ABSTRACT

The power grid network was developed while taking into account all of the substations, lines, and generating that were already in existence and those that were still being built. A model of the electrical grid was built using the 132KV, 220KV, and 400KV networks. Using the created model, symmetrical/asymmetrical fault detection for the system was carried out. Using the developed model, load-flow analysis and symmetrical/asymmetrical fault detection were carried out for the system. Using the established model, the flow analysis for the system was also computed. Fault is created on the bus very close to the highest rating generator and also to the farthest possible bus. Different effect of fault (three phase short circuit fault, single line to ground fault, line to line fault) is analysed. Rashtriya Prasaran Grid Company Limited most current annual report on NEA or its Transmission System Development Plan, as well as associated literature, were used to get the data.

2.1 Bagmati Province

Bagmati Province consists of thirteen districts which are as follows :-

i) Rasuwa
ii) Dhading
iii) Chitwan
iv) Makwanpur
v) Nuwakot
vi) Sindhupalchowk
vii) Kathmandu
viii) Bhaktapur
ix) Lalitpur
x) Kavrepalanchowk
xi) Sindhuli
xii) Ramechhap
xiii) Dolkha

Figure 3: Bagmati Province

Province 3 covers the central region of Nepal. Chitwan, Makwanpur, Dhading, Kathmandu, Lalitpur, Bhaktapur, Kavrepalanchok, Nuwakot, Sindhupalchok, Rasuwa, , Sindhuli, Ramechhap and Dolakha are the districts within Province 3. Budhi Gandaki Storage Hydropower Project (1200 MW), Sunkoshi-2 (1110 MW), Sunkoshi-3 (536 MW), Tamakoshi-3 TA-3 (650MW) are the major hydro power plants located in Zone 4. Power generation from hydro power plants and load demand by the year 2040, expected to reach about 8.03 GW and 6.48 GW respectively.

