SANJIVANI RURAL EDUCATION SOCIETY'S
SANJIVANI COLLEGE OF ENGINEERING KOPARGAON

DEPARTMENT OF ELECTRICAL ENGINEERING

Report

On

Load Flow Analysis on ETAP Software.

Prepared by:

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B.Tech in Electrical Engineering

Sanjivani College of Engineering, Kopargaon

Dr. Dipesh B. Pardeshi

Hod Electrical

Introduction: -

ETAP is the world's leading electrical design and operations digital twin platform for infrastructure, building and industry.

ETAP (Electrical Transient Analyzer Program) is a comprehensive engineering software platform designed for the simulation, design, analysis, monitoring, control, optimization, and automation of electrical power systems. Developed by Operation Technology, Inc., ETAP is widely used by engineers and professionals in various industries, including power generation, transmission, distribution, industrial, transportation, and renewable energy sectors.

Key Features of ETAP:

1.Power System Analysis: ETAP provides a wide range of analysis tools, including load flow, short circuit, motor acceleration, harmonic analysis, and arc flash, enabling engineers to perform detailed electrical studies.

2.Real-Time Monitoring and Control: ETAP's real-time modules allow for the continuous monitoring and control of electrical networks, providing operators with the ability to make informed decisions and respond quickly to changes in the system.

3.Renewable Energy Integration: ETAP supports the modeling and integration of renewable energy sources like wind, solar, and battery storage systems, which is essential for modern power systems.

4.Advanced Modeling Capabilities: The software offers robust modeling tools for creating detailed representations of electrical components and systems, from simple radial networks to complex, interconnected grids.

5.User-Friendly Interface: ETAP features an intuitive graphical user interface that makes it easier for users to navigate and utilize its extensive capabilities, even for those who may not have extensive experience with electrical engineering software.

6.Regulatory Compliance: The software helps organizations comply with industry standards and regulatory requirements by providing tools for safety analysis, reporting, and documentation.

7.Scalability and Flexibility: ETAP is scalable to accommodate systems of various sizes and complexities, from small industrial plants to large utility grids, making it suitable for a broad range of applications.

Applications of ETAP:

- Power System Design: Engineers use ETAP to design electrical systems that are safe, efficient, and cost-effective.
- System Protection: The software is used to analyze protective device coordination and ensure the safety and reliability of electrical systems.
- Power Quality Analysis: ETAP helps identify and mitigate power quality issues, such as harmonics and voltage sags.
- Optimization: The platform provides tools for optimizing system performance and energy usage, which can lead to significant cost savings.
- Training and Education: ETAP is also widely used in academic settings for training the next generation of electrical engineers and technicians.

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CERTIFICATE
OF COMPLETION

This Certificate is Proudly Presented To

Rohit Rajaram Takpere

has successfully completed the course on **ETAP Training on Equipment Modelling**, **Load Flow & Short Circuit Studies** held from **24.06.2024 to 29.06.2024** at **Sanjivani College of Engineering,Kopargaon.**

TÜV SÜD
ISO 9001-2015 CERTIFIED

SelvaKumar S
Business Head

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Office Seal

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CERTIFICATE
OF ATTENDANCE

This Certificate is Proudly Presented To

Rohit Rajaram Takpere

for attending the webinar on **Single Line Diagram**
by **Er. Selvakumar S**, Power Projects on **21st July 2024.**

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SelvaKumar S
Business Head

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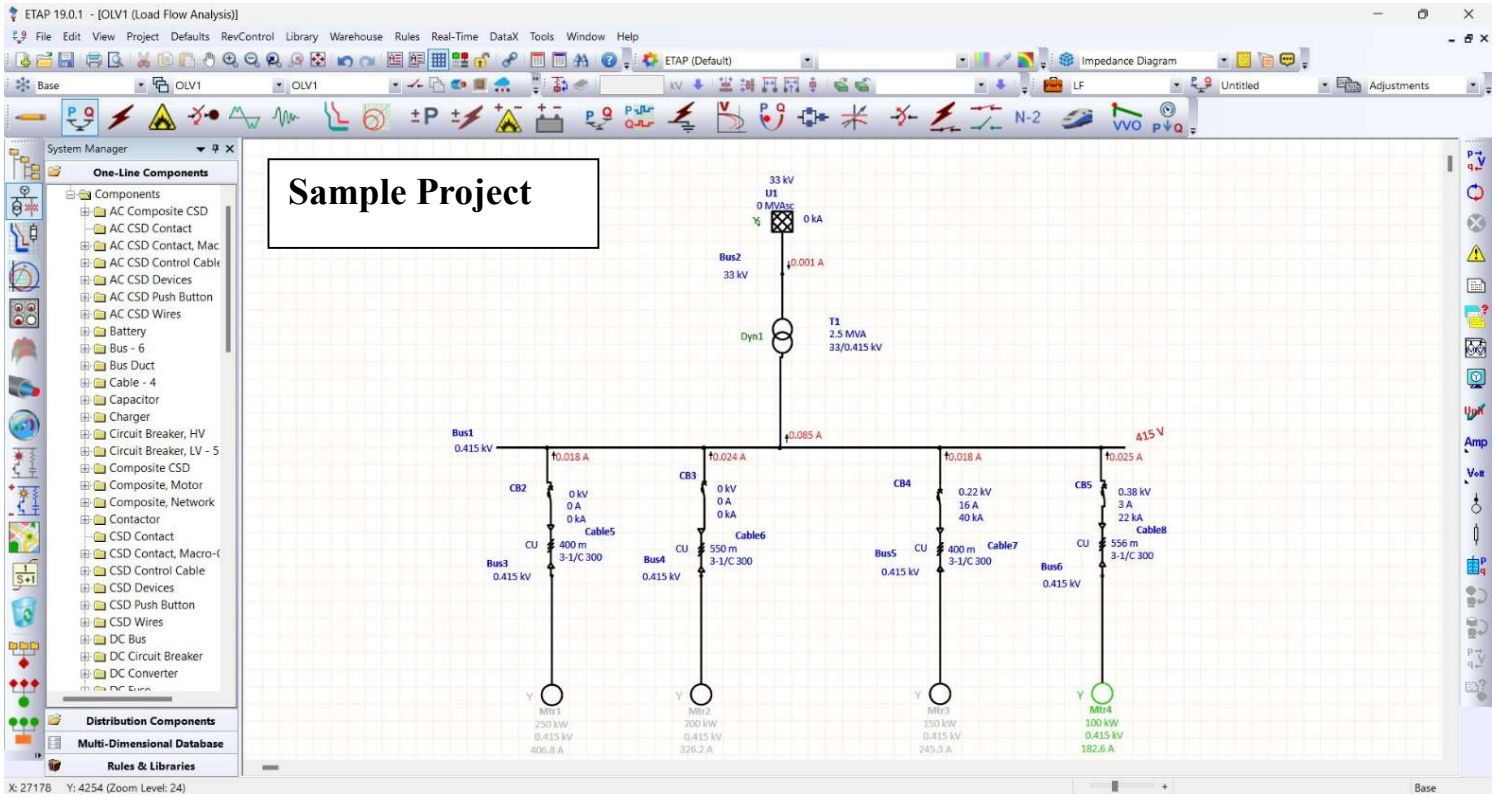
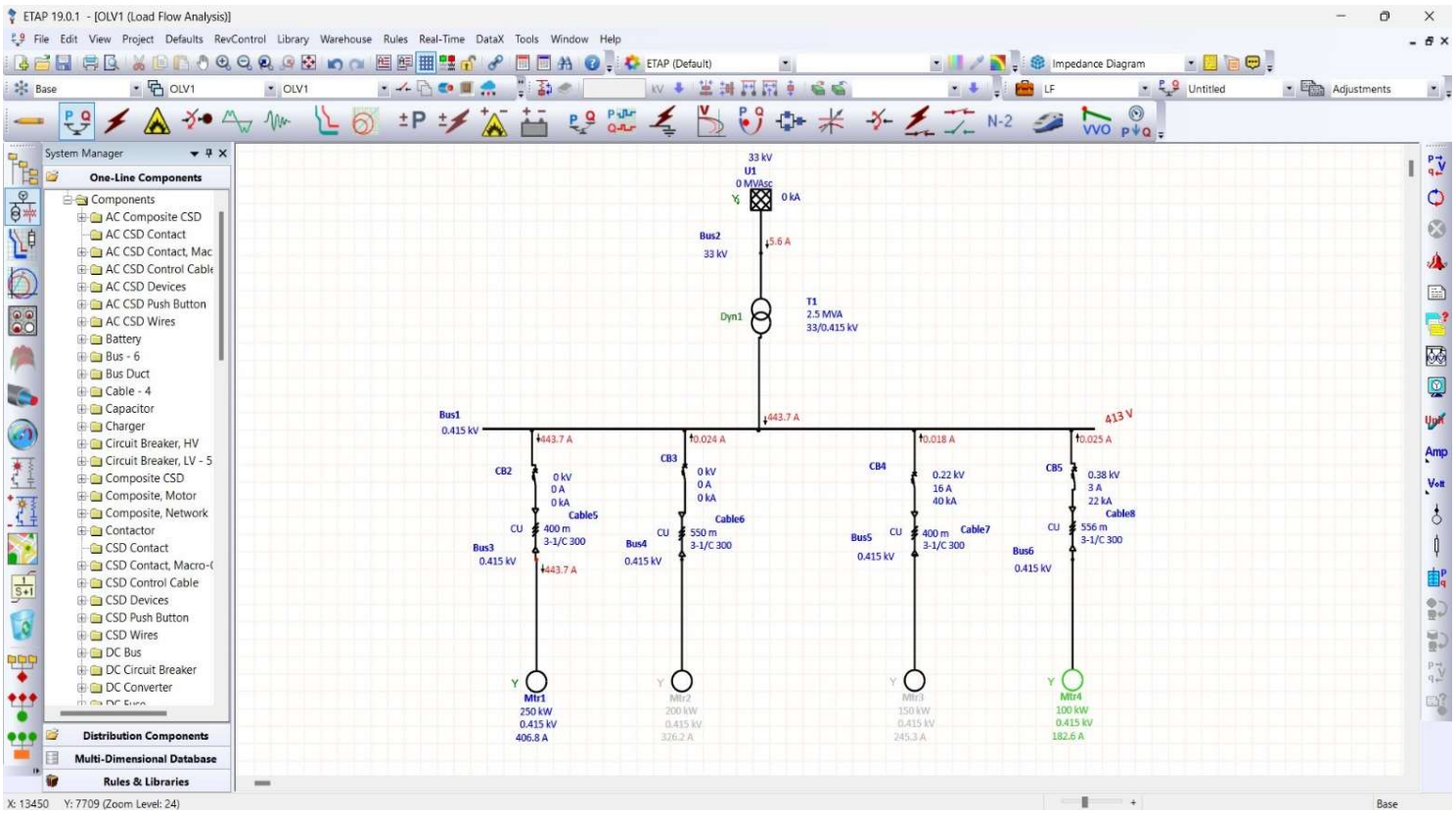

