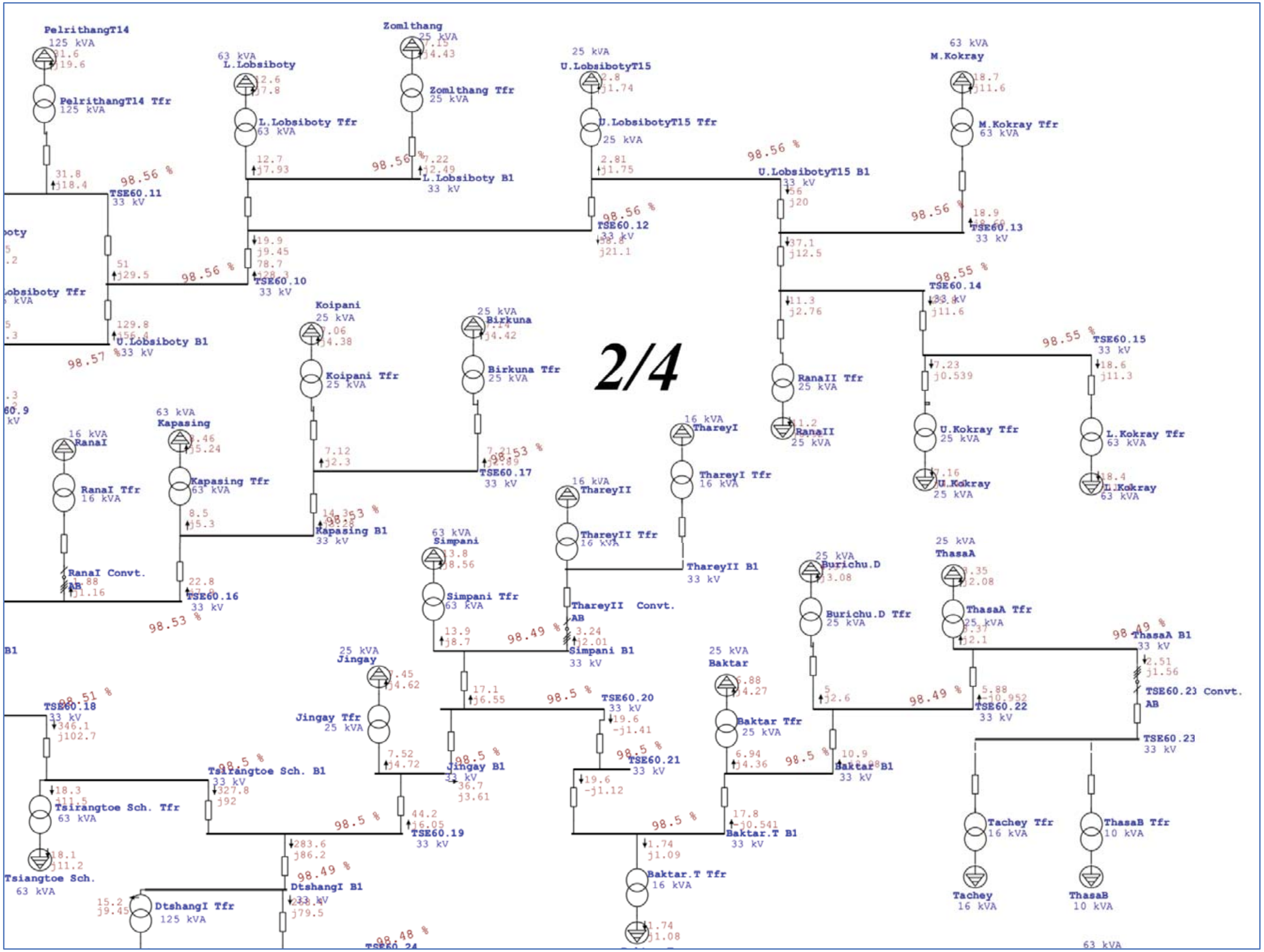


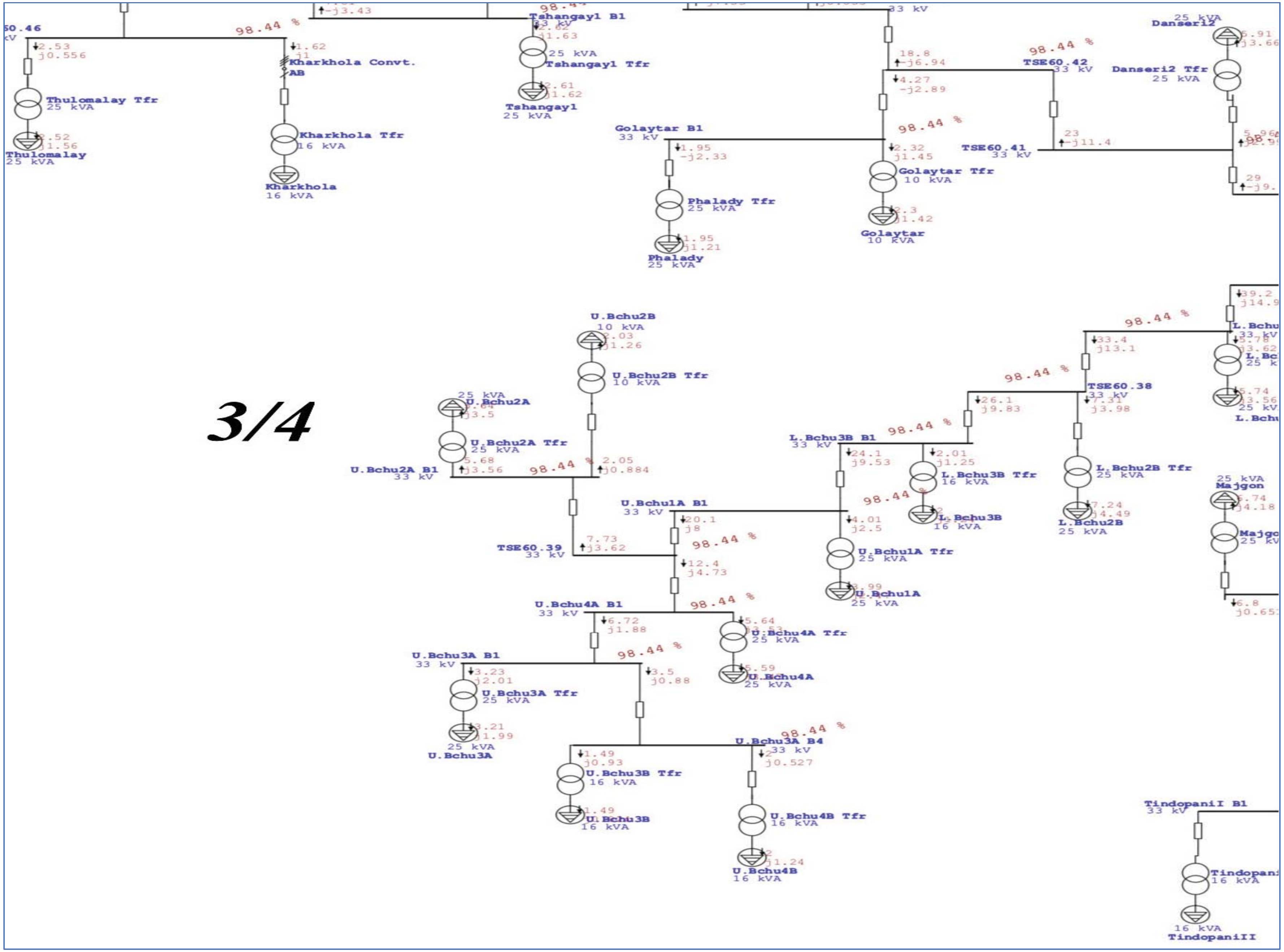
U.GairigonII Tfr
25 kVA
SamzhingB B1
33 kV
SamzhingB Tfr
16 kVA
SamzhingB
U.Pmashong Tfr
63 kVA
U.Pmashong
63 kVA
TSE30.13
33 kV
TSE30.14
33 kV
TSE30.15
33 kV
L.GairigaonI B1
33 kV
L.GairigonI Tfr
25 kVA
L.GairigonI
U.GairigonI Tfr
63 kVA
U.GairigonI
U.GairigonIII Tfr
25 kVA
U.GairigonIII
ToisangI
ToisangI Tfr
ToisangII
ToisangII Tfr
PhirayI B1
PhirayII Tfr
PhirayII
TSE30.18
TSE30.19
TSE30.20
TSE30.21
TSE30.22
DaragonI Tfr
DaragonI
DaragonII Tfr
DaragonII
GairigonB Tfr
GairigonB
98.59 %
98.58 %
101.4
j30.5
7.58
j2.28
93.8
j28.8
91.1
j28
2.79
j1.01
79.9
j23.1
11.2
j5.63
73.9
j21.8
47.3
j13.4
36.8
j9.15
30.5
6.3
j3.32
12.8
j7.25
17.7
j0.62
15.1
j0.442
2.61
j0.977
6.71
j3.49
8.36
3.36
j1.12
5
j1.47

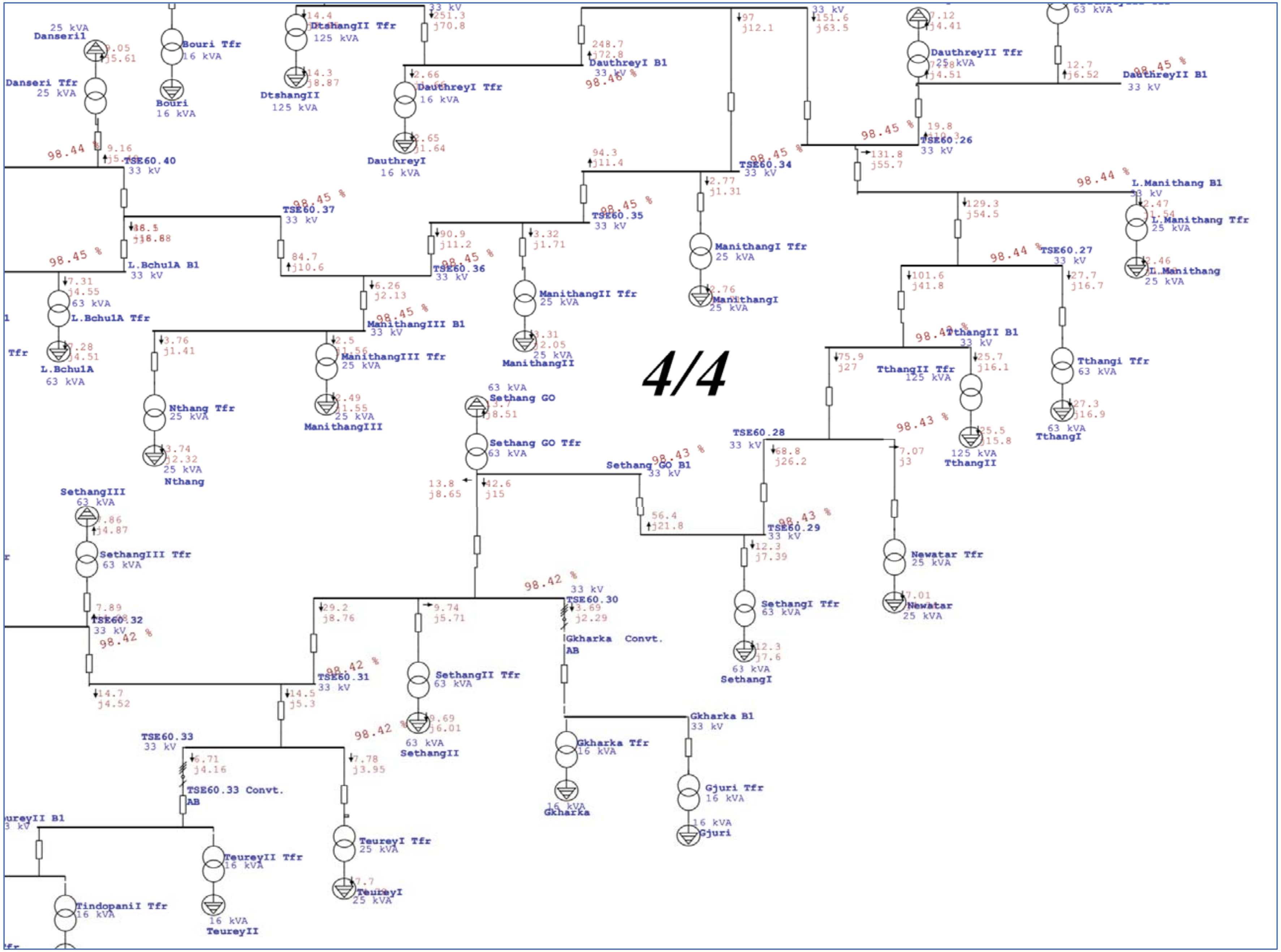
One-Line Diagram - OLV1=>Tsholingkhar Feeder (Load Flow Analysis)




1/4
Dajay SS B2
TSE60.1
33 kV
Mchuna Tfr
25 kVA
Mchuna
25 kVA
Batasey B1
Batasey Tfr
25 kVA
Batasey
25 kVA
Alaichi.T B1
Alaichi.T Tfr
63 kVA
Alaichi.T
63 kVA
TSE60.2
M.Alaichi Tfr
63 kVA
M.Alaichi
63 kVA
TSE60.3
Harpp.T Tfr
63 kVA
Harpp.T
63 kVA
TSE60.4
TSE60.5
L.Harpp Tfr
63 kVA
L.Harpp
63 kVA
Kapasey Tfr
63 kVA
Kapasey
63 kVA
TSE60.6
Dalgoley Tfr
250 kVA
Dalgoley
250 kVA
TSE60.7
SuntolayA Tfr
63 kVA
SuntolayA
63 kVA
SuntolayB Tfr
63 kVA
SuntolayB
63 kVA
TSE60.8
Pmathang Tfr
63 kVA
Pmathang
63 kVA
Lobsiboty Tfr
63 kVA
Lobsiboty
63 kVA
U.Lobsiboty
125 kVA
PelrithangT13 Tfr
63 kVA
PelrithangT13
63 kVA
Chokpur B1
Chokpur Tfr
16 kVA
Chokpur
16 kVA
Kapasing.T B1
Kapasing.T Tfr
25 kVA
Kapasing.T
25 kVA
Tsirangtoe CS Tfr
250 kVA
Tsirangtoe CS
250 kVA
Saurani Tfr
25 kVA
Saurani
25 kVA
TSE60.43
TSE60.44
33 kV
Tshangay2 B1
Tshangay2 Tfr
10 kVA
Tshangay2
10 kVA
Jogitar Tfr
25 kVA
Jogitar
25 kVA
SanumalayA B1
SanumalayA Tfr
16 kVA
SanumalayA
16 kVA
SanumalayB Tfr
25 kVA
SanumalayB
25 kVA
TSE60.45
33 kV


2/4
PelrithangT14
125 kVA
PelrithangT14 Tfr
125 kVA
TSE60.11
33 kV
L.Lobsiboty
63 kVA
L.Lobsiboty Tfr
63 kVA
Zomlthang
25 kVA
Zomlthang Tfr
25 kVA
L.Lobsiboty B1
33 kV
TSE60.10
33 kV
U.Lobsiboty B1
33 kV
U.LobsibotyT15
25 kVA
U.LobsibotyT15 Tfr
25 kVA
TSE60.12
33 kV
U.LobsibotyT15 B1
33 kV
M.Kokray
63 kVA
M.Kokray Tfr
63 kVA
TSE60.13
33 kV
TSE60.14
33 kV
TSE60.15
33 kV
RanaII Tfr
25 kVA
RanaII
25 kVA
U.Kokray Tfr
25 kVA
U.Kokray
25 kVA
L.Kokray Tfr
63 kVA
L.Kokray
63 kVA
Koipani
25 kVA
Koipani Tfr
25 kVA
Birkuna
25 kVA
Birkuna Tfr
25 kVA
TSE60.17
33 kV
Kapasing
63 kVA
Kapasing Tfr
63 kVA
Kapasing B1
33 kV
RanaI
16 kVA
RanaI Tfr
16 kVA
RanaI Convt.
AB
TSE60.16
33 kV
ThareyI
16 kVA
ThareyI Tfr
16 kVA
ThareyII
16 kVA
ThareyII Tfr
16 kVA
ThareyII B1
33 kV
ThareyII Convt.
AB
Simpani
63 kVA
Simpani Tfr
63 kVA
Simpani B1
33 kV
TSE60.20
33 kV
TSE60.21
33 kV
Jingay
25 kVA
Jingay Tfr
25 kVA
Jingay B1
33 kV
TSE60.19
33 kV
TSE60.18
33 kV
Tsirangtoe Sch. B1
33 kV
Tsirangtoe Sch. Tfr
63 kVA
Tsiangtoe Sch.
63 kVA
DtshangI B1
33 kV
DtshangI Tfr
125 kVA
Baktar
25 kVA
Baktar Tfr
25 kVA
Baktar B1
33 kV
Baktar.T B1
33 kV
Baktar.T Tfr
16 kVA
Burichu.D
25 kVA
Burichu.D Tfr
25 kVA
TSE60.22
33 kV
ThasaA
25 kVA
ThasaA Tfr
25 kVA
ThasaA B1
33 kV
TSE60.23 Convt.
AB
TSE60.23
33 kV
Tachey Tfr
16 kVA
Tachey
16 kVA
ThasaB Tfr
10 kVA
ThasaB
10 kVA
63 kVA


3/4
Thulomalay Tfr
25 kVA
Thulomalay
25 kVA
Kharkhola Convt.
AB
Kharkhola Tfr
16 kVA
Kharkhola
16 kVA
Tshangay1 B1
Tshangay1 Tfr
25 kVA
Tshangay1
25 kVA
Golaytar B1
33 kV
Phalady Tfr
25 kVA
Phalady
25 kVA
Golaytar Tfr
10 kVA
Golaytar
10 kVA
TSE60.42
33 kV
TSE60.41
33 kV
Danseri2 Tfr
25 kVA
Danseri2
25 kVA
98.44 %
U.Bchu2B
10 kVA
U.Bchu2B Tfr
10 kVA
U.Bchu2A
25 kVA
U.Bchu2A Tfr
25 kVA
U.Bchu2A B1
33 kV
TSE60.39
33 kV
U.Bchu1A B1
33 kV
U.Bchu1A Tfr
25 kVA
U.Bchu1A
25 kVA
L.Bchu3B B1
33 kV
L.Bchu3B Tfr
16 kVA
L.Bchu3B
16 kVA
TSE60.38
33 kV
L.Bchu2B Tfr
25 kVA
L.Bchu2B
25 kVA
Majgon
25 kVA
U.Bchu4A B1
33 kV
U.Bchu4A Tfr
25 kVA
U.Bchu4A
25 kVA
U.Bchu3A B1
33 kV
U.Bchu3A Tfr
25 kVA
U.Bchu3A
25 kVA
U.Bchu3A B4
33 kV
U.Bchu3B Tfr
16 kVA
U.Bchu3B
16 kVA
U.Bchu4B Tfr
16 kVA
U.Bchu4B
16 kVA
TindopaniI B1
33 kV
TindopaniII
16 kVA



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Danseri1
Danseri Tfr
Bouri Tfr
Bouri
DtshangII Tfr
DtshangII
DauthreyI Tfr
DauthreyI
DauthreyI B1
DauthreyII Tfr
DauthreyII B1
TSE60.26
TSE60.34
TSE60.35
TSE60.36
TSE60.37
TSE60.40
L.BchulA B1
L.BchulA Tfr
L.BchulA
ManithangI Tfr
ManithangI
ManithangII Tfr
ManithangII
ManithangIII B1
ManithangIII Tfr
ManithangIII
Nthang Tfr
Nthang
L.Manithang B1
L.Manithang Tfr
L.Manithang
TSE60.27
Tthangi Tfr
TthangI
TthangII B1
TthangII Tfr
TthangII
TSE60.28
Sethang GO
Sethang GO Tfr
Sethang GO B1
TSE60.29
SethangI Tfr
SethangI
Newatar Tfr
Newatar
TSE60.30
Gkharka Convt.
AB
Gkharka B1
Gkharka Tfr
Gkharka
Gjuri Tfr
Gjuri
SethangII Tfr
SethangII
SethangIII
SethangIII Tfr
TSE60.32
TSE60.31
TSE60.33
TSE60.33 Convt.
AB
TeureyI Tfr
TeureyI
TeureyII Tfr
TeureyII
TindopaniI Tfr

Annexure-I: MV Line Details of Tsirang Dzongkhag

Sl.No.	Source	Feeder details		Voltage (kV)	Section	CONDUCTOR	Conductor type & Line Length					Length (km)		
		Name	ID				3x95sq. mm UG	WOLF	DOG	RABBIT	AAAC	Section Length (km)	Cumulative Length (km)	Phase
1		33kV Damphu Feeder	TSE20	33	TSE20M000							0.000	0.000	3
					TSE20M001 to TSE20M008 (TSE20T1)	DG			625.758			0.626	0.626	3
					TSE20M008 to TSE20M015	DG			497.105			0.497	1.123	3
					TSE20M015 to TSE20M017 (TSE20T2)	DG			148.202			0.148	1.271	3
					TSE20M015 to TSE20M019 (TSE20T3)	DG			177.531			0.178	1.449	3
					TSE20M019 to TSE20M020	DG			86.456			0.086	1.535	3
					TSE20M020 to TSE20M104	DG			65.694			0.066	1.601	3
					TSE20M104 to TSE20M027	DG			402.555			0.403	2.003	3
					TSE20M027 to TSE20M028 (TSE20T4)	DG			30.953			0.031	2.034	3
					TSE20M028 to TSE20M032 (TSE20T5)	DG			202.394			0.202	2.237	3
					TSE20M027 to TSE20M039	DG			394.340			0.394	2.631	3
					TSE20M039 to TSE20M047 (TSE20T6)	DG			524.370			0.524	3.155	3
					TSE20M039 to TSE20M057	DG			804.867			0.805	3.960	3
					TSE20M057 to TSE20M061 (TSE20T7)	DG			241.199			0.241	4.201	3
					TSE20M057 to TSE20M066 (TSE20T8)	DG			250.081			0.250	4.452	3
					TSE20M066 to TSE20M073	DG			467.558			0.468	4.919	3
					TSE20M073 to TSE20M075 (TSE20T9)	DG			140.090			0.140	5.059	3
					TSE20M075 to TSE20M081 (TSE20T10)	DG			385.381			0.385	5.445	3
					TSE20M073 to TSE20M086	DG			366.714			0.367	5.811	3
					TSE20M086 to TSE20M088	DG			141.468			0.141	5.953	3
					TSE20M088 to TSE20M089 (TSE20T11)	DG			146.290			0.146	6.099	3
					TSE20M088 to TSE20M092	RAB				404.920		0.405	6.504	3
					TSE20M092 to TSE20M098 (TSE20T12)	RAB				448.959		0.449	6.953	3
					TSE20M086 to TSE20M103 (TSE20T13)	DG			437.596			0.438	7.390	3
					TSE20M104 to TSE20M107 (TSE20T14)	DG			240.442			0.240	7.631	3
					TSE20M020 to TSE20M110 (TSE20T15)	RAB				225.936		0.226	7.857	3
					TSE20M081 to TSE20M036 (TSE20T16)	RAB				281.350		0.281	8.138	
					TSE20M092 to TSE20M113 (TSE20T17 & 18)	RAB				422.876		0.423	8.561	3
					UG cable for CSS of Damphu Hospital (Pvt.)	UG	135					0.135	8.696	3
					TOTAL		**0**		**6777.043**	**1784.041**		**8.696**	**127.294**	
					TSE60M000									
					TSE60M001 to TSE60M010	DG			860.025			0.860	0.860	3
					TSE60M010 to TSE60M013 (TSE60T1)	DG			174.484			0.174	1.035	3
					TSE60M010 to TSE60M021 (TSE60T2)	DG			591.857			0.592	1.626	3
					TSE60M021 to TSE60M035 (TSE60T3)	DG			963.782			0.964	2.590	3
					TSE60M035 to TSE60M037	DG			127.849			0.128	2.718	3
					TSE60M037 to TSE60M043 (TSE60T4)	DG			433.109			0.433	3.151	3
					TSE60M037 to TSE60M053	DG			805.704			0.806	3.957	3
					TSE60M053 to TSE60M055 (TSE60T5)	DG			89.460			0.089	4.046	3
					TSE60M053 to TSE60M061	DG			336.629			0.337	4.383	3
					TSE60M061 to TSE60M066	RAB				379.793		0.380	4.763	3
					TSE60M066 to TSE60M068 (TSE60T6)	RAB				96.708		0.097	4.859	3
					TSE60M066 to TSE60M078 (TSE60T7)	RAB				745.143		0.745	5.605	3
					TSE60M061 to TSE60M090	DG			936.829			0.937	6.541	3
					TSE60M090 to TSE60M091	RAB				63.519		0.064	6.605	3
					TSE60M091 to TSE60M093 (TSE60T8)	RAB				133.974		0.134	6.739	3
					TSE60M091 to TSE60M101 (TSE60T9)	RAB				517.236		0.517	7.256	3
					TSE60M090 to TSE60M111 (TSE60T10)	RAB				613.034		0.613	7.869	3
					TSE60M090 to TSE60M117	DG			558.646			0.559	8.428	3
					TSE60M117 to TSE60M123	DG			463.756			0.464	8.892	3
					TSE60M123 to TSE60M125 (TSE60T11)	RAB				311.404		0.311	9.203	3

2	Dajey Substation (220/66/33 kV), 5 MVA (T1)	33kV Tsholingkhar Feeder	TSE60	33	TSE60M123 to TSE60M137 (TSE60T12)	DG			1169.472			1.169	10.372	3
					TSE60M137 to TSE60M143	DG			466.153			0.466	10.839	3
					TSE60M143 to TSE60M145	RAB				285.263		0.285	11.124	3
					TSE60M145 to TSE60M146 (TSE60T13)	RAB				47.542		0.048	11.171	3
					TSE60M145 to TSE60M153 (TSE60T14)	RAB				523.601		0.524	11.695	3
					TSE60M143 to TSE60M164	DG			738.263			0.738	12.433	3
					TSE60M164 to TSE60M168 (TSE60T15)	DG			222.276			0.222	12.656	3
					TSE60M164 to TSE60M173 (TSE60T16)	DG			313.132			0.313	12.969	3
					TSE60M173 to TSE60M182 (TSE60T17)	DG			669.102			0.669	13.638	3
					TSE60M123 to TSE60M185 (TSE60T18)	RAB				126.826		0.127	13.765	3
					TSE60M117 to TSE60M204 (TSE60T19)	DG			1290.079			1.290	15.055	3
					TSE60M204 to TSE60M222	DG			1022.812			1.023	16.077	3
					TSE60M222 to TSE60M225 (TSE60T20)	RAB				231.318		0.231	16.309	3
					TSE60M222 to TSE60M237 (TSE60T21)	RAB				1373.054		1.373	17.682	2
					TSE60M168 to TSE60M243	RAB				396.523		0.397	18.078	3
					TSE60M243 to TSE60M253	RAB				643.131		0.643	18.721	3
					TSE60M253 to TSE60M255	RAB				102.554		0.103	18.824	3
					TSE60M255 to TSE60M256 (TSE60T22)	RAB				104.628		0.105	18.929	3
					TSE60M253 to TSE60M267 (TSE60T23)	RAB				1440.730		1.441	20.369	3
					TSE60M243 to TSE60M282 (TSE60T24)	RAB				1101.135		1.101	21.471	3
					TSE60M255 to TSE60M297 (TSE60T25)	RAB				1381.205		1.381	22.852	3
					TSE60M222 to TSE60M309 (TSE60T26)	DG			1010.124			1.010	23.862	3
					TSE60M309 to TSE60M315	DG			466.142			0.466	24.328	3
					TSE60M315 to TSE60M318 (TSE60T27)	DG			268.912			0.269	24.597	3
					TSE60M318 to TSE60M320	DG			94.756			0.095	24.692	3
					TSE60M320 to TSE60M329 (TSE60T28)	DG			918.501			0.919	25.610	3
					TSE60M329 to TSE60M332	DG			222.375			0.222	25.833	3
					TSE60M332 to TSE60M336 (TSE60T29)	DG			392.487			0.392	26.225	3
					TSE60M336 to TSE60M351 (TSE60T30)	DG			1216.764			1.217	27.442	3
					TSE60M351 to TSE60M358	DG			934.532			0.935	28.376	3
					TSE60M358 to TSE60M361	DG			196.555			0.197	28.573	3
					TSE60M361 to TSE60M363 (TSE60T31)	DG			142.579			0.143	28.715	3
					TSE60M361 to TSE60M368	DG			495.743			0.496	29.211	3
					TSE60M368 to TSE60M370 (TSE60T32)	DG			125.951			0.126	29.337	3
					TSE60M368 to TSE60M379	DG			510.160			0.510	29.847	3
					TSE60M379 to TSE60M381 (TSE60T33)	DG			276.504			0.277	30.124	3
					TSE60M381 to TSE60M385 (TSE60T34)	RAB				321.644		0.322	30.445	3
					TSE60M379 to TSE60M392	DG			494.956			0.495	30.940	3
					TSE60M392 to TSE60M395 (TSE60T35)	DG			190.562			0.191	31.131	3
					TSE60M395 to TSE60M404 (TSE60T36)	DG			594.296			0.594	31.725	3
					TSE60M404 to TSE60M407	DG			243.794			0.244	31.969	3
					TSE60M407 to TSE60M411 (TSE60T37)	RAB				213.061		0.213	32.182	3
					TSE60M407 to TSE60M415 (TSE60T38)	RAB				333.078		0.333	32.515	3
					TSE60M415 to TSE60M418 (TSE60T39)	RAB				334.861		0.335	32.850	3
					TSE60M418 to TSE60M420	RAB				123.542		0.124	32.974	3
					TSE60M420 to TSE60M425 (TSE60T40)	RAB				286.217		0.286	33.260	3
					TSE60M425 to TSE60M427 (TSE60T41)	RAB				136.607		0.137	33.396	3
					TSE60M420 to TSE60M430 (TSE60T42)	RAB				233.969		0.234	33.630	3
					TSE60M430 to TSE60M433 (TSE60T43)	RAB				348.575		0.349	33.979	3
					TSE60M433 to TSE60M434 (TSE60T44)	RAB				200.439		0.200	34.179	3
					TSE60M434 to TSE60M436 (TSE60T45)	RAB				249.815		0.250	34.429	3
					TSE60M392 to TSE60M445	DG			891.672			0.892	35.321	3

TSE60M445 to TSE60M447 (TSE60T46)	RAB				98.814		0.099	35.420	3
TSE60M445 to TSE60M452	DG			335.882			0.336	35.756	3
TSE60M452 to TSE60M454 (TSE60T47)	RAB				254.697		0.255	36.010	3
TSE60M452 to TSE60M460	DG			516.171			0.516	36.526	3
TSE60M460 to TSE60M467 (TSE60T48)	RAB				698.097		0.698	37.225	3
TSE60M460 to TSE60M469	DG			147.040			0.147	37.372	3
TSE60M469 to TSE60M477 (TSE60T49)	RAB				634.628		0.635	38.006	3
TSE60M469 to TSE60M482	RAB				549.823		0.550	38.556	3
TSE60M482 to TSE60M486 (TSE60T50)	RAB				341.910		0.342	38.898	3
TSE60M482 to TSE60M490 (TSE60T51)	RAB				321.938		0.322	39.220	3
TSE60M490 to TSE60M500	RAB				977.717		0.978	40.198	3
TSE60M500 to TSE60M502 (TSE60T52)	RAB				99.730		0.100	40.297	3
TSE60M502 to TSE60M510 (TSE60T53)	RAB				869.669		0.870	41.167	3
TSE60M500 to TSE60M515	RAB				568.260		0.568	41.735	3
TSE60M515 to TSE60M518 (TSE60T83)	RAB				351.519		0.352	42.087	3
TSE60M320 to TSE60M528 (TSE60T54)	DG			747.193			0.747	42.834	3
TSE60M528 to TSE60M530	DG			500.873			0.501	43.335	3
TSE60M530 to TSE60M531	DG			92.016			0.092	43.427	3
TSE60M531 to TSE60M538 (TSE60T55)	RAB				576.658		0.577	44.004	3
TSE60M538 to TSE60M545 (TSE60T56)	RAB				665.143		0.665	44.669	3
TSE60M545 to TSE60M552	RAB				1597.881		1.598	46.267	3
TSE60M552 to TSE60M553 (TSE60T57)	RAB				184.329		0.184	46.451	3
TSE60M467 to TSE60M563 (TSE60T58)	RAB				1226.165		1.226	47.677	3
TSE60M486 to TSE60M577 (TSE60T59)	RAB				1577.152		1.577	49.254	3
TSE60M225 to TSE60M583	RAB				663.837		0.664	49.918	3
TSE60M583 to TSE60M589 (TSE60T60)	RAB				564.188		0.564	50.482	3
TSE60M583 to TSE60M597 (TSE60T61)	RAB				749.214		0.749	51.231	3
TSE60M332 to TSE60M606 (TSE60T62)	RAB				714.780		0.715	51.946	2
TSE60M530 to TSE60M623 (TSE60T63)	RAB				1440.358		1.440	53.387	3
TSE60M623 to TSE60M640 (TSE60T64)	RAB				1552.250		1.552	54.939	2
TSE60M640 to TSE60M647 (TSE60T65)	RAB				730.900		0.731	55.670	2
TSE60M358 to TSE60M656	DG			794.479			0.794	56.464	3
TSE60M656 to TSE60M658 (TSE60T66)	RAB				256.515		0.257	56.721	3
TSE60M658 to TSE60M662 (TSE60T67)	RAB				485.444		0.485	57.206	3
TSE60M656 to TSE60M663 (TSE60T68)	DG			132.884			0.133	57.339	3
TSE60M663 to TSE60M678	DG			1321.715			1.322	58.661	3
TSE60M678 to TSE60M683 (TSE60T69)	DG			249.022			0.249	58.910	3
TSE60M678 to TSE60M689 (TSE60T70)	DG			411.669			0.412	59.321	3
TSE60M689 to TSE60M695	DG			720.501			0.721	60.042	3
TSE60M695 to TSE60M700 (TSE60T71)	DG			470.846			0.471	60.513	3
TSE60M695 to TSE60M711	DG			976.277			0.976	61.489	3
TSE60M711 to TSE60M713 (TSE60T72)	DG			108.082			0.108	61.597	3
TSE60M711 to TSE60M718	DG			527.893			0.528	62.125	3
TSE60M718 to TSE60M800 (TSE60T84)	DG			80.306			0.080	62.205	3
TSE60M800 to TSE60M725	DG			585.649			0.586	62.791	3
TSE60M725 to TSE60M727 (TSE60T73)	DG			120.536			0.121	62.912	3
TSE60M725 to TSE60M732 (TSE60T74)	RAB				678.956		0.679	63.591	2
TSE60M732 to TSE60M738 (TSE60T75)	RAB				886.994		0.887	64.478	2
TSE60M725 to TSE60M742	DG			346.298			0.346	64.824	3
TSE60M742 to TSE60M743	DG			67.773			0.068	64.892	3
TSE60M743 to TSE60M745 (TSE60T76)	DG			276.584			0.277	65.168	3
TSE60M743 to TSE60M754 (TSE60T77)	RAB				1253.160		1.253	66.421	3
TSE60M742 to TSE60M760	RAB				972.458		0.972	67.394	3

