ENEL 601 Advance Power System Analysis

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Design Experiment Phase-1

Description for project phase-2 report

Deadline: November 15, 2020

Phase #2 Project Report Guidelines:

a) **Wherever you are asked for answer/discussion, write it below that particular question and wherever you are asked for answers in a table, they are provided there below the questions. Please use them only and don't create new types of tables.**

b) After answering all the questions, convert this word file into PDF and make sure that the name of the PDF file contains your first and last name. Please use lastname_firstname.pdf.

Load Interconnection Study Project

Objectives: This design course project is intended to provide the students with an opportunity to perform most of the technical studies that are involved in real-life network interconnections in power systems. While the test system used is small, it has most of the main features of a real system. Also, the students will be exposed to the reliability standards and the interconnection process that is in place for Alberta.

In this project, you will study a system according to applicable reliability standards, design a transmission plan to connect a new load to the network, and reinforce the system such that the final design passes the reliability tests.

Introduction

As a result of the low electric rates from the local utility, Metropolis Light and Power (MLP), under the jurisdiction of Alberta Electric System Operator, several large server farms and a new factory are going to be built in the eastern portion of the MLP service territory. With an anticipated peak load of about 75 MW and 20 Mvar, this new load also brings additional revenue to MLP. However, in order to supply this additional load, the new TULIP substation will need to be constructed. While the new customers to be connected to this substation would like to receive electricity at the 69 KV level, the new substation location is large enough to accommodate a 138/69 KV transformer if needed. Additionally, for reliability purposes, the TULIP substation needs to have at least two separate lines feeding it.

As a planning engineer for MLP, your job is to make recommendations to ensure that, with new TULIP loads, under peak loading conditions, the transmission system in the eastern region is adequate for any base case and first contingency loading situations. This is also a good opportunity not only to meet the new load, but also to fix some existing first contingency violations that may exist in the eastern portion of the MLP service territory.

The DesignCase1_2015 files provide a power flow base case model of the initial conditions of the system.

Phase 2: Designing a transmission expansion plan to connect the load to the network

As per your findings of phase I, if the provided base case is not reliable according to Alberta's TPL-001 and TPL-002, MLP must take actions to improve system reliability, typically by adding new lines. The objective of this part of the project is to determine the best transmission line expansion plan such that:

- **The system becomes compliant with Alberta's TPL-001 and TPL-002,**
- **The new load is connected to the system through at least two different branches. Note that one may consider a double-circuit line and connect the new load to only one substation using two parallel lines. This option is not acceptable here.**
- **The total cost of this expansion must be the lowest. Note that the total cost is comprised of the cost of new expansions plus the cost of transmission line losses over the next 5 years. You should assume that the system losses remain constant over all hourly intervals of a 5-year planning period. Electricity is priced at $60/MWh.**

In your design process, you only need to consider the base case loading level given in DesignCase_2015. In a real design, typically a number of different operating points/loading levels must be considered (e.g., for summer versus winter). Also, do not modify the status of the capacitors or the transformer taps in the provided case, neither change the setting of generators.

Table 1 shows the available Right-of-Way distances that can be used for the construction of new 69 KV and/or new 138 KV lines. All existing 69 KV-only substations are large enough to accommodate 138 KV as well. However, other substations are limited in space and cannot accommodate new transformers. Also, only 69 kV lines are allowed for connecting two 69 kV substations.

Table 1: Available new right-of-way

Right-of-Way/Substation	Right-of-Way distance (km)
TULIP to ELM	15
TULIP to PLUM	12
TULIP to OLIVE	8
TULIP to CEDAR	10
CEADAR to PLUM	13
OLIVE to CEADAR	10

Cost of building transmission includes the fixed and variable costs. The fixed cost is for the designed work, the purchase/installation of the three-phase circuit breakers, associated relays, and changes to the substation bus structure. The fix costs are $850,000 for a 138 kV line and $500,000 for a 69 kV line. Table 2 provides the specifications of two available transmission line options. The type of tower for this study is 3H5; you can find the details of this tower type in PSCAD. The variable cost values in this table includes the cost of wires towers.

Table 2: The line characteristics

Conductor	Tower	Current Rating (A)	Voltage (kV)	Cost ($/km)

Rook	3H5	770	69	200,000
Crow	3H5	830	138	220,000

Table 3 provides the specifications of a transformer available for this project. Transformer costs include circuit barkers, relaying and installation. The cost of upgrading a 69 kV substation to also include 138 kV bus work is $900,000.