ETAP 19.0.1 - [OLV1 (Load Flow Analysis)]
Sample Project
33 kV
U1
0 MVAsc
0 kA
Bus2
33 kV
0.001 A
Dyn1
T1
2.5 MVA
33/0.415 kV
Bus1
0.415 kV
0.085 A
415 V
0.018 A
0.024 A
0.018 A
0.025 A
CB2
CB3
CB4
CB5
0 kV
0 A
0 kA
0.22 kV
16 A
40 kA
0.38 kV
3 A
22 kA
Cable5
Cable6
Cable7
Cable8
CU
400 m
3-1/C 300
550 m
3-1/C 300
556 m
3-1/C 300
Bus3
0.415 kV
Bus4
0.415 kV
Bus5
0.415 kV
Bus6
0.415 kV
Mtr1
250 kW
0.415 kV
406.8 A
Mtr2
200 kW
0.415 kV
326.2 A
Mtr3
150 kW
0.415 kV
245.3 A
Mtr4
100 kW
0.415 kV
182.6 A
System Manager
One-Line Components
Components
AC Composite CSD
AC CSD Contact
AC CSD Contact, Mac
AC CSD Control Cable
AC CSD Devices
AC CSD Push Button
AC CSD Wires
Battery
Bus - 6
Bus Duct
Cable - 4
Capacitor
Charger
Circuit Breaker, HV
Circuit Breaker, LV - 5
Composite CSD
Composite, Motor
Composite, Network
Contactor
CSD Contact
CSD Contact, Macro-
CSD Control Cable
CSD Devices
CSD Push Button
CSD Wires
DC Bus
DC Circuit Breaker
DC Converter
Distribution Components
Multi-Dimensional Database
Rules & Libraries
X: 27178 Y: 4254 (Zoom Level: 24)