					TSE60M760 to TSE60M763 (TSE60T78)	RAB				327.480		0.327	67.721	3
					TSE60M760 to TSE60M767 (TSE60T79)	RAB				526.146		0.526	68.247	2
					TSE60M767 to TSE60M777 (TSE60T80)	RAB				962.009		0.962	69.209	2
					TSE60M777 to TSE60M782 (TSE60T81)	RAB				506.445		0.506	69.716	2
					TSE60M515 to TSE60M799 (TSE60T82)	RAB				2534.442		2.534	72.250	2
					TSE60M315 to TSE60M801 (TSE60T85)	RAB				22.283		0.022	72.273	3
					TSE60M552 to TSE60M812 (TSE60T86)	RAB				1593.828		1.594	73.844	3
					TSE60M812 to TSE60M815	RAB				449.037		0.449	74.293	2
					TSE60M815 to TSE60M817 (TSE60T87)	RAB				296.567		0.297	74.590	2
					TSE60M815 to TSE60M837 (TSE60T88)	RAB				2367.477		2.367	76.957	2
					TOTAL				**31450.478**	**45529.027**		**76.980**	**4785.980**	
					TSE30M000									
					TSE30M001 to TSE30M005	DG			412.883			0.413	0.413	3
					TSE30M005 to TSE30M006 (TSE30T1)	DG			61.807			0.062	0.475	3
					TSE30M005 to TSE30M019 (TSE30T2)	DG			897.610			0.898	1.372	3
					TSE30M019 to TSE30M032 (TSE30T3)	DG			1256.377			1.256	2.629	3
					TSE30M032 to TSE30M038	DG			644.582			0.645	3.273	3
					TSE30M038 to TSE30M049	DG			1067.064			1.067	4.340	3
					TSE30M049 to TSE30M052 (TSE30T4)	DG			191.605			0.192	4.532	3
					TSE30M049 to TSE30M062	DG			1128.939			1.129	5.661	3
					TSE30M062 to TSE30M063 (TSE30T5)	DG			117.674			0.118	5.779	3
					TSE30M062 to TSE30M065	DG			267.351			0.267	6.046	3
					TSE30M065 to TSE30M067 (TSE30T6)	DG			160.720			0.161	6.207	3
					TSE30M065 to TSE30M073	DG			470.854			0.471	6.677	3
					TSE30M073 to TSE30M080	DG			894.707			0.895	7.572	3
					TSE30M080 to TSE30M086 (TSE30T7)	DG			258.814			0.259	7.831	3
					TSE30M080 to TSE30M089	DG			297.579			0.298	8.129	3
					TSE30M089 to TSE30M092 (TSE30T8)	RAB				152.894		0.153	8.281	3
					TSE30M089 to TSE30M100 (TSE30T9)	DG			609.384			0.609	8.891	3
					TSE30M100 to TSE30M101	DG			83.772			0.084	8.975	3
					TSE30M101 to TSE30M110	DG			824.307			0.824	9.799	3
					TSE30M110 to TSE30M119 (TSE30T10)	DG			934.897			0.935	10.734	3
					TSE30M119 to TSE30M124 (TSE30T11)	DG			481.309			0.481	11.215	3
					TSE30M110 to TSE30M128 (TSE30T12)	RAB				242.552		0.243	11.458	3
					TSE30M128 to TSE30M134	RAB				606.790		0.607	12.064	3
					TSE30M134 to TSE30M140 (TSE30T13)	RAB				376.273		0.376	12.441	3
					TSE30M134 to TSE30M150 (TSE30T14)	RAB				914.796		0.915	13.356	3
					TSE30M150 to TSE30M160 (TSE30T15)	RAB				1211.928		1.212	14.567	3
					TSE30M038 to TSE30M169 (TSE30T16)	RAB				399.235		0.399	14.967	3
					TSE30M169 to TSE30M181 (TSE30T17)	RAB				1148.239		1.148	16.115	3
					TSE30M181 to TSE30M185 (TSE30T18)	RAB				440.141		0.440	16.555	3
					TSE30M185 to TSE30M191	RAB				638.107		0.638	17.193	3
					TSE30M191 to TSE30M196 (TSE30T19)	RAB				708.538		0.709	17.902	3
					TSE30M191 to TSE30M198 (TSE30T20)	RAB				165.273		0.165	18.067	3
					TSE30M198 to TSE30M210 (TSE30T21)	RAB				880.384		0.880	18.947	3
					TSE30M210 to TSE30M216 (TSE30T22)	RAB				692.177		0.692	19.640	3
					TSE30M052 to TSE30M224	RAB				717.612		0.718	20.357	3
					TSE30M224 to TSE30M225 (TSE30T23)	RAB				66.200		0.066	20.423	3
					TSE30M225 to TSE30M231 (TSE30T24)	RAB				708.113		0.708	21.131	3
					TSE30M231 to TSE30M234	RAB				311.125		0.311	21.443	3
					TSE30M234 to TSE30M236 (TSE30T25)	RAB				206.419		0.206	21.649	3
					TSE30M234 to TSE30M241 (TSE30T26)	RAB				313.364		0.313	21.962	3

3		33kV Rangthangling Feeder	TSE30	33	TSE30M224 to TSE30M247 (TSE30T27)	RAB				632.417		0.632	22.595	3
					TSE30M247 to TSE30M265 (TSE30T28)	RAB				1635.655		1.636	24.230	3
					TSE30M265 to TSE30M269	RAB				391.026		0.391	24.621	3
					TSE30M269 to TSE30M276 (TSE30T29)	RAB				791.760		0.792	25.413	3
					TSE30M276 to TSE30M286 (TSE30T30)	RAB				1326.976		1.327	26.740	3
					TSE30M286 to TSE30M310 (TSE30T31)	RAB				2431.257		2.431	29.171	3
					TSE30M269 to TSE30M315	RAB				573.370		0.573	29.745	3
					TSE30M315 to TSE30M320 (TSE30T32)	RAB				684.961		0.685	30.430	3
					TSE30M320 to TSE30M323 (TSE30T33)	RAB				418.240		0.418	30.848	3
					TSE30M323 to TSE30M325	RAB				451.807		0.452	31.300	2
					TSE30M325 to TSE30M326 (TSE30T34)	RAB				41.009		0.041	31.341	2
					TSE30M315 to TSE30M334	RAB				756.519		0.757	32.097	3
					TSE30M334 to TSE30M335 (TSE30T35)	RAB				27.772		0.028	32.125	3
					TSE30M335 to TSE30M339 (TSE30T36)	RAB				282.418		0.282	32.408	2
					TSE30M339 to TSE30M341 (TSE30T37)	RAB				191.092		0.191	32.599	2
					TSE30M334 to TSE30M351 (TSE30T38)	RAB				1039.920		1.040	33.639	3
					TSE30M073 to TSE30M360 (TSE30T39)	RAB				924.837		0.925	34.563	2
					TSE30M160 to TSE30M368 (TSE30T40)	RAB				971.429		0.971	35.535	3
					TSE30M368 to TSE30M372 (TSE30T41)	RAB				553.535		0.554	36.088	3
					TSE30M325 to TSE30M382 (TSE30T42)	RAB				1418.748		1.419	37.507	2
					TSE30M382 to TSE30M388 (TSE30T43)	RAB				1087.417		1.087	38.595	2
					TSE30M388 to TSE30M391 (TSE30T44)	RAB				314.553		0.315	38.909	2
					TSE30M124 to TSE30M392	DG			174.070			0.174	39.083	3
					TSE30M392 to TSE30M397 (TSE30T45)	RAB				855.731		0.856	39.939	3
					TSE30M392 to TSE30M398	DG			88.817			0.089	40.028	3
					TSE30M398 to TSE30M401 (TSE30T46)	RAB				252.355		0.252	40.280	3
					TSE30M398 to TSE30M405	DG			249.463			0.249	40.530	3
					TSE30M405 to TSE30M410 (TSE30T47)	RAB				470.541		0.471	41.000	3
					TSE30M405 to TSE30M416 (TSE30T48)	DG			796.071			0.796	41.796	3
					TSE30M416 to TSE30M419	DG			323.529			0.324	42.120	3
					TSE30M419 to TSE30M420 (TSE30T49)	RAB				268.051		0.268	42.388	3
					TSE30M420 to TSE30M422 (TSE30T50)	RAB				320.938		0.321	42.709	3
					TSE30M422 to TSE30M425 (TSE30T51)	RAB				357.022		0.357	43.066	3
					TSE30M419 to TSE30M431	DG			663.891			0.664	43.730	3
					TSE30M431 to TSE30M432 (TSE30T52)	RAB				355.787		0.356	44.085	3
					TSE30M432 to TSE30M439 (TSE30T53)	RAB				911.391		0.911	44.997	3
					TSE30M439 to TSE30M441 (TSE30T54)	RAB				279.393		0.279	45.276	3
					TSE30M431 to TSE30M447 (TSE30T55)	DG			499.671			0.500	45.776	3
					TSE30M447 to TSE30M450	DG			302.546			0.303	46.078	3
					TSE30M450 to TSE30M455 (TSE30T56)	RAB				215.983		0.216	46.294	3
					TSE30M450 to TSE30M459	DG			362.828			0.363	46.657	3
					TSE30M459 to TSE30M462 (TSE30T57)	RAB				297.428		0.297	46.955	3
					TSE30M459 to TSE30M464	DG			261.043			0.261	47.216	3
					TSE30M464 to TSE30M466 (TSE30T58)	RAB				223.392		0.223	47.439	3
					TSE30M464 to TSE30M474	DG			837.726			0.838	48.277	3
					TSE30M474 to TSE30M475 (TSE30T59)	DG			244.476			0.244	48.521	3
					TSE30M474 to TSE30M483	DG			1004.121			1.004	49.525	3
					TSE30M483 to TSE30M486 (TSE30T60)	RAB				333.857		0.334	49.859	3
					TSE30M487 to TSE30M491 (TSE30T61)	DG			574.428			0.574	50.434	3
					TSE30M086 to TSE30M503	RAB				1607.718		1.608	52.041	3
					TSE30M503 to TSE30M505 (TSE30T62)	RAB				245.044		0.245	52.286	3
					TSE30M503 to TSE30M508 (TSE30T63)	RAB				319.915		0.320	52.606	3

	Dajey Substation (220/66/33 kV), 5 MVA (T2)				TSE30M101 to TSE30M511 (TSE30T64)	RAB				136.322		0.136	52.743	3
					TOTAL				**17444.912**	**35297.749**		**52.743**	**2563.301**	
4		33kV Dagapela Feeder II	TSE40	33	TSE40M000									
					TSE40M001 to TSE40M012	WOLF		889.538				0.890	0.890	3
					TSE40M012 to TSE40M023	WOLF		697.146				0.697	1.587	3
					TSE40M023 to TSE40M032	WOLF		741.104				0.741	2.328	3
					TSE40M032 to TSE40M042	WOLF		805.961				0.806	3.134	3
					TSE40M042 to TSE40M065	WOLF		1480.112				1.480	4.614	3
					TSE40M065 to TSE40M076	WOLF		738.634				0.739	5.352	3
					TSE40M076 to TSE40M095 (TSE40T1)	WOLF		1093.476				1.093	6.446	3
					TSE40M095 to TSE40M098	WOLF		158.644				0.159	6.605	3
					TSE40M023 to TSE40M104 (TSE40T2)	RAB				460.000		0.460	7.065	3
					TSE40M104 to TSE40M111 (TSE40T3)	RAB				748.809		0.749	7.813	3
					TSE40M111 to TSE40M116 (TSE40T4)	RAB				629.942		0.630	8.443	3
					TSE40M116 to TSE40M121 (TSE40T5)	RAB				390.982		0.391	8.834	3
					TSE40M032 to TSE40M123 (TSE40T6)	DG			56.239			0.056	8.891	3
					TSE40M123 to TSE40M128 (TSE40T7)	DG			292.755			0.293	9.183	3
					TSE40M042 to TSE40M131 (TSE40T8)	DG			158.802			0.159	9.342	3
					TSE40M131 to TSE40M139 (TSE40T9)	DG			581.079			0.581	9.923	3
					TSE40M065 to TSE40M150 (TSE40T10)	DG			798.256			0.798	10.721	3
					TSE40M076 to TSE40M151 (TSE40T11)	DG			57.172			0.057	10.779	3
					DAE50M001 to TSE40M185 (TSE40T13)	DG			2220.154			2.220	12.999	3
					TSE40M098 to TSE40M204	RAB				1635.381		1.635	14.634	3
					TSE40M204 to TSE40M210 (TSE40T14)	RAB				671.582		0.672	15.306	3
					TSE40M204 to TSE40M216 (TSE40T15)	RAB				420.425		0.420	15.726	3
					TSE40M012 to TSE40M217 (TSE40T12)	RAB				37.700		0.038	15.764	3
					TOTAL			**6604.614**	**4164.4564**	**4994.820**		**15.764**	**196.379**	
					TSE50M000									
					TSE50M001 to TSE50M018	DG			1036.854			1.0369	1.0369	3
					TSE50M018 to TSE50M022 (TSE50T1)	DG			268.844			0.2688	1.3057	3
					TSE50M018 to TSE50M026	DG			380.155			0.3802	1.6859	3
					TSE50M026 to TSE50M027	DG			74.713			0.0747	1.7606	3
					TSE50M027 to TSE50M034 (TSE50T2)	DG			964.073			0.9641	2.7246	3
					TSE50M034 to TSE50M043 (TSE50T3)	DG			661.235			0.6612	3.3859	3
					TSE50M023 to TSE50M051 (TSE50T4)	DG			849.875			0.8499	4.2357	3
					TSE50M051 to TSE50M060	DG			776.260			0.7763	5.0120	3
					TSE50M060 to TSE50M062 (TSE50T5)	DG			90.811			0.0908	5.1028	3
					TSE50M060 to TSE50M071 (TSE50T6)	DG			855.197			0.8552	5.9580	3
					TSE50M071 to TSE50M077 (TSE50T7)	DG			447.425			0.4474	6.4054	3
					TSE50M077 to TSE50M089	DG			807.140			0.8071	7.2126	3
					TSE50M089 to TSE50M095 (TSE50T8)	DG			355.960			0.3560	7.5685	3
					TSE50M095 to TSE50M099	DG			180.345			0.1803	7.7489	3
					TSE50M099 to TSE50M100 (TSE50T9)	DG			28.963			0.0290	7.7779	3
					TSE50M099 to TSE50M109	DG			744.219			0.7442	8.5221	3
					TSE50M109 to TSE50M116 (TSE50T10)	DG			386.972			0.3870	8.9090	3
					TSE50M109 to TSE50M136 (TSE50T11)	DG			1298.666			1.2987	10.2077	3
					TSE50M136 to TSE50M137	DG			81.762			0.0818	10.2895	3
					TSE50M137 to TSE50M140 (TSE50T12)	RAB				262.947		0.2629	10.5524	3
					TSE50M137 to TSE50M144 (TSE50T13)	RAB				204.574		0.2046	10.7570	3
					TSE50M137 to TSE50M156	DG			603.815			0.6038	11.3608	3
					TSE50M156 to TSE50M157 (TSE50T14)	DG			25.683			0.0257	11.3865	3
					TSE50M157 to TSE50M158	DG			193.170			0.1932	11.5797	3

5		33kV Dunglagang Feeder	TSE50	33	TSE50M158 to TSE50M164 (TSE50T15)	RAB				573.001		0.5730	12.1527	3
					TSE50M156 to TSE50M168 (TSE50T16)	RAB				278.111		0.2781	12.4308	3
					TSE50M168 to TSE50M174 (TSE50T17)	RAB				478.493		0.4785	12.9093	3
					TSE50M174 to TSE50M179 (TSE50T18)	RAB				460.120		0.4601	13.3694	3
					TSE50M179 to TSE50M186	RAB				420.609		0.4206	13.7900	3
					TSE50M186 to TSE50M188 (TSE50T19)	RAB				147.493		0.1475	13.9375	3
					TSE50M186 to TSE50M194 (TSE50T20)	RAB				338.305		0.3383	14.2758	3
					TSE50M156 to TSE50M199	DG			291.965			0.2920	14.5678	3
					TSE50M199 to TSE50M202 (TSE50T21)	DG			131.724			0.1317	14.6995	3
					TSE50M199 to TSE50M214	RAB				869.411		0.8694	15.5689	3
					TSE50M214 to TSE50M216 (TSE50T22)	RAB				108.904		0.1089	15.6778	3
					TSE50M216 to TSE50M222 (TSE50T23)	RAB				306.526		0.3065	15.9843	3
					TSE50M214 to TSE50M225 (TSE50T24)	RAB				262.124		0.2621	16.2464	3
					TSE50M225 to TSE50M232	RAB				439.127		0.4391	16.6856	3
					TSE50M232 to TSE50M233 (TSE50T25)	RAB				85.505		0.0855	16.7711	3
					TSE50M232 to TSE50M236 (TSE50T26)	RAB				184.914		0.1849	16.9560	3
					TSE50M236 to TSE50M241 (TSE50T27)	RAB				251.565		0.2516	17.2076	3
					TSE50M089 to TSE50M256 (TSE50T28)	RAB				985.735		0.9857	18.1933	3
					TSE50M089 to TSE50M268	DG			852.624			0.8526	19.0459	3
					TSE50M268 to TSE50M278 (TSE50T29)	RAB				646.272		0.6463	19.6922	3
					TSE50M268 to TSE50M283	DG			409.747			0.4097	20.1019	3
					TSE50M283 to TSE50M284 (TSE50T30)	DG			69.261			0.0693	20.1712	3
					TSE50M283 to TSE50M305	RAB				1527.875		1.5279	21.6991	3
					TSE50M305 to TSE50M312 (TSE50T31)	RAB				518.216		0.5182	22.2173	3
					TSE50M305 to TSE50M314 (TSE50T32)	RAB				241.553		0.2416	22.4588	3
					TSE50M314 to TSE50M319	RAB				272.686		0.2727	22.7315	3
					TSE50M319 to TSE50M323 (TSE50T33)	RAB				268.806		0.2688	23.0003	3
					TSE50M319 to TSE50M325 (TSE50T34)	RAB				172.134		0.1721	23.1725	3
					TSE50M325 to TSE50M336	RAB				996.597		0.9966	24.1691	3
					TSE50M336 to TSE50M341 (TSE50T35)	RAB				409.206		0.4092	24.5783	3
					TSE50M341 to TSE50M342	RAB				67.030		0.0670	24.6453	3
					TSE50M342 to TSE50M345 (TSE50T36)	RAB				248.340		0.2483	24.8936	3
					TSE50M342 to TSE50M353 (TSE50T37)	RAB				564.174		0.5642	25.4578	3
					TSE50M336 to TSE50M357	RAB				590.351		0.5904	26.0482	3
					TSE50M357 to TSE50M367 (TSE50T38)	RAB				1032.593		1.0326	27.0808	3
					TSE50M353 to TSE50M371	RAB				359.786		0.3598	27.4405	3
					TSE50M371 to TSE50M383 (TSE50T39)	RAB				1007.339		1.0073	28.4479	3
					TSE50M371 to TSE50M392	RAB				1041.092		1.0411	29.4890	3
					TSE50M392 to TSE50M397 (TSE50T40)	RAB				573.723		0.5737	30.0627	2
					TSE50M392 to TSE50M398 (TSE50T41)	RAB				52.562		0.0526	30.1153	3
					TSE50M398 to TSE50M405 (TSE50T42)	RAB				1033.704		1.0337	31.1490	3
					TSE50M357 to TSE50M406 (TSE50T43)	RAB				49.639		0.0496	31.1986	3
					TSE50M026 to TSE50M407 (TSE50T44)	RAB				41.743		0.0417	31.2403	3
					TOTAL				**12867.459**	**18372.881**		**31.240**	**1064.216**	
6	66/11kV, 5MVA, Basochhu Substation	11kV Taksha Feeder	TSE70	11	S70H595 to TSE70M024 (TSE70T1)	RAB				4051.248		4.051	4.051	3
					TSE70M024 to TSE70M032 (TSE70T2)	RAB				1072.745		1.073	5.124	3
					TSE70M032 to TSE70M036 (TSE70T3)	RAB				454.766		0.455	5.579	3
					TOTAL					**5578.759**		**5.579**	**14.754**	
7	0.415/6.6kV, 250kVA (T1), Changchay Power House Substation	6.6kV Changchay Feeder	TSE10	6.6	TSE10M001 to TSE10M010					569.260		0.569	0.569	3
					TSE10M010 to TSE10M015 (TSE10T2)					252.647		0.253	0.822	3

	Substation				TSE10M010 to TSE10M074 (TSE10T3, ICT X'mer)					2892.553		2.893	3.714	3
					TOTAL					**3714.460**		**3.714**	**5.106**	
	Total						**0.000**	**6604.614**	**72704.348**	**115271.737**	**0.000**	**194.716**	**8757.030**	

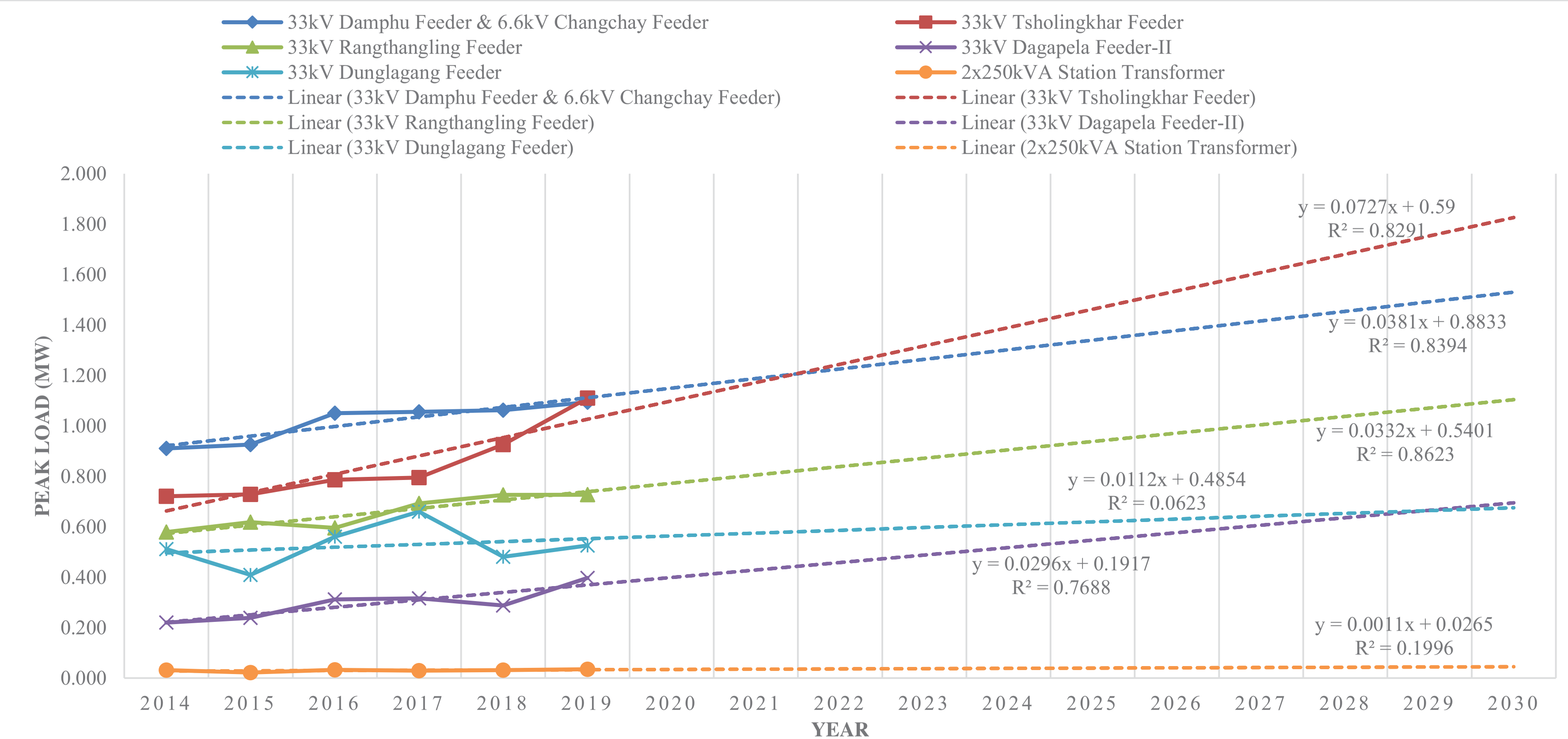
Annexure-2: IS 2026, IEC 60076 (Technical parameters for Distribution Lines and Transformers)

Sl. No.	Parameter	Requirement
1	Applicable standard	IS 2026, IEC 60076
2	Type	Oil filled[1] / two winding
3	Winding material	Copper
4	Core Material	CRGO silicon steel/Amorphous Metal
5	Cooling	Oil natural air natural (ONAN)
6	Terminations	
	· Primary	Outdoor Bushing or cable box[2]
	· Secondary	Outdoor Bushing or Cable box
7	Rated no load voltage	
	· Primary	33 kV or 11 kV
	· Secondary	415/240 V
8	% Impedance	
	10 kVA-24 kVA (1phase/3phase)	3%
	25 kVA-630 kVA	4%
	631 kVA-1250 kVA	5%
9	Vector group	Dyn11
10	Tap changer	
	· Type	Off load
	· Range	+5% to -5%
	· Step value	2.50%
11	Insulation Class (IEC-76)	A
12	Permissible Temperature rise	
	· Maximum winding temperature	55ºC
	· Max. Top oil temperature	50°C
13	Insulation levels	
	· Primary	170 kVp-70 kV/75 kVp-28 kV
	· Secondary	7500 Vp-3000 V

Annexure-3: Load Forecast adopting LRM & TSA

Load forecast for Tsirang Dzongkhag

Sl #	Power Source	Feeder Name	Peak Load (MW)						Forecasted Peak Load (MW)										
			2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
1	220/66/33kV, 2x5MVA, Dhajey Substation & 0.415/6.6kV, 250kVA, Changchay Micro-Hydel	33kV Damphu Feeder & 6.6kV Changchay Feeder	0.91	0.93	1.05	1.06	1.06	1.09	1.24	1.27	1.31	1.35	1.39	1.43	1.46	1.50	1.54	1.58	1.62
		33kV Tsholingkhar Feeder	0.72	0.73	0.79	0.80	0.93	1.11	1.07	1.15	1.22	1.29	1.36	1.44	1.51	1.58	1.66	1.73	1.80
		33kV Rangthangling Feeder	0.58	0.62	0.60	0.69	0.73	0.73	0.83	0.86	0.90	0.93	0.96	1.00	1.03	1.06	1.10	1.13	1.16
		33kV Dagapela Feeder-II	0.22	0.24	0.31	0.32	0.29	0.40	0.40	0.43	0.46	0.49	0.52	0.55	0.58	0.61	0.64	0.67	0.70
		33kV Dunglagang Feeder	0.51	0.41	0.56	0.66	0.48	0.53	0.62	0.63	0.64	0.65	0.67	0.68	0.69	0.70	0.71	0.72	0.73
		2x250kVA Station Transformer	0.03	0.02	0.03	0.03	0.03	0.04	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
2	66/33kV, 2x5MVA Basochu Substation	11kV Taksha Feeder (tapped from 11kV Jala Ula Feeder of ESD Wangdue)						1.27						1.62					1.90



Load forecast methodolgy

1. Load Forecast

1.1 Type of Load Forecast and Power System Planning

One of the power system planning element is the load forecast. Although, there are no documented standards specifying the type of planning however, the power system planning can be short-term planning (STP) (less than one year), medium-term planning (MTP) (1-3 years) and long-term planning (LTP) (3-10 years and even higher). It is necessary to predict the power requirement for a specified time-horizon which is referred to as load (power) forecasting based on the historical consumption pattern for better planning and optimizing the available resources. Analogy to power system planning, the load forecast can be also short-term load forecasting (STLF), medium-term load forecasting (MTLF) and long-term load forecasting (LTLF) and accordingly the distribution network expansion programs are proposed[1] for distributing the electricity.

There are number of driving factors which are listed below affecting the forecasted load.

a) Time
   - Hours of the day (day or night)
   - Day of the week (weekdays or weekend)
   - Time of the year (winter or summer season)

b) Weather conditions (temperature and humidity)

c) Type of customers (residential, commercial, industries etc.)

d) Population

e) Economic indicators (per capita income, Gross Domestic Product (GDP) etc.)

f) Prices of the electricity

As the DSMP is being developed for 10-year period, the load forecast has to be done for same time horizon. Therefore, some of the driving factors as listed above which affects the LTLF may not impact the accuracy as daily, weekly and monthly time factors and weather conditions will have minimum contribution to the load variance.

1.2 Methods of Load (LTLF) Forecast

The LTLF methods are generally the trend analysis or time series analysis, economic modelling, end-use analysis and hybrid analysis. As the DSMP is for 10-year period, the methods of LTFL is being outlined for forecasting the load[1].

1.2.1 Trend Analysis

In the trend analysis, the historical data (power) is used to forecast the load. The details on load forecast adopting power consumption trend is reflected in **Section 1.3.** Typical load forecast is as shown in **Figure 1.**

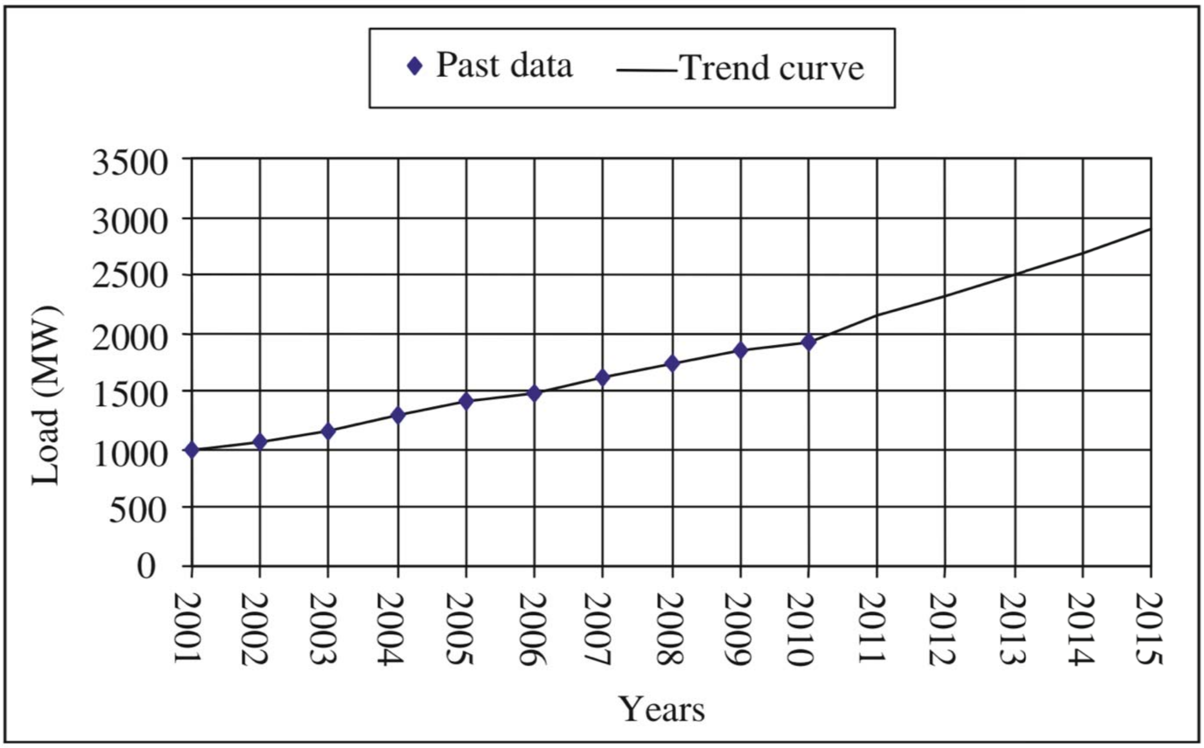


Figure 1: Typical trend curve[1]

1.2.2 Economic Modelling

In this method, the relationship between the load and the driving parameters are established and accordingly the future values of the driving factors are projected. Although, this approach is widely being used, as most of the data for driving factors are not available and for simplicity the trend analysis is adopted to forecast the load.

1.2.3 End-use Analysis

This approach is exclusively used for residential loads which is forecasted in terms of energy and therefore, it requires some methods to convert the predicted energy consumption to load (power demand). There is uncertainty in the accuracy of the predicted load and is also confined to residential customers. Therefore, end-use analysis approach is not adopted to predict the load.

1.2.4 Hybrid Analysis

Although, the end-use and econometric methods may be simultaneously used to forecast the load, it is not widely used as it has advantages and disadvantages of both the approaches.

1.3 Trend Line Analysis

The LTLF is carried out using the trend analysis approach and accordingly for planning the distribution system network. In order to forecast the load, the peak power demand prior to 2020 was considered and the power requirement trend is obtained. Load requirement is then predicted for next ten-year period (2020-2030) by extrapolating the trend line considering the load of 2019 as a base data. The case study of Punakha Dzongkhag is chosen to get insight of actual load forecast.

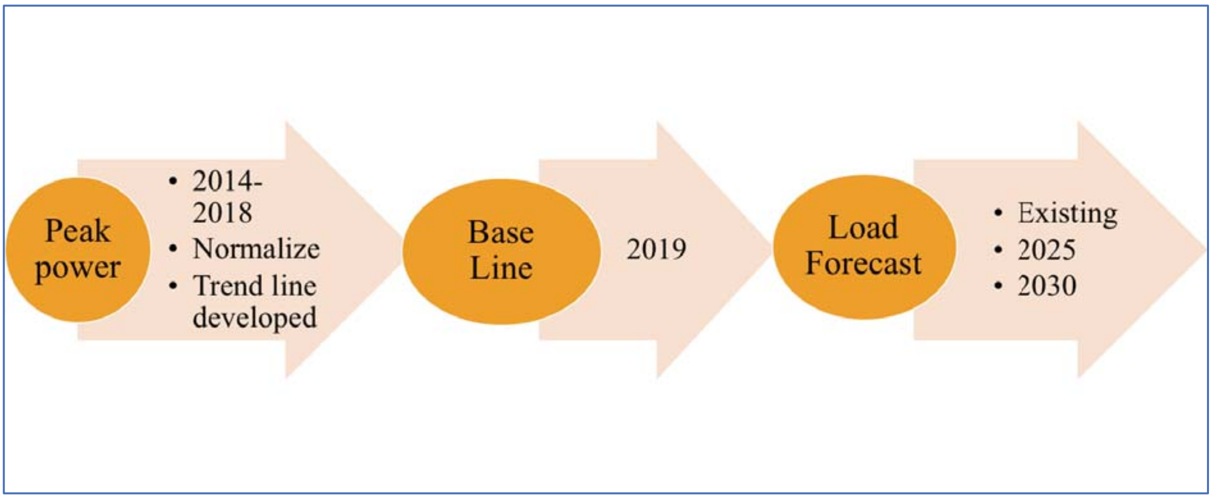


Figure 2: Flow diagram for load forecast

1.3.1 Normalizing the Data

Some of the distribution network do have ring feeders and multiple sources for better reliability and contingency. This in turn has resulted in abnormality in the power consumption data (recordings). Further, in the absence of meters or malfunctioning of the reading equipment or recorded data, some of the feeders have unreliable data for some of the years. Therefore, data is normalized by omitting the outliers or by taking the average of the past data (or average of preceding and future load if a year's data is missing). Such exercise is carried out for all the feeders and substation loads.