Table 3: The transformer characteristics on a 100 MVA S_{base}

Rate (kV)	P(MVA)	R (pu)	X(pu)	Cost ($)
138/69	168	0.0025	0.07	1,800,000

2.1 Explore the available transmission line options to feed the new substitution. Using the information provided in the previous sections, identify all available individual line options to interconnect the new substation to its adjacent substations. For each transmission line, identify all cost components, calculate the associated total cost (<u>without cost of losses</u>). Also, using PSCAD, determine the parameters (i.e., R, X, B) in PU.

The conductor datasheets for Rook and Crow can be accessed through this link:
https://www.midalcable.com/sites/default/files/ACSR-metric.PDF.

a) **Report the resulting alternative scenarios in the table given below. Add as many rows to the table as necessary.**
b) **In the same table, highlight in yellow color the lowest cost transmission expansion plan that interconnects the new load to the rest of the system. (For the sake of consistency, throughout the project, please use the name 'MANGO138' for identifying the new 138 kV bus that you will need to install at TULIP substation).**

Scenario #	Name	Line characteristic	Length [km]	R [pu]	X [pu]	B [pu]	Thermal limit [MVA]	Fixed cost [$]	Variable cost [$]	The cost of upgrading of 69 kV bus to 138 kV [$]	Transformer name	Cost of transformer [$]	Total cost [$]
1	MANGO138 to ELM138	CROW-138 kV	15	0.01279	0.08458	0.004409	198.39	850000	3300000	900000	MANGO138 to TULIP69	1800000	6850000
2	MANGO138 to PLUM138	CROW-138 kV	12	0.01024	0.06767	0.003528	198.39	850000	2640000	900000	MANGO138 to TULIP69	1800000	6190000
3	TULIP69 to OLIVE69	ROOK-69 kV	8	0.01411	0.08436	0.001257	92.02	500000	1600000	0	-----	0	2100000
4	TULIP69 to CEDAR69	ROOK-69 kV	10	0.01764	0.1054	0.001571	92.02	500000	2000000	0	-----	0	2500000
5	MANGO138 to CEDAR138	CROW-138 kV	10	0.008531	0.05639	0.002939	198.39	850000	2200000	900000	MANGO138 to TULIP69	1800000	5750000

2.2 Repeat the calculations of part 2.1 above for the other two transmission line options for which, the right of way is available, i.e., between CEDAR and OLIVE and CEDAR and PLUM. Those two lines could be used to deal with non-compliance with the reliability standards.

c) **Report the results in table given below.**

Scenario #	Name	Line character-istic	Length [km]	R [pu]	X [pu]	B [pu]	Thermal limit [MVA]	Fixed cost [$]	Variable cost [$]	The cost of upgrading of 69 kV bus to 138 kV [$]	Transformer name	Cost of transformer [$]	Total cost [$]
1	CEDAR138 to PLUM138	CROW-138 kV	13	0.01109	0.0733	0.003821	198.39	8,50,000	28,60,000				37,10,000
2	CEDAR69 to OLIVE69	ROOK-69 kV	10	0.017639	0.1054	0.001571	92.02	5,00,000	20,00,000				25,00,000
3	CEDAR138 to OLIVE138	CROW-138 kV	10	0.008531	0.05639	0.002939	198.39	8,50,000	22,00,000	9,00,000	OLIVE138 to OLIVE69	18,00,000	39,50,000

Please make sure that you uncheck the “Enable Island-based AGC” in the base-case by following the steps below:

In Run Mode, under Tools, click on the Simulator Options button. Under Power Flow Solution, there is a tab called "Island based AGC". Uncheck the "Enable Island-based Automatic Generation Control (AGC)".

2.3 Explore all transmission expansion designs that interconnect the new load to the system through only two different branches.