ETAP 19.0.1 - [OLV1 (Load Flow Analysis)]
33 kV
U1
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Bus2
33 kV
5.6 A
Dyn1
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Bus1
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443.7 A
413 V
0.024 A
0.018 A
0.025 A
CB2
CB3
CB4
CB5
0 kV
0 A
0 kA
0.22 kV
16 A
40 kA
0.38 kV
3 A
22 kA
Cable5
Cable6
Cable7
Cable8
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3-1/C 300
556 m
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Bus5
0.415 kV
Bus6
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Mtr1
250 kW
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406.8 A
Mtr2
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0.415 kV
326.2 A
Mtr3
150 kW
0.415 kV
245.3 A
Mtr4
100 kW
0.415 kV
182.6 A
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One-Line Components
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AC Composite CSD
AC CSD Contact
AC CSD Contact, Mac
AC CSD Control Cable
AC CSD Devices
AC CSD Push Button
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Bus Duct
Cable - 4
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Charger
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Circuit Breaker, LV - 5
Composite CSD
Composite, Motor
Composite, Network
Contactor
CSD Contact
CSD Contact, Macro-
CSD Control Cable
CSD Devices
CSD Push Button
CSD Wires
DC Bus
DC Circuit Breaker
DC Converter
Distribution Components
Multi-Dimensional Database
Rules & Libraries
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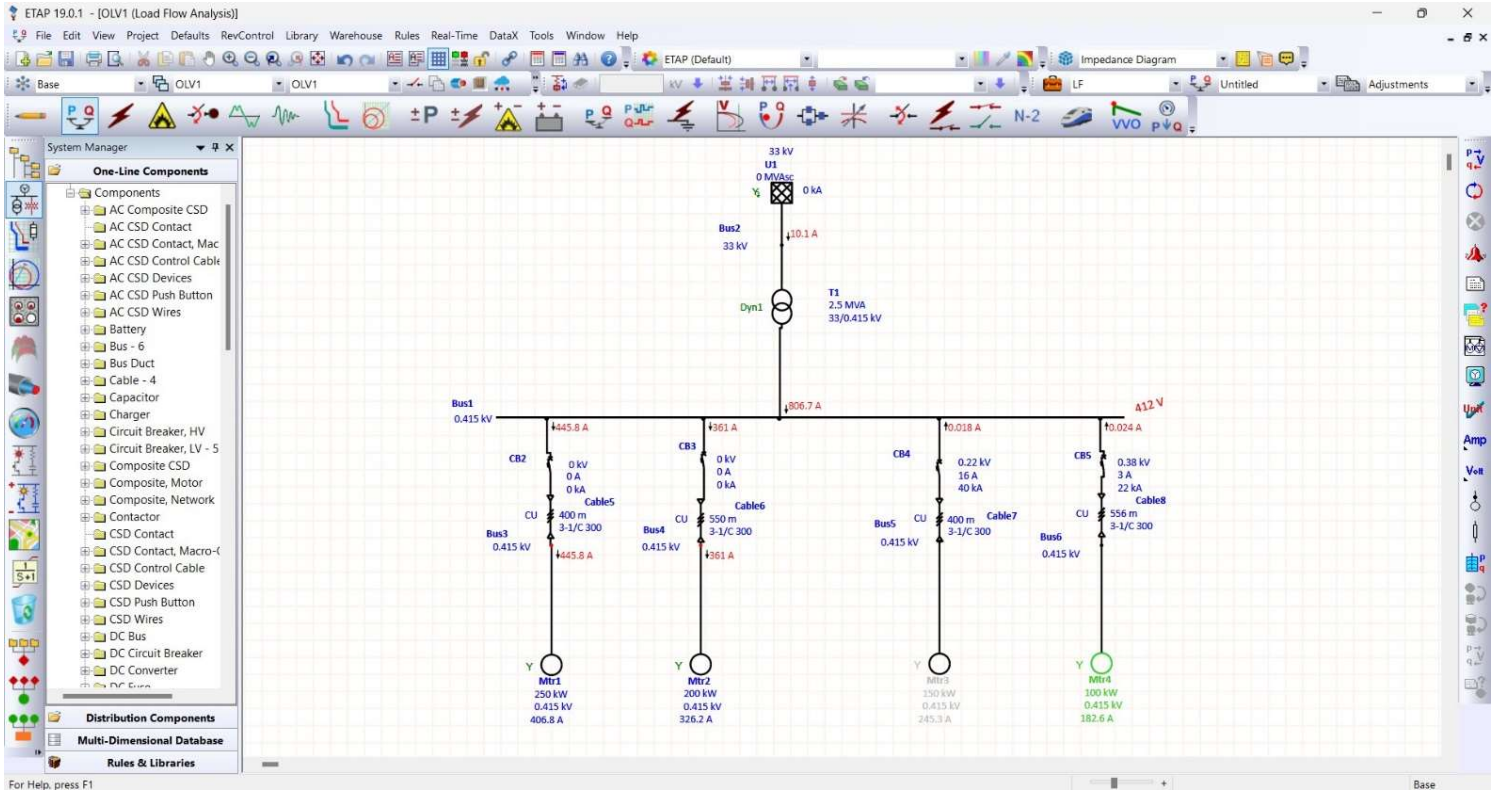
ETAP 19.0.1 - [OLV1 (Load Flow Analysis)]
File Edit View Project Defaults RevControl Library Warehouse Rules Real-Time DataX Tools Window Help
ETAP (Default)
Impedance Diagram
Base
OLV1
LF
Untitled
Adjustments
N-2
VVO
System Manager
One-Line Components
Components
AC Composite CSD
AC CSD Contact