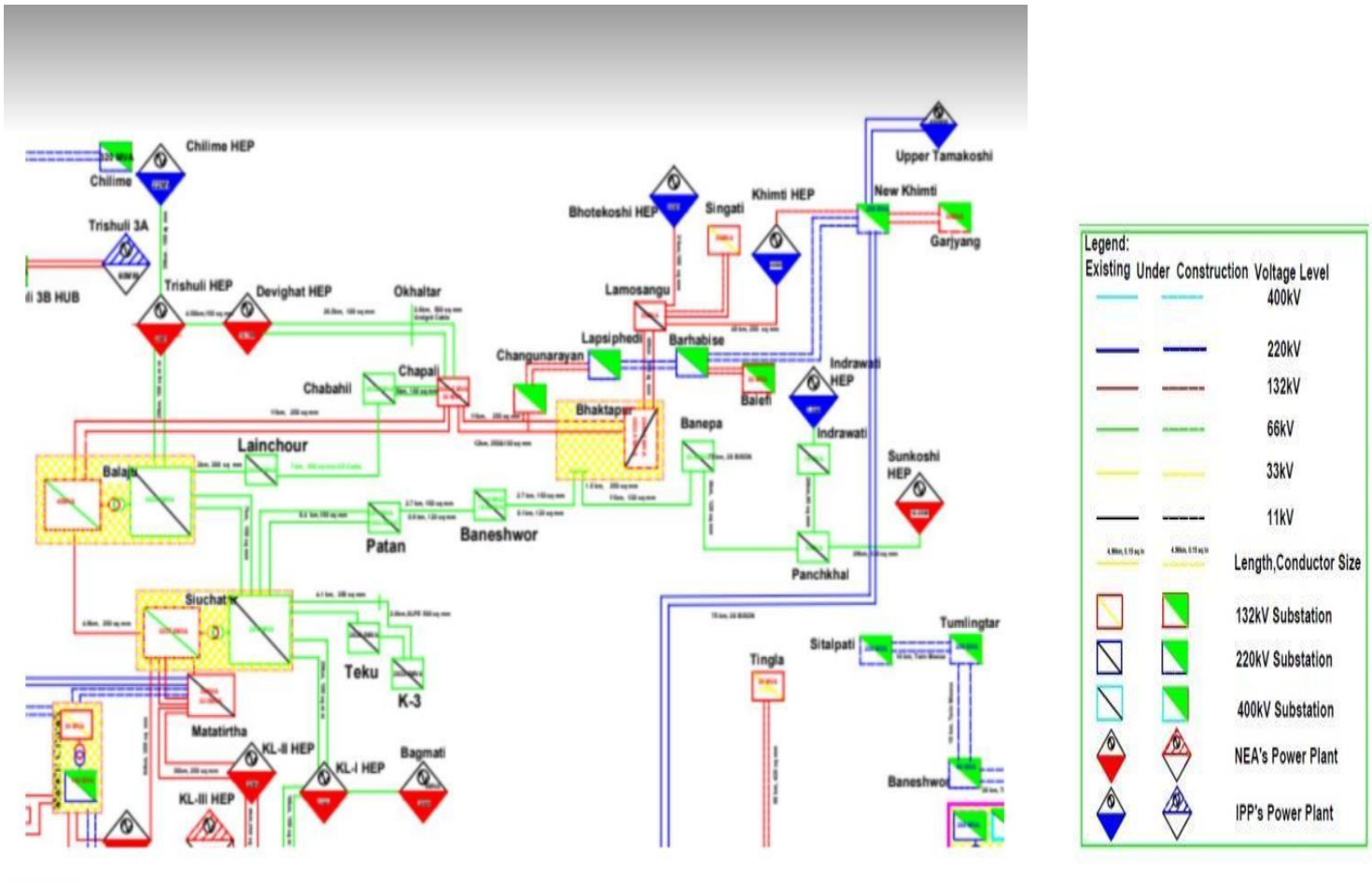

Figure 4: Integrated Nepal Power System Of Bagmati Province

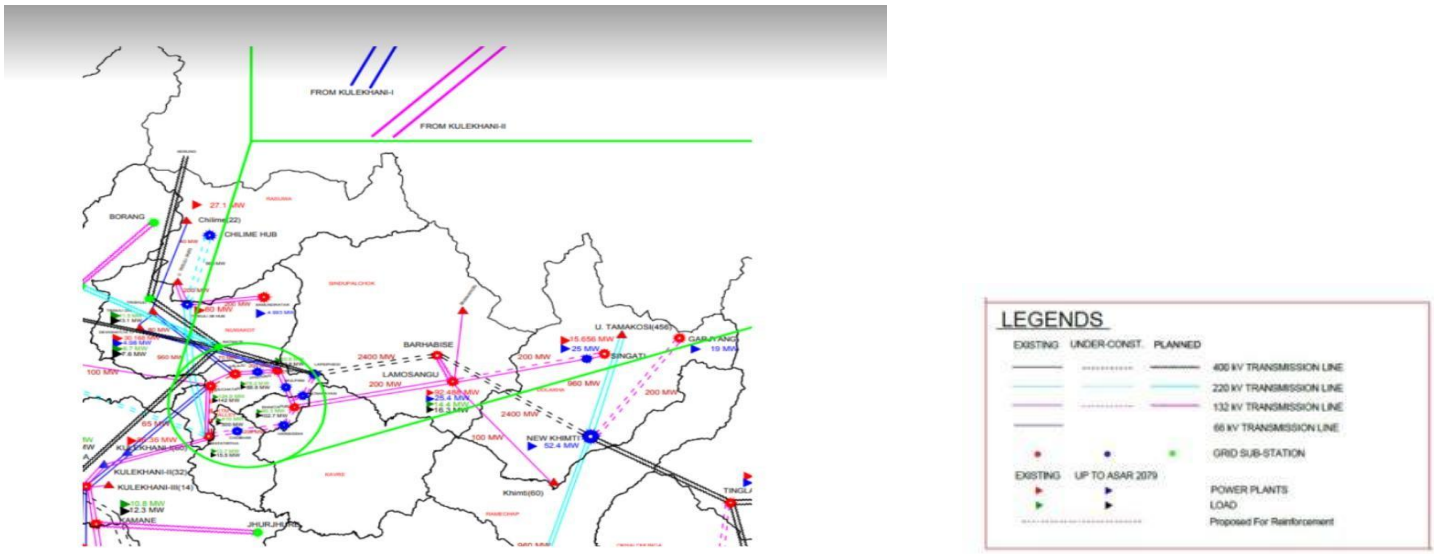

Figure 5: Power Development Map of Province 3

SYSTEM ANALYSIS AND RESULT

3.1 Overall Load Flow Simulation on Etap Software

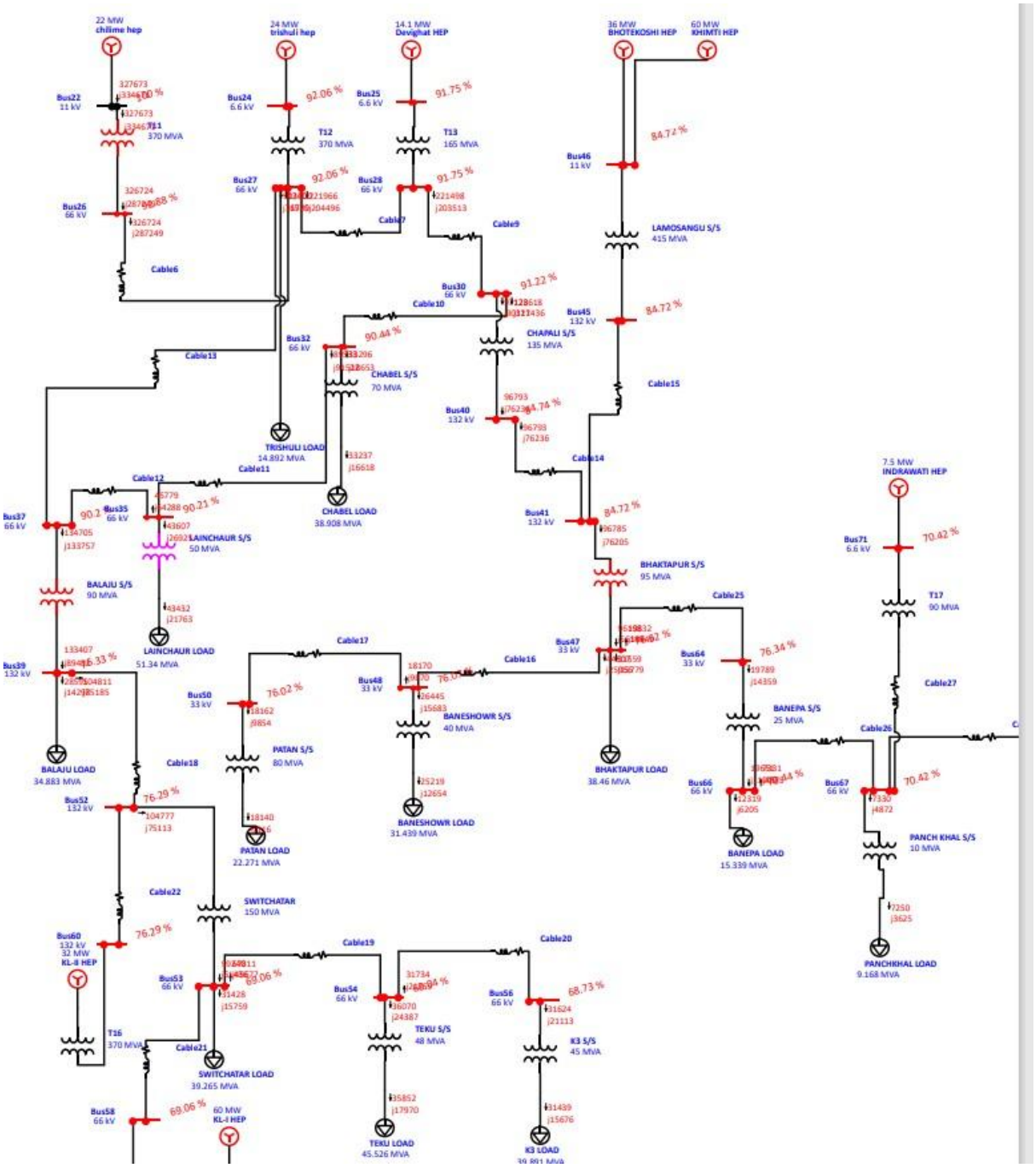

Figure 6: Overall Load Flow Simulation

The above figures show the overall load flow of the Bagmati province. There are eight generating stations (Chilime, Trishuli, Devighat, Bhotekoshi, Khimti, Indrawati, Teku and KL-I). KL-I and Khimti has highest generating capacity in Bagmati province i.e 60MW. There are several substations among which Patan substation has highest rating i.e 50MVA. There are Eight load bus in Bagmati province.