Table 1: Actual power data of Punakha Dzongkhag

Sl.No.	Name of Feeder	Consumption Pattern (MW)						
		2013	2014	2015	2016	2017	2018	2019
1	Feeder A	1.85	2.01	0.90	0.22	2.45	2.64	2.63
2	Feeder B	0.48	0.51	4.86	0.50	0.49	0.74	0.72
3	Feeder C	1.35	1.60	1.60	1.80	2.10	1.76	2.40
4	Feeder D	0.96	1.02	1.47	1.48	1.80	2.24	1.89
	Total	**4.64**	**5.14**	**8.83**	**4.00**	**6.84**	**7.37**	**7.64**

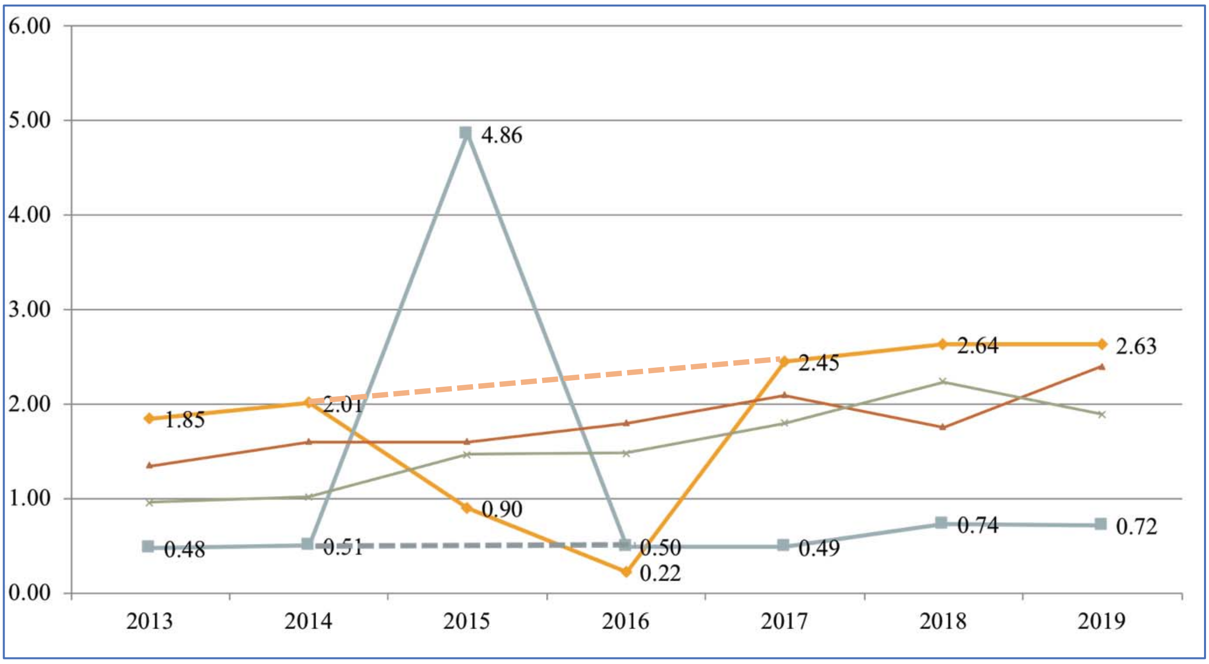


Figure 3: Actual data of Punakha Dzongkhag

$$x = \left(\frac{x_1 + x_2}{2}\right)$$

Where:
x is the normalized data

$x_1 and\ x_2 is\ the\ data\ for\ two\ years$

Table 2: Normalized power data of Punakha Dzongkhag

Sl.No.	Name of Feeder	Consumption Pattern (MW)						
		2013	2014	2015	2016	2017	2018	2019
1	Feeder A	1.85	2.01	1.93	1.97	2.45	2.64	2.63
2	Feeder B	0.48	0.51	0.49	0.50	0.49	0.74	0.72
3	Feeder C	1.35	1.60	1.60	1.80	2.10	1.76	2.40
4	Feeder D	0.96	1.02	1.47	1.48	1.80	2.24	1.89
	Total	**4.64**	**5.14**	**8.83**	**4.00**	**6.84**	**7.37**	**7.64**

1.3.2 Trend Line and Load Forecast

Based on the power data, the trend line is added to portray the power consumption pattern which gets generated as per the linear regression equation[1]. The trend line added is then extrapolated to forecast the load for next ten years which is as shown in **Figure 4.**

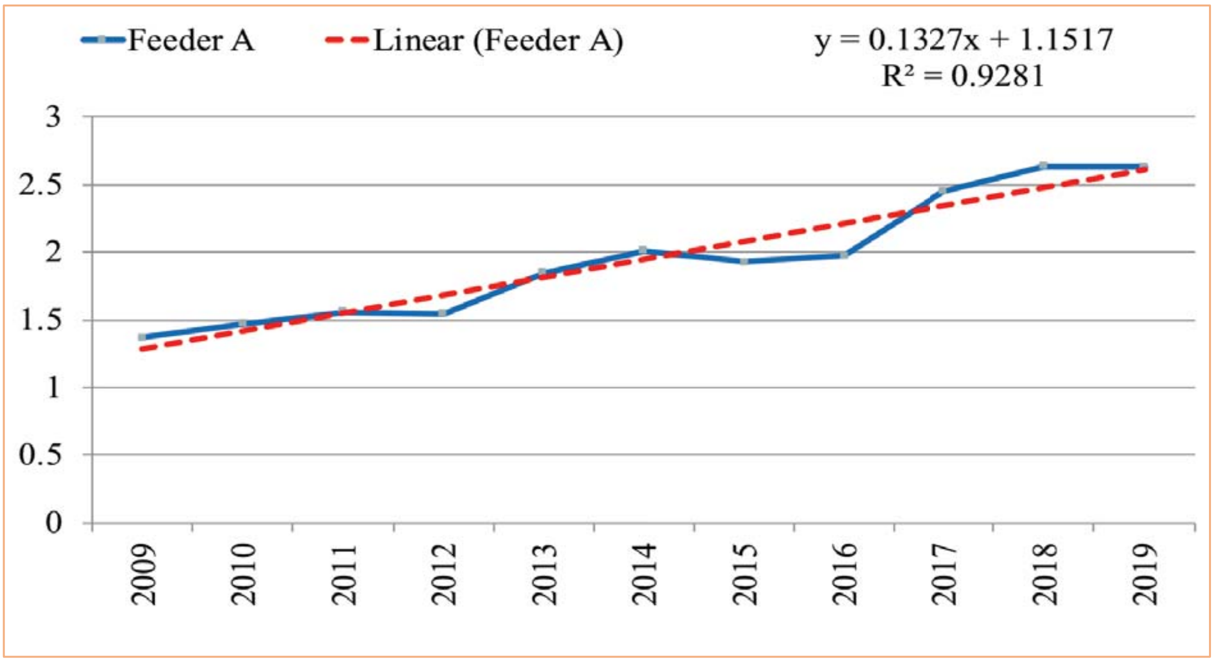


Figure 4: Trend line and load forecast for Punakha Dzongkhag

The trend line equation is given by[2]:

$$y = ax + b$$

Where:

$y -$ *Dependent variable or forecasted load*

$a -$ *Slope which is the average change in* y *for every increment of* x (*increase in year*) *It also gives how dependent variable changes when indepemended variable increases.*

$x -$ *is the independent variable or time in year*

$b -$ *is the intercept which is the predicted value of* y *when* x *is zero* (*time is zero*)

The Pearson correlation coefficient *'r',* which can take values between -1 & 1 corresponds to the linear relationship between variables x & y. If the r value is either -1 or 1, dependent variable can be perfectly explained by a linear function of the other.

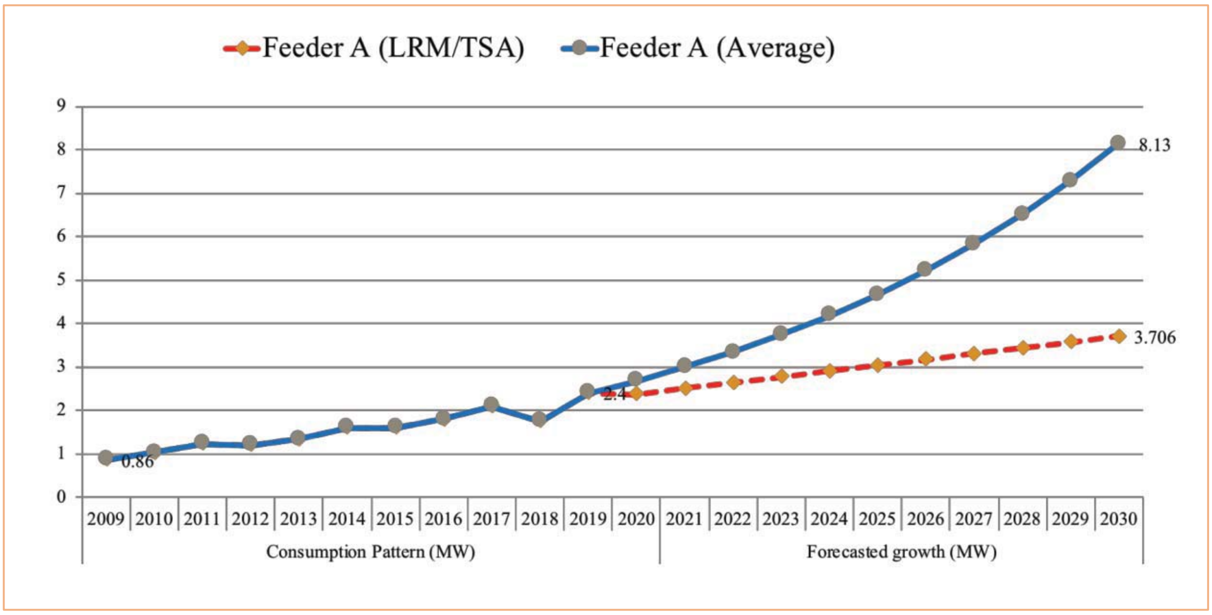


Figure 5: Forecasted load (trend line with red shows the linear regression and one with blue shows the forecast with average method)

2. Electrical Transient Analyser Program (ETAP) –Modelling and Load Flow Analysis

2.1 ETAP Software

"**ETAP** is an analytical engineering solution tool specializing in the simulation, design, monitoring, control, operator training, optimizing, and automating power systems[3]. ETAP's integrated digital platform offers the best comprehensive suite of enterprise solutions."
ETAP software is used in DSMP for modelling/designing, network simulation and to carry out the technical evaluation for distribution power system. The modelled network is fed with the essential data (such as specifications, constraints and parameters for network components) and the simulation results are assessed and analysed. Conclusively, different measures are considered and performed in ETAP for improving the efficiency of a system.

2.2 Load Flow Analysis (ETAP)

Load Flow Analysis (LFA) is a major tool to study and analyse the operation of a power system and determines voltage drops and power flow throughout the electrical system. Using network parameters (Input) for power sources, lines, transformers and connected loads, LFA provides voltages magnitude, real/reactive power, currents, and power losses as a result from the load flow simulation. The study also allows for swing, voltage regulated, and unregulated power sources with multiple power grids and generator connections and the analysis can be performed on both radial and loop systems.

Numerical analysis method such as Adaptive Newton-Raphson, Newton-Raphson, Fast Decoupled, & Accelerated Gauss Seidel methods are accessible in ETAP and can be used for solving the load flow analysis problems.

In this analysis, Adaptive Newton-Raphson method is used for load flow study of distribution networks and the study is carried out under 3-time horizon: present (2019), 2025 and 2030 (forecast load). The results (total generation, loading, system losses, and critical report of load flow) obtained under the scenarios are analysed and corresponding corrective measures are proposed.

2.2.1 Creating the Library

Although, the electrical parameters and specifications are inbuilt, to suit the requirements of the study, the missing electrical parameters are customized by creating a library. The units are set to metric system and accordingly the network is modelled and the relative data for network components such as transformers, line types, power sources and load details are fed in which are detailed as follows:

a) Transmission Cable

- Library-Transmission Line-Phase Conductor-Add-Transmission line library
- In transmission line library: change unit system into Metric, conductor type into ACSR and frequency into 50HZ, and Source name as BPC.
- Click BPC and click edit properties.
- In edit properties add the required conductor parameter by referring the Excel sheet (technical parameters.)
- For AAAC use the source name "Pirelli" and select the required size.

b) UG cable (Since 33kV Al UG Cable is not available):

- Library- Cable- Add-change the source name to BPC and make the necessary changes especially type of conductor to Aluminium and installation into non-magnetic.
- Change insulation type to XLPE.
- Select BPC from the Cable library table and click edit properties
- In edit properties add the required UG cable parameters referring the Excel sheet as shown in Pictures below.

c) Set Loading and Generation Categories.

- Go to Project- Settings- Loading and generation categories
- In Generation Category, set 3 categories as Maximum, Normal and Minimum.
- In AC Load, set 3 categories as 2019, 2025 and 2030.
- Keep the DC Load Empty.

2.2.2 Network Modelling and Load Flow Analysis

a) Draw Distribution Network (SLD).
b) Enter the height=8 and spacing =1.25 in the Transmission line table.
c) Enter the electrical parameters (kW, kVA, kV, etc.) ratings for power sources, transformers, line type, bus kV and loading details.

d) Under the Lump Load, in “Nameplate” edit and enter DT % loading and forecasted % loading details for 2019,2025,2030. Set the load type (80% as constant impedance and 20% as constant KVA) as most of the loads are impedance load.
e) Make sure to run the load flow for each composite network before you continue with other network. This is to avoid numerous errors at the end.
f) After completing the SLD, study case for different load scenarios needs to be created.
g) Switch to “Load Flow Analysis” mode in Mode Toolbar. Go to “Study Case,” select present Case 1 as 2019 and select “Prompt” in “Output Report”
h) Edit the “Load Flow Study Case [Brief Case Symbol].” Go to “Loading” and set to “2019” under Loading Category and set “Normal” under Generation Category. Check the Margins set under Alerts and set “Marginal (±5% for Over and Under Voltage Category)” and set “Critical (±10% for Over and Under Voltage Category)”
i) Close “Load Flow Study Case” and run “Run Load Flow” and save the result as 2019.
j) Similarly, follow step b), c) and d) for 2025 and 2030.
k) To generate the report (SLD drawings) in PDF, go to print preview- set up- change the printer name “Microsoft print to PDF”.

2.3 Consideration/Assumptions made while simulating in ETAP software

a) All Network is considered as balanced system as there is limitation of unbalanced system in ETAP Key.
b) The voltage level of ±10% is given as critical value which is indicated by red colour while simulating and voltage level of ±5% is given as marginal value which is indicated by pink colour while simulating.
c) The typical value of X/R ratio from ETAP inbuilt system is taken for all the power transformers for the simulation.
d) Some of the types of transmission cables /underground cables used in BPC are not available in ETAP library therefore, a new source is created in ETAP library by inserting all the parameters of those unavailable cables/transmission lines.
e) There are three cases created in ETAP simulation depending on the load forecast namely the 2019, 2025 and 2030 where the forecasted loads are given respectively and simulated/analysed accordingly.

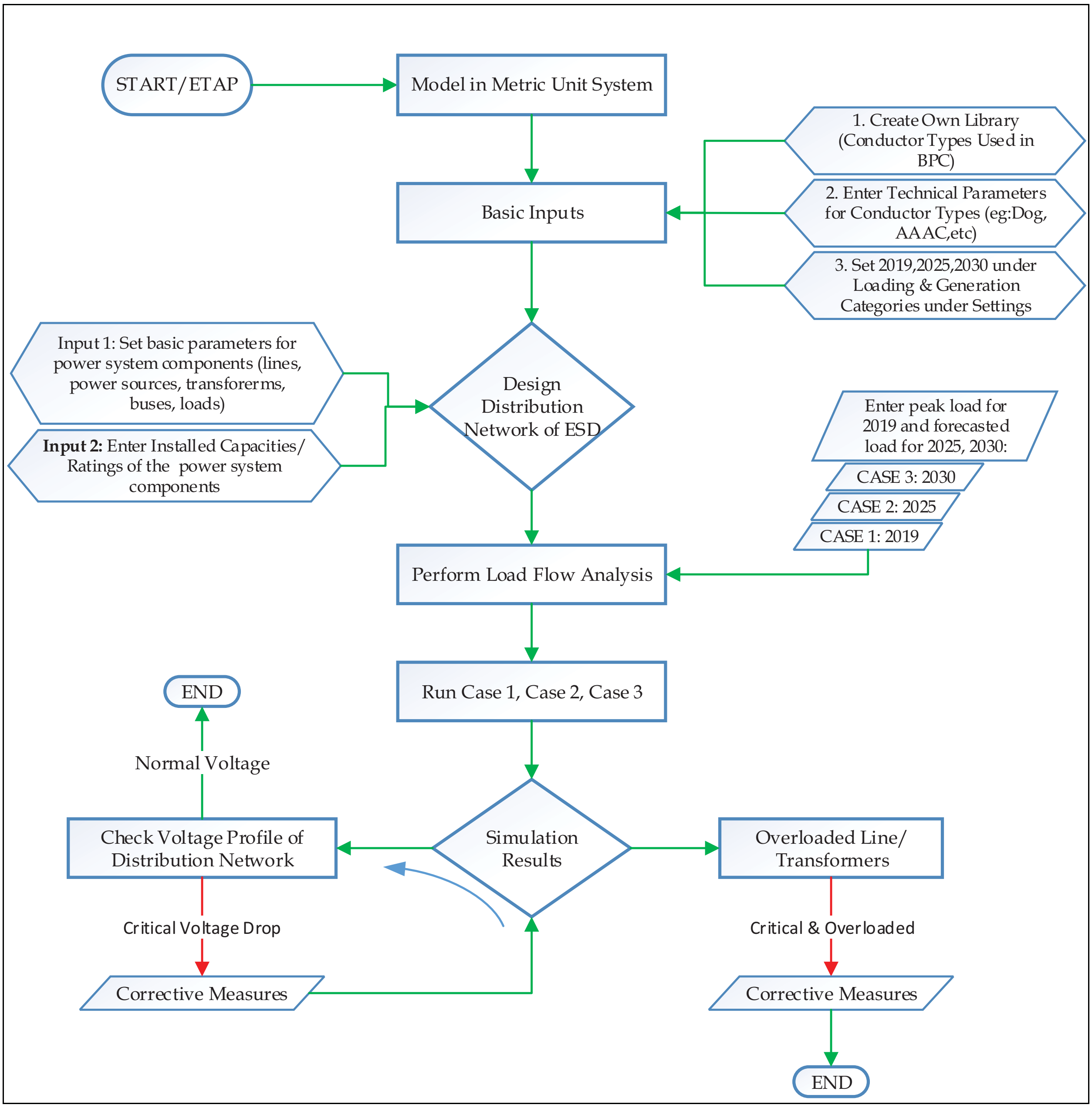


Figure 6: Flow Chart for Network Modelling & Load Flow Analysis (ETAP)

[1]Electric Power System Planning Issues, Algorithms and Solutions by Hossein Seifi Mohammad Sadegh Sepasian

[2]http://sites.utexas.edu/sos/guided/inferential/numeric/bivariate/cor/: dated September 29, 2020

[3]http://www.powerqualityworld.com/2011/05/etap-tutorials-load-flow-analysis.html dated September 30, 2020

Annexure 4: The Simulation Results

Bus Loading Summary Report

Bus			Directly Connected Load								Total Bus Load			
			Constant kVA		Constant Z		Constant I		Generic					Percent
ID	kV	Rated Amp	MW	Mvar	MW	Mvar	MW	Mvar	MW	Mvar	MVA	% PF	Amp	Loading
Alaichi.T B1	33.000										1.869	88.4	33.6	
Alaichi.T B2	0.415		0.004	0.002	0.013	0.008					0.020	85.0	28.5	
B.DCS B1	33.000										0.078	85.2	1.4	
B.DCS B2	0.415		0.008	0.005	0.031	0.019					0.046	85.0	66.7	
B.RECD O B1	33.000										0.049	84.6	0.9	
B.RECD O B2	0.415		0.009	0.005	0.032	0.020					0.048	85.0	69.7	
B.Vet Hosp. B1	33.000										0.133	84.0	2.4	
B.Vet.Hosp B2	0.415		0.024	0.015	0.084	0.052					0.127	85.0	189.5	
Baktar B1	33.000										0.044	92.8	0.8	
Baktar B2	0.415		0.003	0.002	0.012	0.007					0.018	85.0	26.9	
Baktar.T B1	33.000										0.048	93.5	0.9	
Baktar.T B2	0.415		0.001	0.001	0.003	0.002					0.005	85.0	6.8	
BaradhurayI B1	33.000										0.018	92.1	0.3	
BaradhurayI B2	0.415		0.001	0.001	0.004	0.002					0.006	85.0	8.0	
BaradhurayII B1	33.000										0.013	87.3	0.2	
BaradhurayII B2	0.415		0.001	0.001	0.005	0.003					0.007	85.0	10.2	
BaradhurayIII B1	33.000										0.006	84.6	0.1	
BaradhurayIII B2	0.415		0.001	0.001	0.004	0.003					0.006	85.0	9.2	
Batasey B1	33.000										1.889	88.4	33.9	
Batasey B2	0.415		0.004	0.002	0.013	0.008					0.019	85.0	28.6	
Below O.Court B1	33.000										0.049	84.6	0.9	
Below O.Court B2	0.415		0.009	0.005	0.032	0.020					0.048	85.0	69.5	
BeteniA B1	33.000		0.002	0.001	0.006	0.004					0.015	84.9	0.3	
BeteniA B2	0.415		0.001	0.001	0.004	0.002					0.006	85.0	8.1	
Bhalukhop B1	33.000										0.014	84.5	0.2	
Bhalukhop B2	0.415		0.002	0.002	0.009	0.006					0.013	85.0	19.7	
Bhalukop B1	33.000										0.013	84.5	0.2	
Bhalukop B2	0.415		0.002	0.001	0.009	0.005					0.013	85.0	19.0	
Bhudabaray B1	33.000										0.105	84.6	1.9	
Bhudabaray B2	0.415		0.019	0.012	0.069	0.043					0.103	85.0	149.6	
BhulkayI Top B1	33.000										0.042	88.8	0.8	
BhulkayI Top B2	0.415		0.003	0.002	0.011	0.007					0.016	85.0	24.1	
BhulkayIIB B1	33.000										0.166	91.4	3.0	
BhulkayIIB B2	0.415		0.003	0.002	0.011	0.007					0.017	85.0	24.7	
BhulkayIIIA B1	33.000										0.026	88.3	0.5	
BhulkayIIIA B2	0.415		0.001	0.001	0.004	0.002					0.005	85.0	7.7	
BhulkayIIIB B1	33.000										0.007	84.8	0.1	
BhulkayIIIB B2	0.415		0.001	0.001	0.004	0.003					0.006	85.0	9.3	
BhulkayIIIC B1	33.000										0.016	84.4	0.3	

Bus			Directly Connected Load								Total Bus Load			
			Constant kVA		Constant Z		Constant I		Generic					
ID	kV	Rated Amp	MW	Mvar	MW	Mvar	MW	Mvar	MW	Mvar	MVA	% PF	Amp	Percent Loading
BhulkayIIIC B2	0.415		0.003	0.002	0.010	0.006					0.015	85.0	22.2	
Bichgon ATop B1	33.000										0.009	84.7	0.2	
Bichgon ATop B2	0.415		0.002	0.001	0.006	0.004					0.009	85.0	12.7	
Bichgon B1	33.000										0.043	84.7	0.8	
Bichgon B2	0.415		0.008	0.005	0.029	0.018					0.043	85.0	61.8	
Bichgon BTop B1	33.000										0.019	84.7	0.3	
Bichgon BTop B2	0.415		0.003	0.002	0.012	0.008					0.019	85.0	26.7	
Birkuna B1	33.000										0.019	84.3	0.4	
Birkuna B2	0.415		0.004	0.002	0.012	0.008					0.019	85.0	27.9	
Burichu.D B1	33.000										0.014	84.5	0.2	
Burichu.D B2	0.415		0.002	0.002	0.009	0.005					0.013	85.0	19.4	
Changchey Dovan B1	33.000										0.107	84.6	1.9	
Changchey Dovan B2	0.415		0.019	0.012	0.070	0.043					0.105	85.0	152.2	
Changchey Plant B1	0.415										0.084	87.7	117.4	
Changchey Plant B2	6.600										0.083	88.0	7.4	
Changchey.B B1	6.600										0.009	84.8	0.8	
Changchey.B B2	0.415		0.002	0.001	0.006	0.004					0.009	85.0	13.3	
Chokpur B1	33.000										1.045	89.4	18.8	
Chokpur B2	0.415		0.002	0.001	0.006	0.004					0.010	85.0	14.1	
Dajay SS B1	66.000										6.777	86.9	59.3	
Dajay SS B2	33.000										3.525	86.9	63.2	
Dajay SS B3	33.000										3.307	87.5	59.3	
Dalgoley B1	33.000										0.205	84.2	3.7	
Dalgoley B2	0.415		0.037	0.023	0.132	0.082					0.199	85.0	294.2	
Damphu Hosp.CSS B1	33.000													
Danseri1 B1	33.000										0.025	84.1	0.4	
Danseri1 B2	0.415		0.005	0.003	0.016	0.010					0.024	85.0	35.4	
Danseri2 B1	0.415		0.003	0.002	0.010	0.006					0.016	85.0	23.1	
Danseri2 B2	33.000										0.016	84.4	0.3	
DaragonI B1	33.000										0.029	83.9	0.5	
DaragonI B2	0.415		0.005	0.003	0.018	0.011					0.028	85.0	42.1	
DaragonII B1	33.000										0.006	84.8	0.1	
DaragonII B2	0.415		0.001	0.001	0.004	0.002					0.006	85.0	8.6	
DauthreyI B1	33.000										0.638	89.6	11.5	
DauthreyI B2	0.415		0.001	0.001	0.005	0.003					0.007	85.0	10.3	
DauthreyII B1	33.000										0.053	85.6	1.0	
DauthreyII B2	0.415		0.004	0.002	0.012	0.008					0.019	85.0	27.8	
DauthreyIII B1	33.000										0.034	84.5	0.6	
DauthreyIII B2	0.415		0.006	0.004	0.022	0.014					0.033	85.0	49.1	
Dchu B1	33.000										0.027	84.0	0.5	
Dchu B2	0.415		0.005	0.003	0.017	0.011					0.026	85.0	39.2	
DCS B1	33.000										0.032	84.8	0.6	

Bus			Directly Connected Load								Total Bus Load			
			Constant kVA		Constant Z		Constant I		Generic					Percent
ID	kV	Rated Amp	MW	Mvar	MW	Mvar	MW	Mvar	MW	Mvar	MVA	% PF	Amp	Loading
DCS B2	0.415		0.006	0.004	0.021	0.013					0.031	85.0	45.4	
DhajeyT1 B1	33.000										0.126	84.1	2.3	
DhajeyT1 B2	0.415		0.023	0.014	0.080	0.050					0.122	85.0	180.3	
DLSS B1	33.000										0.053	80.8	0.9	
DLSS B2	0.415		0.009	0.005	0.032	0.020					0.047	85.0	68.7	
DtshangI B1	33.000										0.723	89.4	13.1	
DtshangI B2	0.415		0.007	0.005	0.027	0.017					0.041	85.0	58.9	
DtshangII B1	33.000										0.676	89.6	12.2	
DtshangII B2	0.415		0.007	0.004	0.026	0.016					0.038	85.0	55.8	
GagagoanA B1	33.000										0.033	88.2	0.6	
GagagoanA B2	0.415		0.002	0.001	0.006	0.004					0.009	85.0	12.5	
GagagoanB B1	33.000										0.025	86.4	0.5	
GagagoanB B2	0.415		0.002	0.001	0.008	0.005					0.012	85.0	17.9	
GairigonB B1	33.000										0.015	84.1	0.3	
GairigonB B2	0.415		0.003	0.002	0.010	0.006					0.015	85.0	22.1	
Golaytar B1	33.000										0.010	94.6	0.2	
Golaytar B2	0.415		0.001	0.001	0.004	0.003					0.006	85.0	9.0	
Harpp.T B1	33.000										0.023	84.7	0.4	
Harpp.T B2	0.415		0.004	0.003	0.015	0.009					0.023	85.0	32.9	
Hatidunga B1	33.000										0.006	84.8	0.1	
Hatidunga B2	0.415		0.001	0.001	0.004	0.002					0.006	85.0	8.5	
ICT B1	6.600										0.074	88.1	6.6	
ICT B2	33.000										0.073	88.4	1.3	
Janygon B1	33.000										0.038	84.4	0.7	
Janygon B2	0.415		0.007	0.004	0.025	0.015					0.037	85.0	54.4	
Janygon.T B1	33.000										0.035	84.5	0.6	
Janygon.T B2	0.415		0.006	0.004	0.023	0.014					0.035	85.0	50.8	
Jbari ORC B1	33.000		0.003	0.002	0.012	0.007					0.034	84.7	0.6	
Jbari ORC B2	0.415		0.003	0.002	0.011	0.007					0.016	85.0	23.8	
Jbari Sch. B1	33.000										0.049	85.7	0.9	
Jbari Sch. B2	0.415		0.003	0.002	0.010	0.006					0.015	85.0	21.6	
Jingay B1	33.000										0.111	91.3	2.0	
Jingay B2	0.415		0.004	0.002	0.013	0.008					0.020	85.0	29.1	
Jogitar B1	33.000										0.008	84.7	0.1	
Jogitar B2	0.415		0.001	0.001	0.005	0.003					0.008	85.0	11.3	
Kapasey B1	33.000										0.023	84.7	0.4	
Kapasey B2	0.415		0.004	0.003	0.015	0.009					0.023	85.0	33.1	
Kapasing B1	33.000										0.059	88.4	1.1	
Kapasing B2	0.415		0.004	0.003	0.015	0.009					0.023	85.0	33.0	
Kapasing.T B1	33.000										0.973	89.2	17.6	
Kapasing.T B2	0.415		0.005	0.003	0.019	0.012					0.028	85.0	42.6	
Khorsany GO B1	33.000										0.190	89.1	3.4	

Bus			Directly Connected Load								Total Bus Load			
			Constant kVA		Constant Z		Constant I		Generic					
ID	kV	Rated Amp	MW	Mvar	MW	Mvar	MW	Mvar	MW	Mvar	MVA	% PF	Amp	Percent Loading
Khorsany GO B2	0.415		0.004	0.003	0.015	0.009					0.023	85.0	34.2	
Khorsany.T B1	33.000										0.013	84.5	0.2	
Khorsany.T B2	0.415		0.002	0.001	0.008	0.005					0.013	85.0	18.6	
Koipani B1	33.000										0.019	84.3	0.3	
Koipani B2	0.415		0.003	0.002	0.012	0.008					0.019	85.0	27.6	
L.Bararay B1	33.000										0.024	84.1	0.4	
L.Bararay B2	0.415		0.004	0.003	0.015	0.009					0.023	85.0	33.7	
L.Bchu1A B1	33.000										0.121	87.8	2.2	
L.Bchu1A B2	0.415		0.004	0.002	0.013	0.008					0.019	85.0	28.4	
L.Bchu1B B1	33.000										0.102	87.7	1.8	
L.Bchu1B B2	0.415		0.003	0.002	0.010	0.006					0.015	85.0	22.4	
L.Bchu2B B1	33.000										0.020	84.3	0.4	
L.Bchu2B B2	0.415		0.004	0.002	0.013	0.008					0.019	85.0	28.3	
L.Bchu3B B1	33.000										0.068	87.9	1.2	
L.Bchu3B B2	0.415		0.001	0.001	0.004	0.002					0.005	85.0	7.8	
L.Bichgon B1	33.000										0.007	84.7	0.1	
L.Bichgon B2	0.415		0.001	0.001	0.005	0.003					0.007	85.0	10.5	
L.Bockery B1	33.000										0.009	84.7	0.2	
L.Bockery B2	0.415		0.002	0.001	0.006	0.003					0.008	85.0	12.2	
L.Dajay B1	33.000										0.040	84.4	0.7	
L.Dajay B2	0.415		0.007	0.004	0.026	0.016					0.039	85.0	56.5	
L.DaragonA B1	33.000										0.039	84.4	0.7	
L.DaragonA B2	0.415		0.007	0.004	0.025	0.016					0.038	85.0	55.3	
L.DaragonB B1	33.000										0.015	84.1	0.3	
L.DaragonB B2	0.415		0.003	0.002	0.010	0.006					0.015	85.0	21.6	
L.GairigaonI B1	33.000										0.172	90.0	3.1	
L.GairigaonII B1	33.000										0.041	86.3	0.7	
L.GairigaonIII B1	33.000										0.018	86.9	0.3	
L.GairigonI B2	0.415		0.002	0.002	0.009	0.006					0.014	85.0	19.8	
L.GairigonII B2	0.415		0.004	0.003	0.015	0.009					0.023	85.0	34.2	
L.GairigonIII B2	0.415		0.001	0.001	0.005	0.003					0.008	85.0	11.4	
L.GairigonIV B1	33.000										0.010	84.4	0.2	
L.GairigonIV B2	0.415		0.002	0.001	0.007	0.004					0.010	85.0	14.7	
L.Harpp B1	33.000										0.025	84.6	0.5	
L.Harpp B2	0.415		0.005	0.003	0.017	0.010					0.025	85.0	36.1	
L.KatikeyIII B1	33.000										0.358	86.6	6.4	
L.Katiky B2	33.000										0.015	84.1	0.3	
L.KatikyI B2	0.415		0.003	0.002	0.010	0.006					0.015	85.0	21.6	
L.KatikyII B1	33.000										0.010	84.6	0.2	
L.KatikyII B2	0.415		0.002	0.001	0.007	0.004					0.010	85.0	15.0	
L.KatikyIII B2	0.415		0.004	0.003	0.015	0.009					0.023	85.0	34.3	
L.Khorsany B1	33.000										0.019	84.7	0.3	

Bus			Directly Connected Load								Total Bus Load			
			Constant kVA		Constant Z		Constant I		Generic					Percent
ID	kV	Rated Amp	MW	Mvar	MW	Mvar	MW	Mvar	MW	Mvar	MVA	% PF	Amp	Loading
L.Khorsany B2	0.415		0.003	0.002	0.013	0.008					0.019	85.0	27.6	
L.Kokray B1	33.000										0.050	84.3	0.9	
L.Kokray B2	0.415		0.009	0.006	0.032	0.020					0.049	85.0	71.8	
L.Lobsiboty B1	33.000										0.053	86.1	1.0	
L.Lobsiboty B2	0.415		0.006	0.004	0.022	0.014					0.034	85.0	49.2	
L.Majuwa B1	33.000										0.035	87.2	0.6	
L.Majuwa B2	0.415		0.003	0.002	0.011	0.007					0.017	85.0	24.5	
L.Manithang B1	33.000										0.342	87.6	6.2	
L.Manithang B2	0.415		0.001	0.001	0.004	0.003					0.007	85.0	9.6	
L.Market B1	33.000										0.335	84.0	6.0	
L.Market B2	0.415		0.061	0.038	0.212	0.131					0.321	85.0	477.9	
L.Pmashong B1	33.000										0.020	84.7	0.4	
L.Pmashong B2	0.415		0.004	0.002	0.013	0.008					0.020	85.0	28.7	
L.RthalingA B1	33.000										0.052	92.2	0.9	
L.RthalingA B2	0.415		0.002	0.001	0.008	0.005					0.012	85.0	17.6	
L.RthalingB B1	33.000										0.040	93.0	0.7	
L.RthalingB B2	0.415		0.002	0.001	0.009	0.005					0.013	85.0	18.6	
L.Salami B1	33.000										0.066	84.5	1.2	
L.Salami B2	0.415		0.012	0.007	0.043	0.027					0.065	85.0	94.6	
L.Salaray B1	33.000										0.024	84.1	0.4	
L.Salaray B2	0.415		0.004	0.003	0.015	0.009					0.023	85.0	34.3	
L.Tlingkhar B1	33.000										0.119	84.1	2.1	
L.Tlingkhar B2	0.415		0.022	0.013	0.076	0.047					0.115	85.0	169.8	
Lalikharka ORC B1	33.000										0.024	89.7	0.4	
Lalikharka ORC B2	0.415		0.002	0.001	0.008	0.005					0.012	85.0	17.5	
LalikharkaC B1	33.000										0.013	84.5	0.2	
LalikharkaC B2	0.415		0.002	0.001	0.008	0.005					0.012	85.0	18.2	
LhamoiII B1	33.000										0.015	84.4	0.3	
LhamoiIII B1	33.000										0.045	93.0	0.8	
LhamoiIII B2	0.415		0.003	0.002	0.010	0.006					0.014	85.0	21.0	
Lhamoil B1	33.000										0.097	89.7	1.8	
Lhamoil B2	0.415		0.007	0.004	0.025	0.016					0.038	85.0	55.2	
LhaomoiII B2	0.415		0.003	0.002	0.010	0.006					0.015	85.0	21.8	
Lobsiboty B1	33.000										0.046	84.3	0.8	
Lobsiboty B2	0.415		0.008	0.005	0.030	0.018					0.044	85.0	65.6	
Lungsigg B1	33.000										0.106	84.6	1.9	
Lungsigg B2	0.415		0.019	0.012	0.070	0.043					0.105	85.0	151.7	
M.Alaichi B1	33.000										0.023	84.7	0.4	
M.Alaichi B2	0.415		0.004	0.003	0.015	0.009					0.023	85.0	32.9	
M.Bararay B1	33.000										0.054	85.0	1.0	
M.Bararay B2	0.415		0.003	0.002	0.010	0.006					0.015	85.0	22.4	
M.Bichgon B1	33.000										0.455	86.9	8.2	