AC CSD Contact, Mac
AC CSD Control Cable
AC CSD Devices
AC CSD Push Button
AC CSD Wires
Battery
Bus - 6
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Circuit Breaker, LV - 5
Composite CSD
Composite, Motor
Composite, Network
Contactor
CSD Contact
CSD Contact, Macro-(
CSD Control Cable
CSD Devices
CSD Push Button
CSD Wires
DC Bus
DC Circuit Breaker
DC Converter
Distribution Components
Multi-Dimensional Database
Rules & Libraries
33 kV
U1
0 MVAsc
0 kA
Bus2
33 kV
10.1 A
T1
2.5 MVA
33/0.415 kV
Dyn1
806.7 A
412 V
Bus1
0.415 kV
445.8 A
361 A
0.018 A
0.024 A
CB2
CB3
CB4
CB5
0 kV
0 A
0 kA
0.22 kV
16 A
40 kA
0.38 kV
3 A
22 kA
Cable5
Cable6
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400 m
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3-1/C 300
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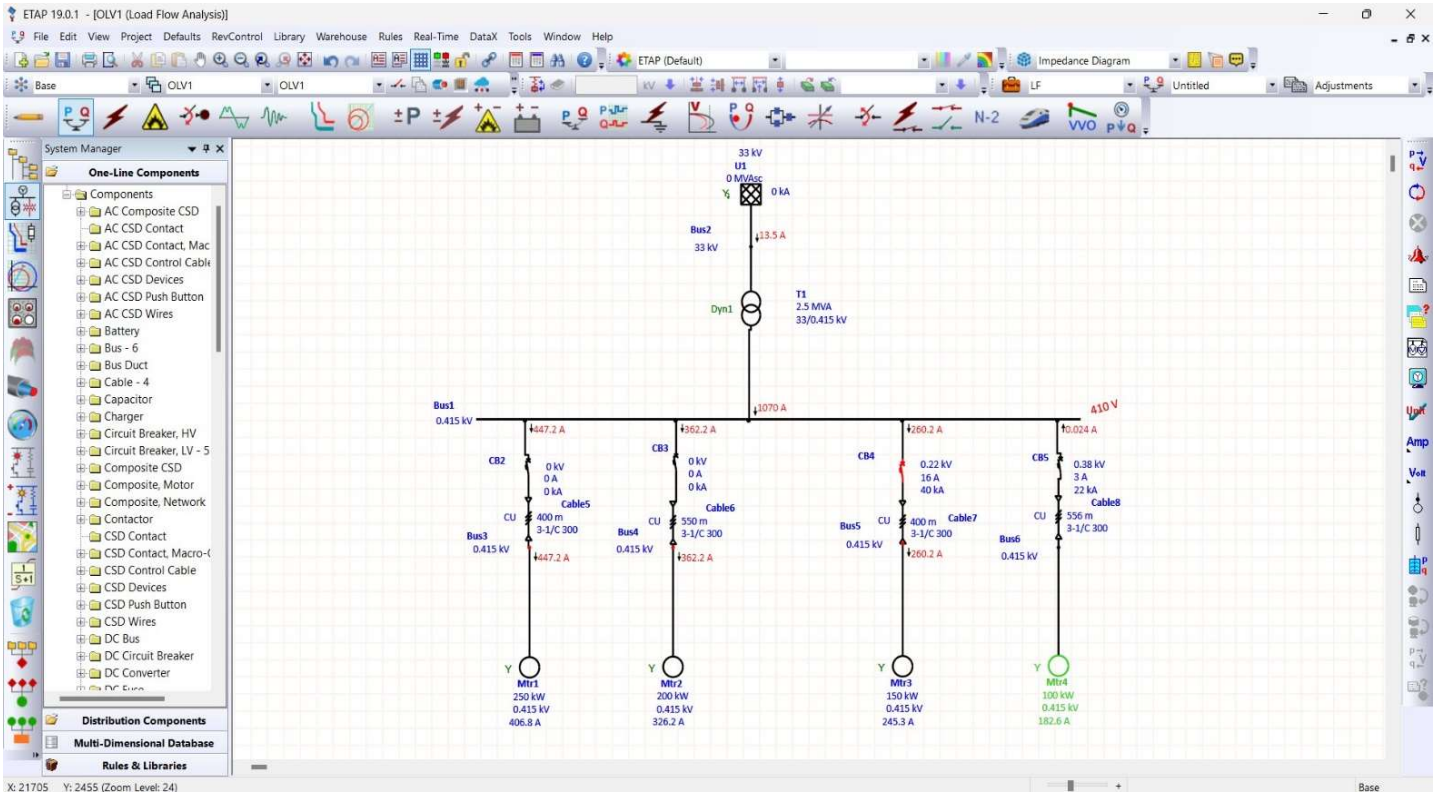
Bus4
0.415 kV
Bus5
0.415 kV
Bus6
0.415 kV
Mtr1
250 kW
0.415 kV
406.8 A
Mtr2
200 kW
0.415 kV
326.2 A
Mtr3
150 kW
0.415 kV
245.3 A
Mtr4
100 kW
0.415 kV
182.6 A
For Help, press F1
Base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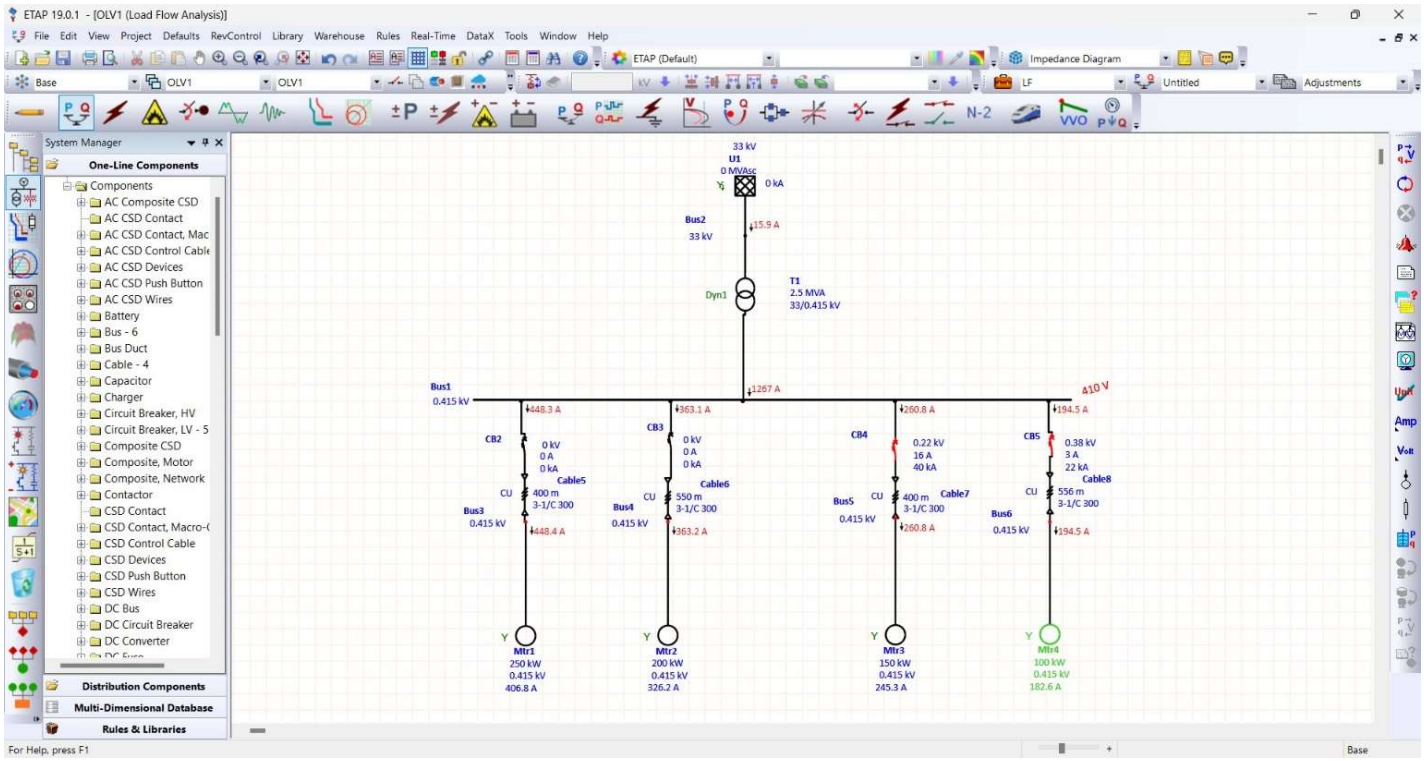
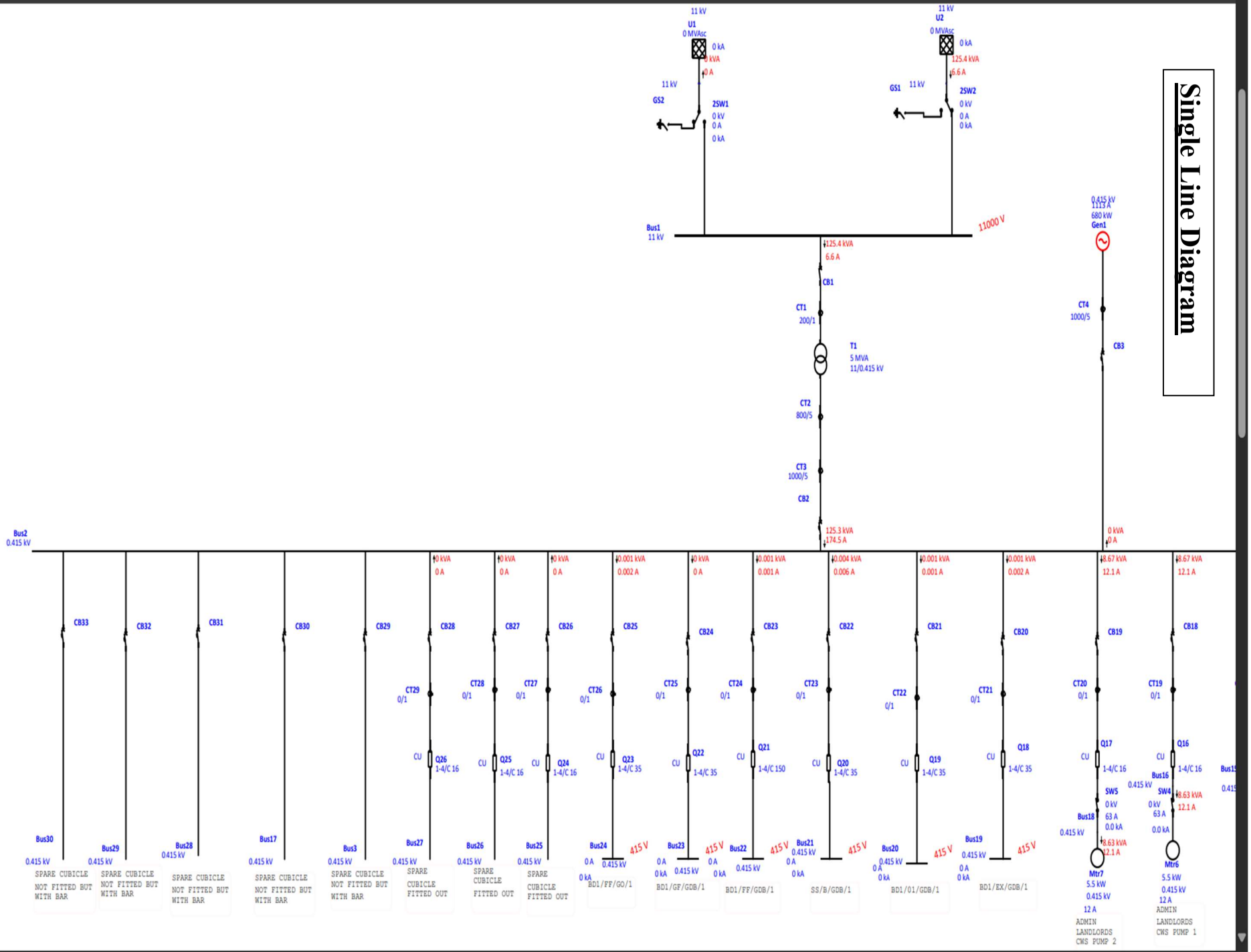
Contactor
CSD Contact
CSD Contact, Macro-(
CSD Control Cable
CSD Devices
CSD Push Button
CSD Wires
DC Bus
DC Circuit Breaker
DC Converter
Distribution Components
Multi-Dimensional Database
Rules & Libraries
33 kV
U1
0 MVAsc
0 kA
Bus2
33 kV
13.5 A
T1
2.5 MVA
33/0.415 kV
Dyn1
1070 A
410 V
Bus1
0.415 kV
447.2 A
362.2 A
260.2 A
0.024 A
CB2
CB3
CB4
CB5
0 kV
0 A
0 kA
0.22 kV
16 A
40 kA
0.38 kV
3 A
22 kA
Cable5
Cable6
Cable7
Cable8
CU
400 m
3-1/C 300
550 m
3-1/C 300
556 m
3-1/C 300
Bus3
0.415 kV
Bus4
0.415 kV
Bus5
0.415 kV
Bus6
0.415 kV
Mtr1
250 kW
0.415 kV
406.8 A
Mtr2
200 kW
0.415 kV
326.2 A
Mtr3
150 kW
0.415 kV
245.3 A
Mtr4
100 kW
0.415 kV
182.6 A
X: 21705 Y: 2455 (Zoom Level: 24)
Base