Using contingency analysis tool of Power-World, determine if your design is complaint with TPL-001 and TPL-002 standards.

d) **Report the details of your designs in below table. Add as many rows to the table as necessary.**

Scenario #	Transmission line/Transformer	Final cost of components [$]	Total losses in the system after expansion [MW]	Cost of total losses in the system after expansion [$]	Total cost of expansion [$]	compliant with TPL-001	Number of violations (Category A)	compliant with TPL-002	Number of violations (Category B)
1	MANGO138 to PLUM138 TULIP69 to CEDAR69 MANGO138 to TULIP69	86,90,000	12.44	3,26,92,320	4,13,82,320	Yes	0	No	7
2	MANGO138 to PLUM138 TULIP69 to MANGO138 TULIP69 to OLIVE69	82,90,000	12.54	3,29,55,120	4,12,45,120	Yes	0	No	10
3	MANGO138 to PLUM138 TULIP69 to MANGO138 MANGO138 to ELM	1,03,40,000	11.76	3,09,05,280	4,12,45,280	Yes	0	No	6
4	MANGO138 to PLUM138 TULIP69 to MANGO138 MANGO138 to CEDAR138	92,40,000	12.44	3,26,92,320	4,19,32,320	Yes	0	No	7
5	MANGO138 to ELM138 TULIP69 to MANGO138 MANGO138 to CEDAR138	99,00,000	11.98	3,14,83,440	4,13,83,440	Yes	0	No	8
6	MANGO138 to ELM138 TULIP69 to MANGO138 TULIP69 to CEDAR69	93,50,000	11.96	3,14,30,880	4,07,80,880	Yes	0	No	7
7	MANGO138 to ELM138 TULIP69 to MANGO138 TULIP69 to OLIVE69	89,50,000	11.91	3,12,99,480	4,02,49,480	Yes	0	No	9
8	MANGO138 to CEDAR138 TULIP69 to MANGO138 TULIP69 to CEDAR69	82,50,000	14.00	3,67,92,000	4,50,42,000	Yes	0	No	8
9	MANGO138 to CEDAR138 TULIP69 to MANGO138 TULIP69 to OLIVE69	78,50,000	14.43	3,79,22,040	4,57,72,040	Yes	0	No	13
10	TULIP69 to CEDAR69 TULIP69 to OLIVE69	46,00,000	15.23	4,00,24,440	4,46,24,440	Yes	0	No	12

Combinations with PLUM138 to CEDAR138									
11	MANGO138 to PLUM138 TULIP69 to MANGO138 TULIP69 to CEDAR69 PLUM138 to CEDAR138	1,24,00,000	12.25	3,21,93,000	4,45,93,000	Yes	0	No	7
12	MANGO138 to PLUM138 TULIP69 to MANGO138 TULIP69 to OLIVE69 PLUM138 to CEDAR138	1,20,00,000	12.52	3,29,02,560	4,49,02,560	Yes	0	No	10
13	MANGO138 to PLUM138 TULIP69 to MANGO138 TULIP69 to MANGO138 PLUM138 to CEDAR138	1,40,50,000	11.53	3,03,00,840	4,43,50,840	Yes	0	No	6
14	MANGO138 to PLUM138 TULIP69 to MANGO138 MANGO138 to CEDAR138 PLUM138 to CEDAR138	1,29,50,000	12.22	3,21,14,160	4,50,64,160	Yes	0	No	7
15	MANGO138 to ELM138 TULIP69 to MANGO138 MANGO138 to CEDAR138 PLUM138 to CEDAR138	1,36,10,000	11.66	3,06,42,480	4,42,52,480	Yes	0	No	6
16	MANGO138 to ELM138 TULIP69 to MANGO138 TULIP69 to CEDAR69 PLUM138 to CEDAR138	1,30,60,000	11.64	3,05,89,920	4,36,49,920	Yes	0	No	7
17	MANGO138 to ELM138 TULIP69 to MANGO138 TULIP69 to OLIVE69 PLUM138 to CEDAR138	1,26,60,000	11.70	3,07,47,600	4,34,07,600	Yes	0	No	9
18	MANGO138 to CEDAR138 TULIP69 to MANGO138 TULIP to CEDAR69 PLUM138 to CEDAR138	1,19,60,000	12.89	3,38,74,920	4,58,34,920	Yes	0	No	7
19	MANGO138 to CEDAR138 TULIP69 to MANGO138 TULIP69 to OLIVE69 PLUM138 to CEDAR138	1,15,60,000	13.26	3,48,47,280	4,64,07,280	Yes	0	No	11
20	TULIP69 to CEDAR69 TULIP69 to OLIVE69 PLUM138 to CEDAR138	83,10,000	14.21	3,73,43,880	4,56,53,880	Yes	0	No	17