Bus			Directly Connected Load								Total Bus Load			
			Constant kVA		Constant Z		Constant I		Generic					Percent
ID	kV	Rated Amp	MW	Mvar	MW	Mvar	MW	Mvar	MW	Mvar	MVA	% PF	Amp	Loading
M.Bichgon B2	0.415		0.005	0.003	0.018	0.011					0.027	85.0	39.6	
M.Khorsany B1	33.000										0.255	88.3	4.6	
M.Khorsany B2	0.415		0.009	0.006	0.035	0.021					0.052	85.0	75.1	
M.Kokray B1	33.000										0.051	84.2	0.9	
M.Kokray B2	0.415		0.009	0.006	0.033	0.020					0.049	85.0	73.2	
M.Salami B1	33.000										0.823	88.2	14.8	
M.Salami B2	0.415		0.006	0.004	0.022	0.013					0.032	85.0	46.8	
M.Salaray B1	33.000										0.089	85.7	1.6	
M.Salaray B2	0.415		0.002	0.001	0.008	0.005					0.012	85.0	17.5	
M.Tlingkhar B1	33.000										0.144	85.1	2.6	
M.Tlingkhar B2	0.415		0.007	0.004	0.026	0.016					0.039	85.0	57.4	
Majgon B1	33.000										0.018	84.3	0.3	
MajgonB2	0.415		0.003	0.002	0.012	0.007					0.018	85.0	26.3	
ManithangI B1	33.000										0.007	84.7	0.1	
ManithangI B2	0.415		0.001	0.001	0.005	0.003					0.007	85.0	10.7	
ManithangII B1	33.000										0.009	84.7	0.2	
ManithangII B2	0.415		0.002	0.001	0.006	0.004					0.009	85.0	12.9	
ManithangIII B1	33.000										0.016	87.0	0.3	
ManithangIII B2	0.415		0.001	0.001	0.004	0.003					0.007	85.0	9.7	
Mchuna B1	33.000										0.020	84.2	0.4	
Mchuna B2	0.415		0.004	0.002	0.013	0.008					0.020	85.0	29.0	
Menchuna B1	33.000										1.521	84.9	27.3	
Menchuna B2	0.415		0.024	0.015	0.084	0.052					0.128	85.0	189.7	
Mendrelgg B1	33.000										0.059	84.1	1.1	
Mendrelgg B2	0.415		0.011	0.007	0.038	0.023					0.057	85.0	84.6	
Mendrelgg.C.S B1	33.000										0.059	84.8	1.1	
Mendrelgg.C.S B2	0.415		0.011	0.007	0.039	0.024					0.058	85.0	84.3	
Municipal WT B1	33.000										0.012	84.8	0.2	
Municipal WT B2	0.415		0.002	0.001	0.008	0.005					0.012	85.0	16.8	
Nevarey B1	33.000										1.102	89.4	19.8	
Nevarey B2	0.415		0.008	0.005	0.029	0.018					0.043	85.0	62.8	
New Court B1	33.000										0.054	84.8	1.0	
New Court B2	0.415		0.010	0.006	0.036	0.022					0.053	85.0	76.8	
Newatar B1	33.000										0.019	84.3	0.3	
Newatar B2	0.415		0.003	0.002	0.012	0.008					0.018	85.0	27.4	
Nimazor B1	33.000										0.011	91.7	0.2	
Nimazor B2	0.415		0.001	0.001	0.005	0.003					0.007	85.0	10.7	
Nr. Forest.O B1	33.000										0.510	84.9	9.2	
Nr. Forest.O B2	0.415		0.009	0.005	0.032	0.020					0.048	85.0	69.2	
Nr. O.Court B1	33.000										1.292	84.9	23.2	
Nr. O.Court B2	0.415		0.012	0.008	0.043	0.026					0.064	85.0	95.8	
Nr. TCom B1	33.000										0.267	84.8	4.8	

Bus			Directly Connected Load								Total Bus Load			
			Constant kVA		Constant Z		Constant I		Generic					Percent
ID	kV	Rated Amp	MW	Mvar	MW	Mvar	MW	Mvar	MW	Mvar	MVA	% PF	Amp	Loading
Nr. TCom B2	0.415		0.010	0.006	0.039	0.024					0.058	85.0	83.0	
Nr.Dratshang B1	33.000										0.097	84.6	1.7	
Nr.Dratshang B2	0.415		0.017	0.011	0.064	0.040					0.096	85.0	138.8	
Nthang B1	33.000										0.010	84.6	0.2	
Nthang B2	0.415		0.002	0.001	0.007	0.004					0.010	85.0	14.6	
PakhayA B1	33.000										0.013	84.8	0.2	
PakhayA B2	0.415		0.002	0.001	0.009	0.005					0.013	85.0	18.8	
PakhayB B1	33.000										0.017	84.7	0.3	
PakhayB B2	0.415		0.003	0.002	0.011	0.007					0.017	85.0	24.7	
PelrithangT13 B1	33.000										0.052	84.2	0.9	
PelrithangT13 B2	0.415		0.009	0.006	0.033	0.021					0.050	85.0	74.3	
PelrithangT14 B1	33.000										0.086	84.4	1.6	
PelrithangT14 B2	0.415		0.016	0.010	0.056	0.034					0.084	85.0	123.3	
Phalady B1	33.000										0.005	84.8	0.1	
Phalady B2	0.415		0.001	0.001	0.003	0.002					0.005	85.0	7.6	
PhirayI B1	33.000										0.102	89.7	1.8	
PhirayI B2	0.415		0.004	0.003	0.015	0.010					0.023	85.0	34.8	
PhirayII B1	33.000										0.015	84.5	0.3	
PhirayII B2	0.415		0.003	0.002	0.009	0.006					0.014	85.0	20.8	
Pmathang B1	33.000										0.028	84.6	0.5	
Pmathang B2	0.415		0.005	0.003	0.019	0.012					0.028	85.0	40.6	
RAA PDC1 B1	0.415		0.022	0.014	0.083	0.051					0.124	85.0	178.5	
RAA PDC2 B1	0.415		0.018	0.011	0.066	0.041					0.098	85.0	141.5	
RanaII B1	33.000										0.030	83.8	0.5	
RanaII B2	0.415		0.006	0.003	0.019	0.012					0.029	85.0	43.7	
RiserboA B1	33.000										0.233	90.9	4.2	
RiserboA B2	0.415		0.005	0.003	0.018	0.011					0.026	85.0	38.2	
RiserboB B1	33.000										0.062	84.1	1.1	
RiserboB B2	0.415		0.011	0.007	0.039	0.024					0.059	85.0	88.3	
RiserboC B1	33.000										0.059	84.6	1.1	
RiserboC B2	0.415		0.011	0.007	0.038	0.024					0.058	85.0	83.9	
Sadugg B1	33.000										0.039	84.4	0.7	
Sadugg B2	0.415		0.007	0.004	0.025	0.016					0.038	85.0	55.7	
SalrayA B1	33.000										0.011	84.6	0.2	
SalrayA B2	0.415		0.002	0.001	0.007	0.004					0.011	85.0	15.4	
SalrayB B1	33.000										0.026	87.0	0.5	
Samalgaon B1	33.000										1.059	89.5	19.0	
Samalgaon B2	0.415		0.002	0.001	0.007	0.004					0.011	85.0	15.7	
SamzhingA B1	33.000										0.250	89.9	4.5	
SamzhingA B2	0.415		0.003	0.002	0.009	0.006					0.014	85.0	20.3	
SamzhingB B1	33.000										0.236	90.0	4.2	
SamzhingB B2	0.415		0.003	0.002	0.011	0.007					0.017	85.0	25.7	

Bus			Directly Connected Load								Total Bus Load			
			Constant kVA		Constant Z		Constant I		Generic					Percent
ID	kV	Rated Amp	MW	Mvar	MW	Mvar	MW	Mvar	MW	Mvar	MVA	% PF	Amp	Loading
SanumalayA B1	33.000										0.009	94.8	0.2	
SanumalayA B2	0.415		0.001	0.001	0.003	0.002					0.005	85.0	7.0	
SanumalayB B1	33.000										0.005	84.8	0.1	
SanumalayB B2	0.415		0.001	0.001	0.003	0.002					0.005	85.0	7.3	
Saunay B1	33.000										0.005	84.7	0.1	
Saunay B2	0.415		0.001	0.001	0.003	0.002					0.005	85.0	6.6	
Saurani B1	33.000										0.012	84.6	0.2	
Saurani B2	0.415		0.002	0.001	0.008	0.005					0.011	85.0	16.6	
Semjong Sch. B1	33.000										0.038	84.4	0.7	
Semjong Sch. B2	0.415		0.007	0.004	0.025	0.015					0.037	85.0	54.0	
Sethang GO B1	33.000										0.147	87.8	2.7	
Sethang GO B2	0.415		0.007	0.004	0.024	0.015					0.036	85.0	53.6	
SethangI B1	33.000										0.033	84.5	0.6	
SethangI B2	0.415		0.006	0.004	0.022	0.013					0.033	85.0	47.9	
SethangII B1	33.000										0.026	84.6	0.5	
SethangII B2	0.415		0.005	0.003	0.017	0.011					0.026	85.0	37.8	
SethangIII B1	33.000										0.021	84.7	0.4	
SethangIII B2	0.415		0.004	0.002	0.014	0.009					0.021	85.0	30.7	
Simpani B1	33.000		0.002	0.001	0.006	0.004					0.046	84.5	0.8	
Simpani B2	0.415		0.007	0.004	0.024	0.015					0.037	85.0	53.9	
SlarayB B2	0.415		0.003	0.002	0.011	0.007					0.016	85.0	23.6	
StationI B2	0.415		0.017	0.011	0.064	0.040					0.095	85.0	137.1	
Sunkosh B1	33.000										0.263	87.0	4.7	
Sunkosh B2	0.415		0.022	0.014	0.080	0.050					0.120	85.0	174.1	
SunkoshA B1	33.000										0.030	83.9	0.5	
SunkoshA B2	0.415		0.005	0.003	0.019	0.012					0.028	85.0	42.6	
SunkoshB B1	33.000										0.012	84.5	0.2	
SunkoshB B2	0.415		0.002	0.001	0.008	0.005					0.012	85.0	17.5	
SuntolayA B1	33.000										0.020	84.7	0.4	
SuntolayA B2	0.415		0.004	0.002	0.014	0.008					0.020	85.0	29.3	
SuntolayB B1	33.000										0.036	84.5	0.6	
SuntolayB B2	0.415		0.006	0.004	0.023	0.015					0.035	85.0	51.5	
TeureyI B1	33.000										0.021	84.2	0.4	
TeureyI B2	0.415		0.004	0.002	0.013	0.008					0.020	85.0	30.1	
ThangrayA B1	33.000										0.151	90.9	2.7	
ThangrayA B2	0.415		0.004	0.002	0.014	0.009					0.021	85.0	31.0	
ThangrayB B1	33.000										0.060	91.4	1.1	
ThangrayB B2	0.415		0.004	0.003	0.016	0.010					0.024	85.0	34.8	
ThangrayC B1	33.000										0.038	91.5	0.7	
ThangrayC B2	0.415		0.002	0.002	0.009	0.006					0.014	85.0	19.6	
ThasaA B1	33.000		0.001	0.001	0.005	0.003					0.016	84.8	0.3	
ThasaA B2	0.415		0.002	0.001	0.006	0.004					0.009	85.0	13.1	

Bus			Directly Connected Load								Total Bus Load			
			Constant kVA		Constant Z		Constant I		Generic					Percent
ID	kV	Rated Amp	MW	Mvar	MW	Mvar	MW	Mvar	MW	Mvar	MVA	% PF	Amp	Loading
Thulomalay B1	33.000										0.007	84.7	0.1	
Thulomalay B2	0.415		0.001	0.001	0.005	0.003					0.007	85.0	9.8	
Tlingkhar Top B1	33.000										0.014	84.5	0.2	
Tlingkhar Top B2	0.415		0.002	0.002	0.009	0.006					0.013	85.0	19.7	
ToisangI B1	33.000										0.008	84.7	0.1	
ToisangI B2	0.415		0.001	0.001	0.005	0.003					0.008	85.0	11.1	
ToisangII B1	33.000										0.012	84.6	0.2	
ToisangII B2	0.415		0.002	0.001	0.008	0.005					0.011	85.0	16.5	
TpangI B1	33.000										0.059	89.0	1.1	
TpangI B2	0.415		0.006	0.004	0.021	0.013					0.031	85.0	45.7	
TpangII B1	33.000										0.505	88.8	9.1	
TpangII B2	0.415		0.009	0.006	0.035	0.021					0.052	85.0	75.4	
TSE20.1	33.000										1.389	84.9	24.9	
TSE20.2	33.000										1.225	85.0	22.0	
TSE20.3	33.000										1.171	84.9	21.0	
TSE20.4	33.000										1.123	84.9	20.2	
TSE20.5	33.000										0.857	84.9	15.4	
TSE20.6	33.000										0.844	84.6	15.2	
TSE20.7	33.000										0.463	84.8	8.3	
TSE20.8	33.000										0.078	85.3	1.4	
TSE20.9	6.600										0.083	87.9	7.4	
TSE20.10	33.000										0.411	85.1	7.4	
TSE20.11	33.000										0.279	85.4	5.0	
TSE20.12	33.000										0.231	85.3	4.2	
TSE20.13	33.000										0.224	84.8	4.0	
TSE30.1	33.000										1.227	89.0	22.0	
TSE30.2	33.000										1.048	89.4	18.8	
TSE30.3	33.000										0.028	93.9	0.5	
TSE30.4	33.000										0.744	88.3	13.4	
TSE30.5	33.000										0.683	88.6	12.3	
TSE30.6	33.000		0.001	0.000	0.003	0.002					0.625	88.8	11.2	
TSE30.7	33.000										0.622	88.6	11.2	
TSE30.8	33.000										0.030	87.1	0.5	
TSE30.9	33.000										0.563	88.5	10.1	
TSE30.10	33.000										0.453	89.2	8.2	
TSE30.11	33.000										0.396	89.5	7.1	
TSE30.12	33.000										0.077	90.2	1.4	
TSE30.13	33.000										0.218	90.3	3.9	
TSE30.14	33.000										0.202	90.2	3.6	
TSE30.15	33.000										0.197	90.1	3.5	
TSE30.17	33.000										0.159	90.2	2.9	
TSE30.18	33.000										0.079	90.8	1.4	

Bus			Directly Connected Load								Total Bus Load			
			Constant kVA		Constant Z		Constant I		Generic					
ID	kV	Rated Amp	MW	Mvar	MW	Mvar	MW	Mvar	MW	Mvar	MVA	% PF	Amp	Percent Loading
TSE30.19	33.000										0.065	91.0	1.2	
TSE30.20	33.000										0.037	94.0	0.7	
TSE30.21	33.000										0.032	92.1	0.6	
TSE30.22	33.000										0.018	90.4	0.3	
TSE30.23	33.000										0.975	89.1	17.5	
TSE30.24	33.000										0.207	91.3	3.7	
TSE30.25	33.000										0.021	87.5	0.4	
TSE30.27	33.000										0.130	91.5	2.3	
TSE30.28	33.000										0.071	89.5	1.3	
TSE30.29	33.000										0.024	90.0	0.4	
TSE40.1	33.000										0.764	87.0	13.7	
TSE40.2	33.000										0.725	87.0	13.0	
TSE40.3	33.000										0.666	86.7	12.0	
TSE40.4	33.000										0.626	86.5	11.2	
TSE40.5	33.000										0.484	86.5	8.7	
TSE40.6	33.000										0.367	86.7	6.6	
TSE40.7	33.000										0.141	88.7	2.5	
TSE40.8	33.000										0.040	87.4	0.7	
TSE50.1	33.000										1.101	87.8	19.8	
TSE50.2	33.000										1.097	87.7	19.7	
TSE50.3	33.000										1.085	87.7	19.5	
TSE50.4	33.000										0.873	88.1	15.7	
TSE50.5	33.000										0.791	88.2	14.2	
TSE50.6	33.000										0.320	89.2	5.8	
TSE50.7	33.000										0.313	89.0	5.6	
TSE50.8	33.000										0.272	88.9	4.9	
TSE50.9	33.000										0.203	89.0	3.6	
TSE50.10	33.000										0.168	89.0	3.0	
TSE50.11	33.000										0.072	86.3	1.3	
TSE50.12	33.000										0.059	92.5	1.1	
TSE50.13	33.000										0.031	94.9	0.6	
TSE50.14	33.000		0.001	0.000	0.003	0.002					0.028	89.2	0.5	
TSE50.15	33.000										0.428	87.0	7.7	
TSE50.16	33.000										0.422	86.8	7.6	
TSE50.17	33.000										0.334	86.8	6.0	
TSE50.18	33.000										0.310	86.5	5.6	
TSE50.19	33.000										0.013	86.3	0.2	
TSE50.20	33.000										0.161	86.4	2.9	
TSE50.21	33.000										0.124	86.0	2.2	
TSE50.22	33.000										0.077	85.2	1.4	
TSE50.23	33.000										0.053	85.5	1.0	
TSE60.1	33.000										1.909	88.4	34.3	

Bus			Directly Connected Load								Total Bus Load			
			Constant kVA		Constant Z		Constant I		Generic					Percent
ID	kV	Rated Amp	MW	Mvar	MW	Mvar	MW	Mvar	MW	Mvar	MVA	% PF	Amp	Loading
TSE60.2	33.000										1.849	88.4	33.2	
TSE60.3	33.000										1.826	88.4	32.8	
TSE60.4	33.000										1.803	88.4	32.4	
TSE60.5	33.000										0.047	86.8	0.8	
TSE60.6	33.000										1.756	88.3	31.6	
TSE60.7	33.000										0.055	86.0	1.0	
TSE60.8	33.000										1.497	88.8	27.0	
TSE60.9	33.000										0.455	87.1	8.2	
TSE60.10	33.000										0.339	87.2	6.1	
TSE60.11	33.000										0.137	84.8	2.5	
TSE60.12	33.000										0.203	88.1	3.7	
TSE60.13	33.000										0.144	88.2	2.6	
TSE60.14	33.000										0.096	88.0	1.7	
TSE60.15	33.000										0.067	86.9	1.2	
TSE60.16	33.000		0.001	0.001	0.003	0.002					1.036	89.3	18.7	
TSE60.17	33.000										0.037	88.5	0.7	
TSE60.18	33.000										0.944	89.3	17.0	
TSE60.19	33.000										0.832	89.9	15.0	
TSE60.20	33.000										0.091	92.0	1.6	
TSE60.21	33.000										0.047	94.6	0.9	
TSE60.22	33.000										0.027	91.9	0.5	
TSE60.24	33.000		0.001	0.001	0.005	0.003					0.682	89.6	12.3	
TSE60.25	33.000										0.632	89.5	11.4	
TSE60.26	33.000										0.394	87.5	7.1	
TSE60.27	33.000										0.337	87.2	6.1	
TSE60.28	33.000										0.196	88.3	3.5	
TSE60.29	33.000										0.179	87.7	3.2	
TSE60.30	33.000		0.002	0.001	0.007	0.004					0.110	88.3	2.0	
TSE60.31	33.000										0.075	89.1	1.4	
TSE60.32	33.000										0.037	89.3	0.7	
TSE60.33	33.000		0.003	0.002	0.012	0.008					0.039	85.6	0.7	
TSE60.34	33.000										0.240	92.1	4.3	
TSE60.35	33.000										0.234	92.0	4.2	
TSE60.36	33.000										0.225	92.0	4.1	
TSE60.37	33.000										0.210	91.9	3.8	
TSE60.38	33.000										0.087	87.9	1.6	
TSE60.39	33.000										0.052	87.9	0.9	
TSE60.40	33.000										0.091	95.1	1.7	
TSE60.41	33.000										0.068	97.2	1.2	
TSE60.42	33.000										0.054	98.3	1.0	
TSE60.43	33.000										0.044	97.7	0.8	
TSE60.44	33.000										0.034	98.1	0.6	

Bus			Directly Connected Load								Total Bus Load			
			Constant kVA		Constant Z		Constant I		Generic					
ID	kV	Rated Amp	MW	Mvar	MW	Mvar	MW	Mvar	MW	Mvar	MVA	% PF	Amp	Percent Loading
TSE60.45	33.000										0.019	94.9	0.3	
TSE60.46	33.000		0.001	0.000	0.003	0.002					0.011	88.7	0.2	
Tshangay1 B1	33.000										0.025	96.0	0.5	
Tshangay1 B2	0.415		0.001	0.001	0.005	0.003					0.007	85.0	10.2	
Tshangay2 B1	33.000										0.009	98.4	0.2	
Tshangay2 B2	0.415		0.001	0.000	0.002	0.001					0.003	85.0	4.5	
Tsirangtoe CS B1	33.000										0.064	84.8	1.2	
Tsirangtoe CS B2	0.415		0.011	0.007	0.042	0.026					0.063	85.0	91.6	
Tsirangtoe Sch. B1	33.000										0.881	89.6	15.9	
Tsirangtoe Sch. B2	0.415		0.009	0.006	0.032	0.020					0.048	85.0	70.9	
TthangI B1	33.000										0.074	83.9	1.3	
TthangI b2	0.415		0.014	0.008	0.047	0.029					0.071	85.0	106.8	
TthangII B1	33.000										0.264	87.7	4.8	
TthangII B2	0.415		0.013	0.008	0.045	0.028					0.068	85.0	99.7	
U.Bchu1A B1	33.000										0.063	87.6	1.1	
U.Bchu1A B2	0.415		0.002	0.001	0.007	0.004					0.011	85.0	15.6	
U.Bchu2A B1	33.000										0.021	85.3	0.4	
U.Bchu2A B2	0.415		0.003	0.002	0.010	0.006					0.015	85.0	22.0	
U.Bchu2B B1	33.000										0.006	84.5	0.1	
U.Bchu2B B2	0.415		0.001	0.001	0.004	0.002					0.005	85.0	7.9	
U.Bchu3A B1	33.000										0.018	87.8	0.3	
U.Bchu3A B2	0.415		0.002	0.001	0.006	0.004					0.009	85.0	12.5	
U.Bchu3A B4	33.000										0.009	88.0	0.2	
U.Bchu3B B2	0.415		0.001	0.000	0.003	0.002					0.004	85.0	5.8	
U.Bchu4A B1	33.000										0.032	87.6	0.6	
U.Bchu4A B2	0.415		0.003	0.002	0.010	0.006					0.015	85.0	21.8	
U.Bchu4B B1	33.000										0.005	84.7	0.1	
U.Bchu4B B2	0.415		0.001	0.001	0.004	0.002					0.005	85.0	7.8	
U.Bockery B1	33.000										1.052	87.5	18.9	
U.Bockery B2	0.415		0.033	0.020	0.111	0.069					0.170	85.0	256.4	
U.BockeryT5 B1	33.000										0.017	84.8	0.3	
U.BockeryT5 B2	0.415		0.003	0.002	0.011	0.007					0.017	85.0	24.1	
U.Daragon B1	33.000										0.088	86.1	1.6	
U.DaragonA B2	0.415		0.002	0.001	0.008	0.005					0.013	85.0	18.4	
U.DaragonB B1	33.000										0.076	85.6	1.4	
U.DaragonB B2	0.415		0.004	0.003	0.014	0.009					0.022	85.0	33.2	
U.GairigonI B1	33.000										0.026	84.6	0.5	
U.GairigonI B2	0.415		0.005	0.003	0.017	0.011					0.025	85.0	37.0	
U.GairigonII B1	33.000										0.017	84.3	0.3	
U.GairigonII B2	0.415		0.003	0.002	0.011	0.007					0.017	85.0	25.0	
U.GairigonIII B1	0.415		0.001	0.001	0.004	0.003					0.006	85.0	9.2	
U.GairigonIII B2	33.000										0.006	84.8	0.1	

Bus			Directly Connected Load								Total Bus Load			
			Constant kVA		Constant Z		Constant I		Generic					
ID	kV	Rated Amp	MW	Mvar	MW	Mvar	MW	Mvar	MW	Mvar	MVA	% PF	Amp	Percent Loading
U.KatikeyA B1	33.000										0.027	86.3	0.5	
U.KatikeyB B1	33.000										0.123	86.1	2.2	
U.KatikyA B2	0.415		0.003	0.002	0.009	0.006					0.014	85.0	20.0	
U.KatikyB B2	0.415		0.006	0.004	0.023	0.015					0.035	85.0	51.4	
U.Kokray B1	33.000										0.020	84.3	0.4	
U.Kokray B2	0.415		0.004	0.002	0.013	0.008					0.019	85.0	28.0	
U.Lobsiboty B1	33.000										0.383	87.1	6.9	
U.Lobsiboty B2	0.415		0.008	0.005	0.030	0.018					0.044	85.0	64.3	
U.LobsibotyT15 B1	33.000										0.151	88.3	2.7	
U.LobsibotyT15 B2	0.415		0.001	0.001	0.005	0.003					0.008	85.0	10.9	
U.Majuwa B1	33.000										0.019	84.7	0.3	
U.Majuwa B2	0.415		0.003	0.002	0.013	0.008					0.019	85.0	27.4	
U.Market B1	33.000										0.209	84.6	3.8	
U.Market B2	0.415		0.037	0.023	0.137	0.085					0.206	85.0	298.5	
U.Menchuna B1	33.000										0.005	84.8	0.1	
U.Menchuna B2	0.415		0.001	0.001	0.004	0.002					0.005	85.0	7.5	
U.Pmashong B1	33.000										0.148	87.8	2.7	
U.Pmashong B2	0.415		0.013	0.008	0.045	0.028					0.069	85.0	102.6	
U.Rthaling B1	33.000										0.075	91.7	1.3	
U.Rthaling B2	0.415		0.004	0.003	0.016	0.010					0.024	85.0	35.0	
U.Salami B1	33.000										0.858	88.1	15.4	
U.Salami B2	0.415		0.006	0.004	0.023	0.014					0.035	85.0	50.5	
U.Salaray B1	33.000										0.036	85.3	0.7	
U.Salaray B2	0.415		0.002	0.001	0.008	0.005					0.012	85.0	18.1	
U.TlingkharA B1	33.000										0.061	88.1	1.1	
U.TlingkharA B2	0.415		0.005	0.003	0.019	0.012					0.028	85.0	40.7	
U.TlingkharB B1	0.415		0.005	0.003	0.019	0.012					0.028	85.0	40.6	
U.TlingkharB B2	33.000										0.042	85.5	0.7	
Utray B1	33.000										0.011	84.6	0.2	
Utray B2	0.415		0.002	0.001	0.007	0.004					0.010	85.0	15.1	
VIP G.H B1	33.000										0.015	84.8	0.3	
VIP G.H B2	0.415		0.003	0.002	0.010	0.006					0.014	85.0	20.9	
Zlingzor B1	33.000										0.047	88.4	0.9	
Zlingzor B2	0.415		0.004	0.002	0.015	0.009					0.022	85.0	32.0	
ZlingzorA B1	33.000										0.059	89.4	1.1	
ZlingzorA B2	0.415		0.002	0.001	0.008	0.005					0.012	85.0	18.0	
Zomlthang B1	33.000										0.019	84.3	0.4	
Zomlthang B2	0.415		0.004	0.002	0.013	0.008					0.019	85.0	27.9	
ZulpheygnA B1	33.000										0.010	84.6	0.2	
ZulpheygnA B2	0.415		0.002	0.001	0.007	0.004					0.010	85.0	14.6	
ZulpheygnB B1	33.000										0.019	93.5	0.3	

Bus			Directly Connected Load								Total Bus Load			
			Constant kVA		Constant Z		Constant I		Generic					Percent
ID	kV	Rated Amp	MW	Mvar	MW	Mvar	MW	Mvar	MW	Mvar	MVA	% PF	Amp	Loading
ZulpheygnB B2	0.415		0.002	0.001	0.006	0.004					0.009	85.0	12.9	

* Indicates operating load of a bus exceeds the bus critical limit (100.0% of the Continuous Ampere rating).

# Indicates operating load of a bus exceeds the bus marginal limit (95.0% of the Continuous Ampere rating).

Branch Loading Summary Report

CKT / Branch		Cable & Reactor			Transformer				
						Loading (input)		Loading (output)	
ID	Type	Ampacity (Amp)	Loading Amp	%	Capability (MVA)	MVA	%	MVA	%
66/33 Tfr1	Transformer				5.000	3.388	67.8	3.307	66.1
66/33 Tfr2	Transformer				5.000	3.388	67.8	3.307	66.1
Alaichi.T Tfr	Transformer				0.063	0.020	31.6	0.020	31.2
B.DCS Tfr	Transformer				0.125	0.047	37.4	0.046	36.8
B.RECD O Tfr	Transformer				0.125	0.049	39.0	0.048	38.4
* B.Vet.Hosp Tfr	Transformer				0.125	0.133	106.1	0.127	101.8
Baktar Tfr	Transformer				0.025	0.019	74.9	0.018	72.7
Baktar.T Tfr	Transformer				0.016	0.005	29.5	0.005	29.1
BaradhurayI Tfr	Transformer				0.016	0.006	34.9	0.006	34.5
BaradhurayII Tfr	Transformer				0.025	0.007	28.4	0.007	28.1
BaradhurayIII Tfr	Transformer				0.016	0.006	40.3	0.006	39.6
Batasey Tfr	Transformer				0.025	0.020	80.2	0.019	77.7
Below O.Court Tfr	Transformer				0.125	0.049	39.0	0.048	38.4
BeteniA Tfr	Transformer				0.025	0.006	22.7	0.006	22.5
Bhalukhop Tfr	Transformer				0.025	0.014	55.1	0.013	53.9
Bhalukop Tfr	Transformer				0.025	0.013	53.4	0.013	52.3
Bhudabaray Tfr	Transformer				0.250	0.105	41.9	0.103	41.3
BhulkayI Top Tfr	Transformer				0.025	0.017	67.3	0.016	65.6
BhulkayIIB Tfr	Transformer				0.025	0.017	69.1	0.017	67.3
BhulkayIIIA Tfr	Transformer				0.016	0.005	33.6	0.005	33.2
BhulkayIIIB Tfr	Transformer				0.025	0.007	26.1	0.006	25.8
BhulkayIIIC Tfr	Transformer				0.025	0.016	62.1	0.015	60.6
Bichgon ATop Tfr	Transformer				0.025	0.009	35.4	0.009	34.9
Bichgon BTop Tfr	Transformer				0.063	0.019	29.7	0.019	29.4
Bichgon Tfr	Transformer				0.125	0.043	34.6	0.043	34.1
Birkuna Tfr	Transformer				0.025	0.019	77.8	0.019	75.4
Burichu.D Tfr	Transformer				0.025	0.014	54.0	0.013	52.9
Changchey Dovan Tfr	Transformer				0.250	0.107	42.6	0.105	41.9
Changchey Plant Tfr	Transformer				0.250	0.084	33.8	0.083	33.4
Changchey.B Tfr	Transformer				0.050	0.009	18.9	0.009	18.8
Chokpur Tfr	Transformer				0.016	0.010	61.6	0.010	60.1
Dalgoley Tfr	Transformer				0.250	0.205	82.2	0.199	79.5
Danseri Tfr	Transformer				0.025	0.025	98.5	0.024	94.7

CKT / Branch		Cable & Reactor			Transformer				
						Loading (input)		Loading (output)	
ID	Type	Ampacity (Amp)	Loading Amp	%	Capability (MVA)	MVA	%	MVA	%
Danseri2 Tfr	Transformer				0.025	0.016	64.2	0.016	62.6
* DaragonI Tfr	Transformer				0.025	0.029	117.6	0.028	112.3
DaragonII Tfr	Transformer				0.025	0.006	24.1	0.006	23.9
DauthreyI Tfr	Transformer				0.016	0.007	44.9	0.007	44.1
DauthreyII Tfr	Transformer				0.025	0.019	77.3	0.019	75.0
DauthreyIII Tfr	Transformer				0.063	0.034	54.2	0.033	53.1
* Dchu Tfr	Transformer				0.025	0.027	109.6	0.026	104.9
DCS Tfr	Transformer				0.125	0.032	25.4	0.031	25.2
* DhajeyT1 Tfr	Transformer				0.125	0.126	101.2	0.122	97.2
DLSS Tfr	Transformer				0.125	0.048	38.4	0.047	37.9
DtshangI Tfr	Transformer				0.125	0.041	32.8	0.041	32.4
DtshangII Tfr	Transformer				0.125	0.039	31.1	0.038	30.7
GagagoanA Tfr	Transformer				0.016	0.009	54.8	0.009	53.6
GagagoanB Tfr	Transformer				0.025	0.013	50.2	0.012	49.2
GairigonB Tfr	Transformer				0.016	0.015	96.6	0.015	93.0
Golaytar Tfr	Transformer				0.010	0.006	62.4	0.006	60.9
Harpp.T Tfr	Transformer				0.063	0.023	36.5	0.023	36.0
Hatidunga Tfr	Transformer				0.025	0.006	23.7	0.006	23.5
ICT Tfr	Transformer				0.250	0.074	29.6	0.073	29.2
Janygon Tfr	Transformer				0.063	0.038	60.3	0.037	58.9
Janygon.T Tfr	Transformer				0.063	0.035	56.3	0.035	55.1
Jbari ORC Tfr	Transformer				0.025	0.017	66.6	0.016	64.9
Jbari Sch. Tfr	Transformer				0.025	0.015	60.5	0.015	59.1
Jingay Tfr	Transformer				0.025	0.020	81.1	0.020	78.5
Jogitar Tfr	Transformer				0.025	0.008	31.3	0.008	30.9
Kapasey Tfr	Transformer				0.063	0.023	36.7	0.023	36.1
Kapasing Tfr	Transformer				0.063	0.023	36.5	0.023	36.0
* Kapasing.T Tfr	Transformer				0.025	0.030	118.6	0.028	113.1
Khorsany GO Tfr	Transformer				0.025	0.024	95.5	0.023	92.0
Khorsany.T Tfr	Transformer				0.025	0.013	52.0	0.013	50.9
Koipani Tfr	Transformer				0.025	0.019	76.9	0.019	74.6
L.Bararay Tfr	Transformer				0.025	0.024	94.2	0.023	90.8
L.Bchu1A Tfr	Transformer				0.063	0.020	31.3	0.019	30.9
L.Bchu1B Tfr	Transformer				0.025	0.016	62.4	0.015	60.8
L.Bchu2B Tfr	Transformer				0.025	0.020	78.7	0.019	76.3

CKT / Branch		Cable & Reactor			Transformer				
						Loading (input)		Loading (output)	
ID	Type	Ampacity (Amp)	Loading Amp	%	Capability (MVA)	MVA	%	MVA	%
L.Bchu3B Tfr	Transformer				0.016	0.005	34.0	0.005	33.5
L.Bichgon Tfr	Transformer				0.025	0.007	29.4	0.007	29.1
L.Bockery Tfr	Transformer				0.025	0.009	34.2	0.008	33.7
L.Dajay Tfr	Transformer				0.063	0.040	62.9	0.039	61.4
L.DaragonA Tfr	Transformer				0.063	0.039	61.3	0.038	59.9
L.DaragonB Tfr	Transformer				0.016	0.015	94.6	0.015	91.1
L.GairigonI Tfr	Transformer				0.025	0.014	55.2	0.014	54.0
L.GairigonII Tfr	Transformer				0.025	0.024	95.6	0.023	92.0
L.GairigonIII Tfr	Transformer				0.016	0.008	49.6	0.008	48.6
L.GairigonIV Tfr	Transformer				0.016	0.010	64.3	0.010	62.7
L.Harpp Tfr	Transformer				0.063	0.025	40.1	0.025	39.5
L.KatikyI Tfr	Transformer				0.016	0.015	94.6	0.015	91.2
L.KatikyII Tfr	Transformer				0.025	0.010	41.8	0.010	41.2
L.KatikyIII Tfr	Transformer				0.025	0.024	95.8	0.023	92.3
L.Khorsany Tfr	Transformer				0.063	0.019	30.7	0.019	30.3
L.Kokray Tfr	Transformer				0.063	0.050	79.5	0.049	77.1
L.Lobsiboty Tfr	Transformer				0.063	0.034	54.4	0.034	53.3
L.Majuwa Tfr	Transformer				0.063	0.017	27.2	0.017	26.9
L.Manithang Tfr	Transformer				0.025	0.007	26.7	0.007	26.4
* L.Market Tfr	Transformer				0.315	0.335	106.2	0.321	101.9
L.Pmashong Tfr	Transformer				0.063	0.020	31.8	0.020	31.5
L.RthalingA Tfr	Transformer				0.025	0.012	49.4	0.012	48.5
L.RthalingB Tfr	Transformer				0.063	0.013	20.6	0.013	20.5
L.Salami Tfr	Transformer				0.125	0.066	52.9	0.065	51.8
L.Salaray Tfr	Transformer				0.025	0.024	96.0	0.023	92.4
L.Tlinghkar Tfr	Transformer				0.125	0.119	95.2	0.115	91.7
Lalikharka ORC Tfr	Transformer				0.025	0.012	49.0	0.012	48.1
LalikharkaC Tfr	Transformer				0.025	0.013	50.8	0.012	49.8
LhamoiII Tfr	Transformer				0.025	0.015	61.0	0.015	59.6
LhamoiIII Tfr	Transformer				0.025	0.015	58.6	0.014	57.3
LhamoiI Tfr	Transformer				0.063	0.039	61.2	0.038	59.8
Lobsiboty Tfr	Transformer				0.063	0.046	72.6	0.044	70.6
Lungsigg Tfr	Transformer				0.250	0.106	42.5	0.105	41.8
M.Alaichi Tfr	Transformer				0.063	0.023	36.5	0.023	36.0
M.Bararay Tfr	Transformer				0.025	0.016	62.5	0.015	61.0