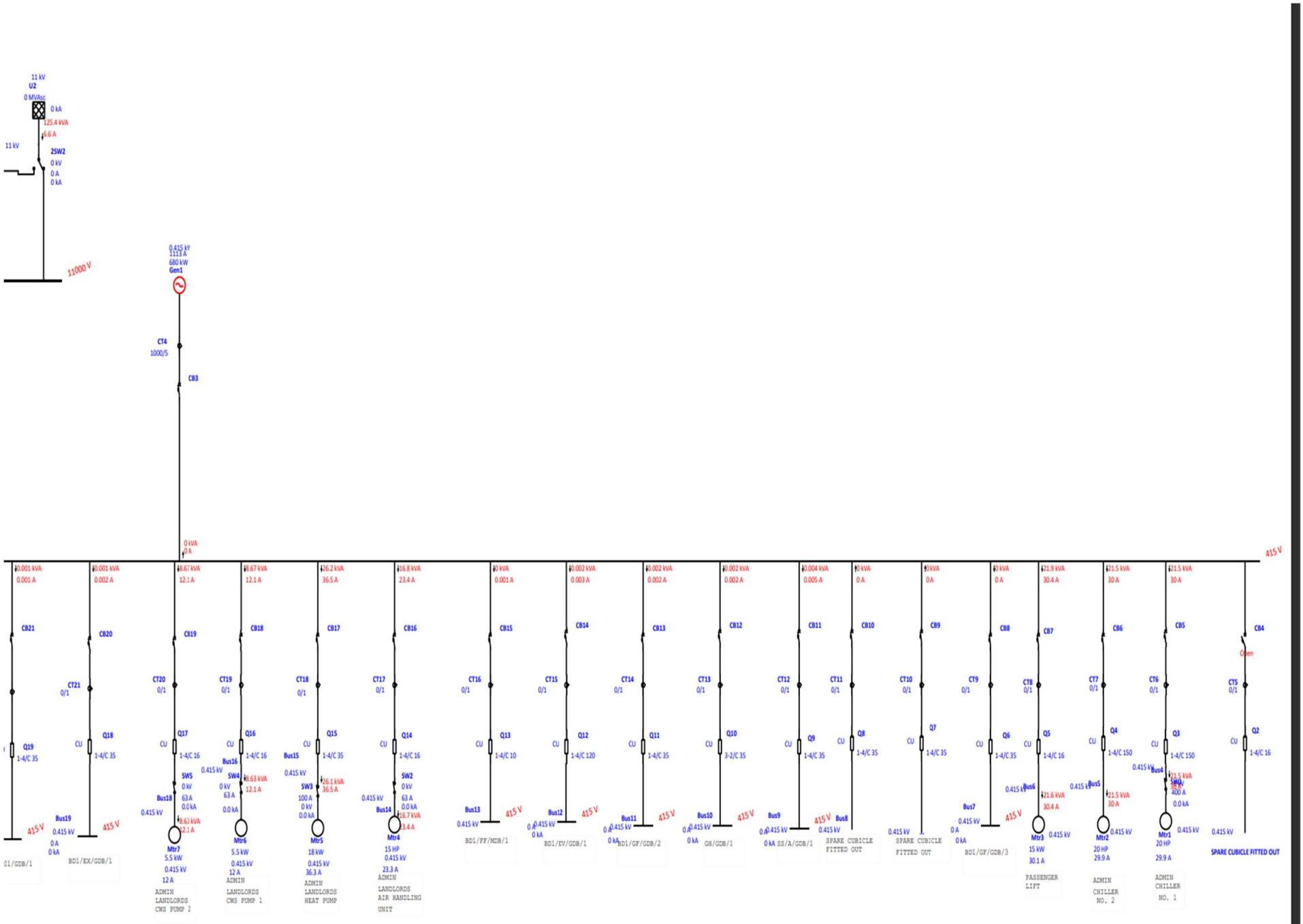


Load flow analysis :-

Case	Available Voltages at bus 2	Current flowing in the transformer MV	Remark	Real power	Reactive power
Case 1	415 V	0 A	No load	0	0
Case 2	413 V	443.7 A	Only m1 in service	286.8 kw	136.1 kvar
Case 3	412 V	806.7 A	Only M1 and M2 in service	518.7 kw	248.3 kvar
Case4	410 V	1070 A	Only M1, M2 and M3 in service	686.8 kw	326.1 kvar
Case 5	410 V	1267 A	All 4 motors in service	812 kw	384.8 kvar

Single Line Diagram




11 kV
U2
0 MVAsc
0 kA
125.4 kVA
6.6 A
11 kV
2SW2
0 kV
0 A
0 kA
11000 V
0.415 kV
1113 A
680 kW
Gen1
CT4
1000/5
CB3
0 kVA
0 A
415 V
0.001 kVA
0.001 A
CB21
CT21
0/1
Q19
1-4/C 35
415 V
0 A
0 kA
01/GDB/1
0.001 kVA
0.002 A
CB20
Q18
1-4/C 35
Bus19
0.415 kV
0 A
0 kA
BD1/EX/GDB/1
8.67 kVA
12.1 A
CB19
CT20
0/1
Q17
1-4/C 16
SW5
0 W
63 A
0.0 kA
Bus18
0.415 kV
8.63 kVA
12.1 A
Mtr7
5.5 kW
0.415 kV
12 A
ADMIN
LANDLORDS
CWS PUMP 2
8.67 kVA
12.1 A
CB18
CT19
0/1
Q16
1-4/C 16
Bus16
0.415 kV
SW4
0 kV
63 A
0.0 kA
8.63 kVA
12.1 A
Mtr6
5.5 kW
0.415 kV
12 A
ADMIN
LANDLORDS
CWS PUMP 1
26.2 kVA
36.5 A
CB17
CT18
0/1
Q15
1-4/C 35
Bus15
0.415 kV
SW3
100 A
0 kV
0.0 kA
26.1 kVA
36.5 A
Mtr5
18 kW
0.415 kV
36.3 A
ADMIN
LANDLORDS
HEAT PUMP
16.8 kVA
23.4 A
CB16
CT17
0/1
Q14
1-4/C 16
SW2
0 kV
63 A
0.0 kA
16.7 kVA
23.4 A
Mtr4
15 HP
0.415 kV
23.3 A
ADMIN
LANDLORDS
AIR HANDLING
UNIT
0 kVA
0.001 A
CB15
CT16
0/1
Q13
1-4/C 10
Bus13
0.415 kV
415 V
BD1/FF/MDB/1
0.002 kVA
0.003 A
CB14
CT15
0/1
Q12
1-4/C 120
Bus12
0.415 kV
0 kA
415 V
BD1/EV/GDB/1
0.002 kVA
0.002 A
CB13
CT14
0/1
Q11
1-4/C 35
Bus11
0.415 kV
0 kA
415 V
BD1/GF/GDB/2
0.002 kVA
0.002 A
CB12
CT13
0/1
Q10
3-2/C 35
Bus10
0.415 kV
0 kA
415 V
GH/GDB/1
0.004 kVA
0.005 A
CB11
CT12
0/1
Q9
1-4/C 35
Bus9
0.415 kV
0 kA
415 V
SS/A/GDB/1
0 kVA
0 A
CB10
CT11
0/1
Q8
1-4/C 35
Bus8
0.415 kV
SPARE CUBICLE
FITTED OUT
0 kVA
0 A
CB9
CT10
0/1
Q7
1-4/C 35
0.415 kV
SPARE CUBICLE
FITTED OUT
0 kVA
0 A
CB8
CT9
0/1
Q6
1-4/C 35
Bus7
0.415 kV
0 A
0 kA
415 V
BD1/GF/GDB/3
21.9 kVA
30.4 A
CB7
CT8
0/1
Q5
1-4/C 16
Bus6
0.415 kV
21.6 kVA
30.4 A
Mtr3
15 kW
30.1 A
0.415 kV
PASSENGER
LIFT
21.5 kVA
30 A
CB6
CT7
0/1
Q4
1-4/C 150
Bus5
0.415 kV
21.5 kVA
30 A
Mtr2
20 HP
29.9 A
0.415 kV
ADMIN
CHILLER
NO. 2
21.5 kVA
30 A
CB5
CT6
0/1
Q3
1-4/C 150
Bus4
0.415 kV
21.5 kVA
30 A
SW1
400 A
0.0 kA
Mtr1
20 HP
29.9 A
0.415 kV
ADMIN
CHILLER
NO. 1
CB4
Open
CT5
0/1
Q2
1-4/C 16
0.415 kV
SPARE CUBICLE FITTED OUT