3.2 Fault In Nearest Bus of Maximum Generation

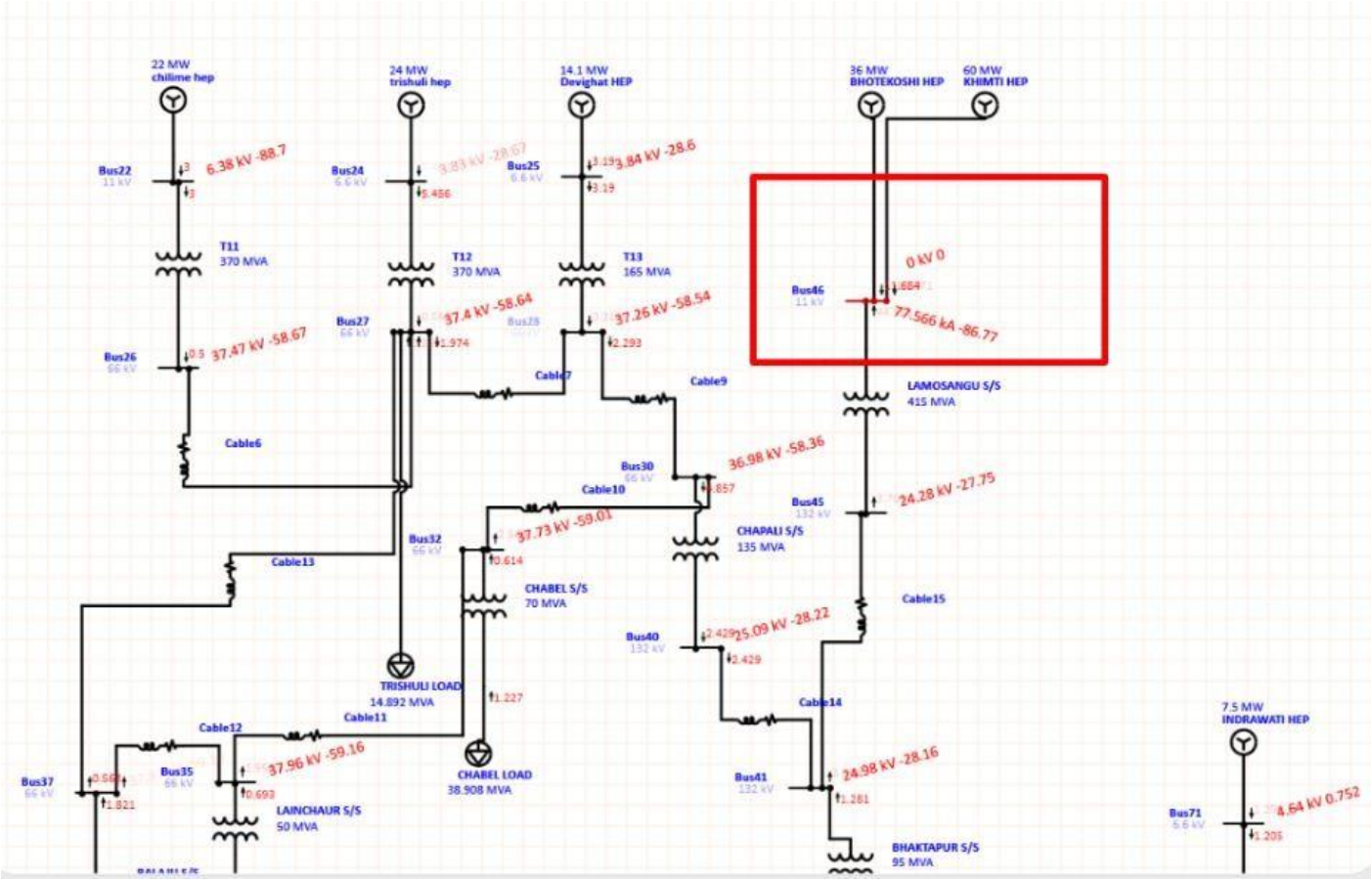

Figure 7: Fault In Nearest Bus of Maximum Generation

Bus 46 is a nearest bus to the highest rating generating station of Bagmati Province. The highest generating station is Khimti HEP of capacity of 60MW. The bus is considered as fault and report is generated through Etap. The current rating after fault in show below.