CKT / Branch		Cable & Reactor			Transformer				
					Capability	Loading (input)		Loading (output)	
ID	Type	Ampacity (Amp)	Loading Amp	%	(MVA)	MVA	%	MVA	%
M.Bichgon Tfr	Transformer				0.125	0.028	22.2	0.027	22.0
M.Khorsany Tfr	Transformer				0.125	0.053	42.0	0.052	41.3
M.Kokray Tfr	Transformer				0.063	0.051	81.0	0.049	78.5
M.Salami Tfr	Transformer				0.125	0.033	26.2	0.032	25.9
M.Salaray Tfr	Transformer				0.025	0.012	48.8	0.012	47.9
M.Tlingkhar Tfr	Transformer				0.063	0.040	63.9	0.039	62.3
Majgon Tfr	Transformer				0.025	0.018	73.2	0.018	71.1
ManithangI Tfr	Transformer				0.025	0.007	29.9	0.007	29.6
ManithangII Tfr	Transformer				0.025	0.009	35.9	0.009	35.4
ManithangIII Tfr	Transformer				0.025	0.007	27.1	0.007	26.8
Mchuna Tfr	Transformer				0.025	0.020	81.4	0.020	78.9
* Menchuna Tfr	Transformer				0.125	0.133	106.4	0.128	102.0
Mendrelgg Tfr	Transformer				0.063	0.059	93.9	0.057	90.5
Mendrelgg.C.S Tfr	Transformer				0.250	0.059	23.6	0.058	23.3
Municipal WT Tfr	Transformer				0.063	0.012	18.7	0.012	18.6
Nevarey Tfr	Transformer				0.125	0.044	35.2	0.043	34.8
New Court Tfr	Transformer				0.250	0.054	21.5	0.053	21.3
Newatar Tfr	Transformer				0.025	0.019	76.1	0.018	73.9
Nimazor Tfr	Transformer				0.025	0.007	30.0	0.007	29.6
Nr. Forest.O Tfr	Transformer				0.125	0.048	38.8	0.048	38.2
* Nr. O.Court Tfr	Transformer				0.063	0.067	106.6	0.064	102.2
Nr. TCom Tfr	Transformer				0.250	0.058	23.3	0.058	23.1
Nr.Dratshang Tfr	Transformer				0.250	0.097	38.9	0.096	38.3
Nthang Tfr	Transformer				0.025	0.010	40.6	0.010	39.9
PakhayA Tfr	Transformer				0.063	0.013	20.9	0.013	20.7
PakhayB Tfr	Transformer				0.063	0.017	27.4	0.017	27.1
PelrithangT13 Tfr	Transformer				0.063	0.052	82.2	0.050	79.6
PelrithangT14 Tfr	Transformer				0.125	0.086	68.8	0.084	67.0
Phalady Tfr	Transformer				0.025	0.005	21.1	0.005	20.9
PhirayI Tfr	Transformer				0.025	0.024	97.1	0.023	93.5
PhirayII Tfr	Transformer				0.025	0.015	58.2	0.014	56.9
Pmathang Tfr	Transformer				0.063	0.028	45.0	0.028	44.2
RAA PDC1 Tfr	Transformer				0.500	0.125	25.0	0.124	24.7
RAA PDC2 Tfr	Transformer				0.500	0.099	19.8	0.098	19.7
* RanaII Tfr	Transformer				0.025	0.030	121.9	0.029	116.1

CKT / Branch		Cable & Reactor			Transformer				
						Loading (input)		Loading (output)	
ID	Type	Ampacity (Amp)	Loading Amp	%	Capability (MVA)	MVA	%	MVA	%
RiserboA Tfr	Transformer				0.063	0.027	42.5	0.026	41.8
RiserboB Tfr	Transformer				0.063	0.062	98.1	0.059	94.3
RiserboC Tfr	Transformer				0.125	0.059	47.0	0.058	46.1
Sadugg Tfr	Transformer				0.063	0.039	61.7	0.038	60.3
SalrayA Tfr	Transformer				0.025	0.011	43.0	0.011	42.3
SalrayB Tfr	Transformer				0.025	0.016	65.9	0.016	64.2
Samalgaon Tfr	Transformer				0.025	0.011	43.9	0.011	43.2
SamzhingA Tfr	Transformer				0.025	0.014	56.6	0.014	55.4
* SamzhingB Tfr	Transformer				0.016	0.018	112.2	0.017	107.4
SanumalayA Tfr	Transformer				0.016	0.005	30.4	0.005	30.0
SanumalayB Tfr	Transformer				0.025	0.005	20.2	0.005	20.0
Saunay Tfr	Transformer				0.016	0.005	28.8	0.005	28.5
Saurani Tfr	Transformer				0.025	0.012	46.1	0.011	45.3
Semjong Sch. tfr	Transformer				0.063	0.038	59.9	0.037	58.5
Sethang GO Tfr	Transformer				0.063	0.037	59.1	0.036	57.8
SethangI Tfr	Transformer				0.063	0.033	52.8	0.033	51.7
SethangII Tfr	Transformer				0.063	0.026	41.7	0.026	41.0
SethangIII Tfr	Transformer				0.063	0.021	33.8	0.021	33.4
Simpani Tfr	Transformer				0.063	0.038	59.6	0.037	58.2
StationI Tfr(2*250kVA)	Transformer				0.500	0.096	19.2	0.095	19.1
Sunkosh Tfr	Transformer				0.250	0.122	48.8	0.120	47.9
* SunkoshA Tfr	Transformer				0.025	0.030	119.3	0.028	113.8
SunkoshB Tfr	Transformer				0.025	0.012	49.0	0.012	48.0
SuntolayA Tfr	Transformer				0.063	0.020	32.5	0.020	32.1
SuntolayB Tfr	Transformer				0.063	0.036	57.1	0.035	55.8
TeureyI Tfr	Transformer				0.025	0.021	83.7	0.020	81.0
ThangrayA Tfr	Transformer				0.063	0.022	34.5	0.021	34.0
ThangrayB Tfr	Transformer				0.063	0.024	38.7	0.024	38.1
ThangrayC Tfr	Transformer				0.063	0.014	21.7	0.014	21.5
ThasaA Tfr	Transformer				0.025	0.009	36.4	0.009	35.9
Thulomalay Tfr	Transformer				0.025	0.007	27.3	0.007	27.0
Tlingkhar Top Tfr	Transformer				0.025	0.014	55.1	0.013	53.9
ToisangI Tfr	Transformer				0.025	0.008	31.0	0.008	30.6
ToisangII Tfr	Transformer				0.025	0.012	46.2	0.011	45.4
TpangI Tfr	Transformer				0.063	0.032	50.7	0.031	49.7

CKT / Branch		Cable & Reactor			Transformer				
						Loading (input)		Loading (output)	
ID	Type	Ampacity (Amp)	Loading Amp	%	Capability (MVA)	MVA	%	MVA	%
TpangII Tfr	Transformer				0.125	0.053	42.2	0.052	41.5
Tshangay1 Tfr	Transformer				0.025	0.007	28.3	0.007	28.0
Tshangay2 Tfr	Transformer				0.010	0.003	31.3	0.003	31.0
Tsirangtoe CS Tfr	Transformer				0.250	0.064	25.5	0.063	25.3
Tsirangtoe Sch. Tfr	Transformer				0.063	0.049	78.4	0.048	76.0
* Tthangi Tfr	Transformer				0.063	0.074	117.9	0.071	112.5
TthangII Tfr	Transformer				0.125	0.069	55.5	0.068	54.3
U,KatikyB Tfr	Transformer				0.063	0.036	57.0	0.035	55.8
U.Bchu1A Tfr	Transformer				0.025	0.011	43.3	0.011	42.6
U.Bchu2A Tfr	Transformer				0.025	0.015	61.3	0.015	59.8
U.Bchu2B Tfr	Transformer				0.010	0.006	55.1	0.005	54.0
U.Bchu3A Tfr	Transformer				0.025	0.009	34.8	0.009	34.4
U.Bchu3B Tfr	Transformer				0.016	0.004	25.3	0.004	25.0
U.Bchu4A Tfr	Transformer				0.025	0.015	60.7	0.015	59.3
U.Bchu4B Tfr	Transformer				0.016	0.005	33.8	0.005	33.4
* U.Bockery Tfr	Transformer				0.125	0.180	143.7	0.170	135.7
U.BockeryT5 Tfr	Transformer				0.063	0.017	26.7	0.017	26.5
U.DaragonA Tfr	Transformer				0.025	0.013	51.6	0.013	50.6
* U.DaragonB Tfr	Transformer				0.016	0.023	145.1	0.022	137.0
U.GairigonI Tfr	Transformer				0.063	0.026	41.1	0.025	40.4
U.GairigonII Tfr	Transformer				0.025	0.017	69.9	0.017	68.0
U.GairigonIII Tfr	Transformer				0.025	0.006	25.8	0.006	25.5
U.KatikyA Tfr	Transformer				0.025	0.014	56.0	0.014	54.8
U.Kokray Tfr	Transformer				0.025	0.020	78.1	0.019	75.7
U.Lobsiboty Tfr	Transformer				0.125	0.045	35.9	0.044	35.4
U.LobsibotyT15 Tfr	Transformer				0.025	0.008	30.5	0.008	30.1
U.Majuwa Tfr	Transformer				0.063	0.019	30.5	0.019	30.1
U.Market Tfr	Transformer				0.500	0.209	41.8	0.206	41.1
U.Menchuna Tfr	Transformer				0.025	0.005	21.1	0.005	20.9
* U.Pmashong Tfr	Transformer				0.063	0.072	113.8	0.069	108.8
U.Rthaling Tfr	Transformer				0.063	0.024	38.9	0.024	38.3
U.Salami Tfr	Transformer				0.063	0.035	56.1	0.035	54.9
U.Salaray Tfr	Transformer				0.025	0.013	50.5	0.012	49.5
U.TlingkharA Tfr	Transformer				0.063	0.029	45.3	0.028	44.5
U.TlingkharB Tfr	Transformer				0.063	0.028	45.2	0.028	44.4

CKT / Branch		Cable & Reactor			Transformer				
					Capability	Loading (input)		Loading (output)	
ID	Type	Ampacity (Amp)	Loading Amp	%	(MVA)	MVA	%	MVA	%
Utray Tfr	Transformer				0.025	0.011	42.3	0.010	41.6
VIP G.H Tfr	Transformer				0.063	0.015	23.2	0.014	23.0
Zlingzor Tfr	Transformer				0.063	0.022	35.5	0.022	35.0
ZlingzorA Tfr	Transformer				0.025	0.013	50.2	0.012	49.3
Zomlthang Tfr	Transformer				0.025	0.019	78.0	0.019	75.6
ZulpheygnA Tfr	Transformer				0.025	0.010	40.9	0.010	40.2
ZulpheygnB Tfr	Transformer				0.025	0.009	36.1	0.009	35.6

* Indicates a branch with operating load exceeding the branch capability.

Branch Losses Summary Report

Branch ID	From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		Vd % Drop
	MW	Mvar	MW	Mvar	kW	kvar	From	To	in Vmag
Alaichi.T-TSE60.2	1.634	0.865	-1.634	-0.865	0.2	-0.2	97.3	97.3	0.01
Batasey-Alaichi.T	-1.651	-0.875	1.652	0.874	1.3	-1.6	97.3	97.4	0.09
Alaichi.T Tfr	0.017	0.011	-0.017	-0.010	0.1	0.2	97.3	96.2	1.18
B.DCS-DCS	0.027	0.016	-0.027	-0.017	0.0	-0.8	97.4	97.4	0.00
TSE20.8-B.DCS	-0.066	-0.041	0.066	0.041	0.0	-0.2	97.4	97.4	0.00
B.DCS Tfr	0.040	0.025	-0.039	-0.024	0.4	0.6	97.4	96.0	1.40
TSE20.11-B.RECD O	-0.041	-0.026	0.041	0.026	0.0	-0.4	97.4	97.4	0.00
B.RECD O Tfr	0.041	0.026	-0.041	-0.025	0.4	0.7	97.4	95.9	1.46
TSE20.10-B.Vet Hosp.	-0.111	-0.072	0.111	0.071	0.0	-1.3	97.4	97.4	0.00
B.Vet.Hosp Tfr	0.111	0.072	-0.108	-0.067	3.3	4.9	97.4	93.4	3.98
Baktar-TSE60.22	0.025	0.006	-0.025	-0.011	0.0	-4.5	96.9	96.9	0.00
Baktar.T-Baktar	-0.041	-0.016	0.041	0.014	0.0	-1.9	96.9	96.9	0.00
Baktar Tfr	0.016	0.010	-0.015	-0.010	0.3	0.5	96.9	94.1	2.82
TSE60.21-Baktar.T	-0.045	-0.017	0.045	0.015	0.0	-1.6	96.9	96.9	0.00
Baktar.T Tfr	0.004	0.003	-0.004	-0.002	0.0	0.0	96.9	95.8	1.11
Baradhuray(I-II)	0.011	0.004	-0.011	-0.006	0.0	-2.6	97.2	97.2	0.00
TSE30.17-BaradhurayI	-0.016	-0.007	0.016	0.006	0.0	-1.0	97.2	97.2	0.00
BaradhurayI Tfr	0.005	0.003	-0.005	-0.003	0.0	0.1	97.2	95.9	1.31
Baradhuray(II-III)	0.005	0.003	-0.005	-0.003	0.0	-0.8	97.2	97.2	0.00
BaradhurayII Tfr	0.006	0.004	-0.006	-0.004	0.0	0.1	97.2	96.1	1.07
BaradhurayIII Tfr	0.005	0.003	-0.005	-0.003	0.1	0.1	97.2	95.7	1.51
TSE60.1-Batasey	-1.669	-0.884	1.670	0.884	0.8	-1.0	97.4	97.5	0.06
Batasey Tfr	0.017	0.011	-0.017	-0.010	0.4	0.6	97.4	94.4	3.01
TSE20.3-Below O.Court	-0.041	-0.026	0.041	0.025	0.0	-0.7	97.5	97.5	0.00
Below O.Court Tfr	0.041	0.026	-0.041	-0.025	0.4	0.7	97.5	96.0	1.46
TSE30.29-BeteniA	-0.013	-0.008	0.013	0.008	0.0	-0.1	97.3	97.3	0.00
BeteniA Tfr	0.005	0.003	-0.005	-0.003	0.0	0.0	97.3	96.4	0.85
TSE50.19-Bhalukhop	-0.012	-0.007	0.012	0.007	0.0	-0.5	97.3	97.3	0.00
Bhalukhop Tfr	0.012	0.007	-0.011	-0.007	0.2	0.3	97.3	95.2	2.06
GagagoanB-Bhalukop	-0.011	-0.007	0.011	0.006	0.0	-1.1	97.5	97.5	0.00
Bhalukop Tfr	0.011	0.007	-0.011	-0.007	0.2	0.2	97.5	95.5	2.00
M.Tlingkhar-Bhudabaray	-0.089	-0.056	0.089	0.054	0.0	-1.7	97.5	97.5	0.00
Bhudabaray Tfr	0.089	0.056	-0.088	-0.054	1.0	1.5	97.5	95.9	1.57
Bhulkay(ITop-IIIA)	0.023	0.010	-0.023	-0.012	0.0	-2.0	97.3	97.3	0.00

Branch ID	From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		Vd % Drop
	MW	Mvar	MW	Mvar	kW	kvar	From	To	in Vmag
TSE30.24-BhulkayI Top	-0.037	-0.019	0.037	0.019	0.0	-0.2	97.3	97.3	0.00
BhulkayI Top Tfr	0.014	0.009	-0.014	-0.009	0.3	0.4	97.3	94.8	2.52
BhulkayIIB-ThangrayA	0.137	0.058	-0.137	-0.063	0.0	-4.6	97.3	97.3	0.02
TSE30.24-BhulkayIIB	-0.152	-0.067	0.152	0.066	0.0	-1.8	97.3	97.3	0.01
BhulkayIIB Tfr	0.015	0.009	-0.014	-0.009	0.3	0.4	97.3	94.7	2.59
BhulkayIIIA-TSE30.25	0.019	0.009	-0.019	-0.010	0.0	-0.9	97.3	97.3	0.00
BhulkayIIIA Tfr	0.005	0.003	-0.005	-0.003	0.0	0.1	97.3	96.1	1.26
TSE30.25-BhulkayIIIB	-0.006	-0.003	0.006	0.003	0.0	-0.6	97.3	97.3	0.00
BhulkayIIIB Tfr	0.006	0.003	-0.005	-0.003	0.0	0.1	97.3	96.4	0.98
TSE30.25-BhulkayIIIC	-0.013	-0.008	0.013	0.007	0.0	-0.9	97.3	97.3	0.00
BhulkayIIIC Tfr	0.013	0.008	-0.013	-0.008	0.2	0.3	97.3	95.0	2.33
TSE50.6-Bichgon ATop	-0.007	-0.005	0.007	0.003	0.0	-1.8	97.3	97.3	0.00
Bichgon ATop Tfr	0.007	0.005	-0.007	-0.005	0.1	0.1	97.3	96.0	1.33
TSE50.7-Bichgon	-0.037	-0.023	0.037	0.023	0.0	-0.2	97.3	97.3	0.00
Bichgon Tfr	0.037	0.023	-0.036	-0.022	0.4	0.5	97.3	96.0	1.30
TSE50.5-Bichgon BTop	-0.016	-0.010	0.016	0.007	0.0	-2.8	97.3	97.3	0.00
Bichgon BTop Tfr	0.016	0.010	-0.016	-0.010	0.1	0.2	97.3	96.2	1.11
TSE60.17-Birkuna	-0.016	-0.010	0.016	0.009	0.0	-1.6	97.0	97.0	0.00
Birkuna Tfr	0.016	0.010	-0.016	-0.010	0.4	0.5	97.0	94.0	2.93
TSE60.22-Burichu.D	-0.011	-0.007	0.011	0.007	0.0	-0.5	96.9	96.9	0.00
Burichu.D Tfr	0.011	0.007	-0.011	-0.007	0.2	0.3	96.9	94.8	2.03
TSE40.7-Changchey Dovan	-0.090	-0.057	0.090	0.050	0.0	-6.6	97.4	97.5	0.01
Changchey Dovan Tfr	0.090	0.057	-0.089	-0.055	1.1	1.6	97.4	95.8	1.59
Changchey Plant Tfr	0.074	0.041	-0.073	-0.040	0.6	0.9	100.0	98.8	1.20
Changchey Line	0.073	0.040	-0.073	-0.040	0.1	0.0	98.8	98.7	0.10
TSE20.9-Changchey.B	-0.008	-0.005	0.008	0.005	0.0	0.0	98.7	98.7	0.01
Changchey.B Tfr	0.008	0.005	-0.008	-0.005	0.0	0.1	98.7	98.0	0.70
Chokpur-TSE60.16	0.925	0.463	-0.925	-0.466	0.4	-2.6	97.0	97.0	0.05
TSE60.8-Chokpur	-0.934	-0.469	0.934	0.465	0.6	-3.3	97.0	97.1	0.07
Chokpur Tfr	0.008	0.005	-0.008	-0.005	0.1	0.2	97.0	94.7	2.32
66/33 Tfr1	2.944	1.678	-2.893	-1.602	50.9	76.4	100.0	97.6	2.42
66/33 Tfr2	2.944	1.678	-2.893	-1.602	50.9	76.4	100.0	97.6	2.42
L1-Menchuna	1.292	0.803	-1.292	-0.804	0.6	-1.3	97.6	97.5	0.05
L1-TSE60.1	1.688	0.893	-1.687	-0.894	1.2	-1.4	97.6	97.5	0.08
StationI Tfr(2*250kVA)	0.082	0.051	-0.081	-0.050	0.4	0.6	97.6	96.9	0.72
L1-TSE30.1	1.092	0.558	-1.092	-0.559	0.2	-1.0	97.6	97.6	0.03
L1-TSE40.1	0.664	0.374	-0.664	-0.377	0.1	-2.6	97.6	97.6	0.03

	From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		Vd % Drop
Branch ID	MW	Mvar	MW	Mvar	kW	kvar	From	To	in Vmag
L1-TSE50.1	0.967	0.525	-0.966	-0.528	0.5	-2.6	97.6	97.5	0.06
TSE60.6-Dalgoley	-0.173	-0.111	0.173	0.109	0.0	-1.7	97.1	97.1	0.01
Dalgoley Tfr	0.173	0.111	-0.169	-0.105	4.0	6.0	97.1	94.0	3.09
U.Market-Damphu Hosp.CSS	0.000	0.000	0.000	0.000	0.0	-0.1	97.5	97.5	0.00
TSE60.40-Danseri1	-0.021	-0.013	0.021	0.013	0.0	-0.3	96.7	96.7	0.00
Danseri Tfr	0.021	0.013	-0.020	-0.012	0.6	0.9	96.7	93.0	3.72
Danseri2 Tfr	-0.013	-0.008	0.014	0.009	0.2	0.4	94.3	96.7	2.42
TSE60.41-Danseri2	-0.014	-0.009	0.014	0.008	0.0	-0.7	96.7	96.7	0.00
TSE30.19-DaragonI	-0.025	-0.016	0.025	0.015	0.0	-0.8	97.2	97.2	0.00
DaragonI Tfr	0.025	0.016	-0.024	-0.015	0.8	1.2	97.2	92.7	4.43
TSE30.20-DaragonII	-0.005	-0.003	0.005	0.003	0.0	-0.6	97.2	97.2	0.00
DaragonII Tfr	0.005	0.003	-0.005	-0.003	0.0	0.1	97.2	96.3	0.90
DauthreyI-TSE60.25	0.566	0.279	-0.566	-0.282	0.1	-2.6	96.8	96.8	0.03
DtshangII-DauthreyI	-0.572	-0.283	0.572	0.280	0.2	-3.4	96.8	96.8	0.04
DauthreyI Tfr	0.006	0.004	-0.006	-0.004	0.1	0.1	96.8	95.1	1.69
Dauthrey(II-III)	0.029	0.017	-0.029	-0.018	0.0	-1.4	96.7	96.7	0.00
TSE60.26-DauthreyII	-0.045	-0.027	0.045	0.027	0.0	-0.7	96.7	96.7	0.00
DauthreyII Tfr	0.016	0.010	-0.016	-0.010	0.4	0.5	96.7	93.8	2.92
DauthreyIII Tfr	0.029	0.018	-0.028	-0.018	0.4	0.7	96.7	94.7	2.04
ThangrayC-Darachu	-0.023	-0.015	0.023	0.008	0.0	-6.9	97.3	97.3	0.01
Dchu Tfr	0.023	0.015	-0.022	-0.014	0.7	1.1	97.3	93.2	4.12
DCS Tfr	0.027	0.017	-0.027	-0.017	0.2	0.3	97.4	96.4	0.95
TSE30.1-DhajeyT1	-0.106	-0.068	0.106	0.068	0.0	-0.2	97.6	97.6	0.00
DhajeyT1 Tfr	0.106	0.068	-0.103	-0.064	3.0	4.5	97.6	93.8	3.79
DLSS-TSE20.7	0.002	0.005	-0.002	-0.006	0.0	-0.9	97.4	97.4	0.00
TSE20.7-DLSS	-0.043	-0.031	0.043	0.031	0.0	-0.4	97.4	97.4	0.00
DLSS Tfr	0.041	0.026	-0.040	-0.025	0.4	0.6	97.4	95.9	1.44
DtshangI-TSE60.24	0.612	0.302	-0.611	-0.303	0.0	-0.6	96.9	96.8	0.01
TSE60.19-DtshangI	-0.646	-0.324	0.646	0.322	0.2	-2.5	96.9	96.9	0.03
DtshangI Tfr	0.035	0.022	-0.034	-0.021	0.3	0.5	96.9	95.6	1.23
TSE60.24-DtshangII	-0.605	-0.300	0.605	0.299	0.1	-1.1	96.8	96.8	0.01
DtshangII Tfr	0.033	0.021	-0.033	-0.020	0.3	0.4	96.8	95.7	1.17
Gagagoan(A-B)	0.022	0.011	-0.022	-0.013	0.0	-1.8	97.5	97.5	0.00
U.TlingkharA-Gagagoan	-0.029	-0.016	0.029	0.014	0.0	-2.1	97.5	97.5	0.00
GagagoanA Tfr	0.007	0.005	-0.007	-0.005	0.1	0.2	97.5	95.5	2.05
GagagoanB Tfr	0.011	0.007	-0.010	-0.006	0.1	0.2	97.5	95.7	1.88
TSE30.21-GairigonB	-0.013	-0.008	0.013	0.008	0.0	-0.7	97.2	97.2	0.00

Branch ID	From-To Bus Flow MW	From-To Bus Flow Mvar	To-From Bus Flow MW	To-From Bus Flow Mvar	Losses kW	Losses kvar	% Bus Voltage From	% Bus Voltage To	Vd % Drop in Vmag
GairigonB Tfr	0.013	0.008	-0.013	-0.008	0.4	0.5	97.2	93.5	3.63
Golaytar-Phalady	0.004	-0.001	-0.004	-0.003	0.0	-3.4	96.7	96.7	0.00
TSE60.43-Golaytar	-0.010	-0.003	0.010	0.001	0.0	-1.9	96.7	96.7	0.00
Golaytar Tfr	0.005	0.003	-0.005	-0.003	0.1	0.1	96.7	94.4	2.35
TSE60.3-Harpp.T	-0.019	-0.012	0.019	0.012	0.0	-0.3	97.3	97.3	0.00
Harpp.T Tfr	0.019	0.012	-0.019	-0.012	0.2	0.3	97.3	95.9	1.37
TSE50.13-Hatidunga	-0.005	-0.003	0.005	0.000	0.0	-2.8	97.2	97.2	0.00
Hatidunga Tfr	0.005	0.003	-0.005	-0.003	0.0	0.0	97.2	96.3	0.89
ICT-TSE20.9	-0.065	-0.035	0.065	0.035	0.1	-0.2	98.4	98.7	0.26
ICT Tfr	0.065	0.035	-0.065	-0.034	0.5	0.8	98.4	97.4	1.06
TSE20.8-ICT	0.065	0.034	-0.065	-0.034	0.0	-0.2	97.4	97.4	0.00
TSE50.11-Janygon	-0.032	-0.020	0.032	0.020	0.0	-0.1	97.2	97.2	0.00
Janygon Tfr	0.032	0.020	-0.032	-0.020	0.5	0.8	97.2	95.0	2.26
TSE50.11-Janygon.T	-0.030	-0.019	0.030	0.016	0.0	-2.9	97.2	97.2	0.00
Janygon.T Tfr	0.030	0.019	-0.030	-0.018	0.5	0.7	97.2	95.1	2.11
Jbari(Sch.-ORC)	-0.029	-0.018	0.029	0.017	0.0	-1.2	97.3	97.3	0.00
Jbari ORC Tfr	0.014	0.009	-0.014	-0.009	0.3	0.4	97.3	94.8	2.50
TSE30.28-Jbari Sch.	-0.042	-0.025	0.042	0.023	0.0	-1.9	97.3	97.3	0.00
Jbari Sch. Tfr	0.013	0.008	-0.013	-0.008	0.2	0.3	97.3	95.0	2.27
Jingay-TSE60.20	0.084	0.034	-0.084	-0.036	0.0	-1.5	96.9	96.9	0.00
TSE60.19-Jingay	-0.101	-0.045	0.101	0.043	0.0	-2.2	96.9	96.9	0.00
Jingay Tfr	0.017	0.011	-0.017	-0.010	0.4	0.6	96.9	93.8	3.06
Tshangay2-Jogitar	-0.007	-0.004	0.007	0.000	0.0	-4.4	96.7	96.7	0.00
Jogitar Tfr	0.007	0.004	-0.007	-0.004	0.1	0.1	96.7	95.6	1.18
TSE60.5-Kapasey	-0.020	-0.012	0.020	0.010	0.0	-2.1	97.2	97.2	0.00
Kapasey Tfr	0.020	0.012	-0.019	-0.012	0.2	0.3	97.2	95.9	1.37
Kapasing-TSE60.17	0.033	0.015	-0.033	-0.017	0.0	-1.9	97.0	97.0	0.00
TSE60.16-Kapasing	-0.052	-0.028	0.052	0.027	0.0	-0.6	97.0	97.0	0.00
Kapasing Tfr	0.019	0.012	-0.019	-0.012	0.2	0.3	97.0	95.6	1.37
Kapasing.T-TSE60.18	0.843	0.423	-0.843	-0.424	0.2	-1.2	96.9	96.9	0.02
TSE60.16-Kapasing.T	-0.868	-0.439	0.869	0.436	0.4	-2.6	96.9	97.0	0.05
Kapasing.T Tfr	0.025	0.016	-0.024	-0.015	0.8	1.2	96.9	92.5	4.47
Khorsany GO-TSE50.10	0.149	0.074	-0.149	-0.076	0.0	-2.8	97.2	97.2	0.01
TSE50.9-Khorsany GO	-0.170	-0.087	0.170	0.086	0.0	-0.5	97.2	97.2	0.00
Khorsany GO Tfr	0.020	0.013	-0.020	-0.012	0.5	0.8	97.2	93.6	3.59
TSE50.9-Khorsany.T	-0.011	-0.007	0.011	0.006	0.0	-0.8	97.2	97.2	0.00
Khorsany.T Tfr	0.011	0.007	-0.011	-0.007	0.2	0.2	97.2	95.3	1.95

Branch ID	From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		Vd % Drop
	MW	Mvar	MW	Mvar	kW	kvar	From	To	in Vmag
TSE60.17-Koipani	-0.016	-0.010	0.016	0.008	0.0	-2.1	97.0	97.0	0.00
Koipani Tfr	0.016	0.010	-0.016	-0.010	0.3	0.5	97.0	94.1	2.89
TSE50.22-L.Bararay	-0.020	-0.013	0.020	0.012	0.0	-0.2	97.2	97.2	0.00
L.Bararay Tfr	0.020	0.013	-0.019	-0.012	0.5	0.8	97.2	93.7	3.54
L.Bchu(1A-1B)	0.089	0.047	-0.089	-0.049	0.0	-1.7	96.7	96.7	0.00
TSE60.37-L.Bchu1A	-0.106	-0.058	0.106	0.057	0.0	-0.6	96.7	96.7	0.00
L.Bchu1A Tfr	0.017	0.010	-0.017	-0.010	0.1	0.2	96.7	95.6	1.18
L.Bchu1B-TSE60.38	0.076	0.041	-0.076	-0.041	0.0	-0.7	96.7	96.7	0.00
L.Bchu1B Tfr	0.013	0.008	-0.013	-0.008	0.2	0.3	96.7	94.4	2.35
TSE60.38-L.Bchu2B	-0.017	-0.011	0.017	0.010	0.0	-0.6	96.7	96.7	0.00
L.Bchu2B Tfr	0.017	0.011	-0.016	-0.010	0.4	0.6	96.7	93.8	2.97
L.Bchu3B-U.Bchu1A	0.055	0.029	-0.055	-0.030	0.0	-0.9	96.7	96.7	0.00
TSE60.38-L.Bchu3B	-0.060	-0.032	0.060	0.031	0.0	-0.9	96.7	96.7	0.00
L.Bchu3B Tfr	0.005	0.003	-0.005	-0.003	0.0	0.1	96.7	95.5	1.28
TSE50.15-L.Bichgon	-0.006	-0.004	0.006	0.004	0.0	-0.1	97.3	97.3	0.00
L.Bichgon Tfr	0.006	0.004	-0.006	-0.004	0.1	0.1	97.3	96.2	1.10
TSE20.12-L.Bockery	-0.007	-0.005	0.007	0.003	0.0	-1.3	97.4	97.4	0.00
L.Bockery Tfr	0.007	0.005	-0.007	-0.004	0.1	0.1	97.4	96.1	1.28
TSE40.1-L.Dajay	-0.033	-0.021	0.033	0.021	0.0	-0.1	97.6	97.6	0.00
L.Dajay Tfr	0.033	0.021	-0.033	-0.020	0.6	0.9	97.6	95.2	2.35
TSE50.23-L.DaragonA	-0.033	-0.021	0.033	0.020	0.0	-0.4	97.3	97.3	0.00
L.DaragonA Tfr	0.033	0.021	-0.032	-0.020	0.6	0.8	97.3	95.0	2.30
TSE50.23-L.DaragonB	-0.013	-0.008	0.013	0.007	0.0	-1.0	97.3	97.3	0.00
L.DaragonB Tfr	0.013	0.008	-0.012	-0.008	0.3	0.5	97.3	93.7	3.55
L.GairigonI-TSE30.17	0.144	0.068	-0.144	-0.069	0.0	-1.0	97.2	97.2	0.00
TSE30.15-L.GairigonI	-0.155	-0.075	0.155	0.073	0.0	-2.4	97.2	97.2	0.01
L.GairigonI Tfr	0.012	0.007	-0.011	-0.007	0.2	0.3	97.2	95.1	2.07
L.Gairigon(II-III)	0.015	0.008	-0.015	-0.009	0.0	-0.9	97.2	97.2	0.00
TSE30.17-L.GairigonII	-0.035	-0.021	0.035	0.020	0.0	-0.8	97.2	97.2	0.00
L.GairigonII Tfr	0.020	0.013	-0.020	-0.012	0.5	0.8	97.2	93.6	3.59
L.Gairigon(III-IV)	0.009	0.005	-0.009	-0.006	0.0	-1.0	97.2	97.2	0.00
L.GairigonIII Tfr	0.007	0.004	-0.007	-0.004	0.1	0.1	97.2	95.3	1.86
L.GairigonIV Tfr	0.009	0.006	-0.009	-0.005	0.2	0.2	97.2	94.8	2.42
TSE60.5-L,Harpp	-0.021	-0.013	0.021	0.013	0.0	-0.3	97.2	97.2	0.00
L.Harpp Tfr	0.021	0.013	-0.021	-0.013	0.2	0.4	97.2	95.7	1.50
L.KatikyIII-TSE50.17	0.290	0.166	-0.290	-0.166	0.0	-0.2	97.3	97.3	0.00
TSE50.16-L.KatikyIII	-0.310	-0.179	0.310	0.175	0.1	-3.8	97.3	97.3	0.02

Branch ID	From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		Vd % Drop
	MW	Mvar	MW	Mvar	kW	kvar	From	To	in Vmag
L.KatikyIII Tfr	0.020	0.013	-0.020	-0.012	0.5	0.8	97.3	93.7	3.60
TSE50.17-L.KatikyI	-0.013	-0.008	0.013	0.007	0.0	-0.7	97.3	97.3	0.00
L.KatikyI Tfr	0.013	0.008	-0.012	-0.008	0.3	0.5	97.3	93.7	3.55
TSE50.17-L.KatikyII	-0.009	-0.006	0.009	0.005	0.0	-0.6	97.3	97.3	0.00
L.KatikyII Tfr	0.009	0.006	-0.009	-0.005	0.1	0.2	97.3	95.7	1.57
TSE50.8-L.Khorsany	-0.016	-0.010	0.016	0.009	0.0	-1.2	97.3	97.3	0.00
L.Khorsany Tfr	0.016	0.010	-0.016	-0.010	0.1	0.2	97.3	96.1	1.15
TSE60.15-L.Kokray	-0.042	-0.027	0.042	0.027	0.0	-0.3	97.0	97.0	0.00
L.Kokray Tfr	0.042	0.027	-0.041	-0.026	0.9	1.4	97.0	94.0	2.99
L.Lobsiboty-Zomlthang	0.016	0.009	-0.016	-0.010	0.0	-2.0	97.1	97.1	0.00
TSE60.12-L.Lobsiboty	-0.045	-0.027	0.045	0.026	0.0	-0.9	97.1	97.1	0.00
L.Lobsiboty Tfr	0.029	0.018	-0.029	-0.018	0.4	0.7	97.1	95.0	2.05
Majuwa(L-U)	0.016	0.008	-0.016	-0.010	0.0	-2.0	97.5	97.5	0.00
TSE50.3-L.Majuwa	-0.031	-0.017	0.031	0.014	0.0	-2.9	97.5	97.5	0.00
L.Majuwa Tfr	0.015	0.009	-0.014	-0.009	0.1	0.2	97.5	96.5	1.02
L.Manithang-TSE60.27	0.294	0.161	-0.294	-0.165	0.1	-3.8	96.7	96.7	0.02
TSE60.26-L.Manithang	-0.300	-0.165	0.300	0.165	0.0	-0.4	96.7	96.7	0.00
L.Manithang Tfr	0.006	0.004	-0.006	-0.003	0.0	0.1	96.7	95.7	1.01
TSE20.6-LMarket	-0.281	-0.181	0.281	0.181	0.0	-0.7	97.4	97.4	0.00
L.Market Tfr	0.281	0.181	-0.273	-0.169	8.3	12.5	97.4	93.4	3.99
TSE30.12-L.Pmashong	-0.017	-0.011	0.017	0.010	0.0	-1.1	97.2	97.2	0.00
L.Pmashong Tfr	0.017	0.011	-0.017	-0.010	0.2	0.2	97.2	96.0	1.19
L.Rthaling(A-B)	0.038	0.014	-0.038	-0.015	0.0	-1.2	97.4	97.4	0.00
Rthaling(U-LA)	-0.048	-0.020	0.048	0.017	0.0	-3.2	97.4	97.4	0.01
L.RthalingA Tfr	0.010	0.007	-0.010	-0.006	0.1	0.2	97.4	95.5	1.85
L.RthalingB-TSE30.3	0.027	0.008	-0.027	-0.010	0.0	-1.8	97.4	97.4	0.00
L.RthalingB Tfr	0.011	0.007	-0.011	-0.007	0.1	0.1	97.4	96.6	0.77
TSE50.16-L.Salami	-0.056	-0.035	0.056	0.034	0.0	-1.2	97.3	97.3	0.00
L.Salami Tfr	0.056	0.035	-0.055	-0.034	0.8	1.2	97.3	95.3	1.98
Salaray(U-L)	-0.020	-0.013	0.020	0.012	0.0	-0.9	97.3	97.3	0.00
L.Salaray Tfr	0.020	0.013	-0.020	-0.012	0.5	0.8	97.3	93.6	3.61
TSE40.5-L.Tlingkhar	-0.100	-0.064	0.100	0.062	0.0	-2.4	97.5	97.5	0.00
L.Tlinghkar Tfr	0.100	0.064	-0.097	-0.060	2.6	4.0	97.5	93.9	3.57
Lalikharka(ORC-C)	0.011	0.004	-0.011	-0.007	0.0	-2.9	97.2	97.2	0.00
TSE50.14-Lalikharka ORC	-0.021	-0.010	0.021	0.010	0.0	-0.1	97.2	97.2	0.00
Lalikharka ORC Tfr	0.010	0.007	-0.010	-0.006	0.1	0.2	97.2	95.4	1.84
LalikharkaC Tfr	0.011	0.007	-0.011	-0.007	0.2	0.2	97.2	95.3	1.91