Electrical Transient Analyzer Program

Load Flow Analysis

Loading Category (1): Design

Generation Category (1): Design

Load Diversity Factor: None

	Swing	V-Control	Load	Total
Number of Buses:	2	1	30	33

	XFMR2	XFMR3	Reactor	Line/Cable/ Busway	Impedance	Tie PD	Total
Number of Branches:	1	0	0	24	0	6	31

Method of Solution:	Adaptive Newton-Raphson Method
Maximum No. of Iteration:	99
Precision of Solution:	0.0001000
System Frequency:	50.00 Hz
Unit System:	Metric
Project Filename:	SLD3
Output Filename:	C:\ETAP 1901\SLD3\Untitled.lfr

Adjustments

Tolerance	Apply Adjustments	Individual /Global	Percent
Transformer Impedance:	Yes	Individual	
Reactor Impedance:	Yes	Individual	
Overload Heater Resistance:	No		
Transmission Line Length:	No		
Cable / Busway Length:	No		

Temperature Correction	Apply Adjustments	Individual /Global	Degree C
Transmission Line Resistance:	Yes	Individual	
Cable / Busway Resistance:	Yes	Individual	

Bus Input Data

Bus			Initial Voltage		Load							
					Constant kVA		Constant Z		Constant I		Generic	
ID	kV	Sub-sys	% Mag.	Ang.	MW	Mvar	MW	Mvar	MW	Mvar	MW	Mvar
.	11.000	2	100.0	0.0								
..	11.000	1	100.0	0.0								
...	0.415	2	100.0	0.0								
Bus1	11.000	2	100.0	0.0								
Bus2	0.415	2	100.0	0.0								
Bus3	0.415	2	100.0	0.0								
Bus4	0.415	2	100.0	0.0	0.019	0.010						
Bus5	0.415	2	100.0	0.0	0.019	0.010						
Bus6	0.415	2	100.0	0.0	0.019	0.010						
Bus7	0.415	2	100.0	0.0								
Bus8	0.415	2	100.0	0.0								
Bus9	0.415	2	100.0	0.0								
Bus10	0.415	2	100.0	0.0								
Bus11	0.415	2	100.0	0.0								
Bus12	0.415	2	100.0	0.0								
Bus13	0.415	2	100.0	0.0								
Bus14	0.415	2	100.0	0.0	0.015	0.008						
Bus15	0.415	2	100.0	0.0	0.023	0.012						
Bus16	0.415	2	100.0	0.0	0.007	0.004						
Bus17	0.415	2	100.0	0.0								
Bus18	0.415	2	100.0	0.0	0.007	0.004						
Bus19	0.415	2	100.0	0.0								
Bus20	0.415	2	100.0	0.0								
Bus21	0.415	2	100.0	0.0								
Bus22	0.415	2	100.0	0.0								
Bus23	0.415	2	100.0	0.0								
Bus24	0.415	2	100.0	0.0								
Bus25	0.415	2	100.0	0.0								
Bus26	0.415	2	100.0	0.0								
Bus27	0.415	2	100.0	0.0								
Bus28	0.415	2	100.0	0.0								
Bus29	0.415	2	100.0	0.0								

Bus			Initial Voltage		Load							
					Constant kVA		Constant Z		Constant I		Generic	
ID	kV	Sub-sys	% Mag.	Ang.	MW	Mvar	MW	Mvar	MW	Mvar	MW	Mvar
Bus30	0.415	2	100.0	0.0								
Total Number of Buses: 33					0.110	0.060	0.000	0.000	0.000	0.000	0.000	0.000

Generation Bus				Voltage		Generation			Mvar Limits	
ID	kV	Type	Sub-sys	% Mag.	Angle	MW	Mvar	% PF	Max	Min
.	11.000	Swing	2	100.0	0.0					
..	11.000	Swing	1	100.0	0.0					
Bus2	0.415	Voltage Control	2	100.0	0.0	0.000			0.000	0.000
						0.000	0.000			

Line/Cable/Busway Input Data

ohms or siemens/1000 m per Conductor (Cable) or per Phase (Line/Busway)

Line/Cable/Busway ID	Library	Size	Length Adj. (m)	Length % Tol.	#/Phase	T (°C)	R	X	Y
Q3	1.0MCUN4	150	70.0	0.0	1	75	0.151650	0.073000	0.0001442
Q4	1.0MCUN4	150	75.0	0.0	1	75	0.151650	0.073000	0.0001442
Q5	1.0MCUN4	16	60.0	0.0	1	75	1.392512	0.080000	0.0000971
Q6	1.0MCUN4	35	10.0	0.0	1	75	0.638076	0.080000	0.0001015
Q7	1.0MCUN4	35	10.0	0.0	1	75	0.638076	0.080000	0.0001015
Q8	1.0MCUN4	35	10.0	0.0	1	75	0.638076	0.080000	0.0001015
Q9	1.0MCUN4	35	205.0	0.0	1	75	0.638076	0.080000	0.0001015
Q10	1.0MCUN2	35	92.0	0.0	1	75	0.638076	0.080000	0.0001096
Q11	1.0MCUN4	35	95.0	0.0	1	75	0.638076	0.080000	0.0001015
Q12	1.0MCUN4	120	70.0	0.0	1	75	0.186940	0.073000	0.0001499
Q13	1.0MCUN4	10	30.0	0.0	1	75	2.222296	0.084000	0.0000807
Q14	1.0MCUN4	16	50.0	0.0	1	75	1.392512	0.080000	0.0000971
Q15	1.0MCUN4	35	35.0	0.0	1	75	0.638076	0.080000	0.0001015
Q16	1.0MCUN4	16	70.0	0.0	1	75	1.392512	0.080000	0.0000971
Q17	1.0MCUN4	16	70.0	0.0	1	75	1.392512	0.080000	0.0000971
Q18	1.0MCUN4	35	70.0	0.0	1	75	0.638076	0.080000	0.0001015
Q19	1.0MCUN4	35	30.0	0.0	1	75	0.638076	0.080000	0.0001015
Q20	1.0MCUN4	35	230.0	0.0	1	75	0.638076	0.080000	0.0001015
Q21	1.0MCUN4	150	30.0	0.0	1	75	0.151650	0.073000	0.0001442
Q22	1.0MCUN4	35	15.0	0.0	1	75	0.638076	0.080000	0.0001015
Q23	1.0MCUN4	35	80.0	0.0	1	75	0.638076	0.080000	0.0001015
Q24	1.0MCUN4	16	10.0	0.0	1	75	1.392512	0.080000	0.0000971
Q25	1.0MCUN4	16	15.0	0.0	1	75	1.392512	0.080000	0.0000971
Q26	1.0MCUN4	16	10.0	0.0	1	75	1.392512	0.080000	0.0000971

Line / Cable / Busway resistances are listed at the specified temperatures.