SHORT- CIRCUIT REPORT

Fault at bus: **Bus46**

Prefault voltage = 11.000 kV = 100.00 % of nominal bus kV (11.000 kV)
= 100.00 % of base kV (11.000 kV)

Contribution		3-Phase Fault		Line-To-Ground Fault					Positive & Zero Sequence Impedances Looking into "From Bus"			
From Bus ID	To Bus ID	% V From Bus	kA Symm. rms	% Voltage at From Bus Va	Vb	Vc	kA Symm. rms Ia	3I0	% Impedance on 100 MVA base R1	X1	R0	X0
Bus46	Total	0.00	77.566	0.00	95.81	99.00	81.753	81.753	3.81E-001	6.76E+000	8.35E-001	5.84E+000
Bus45	Bus46	18.39	44.512	62.48	62.04	99.29	30.987	0.000	6.98E-001	1.18E+001		
BHOTEKOSHI HEP	Bus46	100.00	11.684	100.00	100.00	100.00	17.944	28.896	2.36E+000	4.49E+001	2.36E+000	1.65E+001
KHIMTI HEP	Bus46	104.76	21.371	104.76	104.76	104.76	32.824	52.856	1.29E+000	2.45E+001	1.29E+000	9.04E+000

# Indicates fault current contribution is from three-winding transformers
* Indicates a zero sequence fault current contribution (3I0) from a grounded Delta- Y transformer

Short-Circuit Summary Report

1/2 Cycle - 3-Phase, LG, LL, & LLG Fault Currents

Prefault Voltage = 100 % of the Bus Nominal Voltage

Bus		3-Phase Fault			Line-to-Ground Fault			Line-to-Line Fault			*Line-to-Line-to-Ground		
ID	kV	Real	Imag.	Mag.	Real	Imag.	Mag.	Real	Imag.	Mag.	Real	Imag.	Mag.
Bus46	11.000	4.371	-77.443	77.566	7.542	-81.404	81.753	67.828	4.792	67.997	-71.844	37.464	81.025

All fault currents are symmetrical (1/2 Cycle network) values in rms kA.
* LLG fault current is the larger of the two faulted line currents.