Branch ID	From-To Bus Flow MW	From-To Bus Flow Mvar	To-From Bus Flow MW	To-From Bus Flow Mvar	Losses kW	Losses kvar	% Bus Voltage From	% Bus Voltage To	Vd % Drop in Vmag
TSE50.12-LhamoiII	-0.013	-0.008	0.013	0.007	0.0	-0.7	97.2	97.2	0.00
LhamoiII Tfr	0.013	0.008	-0.013	-0.008	0.2	0.3	97.2	94.9	2.29
LhamoiIII-TSE50.13	0.030	0.009	-0.030	-0.010	0.0	-1.0	97.2	97.2	0.00
TSE50.12-LhamoiIII	-0.042	-0.017	0.042	0.015	0.0	-1.6	97.2	97.2	0.00
LhamoiIII Tfr	0.012	0.008	-0.012	-0.008	0.2	0.3	97.2	95.0	2.20
Lhamoil-TSE50.12	0.055	0.022	-0.055	-0.023	0.0	-0.2	97.2	97.2	0.00
TSE50.10-Lhamoil	-0.087	-0.043	0.087	0.042	0.0	-1.2	97.2	97.2	0.00
Lhamoil Tfr	0.033	0.021	-0.032	-0.020	0.6	0.8	97.2	94.9	2.30
TSE60.9-Lobsiboty	-0.039	-0.025	0.039	0.024	0.0	-0.9	97.1	97.1	0.00
Lobsiboty Tfr	0.039	0.025	-0.038	-0.023	0.8	1.2	97.1	94.4	2.73
TSE40.6-Lungsigg	-0.090	-0.057	0.090	0.056	0.0	-0.2	97.5	97.5	0.00
Lungsigg Tfr	0.090	0.057	-0.089	-0.055	1.1	1.6	97.5	95.9	1.59
TSE60.2-M.Alaichi	-0.019	-0.012	0.019	0.011	0.0	-1.3	97.3	97.3	0.00
M.Alaichi Tfr	0.019	0.012	-0.019	-0.012	0.2	0.3	97.3	96.0	1.37
M.Bararay-Sadugg	0.033	0.020	-0.033	-0.021	0.0	-0.7	97.2	97.2	0.00
TSE50.220M.Bararay	-0.046	-0.029	0.046	0.028	0.0	-0.5	97.2	97.2	0.00
M.Bararay Tfr	0.013	0.008	-0.013	-0.008	0.2	0.3	97.2	94.9	2.34
M.Bichgon-TSE50.15	0.372	0.210	-0.372	-0.211	0.0	-0.5	97.3	97.3	0.00
TSE50.5-M.Bichgon	-0.396	-0.225	0.396	0.224	0.0	-1.0	97.3	97.3	0.01
M.Bichgon Tfr	0.024	0.015	-0.023	-0.014	0.1	0.2	97.3	96.5	0.83
M.Khorsany-TSE50.9	0.181	0.092	-0.181	-0.092	0.0	-0.8	97.2	97.2	0.00
TSE50(7-8)1	-0.225	-0.120	0.225	0.115	0.1	-4.3	97.2	97.3	0.03
M.Khorsany Tfr	0.044	0.028	-0.044	-0.027	0.5	0.8	97.2	95.7	1.58
TSE60.13-M.Kokray	-0.043	-0.027	0.043	0.024	0.0	-3.1	97.0	97.0	0.00
M.Kokray Tfr	0.043	0.027	-0.042	-0.026	1.0	1.5	97.0	94.0	3.05
M.Salami-TSE50.5	0.698	0.371	-0.697	-0.373	0.2	-2.2	97.4	97.3	0.03
Salami(U-M)	-0.725	-0.388	0.726	0.387	0.1	-1.2	97.4	97.4	0.02
M.Salami Tfr	0.028	0.017	-0.028	-0.017	0.2	0.3	97.4	96.4	0.98
M.Salaray-TSE50.22	0.066	0.039	-0.066	-0.040	0.0	-1.2	97.3	97.2	0.00
TSE50.21-M.Salaray	-0.076	-0.046	0.076	0.045	0.0	-0.7	97.3	97.3	0.00
M.Salaray Tfr	0.010	0.007	-0.010	-0.006	0.1	0.2	97.3	95.4	1.83
TSE40.4-M.Tlingkhar	-0.123	-0.076	0.123	0.075	0.0	-0.5	97.5	97.5	0.00
M.Tlingkhar Tfr	0.034	0.022	-0.033	-0.021	0.6	0.9	97.5	95.1	2.39
TSE60.32-Majgon	-0.015	-0.010	0.015	0.006	0.0	-3.5	96.7	96.7	0.00
Majgon Tfr	0.015	0.010	-0.015	-0.009	0.3	0.5	96.7	93.9	2.76
TSE60.34-ManithangI	-0.006	-0.004	0.006	0.004	0.0	-0.4	96.8	96.8	0.00
ManithangI Tfr	0.006	0.004	-0.006	-0.004	0.1	0.1	96.8	95.6	1.13

Branch ID	From-To Bus Flow MW	From-To Bus Flow Mvar	To-From Bus Flow MW	To-From Bus Flow Mvar	Losses kW	Losses kvar	% Bus Voltage From	% Bus Voltage To	Vd % Drop in Vmag
TSE60.35-ManithangII	-0.008	-0.005	0.008	0.004	0.0	-0.4	96.8	96.8	0.00
ManithangII Tfr	0.008	0.005	-0.008	-0.005	0.1	0.1	96.8	95.4	1.35
ManithangIII-Nthang	0.009	0.005	-0.009	-0.005	0.0	-0.9	96.8	96.8	0.00
TSE60.36-ManithangIII	-0.014	-0.008	0.014	0.007	0.0	-0.8	96.8	96.8	0.00
ManithangIII Tfr	0.006	0.004	-0.006	-0.004	0.0	0.1	96.8	95.7	1.02
TSE60.1-Mchuna	-0.017	-0.011	0.017	0.010	0.0	-0.5	97.5	97.5	0.00
Mchuna Tfr	0.017	0.011	-0.017	-0.010	0.4	0.6	97.5	94.5	3.05
Menchuna-TSE20.1	1.180	0.732	-1.179	-0.733	0.4	-1.1	97.5	97.5	0.04
Menchuna Tfr	0.112	0.072	-0.108	-0.067	3.3	4.9	97.5	93.5	3.99
TSE30.9-Mendrelgg	-0.050	-0.032	0.050	0.032	0.0	-0.4	97.2	97.2	0.00
Mendrelgg Tfr	0.050	0.032	-0.048	-0.030	1.3	2.0	97.2	93.7	3.53
TSE30.10-Mendrelgg.C.S	-0.050	-0.031	0.050	0.031	0.0	-0.4	97.2	97.2	0.00
Mendrelgg.C.S Tfr	0.050	0.031	-0.050	-0.031	0.3	0.5	97.2	96.3	0.88
TSE50.2-Municipal WT	-0.010	-0.006	0.010	0.006	0.0	-0.1	97.5	97.5	0.00
Municipal WT Tfr	0.010	0.006	-0.010	-0.006	0.1	0.1	97.5	96.8	0.70
Nevarey-Samalgaon	0.948	0.470	-0.947	-0.473	0.6	-3.2	97.5	97.4	0.07
TSE30.1-Nevarey	-0.985	-0.493	0.985	0.491	0.4	-2.3	97.5	97.6	0.05
Nevarey Tfr	0.037	0.023	-0.037	-0.023	0.4	0.5	97.5	96.2	1.32
TSE20.2-New Court	-0.046	-0.029	0.046	0.028	0.0	-0.6	97.5	97.5	0.00
New Court Tfr	0.046	0.029	-0.045	-0.028	0.3	0.4	97.5	96.7	0.80
TSE60.28-Newatar	-0.016	-0.010	0.016	0.009	0.0	-1.4	96.7	96.7	0.00
Newatar Tfr	0.016	0.010	-0.016	-0.010	0.3	0.5	96.7	93.8	2.87
Nimazor-Saunay	0.004	0.000	-0.004	-0.002	0.0	-2.0	97.4	97.4	0.00
Zulpheygn-Nimazor	-0.010	-0.004	0.010	0.002	0.0	-2.5	97.4	97.4	0.00
Nimazor Tfr	0.006	0.004	-0.006	-0.004	0.1	0.1	97.4	96.3	1.12
Nr. Forest.O-TSE20.7	0.392	0.244	-0.392	-0.245	0.0	-1.4	97.4	97.4	0.01
TSE20.6-Nr. Forest.O	-0.433	-0.269	0.433	0.269	0.0	-0.7	97.4	97.4	0.01
Nr. Forest.O Tfr	0.041	0.026	-0.041	-0.025	0.4	0.7	97.4	95.9	1.45
Nr. O.Court-	1.041	0.646	-1.041	-0.646	0.1	-0.2	97.5	97.5	0.01
TSE20.1-Nr. O.Court	-1.097	-0.682	1.097	0.682	0.1	-0.4	97.5	97.5	0.01
Nr. O.Court Tfr	0.056	0.036	-0.055	-0.034	1.7	2.5	97.5	93.5	4.00
Nr. TCom-U.Market	0.177	0.111	-0.177	-0.111	0.0	-0.6	97.5	97.5	0.00
TSE20.4-Nr. TCom	-0.226	-0.142	0.226	0.141	0.0	-0.1	97.5	97.5	0.00
Nr. TCom Tfr	0.049	0.031	-0.049	-0.030	0.3	0.5	97.5	96.6	0.87
TSE20.1-Nr. Dratshang	-0.082	-0.052	0.082	0.051	0.0	-0.4	97.5	97.5	0.00
Nr.Dratshang Tfr	0.082	0.052	-0.081	-0.050	0.9	1.3	97.5	96.0	1.45
Nthang Tfr	0.009	0.005	-0.008	-0.005	0.1	0.1	96.8	95.2	1.53

Branch ID	From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		Vd % Drop
	MW	Mvar	MW	Mvar	kW	kvar	From	To	in Vmag
TSE30.8-PakhayA	-0.011	-0.007	0.011	0.006	0.0	-0.7	97.3	97.3	0.00
PakhayA Tfr	0.011	0.007	-0.011	-0.007	0.1	0.1	97.3	96.5	0.78
TSE30.8-PakhayB	-0.015	-0.009	0.015	0.008	0.0	-0.9	97.3	97.3	0.00
PakhayB Tfr	0.015	0.009	-0.015	-0.009	0.1	0.2	97.3	96.2	1.03
TSE60.11-PelrithangT13	-0.044	-0.028	0.044	0.028	0.0	-0.1	97.1	97.1	0.00
PelrithangT13 Tfr	0.044	0.028	-0.043	-0.026	1.0	1.5	97.1	94.0	3.09
TSE60.11-PelrithangT14	-0.073	-0.046	0.073	0.045	0.0	-1.5	97.1	97.1	0.00
PelrithangT14 Tfr	0.073	0.046	-0.071	-0.044	1.4	2.1	97.1	94.5	2.59
Phalady Tfr	0.004	0.003	-0.004	-0.003	0.0	0.0	96.7	95.9	0.79
PhirayI-TSE30.18	0.071	0.032	-0.071	-0.033	0.0	-0.9	97.2	97.2	0.00
TSE30.15-L.GairigonI1	-0.092	-0.045	0.092	0.043	0.0	-2.4	97.2	97.2	0.00
PhirayI Tfr	0.020	0.013	-0.020	-0.012	0.6	0.8	97.2	93.5	3.65
TSE30.18-PhirayII	-0.012	-0.008	0.012	0.007	0.0	-0.6	97.2	97.2	0.00
PhirayII Tfr	0.012	0.008	-0.012	-0.007	0.2	0.3	97.2	95.0	2.18
TSE60.9-Pmathang	-0.024	-0.015	0.024	0.015	0.0	-0.4	97.1	97.1	0.00
Pmathang Tfr	0.024	0.015	-0.024	-0.015	0.3	0.5	97.1	95.4	1.69
RAA PDC1 Tfr	-0.105	-0.065	0.106	0.066	0.7	1.1	96.4	97.4	0.93
RAA PDC2 Tfr	-0.084	-0.052	0.084	0.052	0.5	0.7	96.6	97.4	0.74
TSE60.14-RanaII	-0.026	-0.017	0.026	0.012	0.0	-4.3	97.0	97.0	0.00
RanaII Tfr	0.026	0.017	-0.025	-0.015	0.9	1.3	97.0	92.4	4.59
RiserboA-TSE30.24	0.189	0.083	-0.189	-0.085	0.0	-2.0	97.4	97.3	0.01
TSE30.23-RiserboA	-0.212	-0.097	0.212	0.096	0.0	-0.6	97.4	97.4	0.00
RiserboA Tfr	0.023	0.014	-0.022	-0.014	0.3	0.4	97.4	95.8	1.59
TSE30.4-RiserboB	-0.052	-0.033	0.052	0.033	0.0	-0.4	97.3	97.3	0.00
RiserboB Tfr	0.052	0.033	-0.051	-0.031	1.4	2.1	97.3	93.6	3.68
TSE30.5-RiserboC	-0.050	-0.031	0.050	0.031	0.0	-0.5	97.3	97.3	0.00
RiserboC Tfr	0.050	0.031	-0.049	-0.030	0.6	1.0	97.3	95.5	1.76
Sadugg Tfr	0.033	0.021	-0.032	-0.020	0.6	0.8	97.2	94.9	2.32
Salray(B-A)	-0.009	-0.006	0.009	0.004	0.0	-1.6	97.2	97.2	0.00
SalrayA Tfr	0.009	0.006	-0.009	-0.006	0.1	0.2	97.2	95.6	1.61
Zlingzor-SalrayB	-0.023	-0.013	0.023	0.010	0.0	-2.7	97.2	97.2	0.00
SalrayB Tfr	0.014	0.009	-0.014	-0.008	0.3	0.4	97.2	94.7	2.47
Samalgaon-TSE30.2	0.938	0.467	-0.938	-0.469	0.3	-1.7	97.4	97.4	0.03
Samalgaon Tfr	0.009	0.006	-0.009	-0.006	0.1	0.2	97.4	95.8	1.64
Samzhing(A-B)	0.212	0.102	-0.212	-0.103	0.0	-1.4	97.2	97.2	0.01
TSE30.11-SamzhingA	-0.224	-0.109	0.224	0.107	0.0	-2.8	97.2	97.2	0.01
SamzhingA Tfr	0.012	0.008	-0.012	-0.007	0.2	0.3	97.2	95.1	2.12

Branch ID	From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		Vd % Drop
	MW	Mvar	MW	Mvar	kW	kvar	From	To	in Vmag
SamzhingB-TSE30.13	0.197	0.093	-0.197	-0.094	0.0	-0.5	97.2	97.2	0.00
SamzhingB Tfr	0.015	0.010	-0.015	-0.009	0.5	0.7	97.2	93.0	4.22
Sanumalay(A-B)	0.004	0.000	-0.004	-0.003	0.0	-2.4	96.7	96.7	0.00
TSE60.45-SanumalayA	-0.008	-0.003	0.008	0.003	0.0	-0.3	96.7	96.7	0.00
SanumalayA Tfr	0.004	0.003	-0.004	-0.003	0.0	0.1	96.7	95.6	1.14
SanumalayB Tfr	0.004	0.003	-0.004	-0.003	0.0	0.0	96.7	96.0	0.76
Saunay Tfr	0.004	0.002	-0.004	-0.002	0.0	0.0	97.4	96.3	1.08
TSE60.43-Saurani	-0.010	-0.006	0.010	0.004	0.0	-1.8	96.7	96.7	0.00
Saurani Tfr	0.010	0.006	-0.010	-0.006	0.1	0.2	96.7	95.0	1.74
TSE50.20-Semjong Sch.	-0.032	-0.020	0.032	0.020	0.0	-0.4	97.3	97.3	0.00
Semjong Sch. tfr	0.032	0.020	-0.031	-0.019	0.5	0.8	97.3	95.0	2.25
Sethang GO-TSE60.30	0.097	0.050	-0.097	-0.052	0.0	-1.7	96.7	96.7	0.00
TSE60.29-Sethang GO	-0.129	-0.070	0.129	0.068	0.0	-1.8	96.7	96.7	0.00
Sethang GO Tfr	0.031	0.020	-0.031	-0.019	0.5	0.8	96.7	94.5	2.23
TSE60.29-SethangI	-0.028	-0.018	0.028	0.017	0.0	-0.3	96.7	96.7	0.00
SethangI Tfr	0.028	0.018	-0.028	-0.017	0.4	0.6	96.7	94.7	1.99
TSE60.30-SethangII	-0.022	-0.014	0.022	0.014	0.0	-0.4	96.7	96.7	0.00
SethangII Tfr	0.022	0.014	-0.022	-0.014	0.3	0.4	96.7	95.1	1.57
TSE60.32-SethangIII	-0.018	-0.011	0.018	0.011	0.0	-0.8	96.7	96.7	0.00
SethangIII Tfr	0.018	0.011	-0.018	-0.011	0.2	0.3	96.7	95.4	1.27
TSE60.20-Simpani	-0.039	-0.025	0.039	0.021	0.0	-4.0	96.9	96.9	0.01
Simpani Tfr	0.032	0.020	-0.031	-0.019	0.5	0.8	96.9	94.6	2.24
Sunkosh-TSE40.7	0.126	0.065	-0.126	-0.065	0.0	-0.5	97.5	97.5	0.00
TSE40.6-Sunkosh	-0.229	-0.130	0.229	0.126	0.0	-3.4	97.5	97.5	0.01
Sunkosh Tfr	0.103	0.065	-0.102	-0.063	1.4	2.1	97.5	95.6	1.83
TSE40.8-SunkoshA	-0.025	-0.016	0.025	0.014	0.0	-1.9	97.4	97.4	0.00
SunkoshA Tfr	0.025	0.016	-0.024	-0.015	0.8	1.2	97.4	93.0	4.48
TSE40.8-SunkoshB	-0.010	-0.007	0.010	0.005	0.0	-1.2	97.4	97.4	0.00
SunkoshB Tfr	0.010	0.007	-0.010	-0.006	0.1	0.2	97.4	95.6	1.83
TSE60.7-SuntolayA	-0.017	-0.011	0.017	0.011	0.0	-0.4	97.1	97.1	0.00
SuntolayA Tfr	0.017	0.011	-0.017	-0.011	0.2	0.2	97.1	95.9	1.22
TSE60.7-SuntolayB	-0.030	-0.019	0.030	0.018	0.0	-1.5	97.1	97.1	0.00
SuntolayB Tfr	0.030	0.019	-0.030	-0.019	0.5	0.7	97.1	95.0	2.14
TSE60.33-TeureyI	-0.018	-0.011	0.018	0.010	0.0	-0.9	96.7	96.7	0.00
TeureyI Tfr	0.018	0.011	-0.017	-0.011	0.4	0.6	96.7	93.5	3.16
ThangrayA-TSE30.27	0.119	0.051	-0.119	-0.052	0.0	-1.1	97.3	97.3	0.00
ThangrayA Tfr	0.018	0.012	-0.018	-0.011	0.2	0.3	97.3	96.0	1.29

Branch ID	From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		Vd % Drop
	MW	Mvar	MW	Mvar	kW	kvar	From	To	in Vmag
Thangray(B-C)	0.035	0.012	-0.035	-0.015	0.0	-3.7	97.3	97.3	0.00
TSE30.27-ThangrayB	-0.055	-0.025	0.055	0.022	0.0	-2.2	97.3	97.3	0.00
ThangrayB Tfr	0.021	0.013	-0.020	-0.013	0.2	0.3	97.3	95.9	1.45
ThangrayC Tfr	0.012	0.007	-0.012	-0.007	0.1	0.1	97.3	96.5	0.81
TSE60.22-ThasaA	-0.014	-0.008	0.014	0.004	0.0	-4.5	96.9	96.9	0.00
ThasaA Tfr	0.008	0.005	-0.008	-0.005	0.1	0.1	96.9	95.5	1.37
TSE60.46-Thulomalay	-0.006	-0.004	0.006	0.003	0.0	-1.0	96.7	96.7	0.00
Thulomalay Tfr	0.006	0.004	-0.006	-0.004	0.0	0.1	96.7	95.7	1.03
Tlingkhar(U.B-Top)	-0.012	-0.007	0.012	0.006	0.0	-0.9	97.5	97.5	0.00
Tlingkhar Top Tfr	0.012	0.007	-0.011	-0.007	0.2	0.3	97.5	95.5	2.06
TSE30.22-ToisangI	-0.007	-0.004	0.007	0.003	0.0	-0.9	97.2	97.2	0.00
ToisangI Tfr	0.007	0.004	-0.007	-0.004	0.1	0.1	97.2	96.0	1.16
TSE30.22-ToisangII	-0.010	-0.006	0.010	0.005	0.0	-1.6	97.2	97.2	0.00
ToisangII Tfr	0.010	0.006	-0.010	-0.006	0.1	0.2	97.2	95.4	1.73
TpangI-TSE30.8	0.026	0.010	-0.026	-0.015	0.0	-4.5	97.3	97.3	0.00
TSE30.7-TpangI	-0.053	-0.027	0.053	0.026	0.0	-0.8	97.3	97.3	0.00
TpangI Tfr	0.027	0.017	-0.027	-0.016	0.4	0.6	97.3	95.4	1.90
TpangII-TSE30.10	0.404	0.205	-0.404	-0.205	0.0	-0.2	97.2	97.2	0.00
TSE30.9-TpangII	-0.449	-0.233	0.449	0.231	0.1	-1.8	97.2	97.2	0.02
TpangII Tfr	0.045	0.028	-0.044	-0.027	0.5	0.8	97.2	95.7	1.58
TSE20(2-3)	0.995	0.618	-0.995	-0.618	0.0	-0.2	97.5	97.5	0.00
TSE20(3-4)	0.954	0.593	-0.953	-0.594	0.2	-1.0	97.5	97.5	0.02
TSE20(4-5)	0.727	0.452	-0.727	-0.453	0.1	-1.1	97.5	97.4	0.02
TSE20(5-6)	0.715	0.447	-0.715	-0.449	0.2	-2.2	97.4	97.4	0.04
TSE20.5-VIP G.H	0.012	0.006	-0.012	-0.008	0.0	-1.6	97.4	97.4	0.00
TSE20(7-10)	0.350	0.214	-0.350	-0.215	0.0	-1.1	97.4	97.4	0.01
TSE20(10-11)	0.238	0.145	-0.238	-0.145	0.0	-0.4	97.4	97.4	0.00
TSE20(11-12)	0.197	0.120	-0.197	-0.121	0.0	-1.1	97.4	97.4	0.01
TSE20(12-13)	0.190	0.118	-0.190	-0.119	0.0	-1.2	97.4	97.4	0.01
TSE30(2-23)	0.869	0.440	-0.868	-0.443	0.4	-2.8	97.4	97.4	0.05
TSE30.2-U.Rthaling	0.069	0.029	-0.069	-0.030	0.0	-1.1	97.4	97.4	0.00
TSE30.3-ZulpheygnA	0.009	0.003	-0.009	-0.005	0.0	-2.0	97.4	97.4	0.00
TSE30.3-ZulpheygnB	0.018	0.006	-0.018	-0.007	0.0	-0.5	97.4	97.4	0.00
TSE30(4-5)	0.605	0.316	-0.604	-0.317	0.0	-0.7	97.3	97.3	0.01
TSE30(23-4)	-0.656	-0.349	0.657	0.346	0.2	-3.1	97.3	97.4	0.04
TSE30(5-6)	0.555	0.286	-0.555	-0.288	0.1	-1.3	97.3	97.3	0.02
TSE30(6-7)	0.552	0.286	-0.551	-0.288	0.1	-2.5	97.3	97.3	0.03

Branch ID	From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		Vd % Drop
	MW	Mvar	MW	Mvar	kW	kvar	From	To	in Vmag
TSE30(7-9)	0.499	0.262	-0.499	-0.263	0.0	-0.9	97.3	97.2	0.01
TSE30(10-11)	0.354	0.174	-0.354	-0.176	0.1	-2.4	97.2	97.2	0.02
TSE30.11-U.Pmashong	0.130	0.070	-0.130	-0.071	0.0	-0.7	97.2	97.2	0.00
TSE30.12-ZlingzorA	0.053	0.024	-0.053	-0.026	0.0	-2.6	97.2	97.2	0.00
U.Pmashong-TSE30.12	-0.070	-0.033	0.070	0.032	0.0	-1.7	97.2	97.2	0.00
TSE30(13-14)	0.183	0.087	-0.183	-0.087	0.0	-0.3	97.2	97.2	0.00
TSE30.13-U.GairigonII	0.015	0.007	-0.015	-0.009	0.0	-2.4	97.2	97.2	0.00
TSE30(14-15)	0.177	0.084	-0.177	-0.085	0.0	-0.7	97.2	97.2	0.00
TSE30.14-U.GairigonIII	0.005	0.003	-0.005	-0.003	0.0	-0.7	97.2	97.2	0.00
TSE30.15-U.GairigonI	0.022	0.012	-0.022	-0.014	0.0	-1.3	97.2	97.2	0.00
TSE30(18-19)	0.059	0.026	-0.059	-0.027	0.0	-1.1	97.2	97.2	0.00
TSE30(19-20)	0.034	0.012	-0.034	-0.012	0.0	-0.8	97.2	97.2	0.00
TSE30(20-21)	0.029	0.010	-0.029	-0.012	0.0	-2.5	97.2	97.2	0.00
TSE30(21-22)	0.016	0.005	-0.016	-0.008	0.0	-3.0	97.2	97.2	0.00
TSE30(27-28)	0.063	0.030	-0.063	-0.032	0.0	-1.6	97.3	97.3	0.00
TSE30(28-29)	0.021	0.008	-0.021	-0.010	0.0	-2.1	97.3	97.3	0.00
TSE30.29-Utray	0.009	0.003	-0.009	-0.006	0.0	-2.9	97.3	97.3	0.00
TSE40(1-2)	0.631	0.356	-0.631	-0.358	0.1	-2.0	97.6	97.5	0.02
TSE40(2-3)	0.577	0.330	-0.577	-0.333	0.1	-2.2	97.5	97.5	0.02
TSE40.2-U.TlingkharA	0.053	0.027	-0.053	-0.029	0.0	-1.3	97.5	97.5	0.00
TSE40(3-4)	0.542	0.311	-0.541	-0.313	0.1	-2.4	97.5	97.5	0.02
TSE40.3-U.TlingkharB	0.036	0.022	-0.036	-0.022	0.0	-0.2	97.5	97.5	0.00
TSE40(4-5)	0.419	0.238	-0.419	-0.243	0.1	-4.5	97.5	97.5	0.03
TSE40(5-6)	0.319	0.181	-0.319	-0.183	0.0	-2.3	97.5	97.5	0.01
TSE40(7-8)	0.035	0.015	-0.035	-0.020	0.0	-4.6	97.5	97.4	0.01
TSE50(1-2)	0.962	0.526	-0.962	-0.527	0.2	-1.0	97.5	97.5	0.02
TSE50.1-U.Menchuna	0.004	0.002	-0.004	-0.003	0.0	-0.8	97.5	97.5	0.00
TSE50(2-3)	0.952	0.521	-0.952	-0.521	0.0	-0.2	97.5	97.5	0.00
TSE50.3-U.Bockery	0.921	0.507	-0.920	-0.509	0.4	-2.2	97.5	97.5	0.05
TSE50.4-U.BockeryT5	0.014	0.009	-0.014	-0.009	0.0	-0.3	97.4	97.4	0.00
TSE50.4-U.Salami	0.756	0.404	-0.755	-0.406	0.2	-2.3	97.4	97.4	0.04
U.Bockery-TSE50.4	-0.770	-0.412	0.770	0.410	0.2	-2.1	97.4	97.5	0.03
TSE50(5-6)	0.286	0.142	-0.286	-0.145	0.0	-2.5	97.3	97.3	0.01
TSE50(6-7)	0.278	0.142	-0.278	-0.143	0.0	-1.2	97.3	97.3	0.01
TSE50(7-8)	0.242	0.120	-0.241	-0.124	0.1	-4.3	97.3	97.3	0.04
TSE50(10-11)	0.062	0.035	-0.062	-0.036	0.0	-1.7	97.2	97.2	0.00
TSE50(13-14)	0.025	0.009	-0.025	-0.012	0.0	-2.9	97.2	97.2	0.00

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	MW	Mvar	MW	Mvar	kW	kvar	From	To	in Vmag
TSE50(15-16)	0.366	0.207	-0.366	-0.209	0.1	-2.2	97.3	97.3	0.02
TSE50(17-18)	0.268	0.154	-0.268	-0.156	0.0	-1.8	97.3	97.3	0.01
TSE50(18-20)	0.139	0.080	-0.139	-0.081	0.0	-0.9	97.3	97.3	0.00
TSE50.18-U.KatikyA	0.023	0.014	-0.023	-0.014	0.0	-0.1	97.3	97.3	0.00
TSE50.18-U.KatikyB	0.106	0.062	-0.106	-0.063	0.0	-0.8	97.3	97.3	0.00
U.KatikyA-TSE50.19	-0.012	-0.007	0.012	0.006	0.0	-0.6	97.3	97.3	0.00
TSE50(20-21)	0.107	0.061	-0.107	-0.064	0.0	-2.4	97.3	97.3	0.01
TSE50.21-U.Salaray	0.031	0.019	-0.031	-0.019	0.0	-0.3	97.3	97.3	0.00
U.DaragonB-TSE50.23	-0.045	-0.028	0.045	0.026	0.0	-1.2	97.3	97.3	0.00
TSE60(2-3)	1.614	0.854	-1.613	-0.855	1.1	-1.4	97.3	97.3	0.08
TSE60(3-4)	1.594	0.843	-1.594	-0.844	0.4	-0.6	97.3	97.2	0.03
TSE60(4-5)	0.041	0.022	-0.041	-0.023	0.0	-1.1	97.2	97.2	0.00
TSE60(4-6)	1.553	0.822	-1.551	-0.823	1.1	-1.7	97.2	97.1	0.08
TSE60(6-7)	0.048	0.028	-0.048	-0.028	0.0	-0.2	97.1	97.1	0.00
TSE60(6-8)	1.331	0.686	-1.330	-0.687	0.5	-1.2	97.1	97.1	0.04
TSE60(8-9)	0.396	0.222	-0.396	-0.223	0.0	-1.3	97.1	97.1	0.01
TSE60.9-U.Lobsiboty	0.333	0.185	-0.333	-0.188	0.1	-3.4	97.1	97.1	0.02
TSE60(10-11)	0.116	0.072	-0.116	-0.073	0.0	-0.8	97.1	97.1	0.00
TSE60(10-12)	0.179	0.094	-0.179	-0.096	0.0	-2.2	97.1	97.1	0.01
U.Lobsiboty-TSE60.10	-0.295	-0.166	0.295	0.164	0.0	-1.4	97.1	97.1	0.01
TSE60.12-U.LobsibotyT15	0.134	0.070	-0.134	-0.071	0.0	-0.7	97.1	97.1	0.00
TSE60(13-14)	0.084	0.044	-0.084	-0.045	0.0	-1.8	97.0	97.0	0.01
U.LobsibotyT15-TSE60.13	-0.127	-0.068	0.127	0.067	0.0	-1.1	97.0	97.1	0.00
TSE60(14-15)	0.059	0.033	-0.059	-0.033	0.0	-0.3	97.0	97.0	0.00
TSE60.15-U.Kokray	0.016	0.007	-0.016	-0.011	0.0	-3.9	97.0	97.0	0.00
TSE60.18-Tsirangtoe CS	0.054	0.034	-0.054	-0.034	0.0	-0.1	96.9	96.9	0.00
TSE60.18-Tsirangtoe Sch.	0.789	0.390	-0.789	-0.391	0.1	-0.7	96.9	96.9	0.01
Tsirangtoe Sch.-TSE60.19	-0.747	-0.365	0.747	0.364	0.0	-0.3	96.9	96.9	0.00
TSE60(20-21)	0.045	0.015	-0.045	-0.015	0.0	-0.3	96.9	96.9	0.00
TSE60(25-26)	0.345	0.189	-0.345	-0.191	0.0	-2.3	96.8	96.7	0.02
TSE60(25-34)	0.221	0.093	-0.221	-0.094	0.0	-0.6	96.8	96.8	0.00
TSE60.27-TthangI	0.062	0.040	-0.062	-0.040	0.0	-0.7	96.7	96.7	0.00
TSE60.27-TthangII	0.232	0.126	-0.231	-0.127	0.0	-1.2	96.7	96.7	0.01
TSE60(28-29)	0.157	0.083	-0.157	-0.086	0.0	-2.9	96.7	96.7	0.01
TthangII-TSE60.28	-0.173	-0.092	0.173	0.090	0.0	-2.1	96.7	96.7	0.01
TSE60(30-31)	0.067	0.033	-0.067	-0.034	0.0	-1.0	96.7	96.7	0.00
TSE60(31-32)	0.033	0.017	-0.033	-0.017	0.0	-0.2	96.7	96.7	0.00

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	MW	Mvar	MW	Mvar	kW	kvar	From	To	in Vmag
TSE60(31-33)	0.033	0.017	-0.033	-0.020	0.0	-2.7	96.7	96.7	0.00
TSE60(34-35)	0.215	0.090	-0.215	-0.091	0.0	-1.5	96.8	96.8	0.01
TSE60(35-36)	0.207	0.087	-0.207	-0.089	0.0	-1.5	96.8	96.8	0.01
TSE60(36-37)	0.193	0.081	-0.193	-0.083	0.0	-1.5	96.8	96.7	0.01
TSE60(37-40)	0.087	0.026	-0.087	-0.028	0.0	-2.6	96.7	96.7	0.00
TSE60.39-U.Bchu2A	0.018	0.010	-0.018	-0.011	0.0	-0.8	96.7	96.7	0.00
TSE60.39-U.Bchu4A	0.028	0.015	-0.028	-0.016	0.0	-0.7	96.7	96.7	0.00
U.Bchu1A-TSE60.39	-0.046	-0.025	0.046	0.025	0.0	-0.3	96.7	96.7	0.00
TSE60(40-41)	0.066	0.015	-0.066	-0.016	0.0	-1.0	96.7	96.7	0.00
TSE60(41-42)	0.053	0.008	-0.053	-0.010	0.0	-1.5	96.7	96.7	0.00
TSE60(42-43)	0.043	0.009	-0.043	-0.009	0.0	-0.4	96.7	96.7	0.00
TSE60(43-44)	0.033	0.005	-0.033	-0.007	0.0	-1.5	96.7	96.7	0.00
TSE60.44-Tshangay1	0.024	0.006	-0.024	-0.007	0.0	-0.9	96.7	96.7	0.00
TSE60.44-Tshangay2	0.009	0.000	-0.009	-0.001	0.0	-1.0	96.7	96.7	0.00
TSE60(45-46)	0.010	0.003	-0.010	-0.005	0.0	-1.6	96.7	96.7	0.00
Tshangay1-TSE60.45	-0.018	-0.006	0.018	0.003	0.0	-2.7	96.7	96.7	0.00
Tshangay1 Tfr	0.006	0.004	-0.006	-0.004	0.0	0.1	96.7	95.7	1.07
Tshangay2 Tfr	0.003	0.002	-0.003	-0.002	0.0	0.0	96.7	95.6	1.18
Tsirangtoe CS Tfr	0.054	0.034	-0.054	-0.033	0.4	0.6	96.9	95.9	0.96
Tsirangtoe Sch. Tfr	0.042	0.027	-0.041	-0.025	0.9	1.4	96.9	93.9	2.95
Tthangi Tfr	0.062	0.040	-0.060	-0.037	2.1	3.1	96.7	92.3	4.46
TthangII Tfr	0.059	0.037	-0.058	-0.036	0.9	1.4	96.7	94.6	2.09
U.Bchu1A Tfr	0.009	0.006	-0.009	-0.006	0.1	0.2	96.7	95.1	1.63
U.Bchu(2A-2B)	0.005	0.003	-0.005	-0.003	0.0	-0.4	96.7	96.7	0.00
U.Bchu2A Tfr	0.013	0.008	-0.013	-0.008	0.2	0.3	96.7	94.4	2.31
U.Bchu2B Tfr	0.005	0.003	-0.005	-0.003	0.1	0.1	96.7	94.7	2.08
U.Bchu(3A-3B)	0.008	0.004	-0.008	-0.004	0.0	-0.6	96.7	96.7	0.00
U.Bchu(4A-3A)	-0.015	-0.008	0.015	0.007	0.0	-1.0	96.7	96.7	0.00
U.Bchu3A Tfr	0.007	0.005	-0.007	-0.005	0.1	0.1	96.7	95.4	1.31
U.Bchu(3B-4B)	0.005	0.002	-0.005	-0.003	0.0	-0.7	96.7	96.7	0.00
U.Bchu3B Tfr	0.003	0.002	-0.003	-0.002	0.0	0.0	96.7	95.8	0.95
U.Bchu4A Tfr	0.013	0.008	-0.013	-0.008	0.2	0.3	96.7	94.4	2.29
U.Bchu4B Tfr	0.005	0.003	-0.005	-0.003	0.0	0.1	96.7	95.5	1.27
U.Bockery Tfr	0.150	0.098	-0.144	-0.089	6.0	9.0	97.5	92.1	5.40
U.BockeryT5 Tfr	0.014	0.009	-0.014	-0.009	0.1	0.2	97.4	96.4	1.00
U.Daragon(A-B)	0.065	0.038	-0.065	-0.039	0.0	-1.3	97.3	97.3	0.00
U.KatikyB-U.DaragonA	-0.076	-0.045	0.076	0.043	0.0	-1.3	97.3	97.3	0.00