2-Winding Transformer Input Data

Transformer		Rating					Z Variation			% Tap Setting		Adjusted	Phase Shift	
ID	Phase	MVA	Prim. kV	Sec. kV	% Z1	X1/R1	+ 5%	- 5%	% Tol.	Prim.	Sec.	% Z	Type	Angle
T1	3-Phase	2.500	11.000	0.415	6.25	6.00	0	0	0	0	0	6.2500	Dyn	0.000

Branch Connections

CKT/Branch		Connected Bus ID		% Impedance, Pos. Seq., 100 MVA Base			
ID	Type	From Bus	To Bus	R	X	Z	Y
T1	2W XFMR	Bus1	Bus2	41.10	246.60	250.00	
Q3	Cable	Bus2	Bus4	616.37	296.70	684.07	0.0000017
Q4	Cable	Bus2	Bus5	660.40	317.90	732.93	0.0000019
Q5	Cable	Bus2	Bus6	4851.25	278.71	4859.25	0.0000010
Q6	Cable	Bus2	Bus7	370.49	46.45	373.39	0.0000002
Q7	Cable	Bus2	...	370.49	46.45	373.39	0.0000002
Q8	Cable	Bus2	Bus8	370.49	46.45	373.39	0.0000002
Q9	Cable	Bus2	Bus9	7595.04	952.24	7654.50	0.0000036
Q10	Cable	Bus2	Bus10	3408.50	427.35	3435.19	0.0000017
Q11	Cable	Bus2	Bus11	3519.65	441.28	3547.21	0.0000017
Q12	Cable	Bus2	Bus12	759.81	296.70	815.69	0.0000018
Q13	Cable	Bus2	Bus13	3871.03	146.32	3873.80	0.0000004
Q14	Cable	Bus2	Bus14	4042.71	232.25	4049.38	0.0000008
Q15	Cable	Bus2	Bus15	1296.71	162.58	1306.87	0.0000006
Q16	Cable	Bus2	Bus16	5659.80	325.16	5669.13	0.0000012
Q17	Cable	Bus2	Bus18	5659.80	325.16	5669.13	0.0000012
Q18	Cable	Bus2	Bus19	2593.43	325.16	2613.73	0.0000012
Q19	Cable	Bus2	Bus20	1111.47	139.35	1120.17	0.0000005
Q20	Cable	Bus2	Bus21	8521.26	1068.37	8587.97	0.0000040
Q21	Cable	Bus2	Bus22	264.16	127.16	293.17	0.0000007
Q22	Cable	Bus2	Bus23	555.73	69.68	560.09	0.0000003
Q23	Cable	Bus2	Bus24	2963.92	371.61	2987.12	0.0000014
Q24	Cable	Bus2	Bus25	808.54	46.45	809.88	0.0000002
Q25	Cable	Bus2	Bus26	1212.81	69.68	1214.81	0.0000003
Q26	Cable	Bus2	Bus27	808.54	46.45	809.88	0.0000002
CB29	Tie Breakr	Bus2	Bus3				
CB30	Tie Breakr	Bus2	Bus17				
CB31	Tie Breakr	Bus2	Bus28				
CB32	Tie Breakr	Bus2	Bus29				
CB33	Tie Breakr	Bus2	Bus30				
2SW2	Tie Switch	.	Bus1				

LOAD_FLOW_REPORT

Bus		Voltage		Generation		Load		Load Flow					XFMR
ID	kV	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	%PF	%Tap
* .	11.000	100.000	0.0	0.110	0.060	0.000	0.000	Bus1	0.110	0.060	6.6	87.9	
...	0.415	99.807	-0.1	0.000	0.000	0.000	0.000	Bus2	0.000	0.000	0.0	0.0	
Bus1	11.000	100.000	0.0	0.000	0.000	0.000	0.000	Bus2	0.110	0.060	6.6	87.9	
								.	-0.110	-0.060	6.6	87.9	
Bus2	0.415	99.807	-0.1	0.000	0.000	0.000	0.000	Bus4	0.019	0.010	30.0	88.2	
								Bus5	0.019	0.010	30.0	88.2	
								Bus6	0.019	0.010	30.5	88.4	
								Bus7	0.000	0.000	0.0	0.0	
								...	0.000	0.000	0.0	0.0	
								Bus8	0.000	0.000	0.0	0.0	
								Bus9	0.000	0.000	0.0	0.0	
								Bus10	0.000	0.000	0.0	0.0	
								Bus11	0.000	0.000	0.0	0.0	
								Bus12	0.000	0.000	0.0	0.0	
								Bus13	0.000	0.000	0.0	0.0	
								Bus14	0.015	0.008	23.5	87.7	
								Bus15	0.023	0.012	36.5	88.7	
								Bus16	0.007	0.004	12.1	85.9	
								Bus18	0.007	0.004	12.1	85.9	
								Bus19	0.000	0.000	0.0	0.0	
								Bus20	0.000	0.000	0.0	0.0	
								Bus21	0.000	0.000	0.0	0.0	
								Bus22	0.000	0.000	0.0	0.0	
								Bus23	0.000	0.000	0.0	0.0	
								Bus24	0.000	0.000	0.0	0.0	
								Bus25	0.000	0.000	0.0	0.0	
								Bus26	0.000	0.000	0.0	0.0	
								Bus27	0.000	0.000	0.0	0.0	
								Bus1	-0.110	-0.060	174.7	88.0	
								Bus3	0.000	0.000	0.0	0.0	
								Bus17	0.000	0.000	0.0	0.0	

Bus		Voltage		Generation		Load		Load Flow					XFMR
ID	kV	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	%PF	%Tap
								Bus28	0.000	0.000	0.0	0.0	
								Bus29	0.000	0.000	0.0	0.0	
								Bus30	0.000	0.000	0.0	0.0	
Bus3	0.415	99.807	-0.1	0.000	0.000	0.000	0.000	Bus2	0.000	0.000	0.0	0.0	
Bus4	0.415	99.660	-0.1	0.000	0.000	0.019	0.010	Bus2	-0.019	-0.010	30.0	88.2	
Bus5	0.415	99.649	-0.1	0.000	0.000	0.019	0.010	Bus2	-0.019	-0.010	30.0	88.2	
Bus6	0.415	98.841	0.1	0.000	0.000	0.019	0.010	Bus2	-0.019	-0.010	30.5	88.2	
Bus7	0.415	99.807	-0.1	0.000	0.000	0.000	0.000	Bus2	0.000	0.000	0.0	0.0	
Bus8	0.415	99.807	-0.1	0.000	0.000	0.000	0.000	Bus2	0.000	0.000	0.0	0.0	
Bus9	0.415	99.807	-0.1	0.000	0.000	0.000	0.000	Bus2	0.000	0.000	0.0	0.0	
Bus10	0.415	99.807	-0.1	0.000	0.000	0.000	0.000	Bus2	0.000	0.000	0.0	0.0	
Bus11	0.415	99.807	-0.1	0.000	0.000	0.000	0.000	Bus2	0.000	0.000	0.0	0.0	
Bus12	0.415	99.807	-0.1	0.000	0.000	0.000	0.000	Bus2	0.000	0.000	0.0	0.0	
Bus13	0.415	99.807	-0.1	0.000	0.000	0.000	0.000	Bus2	0.000	0.000	0.0	0.0	
Bus14	0.415	99.191	0.0	0.000	0.000	0.015	0.008	Bus2	-0.015	-0.008	23.5	87.5	
Bus15	0.415	99.485	-0.1	0.000	0.000	0.023	0.012	Bus2	-0.023	-0.012	36.5	88.7	
Bus16	0.415	99.371	0.0	0.000	0.000	0.007	0.004	Bus2	-0.007	-0.004	12.1	85.8	
Bus17	0.415	99.807	-0.1	0.000	0.000	0.000	0.000	Bus2	0.000	0.000	0.0	0.0	
Bus18	0.415	99.371	0.0	0.000	0.000	0.007	0.004	Bus2	-0.007	-0.004	12.1	85.8	
Bus19	0.415	99.807	-0.1	0.000	0.000	0.000	0.000	Bus2	0.000	0.000	0.0	0.0	
Bus20	0.415	99.807	-0.1	0.000	0.000	0.000	0.000	Bus2	0.000	0.000	0.0	0.0	
Bus21	0.415	99.807	-0.1	0.000	0.000	0.000	0.000	Bus2	0.000	0.000	0.0	0.0	
Bus22	0.415	99.807	-0.1	0.000	0.000	0.000	0.000	Bus2	0.000	0.000	0.0	0.0	
Bus23	0.415	99.807	-0.1	0.000	0.000	0.000	0.000	Bus2	0.000	0.000	0.0	0.0	
Bus24	0.415	99.807	-0.1	0.000	0.000	0.000	0.000	Bus2	0.000	0.000	0.0	0.0	
Bus25	0.415	99.807	-0.1	0.000	0.000	0.000	0.000	Bus2	0.000	0.000	0.0	0.0	
Bus26	0.415	99.807	-0.1	0.000	0.000	0.000	0.000	Bus2	0.000	0.000	0.0	0.0	
Bus27	0.415	99.807	-0.1	0.000	0.000	0.000	0.000	Bus2	0.000	0.000	0.0	0.0	
Bus28	0.415	99.807	-0.1	0.000	0.000	0.000	0.000	Bus2	0.000	0.000	0.0	0.0	
Bus29	0.415	99.807	-0.1	0.000	0.000	0.000	0.000	Bus2	0.000	0.000	0.0	0.0	
Bus30	0.415	99.807	-0.1	0.000	0.000	0.000	0.000	Bus2	0.000	0.000	0.0	0.0	