Figure 8: Report of Short Circuit Fault In BUS 46

3.3 Fault In Farthest Bus of Maximum Generation

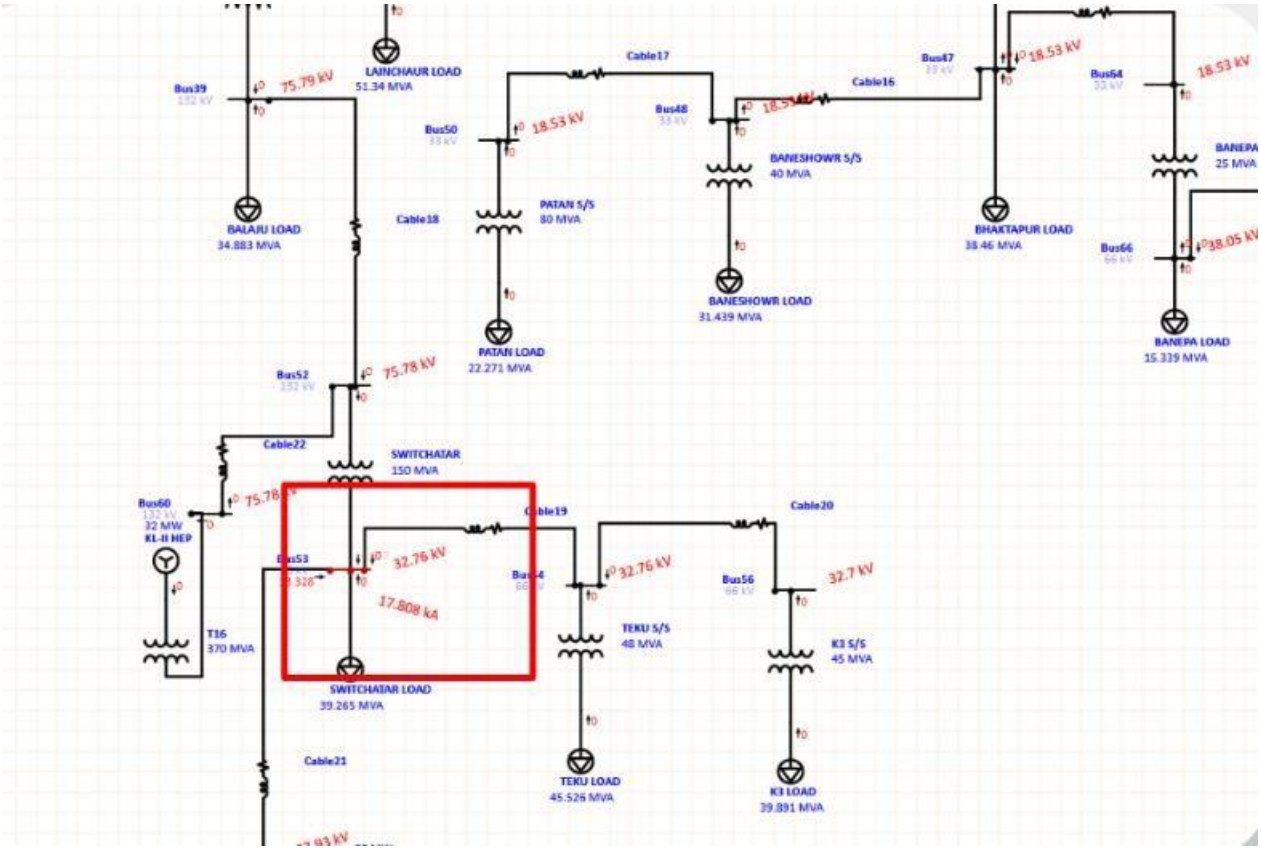

Figure 9:Fault In Farthest Bus of Maximum Generation

Bus 53 is a farthest bus to the highest rating generating station of Bagmati Province. The highest generating station is Khimti HEP of capacity of 60MW. The bus is considered as fault and report is generated through Etap. The current rating after fault in show below.

SHORT- CIRCUIT REPORT

Fault at bus: **Bus53**

Prefault voltage = 66.000 kV = 100.00 % of nominal bus kV (66.000 kV)
= 100.00 % of base kV (66.000 kV)

Contribution		3-Phase Fault		Line-To-Ground Fault					Positive & Zero Sequence Impedances Looking into "From Bus"			
From Bus ID	To Bus ID	% V From Bus	kA Symm. rms	% Voltage at From Bus Va	Vb	Vc	kA Symm. rms Ia	3I0	% Impedance on 100 MVA base R1	X1	R0	X0
Bus53	Total	0.00	12.939	0.00	85.97	88.16	17.808	17.808	7.84E-001	6.72E+000	2.95E-001	1.29E+000
Bus54	Bus53	0.06	2.537	0.06	85.97	88.17	2.310	0.000	2.96E+000	3.44E+001		
Bus58	Bus53	2.24	3.047	5.36	86.42	87.04	7.282	13.328	1.72E+000	2.87E+001	3.00E-001	1.74E+000
Bus52	Bus53	33.02	5.591	55.23	99.44	64.74	6.626	4.557 *	2.58E+000	1.54E+001	1.94E+000	4.79E+000
SWITCHATAR LOAD	Bus53	100.00	1.777	100.00	100.00	100.00	1.619	0.000	4.90E+000	4.90E+001		

\# Indicates fault current contribution is from three-winding transformers
* Indicates a zero sequence fault current contribution (3I0) from a grounded Delta-Y transformer

Short-Circuit Summary Report

1/2 Cycle - 3-Phase, LG, LL, & LLG Fault Currents

Prefault Voltage = 100 % of the Bus Nominal Voltage

Bus		3-Phase Fault			Line-to-Ground Fault			Line-to-Line Fault			*Line-to-Line-to-Ground		
ID	kV	Real	Imag.	Mag.	Real	Imag.	Mag.	Real	Imag.	Mag.	Real	Imag.	Mag.
Bus53	66.000	1.500	-12.852	12.939	2.382	-17.647	17.808	11.201	1.410	11.290	-13.158	12.462	18.122

All fault currents are symmetrical (1/2 Cycle network) values in rms kA.
* LLG fault current is the larger of the two faulted line currents.

Figure 10:: Report of Short Circuit Fault In BUS 53

CHAPTER IV
CONCLUSION

All the generating and substation loads of Bagmati province are mapped in Etap. The line losses and bus voltages are analyzed using Etap. Further, the short circuit fault analysis was done to Nearest bus of Highest Generating Station (Khimti HEP) and the farthest bus (BUS 53) was taken into consideration and its fault analysis was also performed.

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