Branch ID	From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		Vd % Drop
	MW	Mvar	MW	Mvar	kW	kvar	From	To	in Vmag
U.DaragonA Tfr	0.011	0.007	-0.011	-0.007	0.2	0.2	97.3	95.3	1.93
U.DaragonB Tfr	0.019	0.013	-0.019	-0.012	0.8	1.2	97.3	91.8	5.46
U.GairigonI Tfr	0.022	0.014	-0.022	-0.013	0.2	0.4	97.2	95.6	1.54
U.GairigonII Tfr	0.015	0.009	-0.014	-0.009	0.3	0.4	97.2	94.6	2.63
U.GairigonIII Tfr	-0.005	-0.003	0.005	0.003	0.0	0.1	96.2	97.2	0.97
U.KatikyA Tfr	0.012	0.007	-0.012	-0.007	0.2	0.3	97.3	95.2	2.10
U,KatikyB Tfr	0.030	0.019	-0.030	-0.019	0.5	0.7	97.3	95.1	2.14
U.Kokray Tfr	0.016	0.011	-0.016	-0.010	0.4	0.5	97.0	94.1	2.94
U.Lobsiboty Tfr	0.038	0.024	-0.038	-0.023	0.4	0.6	97.1	95.7	1.35
U.LobsibotyT15 Tfr	0.006	0.004	-0.006	-0.004	0.1	0.1	97.1	95.9	1.14
U.Majuwa Tfr	0.016	0.010	-0.016	-0.010	0.1	0.2	97.5	96.4	1.14
U.Market Tfr	0.177	0.111	-0.175	-0.108	2.0	3.1	97.5	95.9	1.56
U.Menchuna Tfr	0.004	0.003	-0.004	-0.003	0.0	0.0	97.5	96.7	0.79
U.Pmashong Tfr	0.060	0.039	-0.058	-0.036	1.9	2.9	97.2	92.9	4.28
U.Rthaling Tfr	0.021	0.013	-0.020	-0.013	0.2	0.3	97.4	95.9	1.45
U.Salami Tfr	0.030	0.019	-0.029	-0.018	0.5	0.7	97.4	95.3	2.10
U.Salaray Tfr	0.011	0.007	-0.011	-0.007	0.1	0.2	97.3	95.4	1.89
U.TlingkharA Tfr	0.024	0.015	-0.024	-0.015	0.3	0.5	97.5	95.8	1.69
U.TlingkharB Tfr	-0.024	-0.015	0.024	0.015	0.3	0.5	95.8	97.5	1.69
Utray Tfr	0.009	0.006	-0.009	-0.005	0.1	0.2	97.3	95.7	1.58
VIP G.H Tfr	0.012	0.008	-0.012	-0.008	0.1	0.1	97.4	96.6	0.87
TSE30.12-ZlingzorA1	-0.042	-0.022	0.042	0.020	0.0	-2.6	97.2	97.2	0.00
Zlingzor Tfr	0.019	0.012	-0.019	-0.012	0.2	0.3	97.2	95.9	1.33
ZlingzorA Tfr	0.011	0.007	-0.010	-0.006	0.1	0.2	97.2	95.3	1.88
Zomlthang Tfr	0.016	0.010	-0.016	-0.010	0.4	0.5	97.1	94.1	2.93
ZulpheygnA Tfr	0.009	0.005	-0.009	-0.005	0.1	0.1	97.4	95.9	1.53
ZulpheygnB Tfr	0.008	0.005	-0.008	-0.005	0.1	0.1	97.4	96.0	1.35
					221.5	-159.6			

Alert Summary Report

	% Alert Settings	
	Critical	**Marginal**
Loading		
Bus	100.0	95.0
Cable	100.0	95.0
Reactor	100.0	95.0
Line	100.0	95.0
Transformer	100.0	95.0
Panel	100.0	95.0
Protective Device	100.0	95.0
Generator	100.0	95.0
Inverter/Charger	100.0	95.0
Bus Voltage		
OverVoltage	110.0	105.0
UnderVoltage	90.0	95.0
Generator Excitation		
OverExcited (Q Max.)	100.0	95.0
UnderExcited (Q Min.)	100.0	

Critical Report

Device ID	Type	Condition	Rating/Limit	Unit	Operating	% Operating	Phase Type
B.Vet.Hosp Tfr	Transformer	Overload	0.125	MVA	0.133	106.1	3-Phase
DragonI Tfr	Transformer	Overload	0.025	MVA	0.03	117.6	3-Phase
Dchu Tfr	Transformer	Overload	0.025	MVA	0.03	109.6	3-Phase
DhajeyT1 Tfr	Transformer	Overload	0.125	MVA	0.13	101.2	3-Phase
Kapasing.T Tfr	Transformer	Overload	0.025	MVA	0.03	118.6	3-Phase
L.Market Tfr	Transformer	Overload	0.315	MVA	0.33	106.2	3-Phase
Menchuna Tfr	Transformer	Overload	0.125	MVA	0.13	106.4	3-Phase
Nr. O.Court Tfr	Transformer	Overload	0.063	MVA	0.07	106.6	3-Phase
RanaII Tfr	Transformer	Overload	0.025	MVA	0.03	121.9	3-Phase
SamzhingB Tfr	Transformer	Overload	0.016	MVA	0.02	112.2	3-Phase
SunkoshA Tfr	Transformer	Overload	0.025	MVA	0.03	119.3	3-Phase
Tthangi Tfr	Transformer	Overload	0.063	MVA	0.07	117.9	3-Phase
U.Bockery Tfr	Transformer	Overload	0.125	MVA	0.18	143.7	3-Phase
U.DaragonB Tfr	Transformer	Overload	0.016	MVA	0.02	145.1	3-Phase
U.Pmashong Tfr	Transformer	Overload	0.063	MVA	0.07	113.8	3-Phase

Marginal Report

Device ID	Type	Condition	Rating/Limit	Unit	Operating	% Operating	Phase Type
B.Vet.Hosp B2	Bus	Under Voltage	0.415	kV	0.388	93.4	3-Phase
Baktar B2	Bus	Under Voltage	0.415	kV	0.39	94.1	3-Phase
Batasey B2	Bus	Under Voltage	0.415	kV	0.39	94.4	3-Phase
BhulkayI Top B2	Bus	Under Voltage	0.415	kV	0.39	94.8	3-Phase
BhulkayIIB B2	Bus	Under Voltage	0.415	kV	0.39	94.7	3-Phase
Birkuna B2	Bus	Under Voltage	0.415	kV	0.39	94.0	3-Phase
Burichu.D B2	Bus	Under Voltage	0.415	kV	0.39	94.8	3-Phase
Chokpur B2	Bus	Under Voltage	0.415	kV	0.39	94.7	3-Phase
Dalgoley B2	Bus	Under Voltage	0.415	kV	0.39	94.0	3-Phase
Danseri Tfr	Transformer	Overload	0.025	MVA	0.02	98.5	3-Phase
Danseri1 B2	Bus	Under Voltage	0.415	kV	0.39	93.0	3-Phase
Danseri2 B1	Bus	Under Voltage	0.415	kV	0.39	94.3	3-Phase
DaragonI B2	Bus	Under Voltage	0.415	kV	0.38	92.7	3-Phase
DauthreyII B2	Bus	Under Voltage	0.415	kV	0.39	93.8	3-Phase
DauthreyIII B2	Bus	Under Voltage	0.415	kV	0.39	94.7	3-Phase
Dchu B2	Bus	Under Voltage	0.415	kV	0.39	93.2	3-Phase
DhajeyT1 B2	Bus	Under Voltage	0.415	kV	0.39	93.8	3-Phase
GairigonB B2	Bus	Under Voltage	0.415	kV	0.39	93.5	3-Phase
GairigonB Tfr	Transformer	Overload	0.016	MVA	0.02	96.6	3-Phase
Golaytar B2	Bus	Under Voltage	0.415	kV	0.39	94.4	3-Phase
Janygon B2	Bus	Under Voltage	0.415	kV	0.39	95.0	3-Phase
Jbari ORC B2	Bus	Under Voltage	0.415	kV	0.39	94.8	3-Phase
Jingay B2	Bus	Under Voltage	0.415	kV	0.39	93.8	3-Phase
Kapasing.T B2	Bus	Under Voltage	0.415	kV	0.38	92.5	3-Phase
Khorsany GO B2	Bus	Under Voltage	0.415	kV	0.39	93.6	3-Phase
Khorsany GO Tfr	Transformer	Overload	0.025	MVA	0.02	95.5	3-Phase
Koipani B2	Bus	Under Voltage	0.415	kV	0.39	94.1	3-Phase
L.Bararay B2	Bus	Under Voltage	0.415	kV	0.39	93.7	3-Phase
L.Bchu1B B2	Bus	Under Voltage	0.415	kV	0.39	94.4	3-Phase
L.Bchu2B B2	Bus	Under Voltage	0.415	kV	0.39	93.8	3-Phase
L.DaragonA B2	Bus	Under Voltage	0.415	kV	0.39	95.0	3-Phase
L.DaragonB B2	Bus	Under Voltage	0.415	kV	0.39	93.7	3-Phase
L.GairigonII B2	Bus	Under Voltage	0.415	kV	0.39	93.6	3-Phase
L.GairigonII Tfr	Transformer	Overload	0.025	MVA	0.02	95.6	3-Phase
L.GairigonIV B2	Bus	Under Voltage	0.415	kV	0.39	94.8	3-Phase
L.KatikyI B2	Bus	Under Voltage	0.415	kV	0.39	93.7	3-Phase

Marginal Report

Device ID	Type	Condition	Rating/Limit	Unit	Operating	% Operating	Phase Type
L.KatikyIII B2	Bus	Under Voltage	0.415	kV	0.389	93.7	3-Phase
L.KatikyIII Tfr	Transformer	Overload	0.025	MVA	0.02	95.8	3-Phase
L.Kokray B2	Bus	Under Voltage	0.415	kV	0.39	94.0	3-Phase
L.Market B2	Bus	Under Voltage	0.415	kV	0.39	93.4	3-Phase
L.Salaray B2	Bus	Under Voltage	0.415	kV	0.39	93.6	3-Phase
L.Salaray Tfr	Transformer	Overload	0.025	MVA	0.02	96.0	3-Phase
L.Tlinghkar Tfr	Transformer	Overload	0.125	MVA	0.12	95.2	3-Phase
L.Tlingkhar B2	Bus	Under Voltage	0.415	kV	0.39	93.9	3-Phase
Lhamoil B2	Bus	Under Voltage	0.415	kV	0.39	94.9	3-Phase
LhaomoilI B2	Bus	Under Voltage	0.415	kV	0.39	94.9	3-Phase
Lobsiboty B2	Bus	Under Voltage	0.415	kV	0.39	94.4	3-Phase
M.Bararay B2	Bus	Under Voltage	0.415	kV	0.39	94.9	3-Phase
M.Kokray B2	Bus	Under Voltage	0.415	kV	0.39	94.0	3-Phase
MajgonB2	Bus	Under Voltage	0.415	kV	0.39	93.9	3-Phase
Mchuna B2	Bus	Under Voltage	0.415	kV	0.39	94.5	3-Phase
Menchuna B2	Bus	Under Voltage	0.415	kV	0.39	93.5	3-Phase
Mendrelgg B2	Bus	Under Voltage	0.415	kV	0.39	93.7	3-Phase
Newatar B2	Bus	Under Voltage	0.415	kV	0.39	93.8	3-Phase
Nr. O.Court B2	Bus	Under Voltage	0.415	kV	0.39	93.5	3-Phase
PelrithangT13 B2	Bus	Under Voltage	0.415	kV	0.39	94.0	3-Phase
PelrithangT14 B2	Bus	Under Voltage	0.415	kV	0.39	94.5	3-Phase
PhirayI B2	Bus	Under Voltage	0.415	kV	0.39	93.5	3-Phase
PhirayI Tfr	Transformer	Overload	0.025	MVA	0.02	97.1	3-Phase
PhirayII B2	Bus	Under Voltage	0.415	kV	0.39	95.0	3-Phase
RanaII B2	Bus	Under Voltage	0.415	kV	0.38	92.4	3-Phase
RiserboB B2	Bus	Under Voltage	0.415	kV	0.39	93.6	3-Phase
RiserboB Tfr	Transformer	Overload	0.063	MVA	0.06	98.1	3-Phase
Sadugg B2	Bus	Under Voltage	0.415	kV	0.39	94.9	3-Phase
SamzhingB B2	Bus	Under Voltage	0.415	kV	0.39	93.0	3-Phase
Sethang GO B2	Bus	Under Voltage	0.415	kV	0.39	94.5	3-Phase
SethangI B2	Bus	Under Voltage	0.415	kV	0.39	94.7	3-Phase
Simpani B2	Bus	Under Voltage	0.415	kV	0.39	94.6	3-Phase
SlarayB B2	Bus	Under Voltage	0.415	kV	0.39	94.7	3-Phase
SunkoshA B2	Bus	Under Voltage	0.415	kV	0.39	93.0	3-Phase
TeureyI B2	Bus	Under Voltage	0.415	kV	0.39	93.5	3-Phase
Tsirangtoe Sch. B2	Bus	Under Voltage	0.415	kV	0.39	93.9	3-Phase

Marginal Report

Device ID	Type	Condition	Rating/Limit	Unit	Operating	% Operating	Phase Type
TthangI b2	Bus	Under Voltage	0.415	kV	0.383	92.3	3-Phase
TthangII B2	Bus	Under Voltage	0.415	kV	0.39	94.6	3-Phase
U.Bchu2A B2	Bus	Under Voltage	0.415	kV	0.39	94.4	3-Phase
U.Bchu2B B2	Bus	Under Voltage	0.415	kV	0.39	94.7	3-Phase
U.Bchu4A B2	Bus	Under Voltage	0.415	kV	0.39	94.4	3-Phase
U.Bockery B2	Bus	Under Voltage	0.415	kV	0.38	92.1	3-Phase
U.DaragonB B2	Bus	Under Voltage	0.415	kV	0.38	91.8	3-Phase
U.GairigonII B2	Bus	Under Voltage	0.415	kV	0.39	94.6	3-Phase
U.Kokray B2	Bus	Under Voltage	0.415	kV	0.39	94.1	3-Phase
U.Pmashong B2	Bus	Under Voltage	0.415	kV	0.39	92.9	3-Phase
Zomlthang B2	Bus	Under Voltage	0.415	kV	0.39	94.1	3-Phase

SUMMARY OF TOTAL GENERATION , LOADING & DEMAND

	MW	Mvar	MVA	% PF
Source (Swing Buses):	5.961	3.397	6.861	86.88 Lagging
Source (Non-Swing Buses):	0.000	0.000	0.000	
Total Demand:	5.961	3.397	6.861	86.88 Lagging
Total Motor Load:	1.247	0.773	1.467	85.00 Lagging
Total Static Load:	4.493	2.784	5.285	85.00 Lagging
Total Constant I Load:	0.000	0.000	0.000	
Total Generic Load:	0.000	0.000	0.000	
Apparent Losses:	0.222	-0.160		
System Mismatch:	0.000	0.000		

Number of Iterations: 3

Annexure 5: Feeder Wise Reliability Indices

SL. No.	Year	Month	Reliability Indices	33kV Damphu & 6.6kV Changchay feeder	33kV Rangthangling feeder	33kV Dagapela feeder II	33kV Dunglagang feeder	33kV Tsholingkhar feeder
1	2017	January	SAIFI	0.16	0.26			
			SAIDI	0.15	0.28			
2		February	SAIFI	0.15	0.26	0.06	0.40	
			SAIDI	0.18	0.53	0.04	0.20	
3		March	SAIFI		0.26		0.60	0.97
			SAIDI		0.13		0.39	1.39
4		April	SAIFI		0.24			
			SAIDI		0.07			
5		May	SAIFI		0.48	0.07		0.64
			SAIDI		2.77	0.10		3.67
6		June	SAIFI			0.06	0.18	0.64
			SAIDI			0.08	0.09	0.32
7		July	SAIFI	0.37	0.73	0.26	0.37	
			SAIDI	0.35	0.45	0.66	0.08	
8		August	SAIFI					
			SAIDI					
9		September	SAIFI		0.25	0.06		0.31
			SAIDI		0.33	0.06		0.05
10		October	SAIFI		0.25		0.19	0.31
			SAIDI		0.37		0.06	0.10
11		November	SAIFI		0.25		0.19	0.31
			SAIDI		1.18		0.08	2.69
12		December	SAIFI			0.06	0.19	0.31
			SAIDI			0.02	1.17	0.31
Total			**SAIFI**	**0.68**	**2.97**	**0.58**	**2.11**	**3.47**
			SAIDI	**0.68**	**6.09**	**0.96**	**2.07**	**8.53**
1	2018	January	SAIFI		0.25			
			SAIDI		1.59			
2		February	SAIFI	0.19				
			SAIDI	0.17				
3		March	SAIFI		0.25		0.19	0.31
			SAIDI		1.11		0.32	1.15
4		April	SAIFI	0.19	0.25			0.31
			SAIDI	0.06	0.88			0.87
5		May	SAIFI		0.49		0.19	
			SAIDI		1.37		0.59	
6		June	SAIFI		0.49		0.19	
			SAIDI		0.72		0.94	
7		July	SAIFI		0.49	0.06	0.19	
			SAIDI		0.31	0.21	0.08	
8		August	SAIFI					0.31
			SAIDI					0.79
9		September	SAIFI		0.24			0.31
			SAIDI		0.68			0.43
10		October	SAIFI		0.24			0.31
			SAIDI		0.38			0.10
11		November	SAIFI		0.71			0.31
			SAIDI		1.26			1.12
12		December	SAIFI					
			SAIDI					
Total			**SAIFI**	**0.38**	**3.41**	**0.06**	**0.75**	**1.85**

Total			**SAIDI**	**0.23**	**8.29**	**0.21**	**1.93**	**4.47**
1	2019	January	SAIFI					0.31
			SAIDI					0.31
2		February	SAIFI		0.48			0.31
			SAIDI		0.78			0.75
3		March	SAIFI				0.18	1.26
			SAIDI				0.24	1.82
4		April	SAIFI					0.32
			SAIDI					0.29
5		May	SAIFI		0.24			
			SAIDI		0.18			
6		June	SAIFI	0.19	0.95			0.31
			SAIDI	0.36	2.05			1.44
7		July	SAIFI		0.48			0.32
			SAIDI		0.70			0.29
8		August	SAIFI		0.71	0.20		1.26
			SAIDI		1.21	1.27		3.47
9		September	SAIFI		0.24			
			SAIDI		0.03			
10		October	SAIFI			0.07		
			SAIDI			0.19		
11		November	SAIFI					
			SAIDI					
12		December	SAIFI		0.24		0.19	
			SAIDI		0.29		0.95	
Total			**SAIFI**	**0.19**	**3.33**	**0.27**	**0.37**	**4.08**
			SAIDI	**0.36**	**5.23**	**1.46**	**1.19**	**8.36**
Overall Total			**SAIFI**	**1.26**	**9.71**	**0.92**	**3.22**	**9.40**
			SAIDI	**1.27**	**19.61**	**2.64**	**5.19**	**21.36**
Average			**SAIFI**	**4.90**				
			SAIDI	**10.01**				

Annexure 6: Material Cost for Upgrading single phase (11 kV and 33 kV) Lines to three-phase

Sl. No	Name of ESDs	Total Cost in Nu. For upgradation of Line to 3Φ from 1Φ		Total cost in Nu.
		11 kV Line in Km	33 kV Line in Km	
		Cost in Nu.	Cost in Nu.	
1	Bumthang	604,083.80	626,364.17	1,230,447.97
2	Chukhha	1,372,746.06	6,450,371.80	7,823,117.86
3	Dagana	–	2,495,645.61	2,495,645.61
4	Haa	–	341,755.04	341,755.04
5	Lhuntse	1,648,680.77	6,292,698.01	7,941,378.78
6	Mongar	–	–	–
7	Paro	1,576,599.08	1,663,407.47	3,240,006.55
8	Pemagatshel	–	2,467,625.51	2,467,625.51
9	Punakha	612,259.13	8,183,731.48	8,795,990.60
10	S/Jongkhar	–	7,593,301.40	7,593,301.40
11	Samtse	2,031,083.74	536,799.03	2,567,882.76
12	Sarpang	756,490.07	1,112,902.61	1,869,392.68
13	Trashi Gang	251,649.96	626,304.45	877,954.41
14	Trashiyangtse		2,207,281.49	2,207,281.49
15	Thimphu	5,228,316.74	-	5,228,316.74
16	Trongsa	–	651,860.25	651,860.25
17	Tsirang	–	1,693,286.88	1,693,286.88
18	Wangdue	98,146.90	3,133,078.14	3,231,225.04
19	Zhemgang	–	5,303,863.16	5,303,863.16
	TOTAL	**14,180,056.24**	**51,380,276.50**	**65,560,332.75**

The cost of extending one phase in case of ACSR conductor and AAAC covered conductor were considered and incase of HV ABC, the cost of constructing three core cable has been considered in estimation. Above estimation indicates the total material cost involved in upgrading the existing single phase line to three phase under each ESD.

The total cost including material cost (Nu. 65 million), transportation cost (Nu. 3.47 million) and labor cost (Nu. 28 million) will amount to Nu. 97 million.

11 kV and 33 kV Single Phase Line Length in km under each ESD

Sl. No	Name of ESDs	11kV 1Φ Line (km)	33kV 1Φ Line (km)	Total 1Φ Line (km)
1	Bumthang	6.96276	5.6246	12.58736
2	Chukhha	21.569	78.274	99.843
3	Dagana	0	30.527	30.527
4	Haa	0	4.391	4.391
5	Lhuntse	18.7075	80.851	99.5585
6	Mongar	0	0	0
7	Paro	24.772	14.937	39.709
8	Pemagatshel	0	31.705	31.705
9	Punakha	9.62	58.4	68.02
10	S/Jongkhar	0	93.672	93.672
11	Samtse	31.913	6.897	38.81
12	Sarpang	11.8862	14.299	26.1852
13	Trashigang	3.954	8.047	12.001
14	Trashiyangtse	0	28.36	28.36
15	Thimphu	5.93	0	5.93
16	Trongsa	0	5.383	5.383
17	Tsirang	0	21.756	21.756
18	Wangdue	1.01	29.7	30.71
19	Zhemgang	0	66.785	66.785
TOTAL		**136.32446**	**579.6086**	**715.93306**

Annexure 7: Distribution Transformer Loading

Tsirang Transformer Loading Details

Sl.No.	Name of Feeder	DT Location Name	Transformer Ratio	Transformer Details				Peak Load (KVA)**	% Loading	Forecasted Peak Load (kVA)	% Loaing	Forecasted Peak Load (kVA)	% Loaing
				kVA	Installed Yr/MFD*	Serial Number	Trans ID	2019-2020	2019-2020	2025	2025	2030	2030
1	6.6kV,Chanchey Feeder	CHANGCHAY BAZAR	6.6/0.415Kv	50	1990	902070802	TSE10T2	**7.19**		**8.55**		9.69	
												9.69	
									14.38%	**1678.24**	**17.10%**	**1902.35**	**19.39%**
										0.19		**0.13**	
										1.19		**1.13**	
2	33kV,Damphu Feeder	MENCHUNA	33/0.415kV	125	2013	3682	TSE20T1	105.10	84.08%	125.01	100.01%	141.71	113.36%
3	33kV,Damphu Feeder	NEAR DRATSANG	33/0.415kV	250	2009	72319	TSE20T2	75.75	30.30%	90.10	36.04%	102.13	40.85%
4	33kV,Damphu Feeder	NEAR OLD COURT	33/0.415kV	63	2006	30471	TSE20T3	53.12	84.32%	63.18	100.29%	71.62	113.68%
5	33kV,Damphu Feeder	NEAR TELECOM	33/0.415kV	250	2013	6071	TSE20T4	45.19	18.08%	53.75	21.50%	60.93	24.37%
6	33kV,Damphu Feeder	UPPER MARKET	33/0.415kV	500	2008	9572	TSE20T5	163.10	32.62%	194.00	38.80%	219.91	43.98%
7	33kV,Damphu Feeder	VIP GUEST HOUSE	33/0.415kV	63	2009	72328	TSE20T6	11.35	18.02%	13.50	21.43%	15.30	24.29%
8	33kV,Damphu Feeder	LOWER MARKET	33/0.415kV	315	2008	55437	TSE20T7	264.98	84.12%	315.18	100.06%	357.27	113.42%
9	33kV,Damphu Feeder	NEAR FOREST OFFICE	33/0.415kV	125	2010	11549	TSE20T8	37.80	30.24%	44.96	35.97%	50.97	40.77%
10	33kV,Damphu Feeder	DAMPHU L.S.S	33/0.415kV	125	2017	E-20637	TSE20T9	37.50	30.00%	44.60	35.68%	50.56	40.45%
11	33kV,Damphu Feeder	BELOW D.C.S	33/0.415kV	125	2009	10476	TSE20T10	36.43	29.14%	43.33	34.67%	49.12	39.29%
12	33kV,Damphu Feeder	BELOW RECD OFFICE	33/0.415kV	125	2010	11565	TSE20T11	38.07	30.46%	45.28	36.23%	51.33	41.06%
13	33kV,Damphu Feeder	LOWER BOCKREY	33/0.415kV	25	2010	11069	TSE20T12	6.64	26.56%	7.90	31.59%	8.95	35.81%
14	33kV,Damphu Feeder	BELOW VET. HOSPITAL	33/0.415kV	125	2015	2809	TSE20T13	105.12	84.10%	125.03	100.03%	141.73	113.39%
15	33kV,Damphu Feeder	BELOW HOSPITAL	33/0.415kV	125	2015	3864	TSE20T14	37.95	30.36%	45.14	36.11%	51.17	40.93%
16	33kV,Damphu Feeder	NEW COURT	33/0.415kV	250	2014	1337	TSE20T15	41.75	16.70%	49.66	19.86%	56.29	22.52%
17	33kV,Damphu Feeder	DAMPHU C.S	33/0.415kV	125	2016	17683	TSE20T16	24.74	19.79%	29.43	23.54%	33.36	26.69%
18	33kV,Damphu Feeder	RAA PDC	33/0.415kV	500	2018	17690	TSE20T17	97.18	19.44%	115.59	23.12%	131.03	26.21%
19	33kV,Damphu Feeder	RAA PDC	33/0.415kV	500	2018	17701	TSE20T18	76.98	15.40%	91.56	18.31%	103.79	20.76%
20	33kV,Damphu Feeder	Damphu Hospital	33/0.415kV	750	2018			145.00	19.33%	172.47	23.00%	195.50	26.07%
								1403.75		**1669.68**			
								1410.94		**1678.24**			
										1171.76		**1367.06**	
										0.73		**0.17**	
										1.73		**1.17**	
1	33kV,Rangthaling Feeder	DHAJEY	33/0.415kV	125	2010	11546	TSE30T1	66.83	53.46%	115.31	92.25%	134.53	107.63%
2	33kV,Rangthaling Feeder	NEVAREY	33/0.415kV	125	2010	11534	TSE30T2	22.95	18.36%	39.60	31.68%	46.20	36.96%
3	33kV,Rangthaling Feeder	SAMALGAON	33/0.240kV	25	2009	11133	TSE30T3	5.74	22.96%	9.90	39.62%	11.55	46.22%
4	33kV,Rangthaling Feeder	RESERBU, A	33/0.415kV	63	2010	11429	TSE30T4	14.00	22.22%	24.15	38.34%	28.18	44.73%
5	33kV,Rangthaling Feeder	RESERBU, B	33/0.415kV	63	2010	11417	TSE30T5	32.76	52.00%	56.53	89.72%	65.95	104.68%
6	33kV,Rangthaling Feeder	RESERBU, C	33/0.415kV	125	2010	11531	TSE30T6	30.79	24.63%	53.12	42.50%	61.98	49.58%
7	33kV,Rangthaling Feeder	TASHIPANG, I	33/0.415kV	63	2010	11441	TSE30T7	16.77	26.62%	28.94	45.93%	33.76	53.59%
8	33kV,Rangthaling Feeder	MENDRELGANG	33/0.415kV	63	2010	11466	TSE30T8	31.38	49.81%	54.15	85.94%	63.17	100.27%

9	33kV,Rangthaling Feeder	TASHIPANG, II	33/0.415kV	125	2010	11536	TSE30T9	27.65	22.12%	47.71	38.17%	55.66	44.53%
10	33kV,Rangthaling Feeder	SAMZHINGGADEN, A	33/0.415kV	25	2010	10969	TSE30T10	7.45	29.80%	12.85	51.42%	15.00	59.99%
11	33kV,Rangthaling Feeder	SAMZHINGGADEN, B	33/0.240kV	16	2010	10790	TSE30T11	9.57	59.81%	16.51	103.20%	19.26	120.41%
12	33kV,Rangthaling Feeder	UPPER PEMASHONG	33/0.415kV	63	2010	11414	TSE30T12	38.21	60.65%	65.93	104.65%	76.92	122.09%
13	33kV,Rangthaling Feeder	LOWER PEMASHONG	33/0.415kV	63	2010	11475	TSE30T13	10.50	16.67%	18.12	28.76%	21.14	33.55%
14	33kV,Rangthaling Feeder	ZOMLINGZOR, A	33/0.415kV	25	2010	11018	TSE30T14	6.60	26.40%	11.39	45.55%	13.29	53.14%
15	33kV,Rangthaling Feeder	ZOMLINGZOR, B	33/0.415kV	63	2010	11446	TSE30T15	11.72	18.60%	20.22	32.10%	23.59	37.45%
16	33kV,Rangthaling Feeder	UPPER RANGTHANGLING	33/0.415kV	63	2010	11461	TSE30T16	12.79	20.30%	22.07	35.03%	25.75	40.87%
17	33kV,Rangthaling Feeder	LOWER RANGTHANGLING, A	33/0.415kV	25	2011	11076	TSE30T17	6.47	25.88%	11.16	44.66%	13.02	52.10%
18	33kV,Rangthaling Feeder	LOWER RANGTHANGLING, B	33/0.415kV	63	2011	11482	TSE30T18	6.77	10.75%	11.68	18.54%	13.63	21.63%
19	33kV,Rangthaling Feeder	ZULPHEYGOAN, A	33/0.415kV	25	2011	11129	TSE30T19	5.34	21.36%	9.21	36.86%	10.75	43.00%
20	33kV,Rangthaling Feeder	ZULPHEYGAON, B	33/0.415kV	25	2011	11028	TSE30T20	4.71	18.84%	8.13	32.51%	9.48	37.93%
21	33kV,Rangthaling Feeder	NIMAZOR	33/0.415kV	25	2011	10976	TSE30T21	3.91	15.64%	6.75	26.99%	7.87	31.48%
22	33kV,Rangthaling Feeder	SAUNEY	33/0.240kV	16	2011	10882	TSE30T22	2.40	15.00%	4.14	25.88%	4.83	30.20%
23	33kV,Rangthaling Feeder	BHULKAY I TOP	33/0.415kV	25	2011	11177	TSE30T23	8.86	35.44%	15.29	61.15%	17.84	71.34%
24	33kV,Rangthaling Feeder	BHULKAY III A	33/0.240kV	16	2011	10953	TSE30T24	2.81	17.56%	4.85	30.30%	5.66	35.35%
25	33kV,Rangthaling Feeder	BHULKAY III B	33/0.415kV	25	2011	11257	TSE30T25	3.40	13.60%	5.87	23.47%	6.84	27.38%
26	33kV,Rangthaling Feeder	BHULKAY III C	33/0.415kV	25	2011	11172	TSE30T26	8.16	32.64%	14.08	56.32%	16.43	65.71%
27	33kV,Rangthaling Feeder	BHULKAY II B/PWD CAMP	33/0.415kV	25	2011	11117	TSE30T27	9.11	36.42%	15.71	62.84%	18.33	73.32%
28	33kV,Rangthaling Feeder	THANGRAY, A	33/0.415kV	63	2011	11502	TSE30T28	11.35	18.02%	19.58	31.09%	22.85	36.27%
29	33kV,Rangthaling Feeder	THANGRAY, B	33/0.415kV	63	2011	11516	TSE30T29	12.75	20.24%	22.00	34.92%	25.67	40.74%
30	33kV,Rangthaling Feeder	THANGRAY, C/KHOCHI	33/0.415kV	63	2011	11525	TSE30T30	7.14	11.33%	12.32	19.56%	14.37	22.81%
31	33kV,Rangthaling Feeder	DARACHU	33/0.415kV	25	2011	10972	TSE30T31	14.57	58.28%	25.14	100.56%	29.33	117.32%
32	33kV,Rangthaling Feeder	JAWBARI SCHOOL	33/0.415kV	25	2011	11186	TSE30T32	7.96	31.84%	13.73	54.94%	16.02	64.10%
33	33kV,Rangthaling Feeder	JAWBARI ORC	33/0.415kV	25	2011	11170	TSE30T33	8.77	35.08%	15.13	60.53%	17.65	70.62%
34	33kV,Rangthaling Feeder	JAWBARI, II A	33/0.240kV	16	2011	10788	TSE30T34	4.21	26.31%	7.26	45.40%	8.47	52.97%
35	33kV,Rangthaling Feeder	BETENI, A	33/0.415kV	25	2011	11523	TSE30T35	2.96	11.84%	5.11	20.43%	5.96	23.83%
36	33kV,Rangthaling Feeder	BETENI B TOP	33/0.240kV	16	2011	10801	TSE30T36	2.80	17.50%	4.83	30.20%	5.64	35.23%
37	33kV,Rangthaling Feeder	JAWBARI II B	33/0.240kV	10	2011	10759	TSE30T37	1.90	19.00%	3.28	32.78%	3.82	38.25%
38	33kV,Rangthaling Feeder	UTARAY	33/0.415kV	25	2011	11176	TSE30T38	5.54	22.16%	9.56	38.24%	11.15	44.61%
39	33kV,Rangthaling Feeder	MIRKAYPANI	33/0.240kV	16	2011	10911	TSE30T39	1.97	12.31%	3.40	21.24%	3.97	24.79%
40	33kV,Rangthaling Feeder	SALARY, B	33/0.415kV	25	2011	11085	TSE30T40	8.69	34.76%	14.99	59.98%	17.49	69.97%
41	33kV,Rangthaling Feeder	SALARAY, A	33/0.415kV	25	2011	11131	TSE30T41	5.65	22.58%	9.74	38.96%	11.36	45.45%
42	33kV,Rangthaling Feeder	CHAKALING, I/KHOPI	33/0.240kV	10	2014	3885	TSE30T42	1.46	14.60%	2.52	25.19%	2.94	29.39%
43	33kV,Rangthaling Feeder	CHAKALING, II	33/0.240kV	16	2017	10851	TSE30T43	1.72	10.75%	2.97	18.55%	3.46	21.64%
44	33kV,Rangthaling Feeder	CHAKALING, III	33/0.240kV	16	2012	10878	TSE30T44	1.86	11.63%	3.21	20.06%	3.74	23.40%
45	33kV,Rangthaling Feeder	UPPER GAIRIGAON, II	33/0.415kV	25	2011	11198	TSE30T45	9.23	36.92%	15.93	63.70%	18.58	74.32%
46	33kV,Rangthaling Feeder	UPPER GAIRIGAON, III	33/0.415kV	25	2011	11006	TSE30T46	3.37	13.48%	5.81	23.26%	6.78	27.14%
47	33kV,Rangthaling Feeder	UPPER GAIRIGAON, I	33/0.415kV	63	2011	72322	TSE30T47	13.57	21.54%	23.41	37.17%	27.32	43.36%
48	33kV,Rangthaling Feeder	LOWER GAIRIGAON, I	33/0.415kV	25	2011	11167	TSE30T48	7.27	29.06%	12.54	50.14%	14.62	58.50%
49	33kV,Rangthaling Feeder	LOWER GAIRIGAON, II	33/0.415kV	25	2011	11200	TSE30T49	12.69	50.76%	21.90	87.58%	25.55	102.18%
50	33kV,Rangthaling Feeder	LOWER GAIRIGAON, III	33/0.240kV	16	2011	10826	TSE30T50	4.17	26.06%	7.20	44.97%	8.39	52.46%
51	33kV,Rangthaling Feeder	LOWER GAIRIGAON, IV	33/0.415kV	16	2012	10831	TSE30T51	5.43	33.94%	9.37	58.56%	10.93	68.32%
52	33kV,Rangthaling Feeder	BARADHURAY, I	33/0.240kV	16	2012	10828	TSE30T52	2.93	18.31%	5.06	31.60%	5.90	36.86%
53	33kV,Rangthaling Feeder	BARADHURAY, II	33/0.415kV	25	2012	11070	TSE30T53	3.72	14.88%	6.42	25.67%	7.49	29.95%
54	33kV,Rangthaling Feeder	BARADHURAY, III	33/0.240kV	16	2012	10918	TSE30T54	3.38	21.13%	5.83	36.45%	6.80	42.53%
55	33kV,Rangthaling Feeder	PHIRPHIRAY, I	33/0.415kV	25	2012	11202	TSE30T55	12.90	51.60%	22.26	89.03%	25.97	103.87%
56	33kV,Rangthaling Feeder	PHIRPHIRAY, II	33/0.415kV	25	2012	11252	TSE30T56	7.66	30.64%	13.22	52.87%	15.42	61.68%
57	33kV,Rangthaling Feeder	DARAGAON, I	33/0.415kV	25	2012	11190	TSE30T57	15.70	62.80%	27.09	108.36%	31.60	126.42%