* Indicates a voltage regulated bus (voltage controlled or swing type machine connected to it)

# Indicates a bus with a load mismatch of more than 0.1 MVA

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
..	11.000													
.	11.000										0.126	87.9	6.6	
...	0.415													
Bus1	11.000										0.126	87.9	6.6	
Bus2	0.415										0.125	88.0	174.7	
Bus3	0.415													
Bus4	0.415		0.019	0.010							0.022	88.2	30.0	
Bus5	0.415		0.019	0.010							0.022	88.2	30.0	
Bus6	0.415		0.019	0.010							0.022	88.2	30.5	
Bus7	0.415													
Bus8	0.415													
Bus9	0.415												-	
Bus10	0.415												-	
Bus11	0.415												-	
Bus12	0.415												-	
Bus13	0.415												-	
Bus14	0.415		0.015	0.008							0.017	87.5	23.5	
Bus15	0.415		0.023	0.012							0.026	88.7	36.5	
Bus16	0.415		0.007	0.004							0.009	85.8	12.1	
Bus17	0.415													
Bus18	0.415		0.007	0.004							0.009	85.8	12.1	
Bus19	0.415												-	
Bus20	0.415												-	
Bus21	0.415												-	
Bus22	0.415													
Bus23	0.415												-	
Bus24	0.415												-	
Bus25	0.415													
Bus26	0.415													
Bus27	0.415													
Bus28	0.415													
Bus29	0.415													
Bus30	0.415													

* 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		Busway / Cable & Reactor			Transformer				
						Loading (input)		Loading (output)	
ID	Type	Ampacity (Amp)	Loading Amp	%	Capability (MVA)	MVA	%	MVA	%
Q3	Cable	345.48	30.03	8.69					
Q4	Cable	345.48	30.03	8.69					
Q5	Cable	89.40	30.46	34.07					
Q6	Cable	136.89	0.00	0.00					
Q7	Cable	136.89	0.00	0.00					
Q8	Cable	136.89	0.00	0.00					
Q9	Cable	136.89	0.00	0.00					
Q10	Cable	118.54	0.00	0.00					
Q11	Cable	136.89	0.00	0.00					
Q12	Cable	299.85	0.00	0.00					
Q13	Cable	66.12	0.00	0.00					
Q14	Cable	89.40	23.47	26.25					
Q15	Cable	136.89	36.54	26.69					
Q16	Cable	89.40	12.08	13.52					
Q17	Cable	89.40	12.08	13.52					
Q18	Cable	136.89	0.00	0.00					
Q19	Cable	136.89	0.00	0.00					
Q20	Cable	136.89	0.01	0.00					
Q21	Cable	345.48	0.00	0.00					
Q22	Cable	136.89	0.00	0.00					
Q23	Cable	136.89	0.00	0.00					
Q24	Cable	89.40	0.00	0.00					
Q25	Cable	89.40	0.00	0.00					
Q26	Cable	89.40	0.00	0.00					
T1	Transformer				2.500	0.126	5.0	0.125	5.0

* 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
Q10	0.000	0.000	0.000	0.000	0.0	0.0	99.8	99.8	0.00
Q11	0.000	0.000	0.000	0.000	0.0	0.0	99.8	99.8	0.00
Q12	0.000	0.000	0.000	0.000	0.0	0.0	99.8	99.8	0.00
Q13	0.000	0.000	0.000	0.000	0.0	0.0	99.8	99.8	0.00
Q14	0.015	0.008	-0.015	-0.008	0.1	0.0	99.8	99.2	0.62
Q15	0.023	0.012	-0.023	-0.012	0.1	0.0	99.8	99.5	0.32
Q16	0.007	0.004	-0.007	-0.004	0.0	0.0	99.8	99.4	0.44
Q17	0.007	0.004	-0.007	-0.004	0.0	0.0	99.8	99.4	0.44
Q18	0.000	0.000	0.000	0.000	0.0	0.0	99.8	99.8	0.00
Q19	0.000	0.000	0.000	0.000	0.0	0.0	99.8	99.8	0.00
Q20	0.000	0.000	0.000	0.000	0.0	0.0	99.8	99.8	0.00
Q21	0.000	0.000	0.000	0.000	0.0	0.0	99.8	99.8	0.00
Q22	0.000	0.000	0.000	0.000	0.0	0.0	99.8	99.8	0.00
Q23	0.000	0.000	0.000	0.000	0.0	0.0	99.8	99.8	0.00
Q24	0.000	0.000	0.000	0.000	0.0	0.0	99.8	99.8	0.00
Q25	0.000	0.000	0.000	0.000	0.0	0.0	99.8	99.8	0.00
Q26	0.000	0.000	0.000	0.000	0.0	0.0	99.8	99.8	0.00
Q3	0.019	0.010	-0.019	-0.010	0.0	0.0	99.8	99.7	0.15
Q4	0.019	0.010	-0.019	-0.010	0.0	0.0	99.8	99.6	0.16
Q5	0.019	0.010	-0.019	-0.010	0.2	0.0	99.8	98.8	0.97
Q6	0.000	0.000	0.000	0.000	0.0	0.0	99.8	99.8	0.00
Q7	0.000	0.000	0.000	0.000	0.0	0.0	99.8	99.8	0.00
Q8	0.000	0.000	0.000	0.000	0.0	0.0	99.8	99.8	0.00
Q9	0.000	0.000	0.000	0.000	0.0	0.0	99.8	99.8	0.00
T1	0.110	0.060	-0.110	-0.060	0.1	0.4	100.0	99.8	0.19
					0.6	0.4			

* This Transmission Line includes Series Capacitor.

Alert Summary Report

% Alert Settings

	Critical	Marginal
Loading		
Bus	100.0	95.0
Cable / Busway	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	105.0	102.0
UnderVoltage	95.0	98.0
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
Gen1	Generator	Under Excited	0.000	Mvar	0.000	0.0	3-Phase
Gen1	Generator	Under Power	0.000	MW	0.000	0.0	3-Phase

SUMMARY OF TOTAL GENERATION , LOADING & DEMAND

	MW	Mvar	MVA	% PF
Source (Swing Buses):	0.110	0.060	0.126	87.86 Lagging
Source (Non-Swing Buses):	0.000	0.000	0.000	
Total Demand:	0.110	0.060	0.126	87.86 Lagging
Total Motor Load:	0.110	0.060	0.125	87.89 Lagging
Total Static Load:	0.000	0.000	0.000	
Total Constant I Load:	0.000	0.000	0.000	
Total Generic Load:	0.000	0.000	0.000	
Apparent Losses:	0.001	0.000		
System Mismatch:	0.000	0.000		

Number of Iterations: 2

Conclusion:-

The completion of the single line diagram and load flow analysis using ETAP software provided a clear representation of the electrical network and valuable insights into the system's performance under various operating conditions. The analysis identified key areas for optimization, potential reliability issues, and opportunities for improving efficiency. This information is crucial for enhancing system reliability, ensuring regulatory compliance, and supporting informed decision-making for future planning and network upgrades. Overall, the project successfully achieved its goal of analyzing and optimizing the power system's performance.