58	33kV,Rangthaling Feeder	DARAGAON, II	33/0.415kV	25	2012	11178	TSE30T58	3.15	12.60%	5.44	21.74%	6.34	25.36%
59	33kV,Rangthaling Feeder	GAIRIGAON, B	33/0.240kV	16	2012	10854	TSE30T59	8.21	51.31%	14.17	88.54%	16.53	103.29%
60	33kV,Rangthaling Feeder	TOISANG, I	33/0.415kV	25	2012	11147	TSE30T60	4.06	16.24%	7.01	28.02%	8.17	32.69%
61	33kV,Rangthaling Feeder	TOISANG, II	33/0.415kV	25	2012	11245	TSE30T61	6.07	24.28%	10.47	41.89%	12.22	48.88%
62	33kV,Rangthaling Feeder	PAKHAY, A	33/0.415kV	63	2012	11467	TSE30T62	6.87	10.90%	11.85	18.82%	13.83	21.95%
63	33kV,Rangthaling Feeder	PAKHAY, B	33/0.415kV	63	2012	11468	TSE30T63	9.03	14.33%	15.58	24.73%	18.18	28.85%
64	33kV,Rangthaling Feeder	MENDRELGANG CENTRAL SCHOOL	33/0.415kV	250	2018	E-20642	TSE30T64	30.76	12.30%	53.08	21.23%	61.92	24.77%
								679.10		**1171.76**			
										643.53		**817.65**	
										0.25		**0.27**	
										1.25		**1.27**	
1	33kV,Dagapela Feeder II	SUNKOSH	33/0.415kV	250	2010	10472	TSE40T1	80.56	32.22%	101.09	40.44%	128.45	51.38%
2	33kV,Dagapela Feeder II	UPPER TSHOLINGKHAR, A	33/0.415kV	63	2010	11433	TSE40T2	18.82	29.87%	23.61	37.48%	30.00	47.62%
3	33kV,Dagapela Feeder II	GAGAGAON 'A'	33/0.240kV	16	2010	10810	TSE40T3	5.79	36.18%	7.26	45.40%	9.23	57.68%
4	33kV,Dagapela Feeder II	GAGAGAON 'B'	33/0.415kV	25	2010	10978	TSE40T4	8.28	33.12%	10.39	41.56%	13.20	52.80%
5	33kV,Dagapela Feeder II	BHALUKHOP	33/0.415kV	25	2010	11109	TSE40T5	8.81	35.24%	11.06	44.22%	14.05	56.19%
6	33kV,Dagapela Feeder II	UPPER TSHOLINGKHAR, B	33/0.415kV	63	2010	11432	TSE40T6	18.77	29.80%	23.56	37.40%	29.94	47.52%
7	33kV,Dagapela Feeder II	TSHOLINGKHAR TOP	33/0.415kV	25	2010	11002	TSE40T7	9.10	36.41%	11.42	45.70%	14.52	58.06%
8	33kV,Dagapela Feeder II	MIDDLE TSHOLINGKHAR	33/0.415kV	63	2010	11451	TSE40T8	26.66	42.32%	33.46	53.11%	42.51	67.48%
9	33kV,Dagapela Feeder II	BUDHABARAY	33/0.415kV	250	2010	11582	TSE40T9	69.11	27.64%	86.72	34.69%	110.18	44.07%
10	33kV,Dagapela Feeder II	LOWER TSHOLINGKHAR	33/0.415kV	125	2010	11556	TSE40T10	79.40	63.52%	99.64	79.71%	126.60	101.28%
11	33kV,Dagapela Feeder II	LUNGSIGANG	33/0.415kV	250	2016	320	TSE40T11	70.08	28.03%	87.95	35.18%	111.74	44.70%
12	33kV,Dagapela Feeder II	LOWER DHAJEY	33/0.415kV	63	2010	11431	TSE40T12	26.21	41.61%	32.89	52.21%	41.80	66.34%
13	33kV,Dagapela Feeder II	CHANGCHAY DOVAN	33/0.415kV	250	2018	250/33/PVT/01	TSE40T13	70.32	28.13%	88.24	35.30%	112.12	44.85%
14	33kV,Dagapela Feeder II	SUNKOSH, A	33/0.240kV	16	2014	10797	TSE40T14	12.81	80.06%	16.08	100.47%	20.42	127.66%
15	33kV,Dagapela Feeder II	SUNKOSH, B	33/0.415kV	25	2009	11015	TSE40T15	8.09	32.34%	10.15	40.59%	12.89	51.57%
								512.81		**643.53**			
										796.47		**862.35**	
										0.43		**0.08**	
										1.43		**1.51**	
1	33kV,Dunglagang Feeder	UPPER MENCHUNA	33/0.415kV	25	2009	11053	TSE50T1	2.56	10.22%	3.65	14.58%	5.50	22.02%
2	33kV,Dunglagang Feeder	LOWER MAJUWA	33/0.415kV	63	2009	11453	TSE50T2	8.34	13.24%	11.90	18.89%	17.97	28.52%
3	33kV,Dunglagang Feeder	UPPER MAJUWA	33/0.415kV	63	2009	11415	TSE50T3	9.35	14.84%	13.34	21.18%	20.14	31.97%
4	33kV,Dunglagang Feeder	UPPER BOCKREY	33/0.415kV	125	2010	11547	TSE50T4	89.70	71.76%	128.00	102.40%	193.23	154.58%
5	33kV,Dunglagang Feeder	UPPER BOCKREY	33/0.415kV	63	2009	11436	TSE50T5	8.20	13.02%	11.70	18.57%	17.66	28.04%
6	33kV,Dunglagang Feeder	UPPER SALAMI	33/0.415kV	63	2009	11458	TSE50T6	17.33	27.51%	24.73	39.25%	37.33	59.26%
7	33kV,Dunglagang Feeder	MIDDLE SALAMI	33/0.415kV	125	2009	11544	TSE50T7	15.95	12.76%	22.76	18.21%	34.36	27.49%
8	33kV,Dunglagang Feeder	MIDDLE BICHGAON	33/0.415kV	125	2009	11539	TSE50T8	13.50	10.80%	19.26	15.41%	29.08	23.27%
9	33kV,Dunglagang Feeder	LOWER BICHGAON	33/0.415kV	25	2009	11016	TSE50T9	3.59	14.36%	5.12	20.49%	7.73	30.93%
10	33kV,Dunglagang Feeder	LOWER SALAMI	33/0.415kV	125	2009	11545	TSE50T10	32.45	25.96%	46.30	37.04%	69.90	55.92%
11	33kV,Dunglagang Feeder	LOWER KATIKEY 'III'	33/0.415kV	25	2009	11003	TSE50T11	11.87	47.48%	16.94	67.75%	25.57	102.28%
12	33kV,Dunglagang Feeder	LOWER KATIKEY 'I'	33/0.240kV	16	2009	10789	TSE50T12	7.50	46.88%	10.70	66.89%	16.16	100.98%
13	33kV,Dunglagang Feeder	LOWER KATIKEY 'II'	33/0.415kV	25	2009	10973	TSE50T13	5.12	20.48%	7.31	29.22%	11.03	44.12%
14	33kV,Dunglagang Feeder	UPPER KATIKEY 'A'	33/0.415kV	25	2009	10990	TSE50T14	6.88	27.52%	9.82	39.27%	14.82	59.28%
15	33kV,Dunglagang Feeder	BHALUKHOP	33/0.415kV	25	2009	11090	TSE50T15	6.76	27.04%	9.65	38.58%	14.56	58.25%
16	33kV,Dunglagang Feeder	UPPER KATIKEY'B'	33/0.415kV	63	2009	10632	TSE50T16	17.66	28.03%	25.20	40.00%	38.04	60.39%

17	33kV,Dunglagang Feeder	UPPER DARAGAON'A'	33/0.415kV	25	2009	11113	TSE50T17	6.33	25.32%	9.03	36.13%	13.64	54.54%
18	33kV,Dunglagang Feeder	UPPER DARAGAON 'B'	33/0.240kV	16	2009	10838	TSE50T18	7.45	46.56%	10.63	66.44%	16.05	100.30%
19	33kV,Dunglagang Feeder	LOWER DARAGAON'A'	33/0.415kV	63	2010	11481	TSE50T19	19.01	30.17%	27.13	43.06%	40.95	65.00%
20	33kV,Dunglagang Feeder	LOWER DARAGAON' B'	33/0.240kV	16	2009	10813	TSE50T20	7.50	46.88%	10.70	66.89%	16.16	100.98%
21	33kV,Dunglagang Feeder	SEMJONG SCHOOL	33/0.415kV	63	2006	30481	TSE50T21	18.56	29.46%	26.48	42.04%	39.98	63.46%
22	33kV,Dunglagang Feeder	UPPER SALARAY	33/0.415kV	25	2009	10963	TSE50T22	6.20	24.80%	8.85	35.39%	13.36	53.42%
23	33kV,Dunglagang Feeder	LOWER SALARAY	33/0.415kV	25	2009	11086	TSE50T23	11.90	47.60%	16.98	67.92%	25.63	102.54%
24	33kV,Dunglagang Feeder	MIDDLE SALARAY	33/0.415kV	25	2009	11054	TSE50T24	5.99	23.96%	8.55	34.19%	12.90	51.61%
25	33kV,Dunglagang Feeder	LOWER BARARAY	33/0.415kV	25	2009	11030	TSE50T25	11.67	46.68%	16.65	66.61%	25.14	100.56%
26	33kV,Dunglagang Feeder	MIDDLE BARARAY	33/0.415kV	25	2009	11057	TSE50T26	7.69	30.76%	10.97	43.89%	16.57	66.26%
27	33kV,Dunglagang Feeder	SADUGONG	33/0.415kV	63	2009	11463	TSE50T27	19.14	30.38%	27.31	43.35%	41.23	65.45%
28	33kV,Dunglagang Feeder	BEACHGAON 'B' TOP	33/0.415kV	63	2009	11430	TSE50T28	9.13	14.49%	13.03	20.68%	19.67	31.22%
29	33kV,Dunglagang Feeder	BEACHGAON'A' TOP	33/0.415kV	25	2009	11064	TSE50T29	4.33	17.30%	6.17	24.69%	9.32	37.27%
30	33kV,Dunglagang Feeder	BICHGAON(PARADARA)	33/0.415kV	125	2009	11533	TSE50T30	21.13	16.90%	30.14	24.12%	45.51	36.41%
31	33kV,Dunglagang Feeder	LOWER KHORSANEY	33/0.415kV	63	2009	11416	TSE50T31	9.44	14.98%	13.47	21.38%	20.34	32.28%
32	33kV,Dunglagang Feeder	MIDDLE KHORSANEY	33/0.415kV	125	2012	1015	TSE50T32	25.74	20.59%	36.73	29.38%	55.44	44.35%
33	33kV,Dunglagang Feeder	KHORSANEY TOP	33/0.415kV	25	2009	11032	TSE50T33	6.38	25.52%	9.10	36.42%	13.74	54.97%
34	33kV,Dunglagang Feeder	KHORSANEY GUP OFFICE	33/0.415kV	25	2009	11044	TSE50T34	11.84	47.36%	16.89	67.58%	25.51	102.02%
35	33kV,Dunglagang Feeder	LHAMOILUM 'I'	33/0.415kV	63	2009	11423	TSE50T35	18.98	30.13%	27.08	42.99%	40.89	64.90%
36	33kV,Dunglagang Feeder	LHAMOILUM 'II'	33/0.415kV	25	2009	11119	TSE50T36	7.51	30.04%	10.72	42.87%	16.18	64.71%
37	33kV,Dunglagang Feeder	LHAMOILUM 'III'	33/0.415kV	25	2009	10999	TSE50T37	7.21	28.84%	10.29	41.15%	15.53	62.13%
38	33kV,Dunglagang Feeder	JANEYGAON TOP	33/0.415kV	63	2009	72327	TSE50T38	17.45	27.70%	24.90	39.52%	37.59	59.67%
39	33kV,Dunglagang Feeder	HATIDUNGA	33/0.415kV	25	2009	11033	TSE50T39	2.89	11.56%	4.12	16.50%	6.23	24.90%
40	33kV,Dunglagang Feeder	LALIKHARKA 'B'	33/0.240kV	16	2009	10875	TSE50T40	1.26	7.86%	1.79	11.21%	2.71	16.92%
41	33kV,Dunglagang Feeder	LALIKHARKA ORC	33/0.415kV	25	2009	11058	TSE50T41	6.02	24.08%	8.59	34.36%	12.97	51.87%
42	33kV,Dunglagang Feeder	LALIKHARKA 'C'	33/0.415kV	25	2009	11073	TSE50T42	6.24	24.96%	8.90	35.62%	13.44	53.77%
43	33kV,Dunglagang Feeder	JANEYGAON	33/0.415kV	63	2009	10633	TSE50T43	18.71	29.70%	26.70	42.38%	40.30	63.98%
44	33kV,Dunglagang Feeder	MUNICIPAL WATER TANK	33/0.415kV	63	2009	72323	TSE50T44	5.73	9.10%	8.18	12.98%	12.34	19.59%
								558.17		**796.47**			
										1691.18		**2118.82**	
										0.89		**0.25**	
										1.89		**1.25**	
1	33kV,Tsholingkhar Feeder	MENCHUNA	33/0.415kV	25	2010	11254	TSE60T1	9.12	36.48%	17.23	68.92%	21.59	86.34%
2	33kV,Tsholingkhar Feeder	BATASEY	33/0.415kV	25	2010	11013	TSE60T2	8.99	35.96%	16.98	67.93%	21.28	85.11%
3	33kV,Tsholingkhar Feeder	ALAICHI TOP	33/0.415kV	63	2010	11470	TSE60T3	8.85	14.05%	16.72	26.54%	20.95	33.25%
4	33kV,Tsholingkhar Feeder	MIDDLE ALAICHI	33/0.415kV	63	2010	11439	TSE60T4	10.22	16.22%	19.31	30.65%	24.19	38.40%
5	33kV,Tsholingkhar Feeder	HARPEYPANI TOP	33/0.415kV	63	2010	11457	TSE60T5	10.23	16.24%	19.33	30.68%	24.21	38.43%
6	33kV,Tsholingkhar Feeder	LOWER HARPEYPANI	33/0.415kV	63	2010	11437	TSE60T6	11.26	17.87%	21.27	33.76%	26.65	42.30%
7	33kV,Tsholingkhar Feeder	KAPASEY	33/0.415kV	63	2010	11459	TSE60T7	10.29	16.33%	19.44	30.86%	24.36	38.66%
8	33kV,Tsholingkhar Feeder	LOWER SUNTOLEY, A	33/0.415kV	63	2011	11523	TSE60T8	9.12	14.48%	17.23	27.35%	21.59	34.26%
9	33kV,Tsholingkhar Feeder	LOWER SUNTOLEY, B	33/0.415kV	63	2010	11530	TSE60T9	16.11	25.57%	30.43	48.31%	38.13	60.52%
10	33kV,Tsholingkhar Feeder	DALGOLEY	33/0.415kV	250	2013	3844	TSE60T10	92.58	37.03%	174.89	69.96%	219.11	87.65%
11	33kV,Tsholingkhar Feeder	LOBSIBOTEY	33/0.415kV	63	2010	11442	TSE60T11	20.59	32.68%	38.90	61.74%	48.73	77.36%
12	33kV,Tsholingkhar Feeder	UPPER LOBSIBOTEY	33/0.415kV	125	2010	11542	TSE60T12	20.03	16.02%	37.84	30.27%	47.41	37.93%
13	33kV,Tsholingkhar Feeder	PELRITHANG	33/0.415kV	63	2010	11486	TSE60T13	23.38	37.11%	44.17	70.11%	55.34	87.84%
14	33kV,Tsholingkhar Feeder	PERITHANG	33/0.415kV	125	2010	11537	TSE60T14	38.71	30.97%	73.13	58.50%	91.62	73.30%
15	33kV,Tsholingkhar Feeder	UPPER LOBSIBOTEY	33/0.415kV	25	2010	10993	TSE60T15	3.40	13.60%	6.42	25.69%	8.05	32.19%
16	33kV,Tsholingkhar Feeder	LOWER LOBSIBOTEY	33/0.415kV	63	2010	11440	TSE60T16	15.38	24.41%	29.06	46.12%	36.40	57.78%
17	33kV,Tsholingkhar Feeder	ZOMLINGTHANG	33/0.415kV	25	2010	11004	TSE60T17	8.79	35.16%	16.61	66.42%	20.80	83.22%

18	33kV,Tsholingkhar Feeder	PEMATHANG	33/0.415kV	63	2010	11492	TSE60T18	12.68	20.13%	23.95	38.02%	30.01	47.64%
19	33kV,Tsholingkhar Feeder	CHOKPUR	33/0.240kV	16	2010	10820	TSE60T19	4.43	27.69%	8.37	52.31%	10.49	65.53%
20	33kV,Tsholingkhar Feeder	KAPASING	33/0.415kV	63	2010	11472	TSE60T20	10.29	16.33%	19.44	30.86%	24.36	38.66%
21	33kV,Tsholingkhar Feeder	RANAHUNG I	33/0.240kV	16	2010	10799	TSE60T21	2.26	14.13%	4.27	26.68%	5.35	33.43%
22	33kV,Tsholingkhar Feeder	LOWER KOKRAY	33/0.415kV	63	2011	11454	TSE60T22	22.60	35.87%	42.69	67.76%	53.49	84.90%
23	33kV,Tsholingkhar Feeder	RANAHUNG II	33/0.415kV	25	2010	11021	TSE60T23	13.88	55.52%	26.22	104.89%	32.85	131.41%
24	33kV,Tsholingkhar Feeder	MIDLE KOKRAY	33/0.415kV	63	2016	11420	TSE60T24	23.03	36.56%	43.51	69.06%	54.51	86.52%
25	33kV,Tsholingkhar Feeder	UPPER KOKRAY	33/0.415kV	25	2010	11043	TSE60T25	8.80	35.20%	16.62	66.50%	20.83	83.31%
26	33kV,Tsholingkhar Feeder	KAPASING TOP	33/0.415kV	25	2011	11039	TSE60T26	13.52	54.08%	25.54	102.17%	32.00	128.00%
27	33kV,Tsholingkhar Feeder	TSIRANDTOE SCHOOL	33/0.415kV	63	2011	11527	TSE60T27	22.32	35.43%	42.17	66.93%	52.83	83.86%
28	33kV,Tsholingkhar Feeder	DAMTSHANG I	33/0.415kV	125	2011	11567	TSE60T28	18.38	14.70%	34.71	27.77%	43.49	34.79%
29	33kV,Tsholingkhar Feeder	DAMTSHANG II	33/0.415kV	125	2011	11568	TSE60T29	17.40	13.92%	32.87	26.30%	41.18	32.95%
30	33kV,Tsholingkhar Feeder	DAUTHREY I	33/0.240kV	16	2011	10902	TSE60T30	3.23	20.19%	6.10	38.14%	7.65	47.78%
31	33kV,Tsholingkhar Feeder	MANITHANG I	33/0.415kV	25	2010	11087	TSE60T31	3.35	13.40%	6.33	25.31%	7.93	31.72%
32	33kV,Tsholingkhar Feeder	MANITHANG II	33/0.415kV	25	2010	11107	TSE60T32	4.03	16.12%	7.61	30.45%	9.54	38.15%
33	33kV,Tsholingkhar Feeder	MANITHANG III	33/0.415kV	25	2011	10971	TSE60T33	3.03	12.12%	5.72	22.90%	7.17	28.69%
34	33kV,Tsholingkhar Feeder	NORBUTHANG	33/0.415kV	25	2011	11164	TSE60T34	4.56	18.24%	8.61	34.46%	10.79	43.17%
35	33kV,Tsholingkhar Feeder	LOWER BURICHU 1A	33/0.415kV	63	2011	11422	TSE60T35	8.85	14.05%	16.72	26.54%	20.95	33.25%
36	33kV,Tsholingkhar Feeder	LOWER BURICHU 1B	33/0.415kV	25	2011	11197	TSE60T36	7.04	28.16%	13.30	53.20%	16.66	66.65%
37	33kV,Tsholingkhar Feeder	LOWER BURICHU 2 B	33/0.415kV	25	2011	11159	TSE60T37	8.92	35.68%	16.85	67.41%	21.11	84.45%
38	33kV,Tsholingkhar Feeder	LOWER BURICHU 3 B	33/0.240kV	16	2011	10855	TSE60T38	2.44	15.25%	4.61	28.81%	5.78	36.10%
39	33kV,Tsholingkhar Feeder	UPPER BURICHU 1 A	33/0.415kV	25	2011	11247	TSE60T39	4.87	19.48%	9.20	36.80%	11.53	46.11%
40	33kV,Tsholingkhar Feeder	UPPER BURICHU 2 A	33/0.415kV	25	2011	11233	TSE60T40	6.92	27.67%	13.07	52.27%	16.37	65.49%
41	33kV,Tsholingkhar Feeder	UPPER BURICHU 2 B	33/0.240kV	10	2011	10772	TSE60T41	2.49	24.87%	4.70	46.98%	5.89	58.86%
42	33kV,Tsholingkhar Feeder	UPPER BURICHU 4A	33/0.415kV	25	2011	11188	TSE60T42	6.86	27.43%	12.95	51.82%	16.23	64.92%
43	33kV,Tsholingkhar Feeder	UPPER BURICHU 3A	33/0.415kV	25	2011	11179	TSE60T43	3.91	15.64%	7.39	29.55%	9.25	37.02%
44	33kV,Tsholingkhar Feeder	UPPER BURICHU 3B	33/0.240kV	16	2011	10931	TSE60T44	1.81	11.31%	3.42	21.37%	4.28	26.78%
45	33kV,Tsholingkhar Feeder	UPPER BURICHU 4B	33/0.240kV	16	2011	10888	TSE60T45	2.43	15.19%	4.59	28.69%	5.75	35.95%
46	33kV,Tsholingkhar Feeder	DHANSERI 1	33/0.415kV	25	2012	11271	TSE60T46	11.21	44.84%	21.18	84.71%	26.53	106.13%
47	33kV,Tsholingkhar Feeder	DHANSERI 2	33/0.415kV	25	2012	11208	TSE60T47	7.25	29.00%	13.70	54.79%	17.16	68.64%
48	33kV,Tsholingkhar Feeder	GOLAYTAR	33/0.240kV	10	2012	10779	TSE60T48	2.82	28.19%	5.33	53.26%	6.67	66.72%
49	33kV,Tsholingkhar Feeder	SAURANI	33/0.415kV	25	2012	10966	TSE60T49	5.19	20.76%	9.80	39.22%	12.28	49.14%
50	33kV,Tsholingkhar Feeder	TSHANGAY 2	33/0.240kV	10	2012	12027	TSE60T50	1.41	14.06%	2.66	26.56%	3.33	33.28%
51	33kV,Tsholingkhar Feeder	TSHANGAY 1	33/0.415kV	25	2012	11236	TSE60T51	3.18	12.70%	6.00	23.99%	7.51	30.06%
52	33kV,Tsholingkhar Feeder	SANUMALAY A	33/0.240kV	16	2012	10806	TSE60T52	2.18	13.63%	4.12	25.74%	5.16	32.25%
53	33kV,Tsholingkhar Feeder	SANUMALAY B	33/0.415kV	25	2012	11143	TSE60T53	2.26	9.04%	4.27	17.08%	5.35	21.40%
54	33kV,Tsholingkhar Feeder	JINGAY	33/0.415kV	25	2012	11226	TSE60T54	9.17	36.68%	17.32	69.29%	21.70	86.82%
55	33kV,Tsholingkhar Feeder	BAKTAR TOP	33/0.240kV	16	2012	10917	TSE60T55	2.11	13.19%	3.99	24.91%	4.99	31.21%
56	33kV,Tsholingkhar Feeder	BAKTAR	33/0.415kV	25	2010	11104	TSE60T56	8.46	33.84%	15.98	63.93%	20.02	80.10%
57	33kV,Tsholingkhar Feeder	BURICHU DOVAN	33/0.415kV	25	2013	B109	TSE60T57	6.08	24.31%	11.48	45.92%	14.38	57.53%
58	33kV,Tsholingkhar Feeder	PHALADAY	33/0.415kV	25	2013	B164	TSE60T58	2.36	9.44%	4.46	17.83%	5.59	22.34%
59	33kV,Tsholingkhar Feeder	JOGITAR	33/0.415kV	25	2013	B131	TSE60T59	3.51	14.04%	6.63	26.52%	8.31	33.23%
60	33kV,Tsholingkhar Feeder	BIRKUNA	33/0.415kV	25	2012	11205	TSE60T60	8.78	35.11%	16.58	66.33%	20.77	83.10%
61	33kV,Tsholingkhar Feeder	KOIPANI	33/0.415kV	25	2012	11251	TSE60T61	8.68	34.71%	16.39	65.57%	20.54	82.15%
62	33kV,Tsholingkhar Feeder	BOURI	33/0.240kV	16	2012	10929	TSE60T62	3.18	19.88%	6.01	37.55%	7.53	47.04%
63	33kV,Tsholingkhar Feeder	SIMPANI	33/0.415kV	63	2010	72331	TSE60T63	16.90	26.83%	31.93	50.68%	40.00	63.49%
64	33kV,Tsholingkhar Feeder	THAREY II	33/0.240kV	16	2011	10819	TSE60T64	1.99	12.44%	3.76	23.50%	4.71	29.44%
65	33kV,Tsholingkhar Feeder	THAREY I	33/0.240kV	16	2011	10894	TSE60T65	1.91	11.94%	3.61	22.55%	4.52	28.25%
66	33kV,Tsholingkhar Feeder	DAUTHREY II	33/0.415kV	25	2012	11020	TSE60T66	8.76	35.04%	16.55	66.20%	20.73	82.94%

67	33kV,Tsholingkhar Feeder	DAUTHREY III	33/0.415kV	63	2011	11491	TSE60T67	15.40	24.44%	29.09	46.17%	36.44	57.85%
68	33kV,Tsholingkhar Feeder	LOWER MANITHANG	33/0.415kV	25	2011	11165	TSE60T68	2.99	11.96%	5.65	22.59%	7.08	28.31%
69	33kV,Tsholingkhar Feeder	TASHITHANG I	33/0.415kV	63	2010	11450	TSE60T69	33.98	53.94%	64.19	101.90%	80.43	127.66%
70	33kV,Tsholingkhar Feeder	TASHTHANG II	33/0.415kV	125	2011	11560	TSE60T70	31.28	25.02%	59.09	47.27%	74.04	59.23%
71	33kV,Tsholingkhar Feeder	NEWATAR	33/0.415kV	25	2010	11166	TSE60T71	8.63	34.50%	16.29	65.18%	20.41	81.66%
72	33kV,Tsholingkhar Feeder	SERGITHANG I	33/0.415kV	63	2011	11504	TSE60T72	15.01	23.83%	28.36	45.01%	35.53	56.39%
73	33kV,Tsholingkhar Feeder	SERGITHANG II	33/0.415kV	63	2011	11488	TSE60T73	11.83	18.77%	22.34	35.46%	27.99	44.43%
74	33kV,Tsholingkhar Feeder	GAIRIKHARKA	33/0.240kV	16	2017	10895	TSE60T74	2.53	15.81%	4.78	29.86%	5.99	37.41%
75	33kV,Tsholingkhar Feeder	GORUJURI	33/0.240kV	16	2011	10890	TSE60T75	1.92	12.00%	3.63	22.67%	4.54	28.40%
76	33kV,Tsholingkhar Feeder	SERGITHANG III	33/0.415kV	63	2011	11413	TSE60T76	9.57	15.19%	18.08	28.70%	22.65	35.95%
77	33kV,Tsholingkhar Feeder	MAJGAON	33/0.415kV	25	2011	11097	TSE60T77	8.30	33.19%	15.67	62.70%	19.64	78.55%
78	33kV,Tsholingkhar Feeder	TEUREY I	33/0.415kV	25	2011	11239	TSE60T78	9.51	38.02%	17.96	71.83%	22.50	89.99%
79	33kV,Tsholingkhar Feeder	TEUREY II	33/0.240kV	16	2011	10898	TSE60T79	1.93	12.06%	3.65	22.79%	4.57	28.55%
80	33kV,Tsholingkhar Feeder	TINDOPANEY I	33/0.240kV	16	2010	10822	TSE60T80	3.33	20.80%	6.29	39.29%	7.88	49.23%
81	33kV,Tsholingkhar Feeder	TINDOPANEY II	33/0.240kV	16	2010	10842	TSE60T81	2.84	17.75%	5.37	33.53%	6.72	42.01%
82	33kV,Tsholingkhar Feeder	KHARKHOLA	33/0.240kV	16	2011	B48	TSE60T82	1.95	12.19%	3.68	23.02%	4.62	28.85%
83	33kV,Tsholingkhar Feeder	THULOMALAY	33/0.415kV	25	2012	11234	TSE60T83	3.06	12.24%	5.78	23.12%	7.24	28.97%
84	33kV,Tsholingkhar Feeder	SERGITHANG GEWOG OFFICE	33/0.415kV	63	2017	72330	TSE60T84	16.82	26.70%	31.78	50.44%	39.81	63.19%
85	33kV,Tsholingkhar Feeder	TSIRANGTOE CENTRALSCHOOL	33/0.415kV	250	2018	E-20639	TSE60T85	28.50	11.40%	53.84	21.54%	67.46	26.98%
86	33kV,Tsholingkhar Feeder	THASA, A	33/0.415kV	25	2018	1107	TSE60T86	4.08	16.32%	7.71	30.83%	9.66	38.63%
87	33kV,Tsholingkhar Feeder	THASA, B	33/0.240kV	10	2013	B25	TSE60T87	1.15	11.50%	2.17	21.73%	2.72	27.22%
88	33kV,Tsholingkhar Feeder	TACHEY	33/0.240kV	16	2013	B58	TSE60T88	1.88	11.75%	3.55	22.20%	4.45	27.81%
								895.19		**1691.18**			
										61.65		**65.18**	
										2.87		**0.06**	
										3.87		**1.06**	
1	11KV,Tsaha Feeder	WAKLAYTAR	11/0.415Kv	25	2013	B265	TSE70T1	7.42	29.68%	28.75	115.00%	30.40	121.59%
2	11KV,Tsaha Feeder	RELANGTHANG A	11/0.415Kv	63	2018	24/02/2001	TSE70T2	3.02	4.79%	11.70	18.57%	12.37	19.64%
3	11KV,Tsaha Feeder	RELANGTHANG B	11/0.415Kv	25	2018	B302	TSE70T3	5.47	21.88%	21.19	84.78%	22.41	89.63%
								15.91		**61.65**			

Annexure-8: Material Cost of three phase (3Φ) Transformers

Sl. No	Name of ESDs	Cost for replacement of single phase transformers and distribution boards with three phase		Total cost in Nu.
		11 kV transformers	33 kV transformers	
		Cost in Nu.	Cost in Nu.	
1	Bumthang	421,565.09	132,535.04	554,100.14
2	Chukhha	956,241.73	9,144,917.99	10,101,159.72
3	Dagana	–	6,361,682.08	6,361,682.08
4	Haa	–	3,048,306.00	3,048,306.00
5	Lhuntse	731,506.19	8,747,312.86	9,478,819.05
6	Mongar	182,876.55	4,108,586.34	4,291,462.89
7	Paro	836,897.46	1,060,280.35	1,897,177.81
8	Pemagatshel	91,438.27	6,759,287.21	6,850,725.48
9	Punakha	274,314.82	4,771,261.56	5,045,576.38
10	S/Jongkhar	–	15,506,600.07	15,506,600.07
11	Samtse	6,674,993.95	4,241,121.39	10,916,115.34
12	Sarpang	2,053,501.01	3,445,911.13	5,499,412.14
13	Trashi Gang	906,662.46	4,903,796.60	5,810,459.06
14	Trashiyangtse	–	4,638,726.52	4,638,726.52
15	Thimphu	723,785.91	–	723,785.91
16	Trongsa	91,438.27	3,445,911.13	3,537,349.40
17	Tsirang	–	5,168,866.69	5,168,866.69
18	Wangdue	182,876.55	1,457,885.48	1,640,762.02
19	Zhemgang	105,391.27	11,928,153.90	12,033,545.17
	TOTAL	**14,233,489.55**	**98,871,142.33**	**113,104,631.87**

Here the existing single phase transformers and distribution boards were replaced by three phase system, therefore the estimation includes the cost of three phase transformers and distribution boards.In line with Distribution Design and Construction Standard (DDCS) 2015, the transformer capacities according to voltage level are standardized as shown below:

33 kV System		11 kV System	
3 Φ	1Φ	3 Φ	1Φ
25 kVA	25 kVA, 16 kVA	25 kVA, 16 kVA	25 kVA,16 kVA, 10 kVA

Therefore, during the estimation, on 33 kV system, the cost of 25 kVA transformers was taken for 10 kVA and 16 kVA transformers and for 11 kV system, the cost of 16 kVA transformers was taken for 10 kVA ratings. The total cost for replacing the 1-phase transformers under whole ESD including transportation cost (Nu. 2.6 million) and labor cost (Nu. 70 million) is Nu. 186 million. Therefore, the total cost under this option will amount to Nu. 283 million.

11 kV & 33 kV Single Phase Transformers used under each ESD

Sl. No	Name of ESDs	TRANSFORMERS (Nos.)					
		11/0.240 kV			33/0.240 kV		
		10 kVA	16kVA	25kVA	10 kVA	16kVA	25kVA
1	Bumthang	–	–	4	–	1	–
2	Chukhha	2	5	3	19	31	19
3	Dagana	–	–	–	4	43	1
4	Haa	–	–	–	8	13	2
5	Lhuntse	3	5	–	3	19	44
6	Mongar		2	–	12	17	2
7	Paro	5	3	1	6	2	–
8	Pemagatshel	–	1	–	4	8	39
9	Punakha	1	2	–	2	5	29
10	S/Jongkhar	–	–	–	18	24	75
11	Samtse	15	58	–	–	32	–
12	Sarpang	10	9	3	9	8	9
13	Trashi Gang	3	–	6	–	–	37
14	Trashiyangtse	–	–	–	16	19	–
15	Thimphu*	–	1	6	–	–	–
16	Trongsa	1	–	–	9	17	–
17	Tsirang	–	–	–	7	32	–
18	Wangdue	1	1	–	–	2	9
19	Zhemgang	–	–	1	27	36	27
	TOTAL	**41**	**87**	**24**	**144**	**309**	**293**