Combinations with OLIVE138 to CEDAR138									
21	MANGO138 to PLUM138 TULIP69 to MANGO138 TULIP69 to CEDAR69 OLIVE138 to CEDAR138 OLIVE69 to OLIVE138	1,51,00,000	11.84	3,11,15,520	4,62,15,520	Yes	0	Yes	0
22	MANGO138 to PLUM138 TULIP69 to MANGO138 TULIP69 to OLIVE69 OLIVE138 to CEDAR138 OLIVE69 to OLIVE138	1,47,00,000	11.97	3,14,57,160	4,61,57,160	Yes	0	No	2
23	MANGO138 to PLUM138 TULIP69 to MANGO138 MANGO138 to ELM138 OLIVE138 to CEDAR138 OLIVE69 to OLIVE138	1,67,50,000	11.15	2,93,02,200	4,60,52,200	Yes	0	Yes	0
24	MANGO138 to PLUM138 TULIP69 to MANGO138 MANGO138 to CEDAR138 OLIVE138 to CEDAR138 OLIVE69 to OLIVE138	1,56,50,000	11.86	3,11,68,080	4,68,18,080	Yes	0	No	1
25	MANGO138 to ELM138 TULIP69 to MANGO138 MANGO138 to CEDAR138 OLIVE138 to CEDAR138 OLIVE69 to OLIVE138	1,63,10,000	11.35	2,98,27,800	4,61,37,800	Yes	0	No	1
26	MANGO138 to ELM138 TULIP69 to MANGO138 TULIP69 to CEDAR69 OLIVE138 to CEDAR138 OLIVE69 to OLIVE138	1,57,60,000	11.34	2,98,01,520	4,55,61,520	Yes	0	Yes	0
27	MANGO138 to ELM138 TULIP69 to MANGO138 TULIP69 to OLIVE69 OLIVE138 to CEDAR138 OLIVE69 to OLIVE138	1,53,60,000	11.40	2,99,59,200	4,53,19,200	Yes	0	No	2
28	MANGO138 to CEDAR138 TULIP69 to MANGO138 TULIP69 to CEDAR69 OLIVE138 to CEDAR138 OLIVE69 to OLIVE138	1,46,60,000	13.45	3,53,46,600	5,00,06,600	Yes	0	No	3
29	MANGO138 to CEDAR138 TULIP69 to MANGO138 TULIP69 to OLIVE69 OLIVE138 to CEDAR138 OLIVE69 to OLIVE138	1,42,60,000	13.75	3,61,35,000	5,03,95,000	Yes	0	No	10
30	TULIP69 to CEDAR69 TULIP69 to OLIVE69 OLIVE138 to CEDAR138 OLIVE69 to OLIVE138	1,10,10,000	14.19	3,72,91,320	4,83,01,320	Yes	0	No	3

Combinations with OLIVE69 to CEDAR69									
31	MANGO138 to PLUM138 TULIP69 to MANGO138 TULIP69 to CEDAR69 OLIVE69 to CEDAR69	1,11,90,000	12.19	3,20,35,320	4,32,25,320	Yes	0	Yes	0
32	MANGO138 to PLUM138 TULIP69 to MANGO138 TULIP69 to OLIVE69 OLIVE69 to CEDAR69	1,07,90,000	12.25	3,21,93,000	4,29,83,000	Yes	0	No	4
33	MANGO138 to PLUM138 TULIP69 to MANGO138 MANGO138 to ELM138 OLIVE69 to CEDAR69	1,28,40,000	11.47	3,01,43,160	4,29,83,160	Yes	0	Yes	0
34	MANGO138 to PLUM138 TULIP69 to MANGO138 MANGO138 to CEDAR138 OLIVE69 to CEDAR69	1,17,40,000	12.18	3,20,09,040	4,37,49,040	Yes	0	No	1
35	MANGO138 to ELM138 TULIP69 to MANGO138 MANGO138 to CEDAR138 OLIVE69 to CEDAR69	1,24,00,000	11.69	3,07,21,320	4,31,21,320	Yes	0	No	1
36	MANGO138 to ELM138 TULIP69 to MANGO138 TULIP69 to CEDAR69 OLIVE69 to CEDAR69	1,18,50,000	11.64	3,05,89,920	4,24,39,920	Yes	0	Yes	0
37	MANGO138 to ELM138 TULIP69 to MANGO138 TULIP69 to OLIVE69 OLIVE69 to CEDAR69	1,14,50,000	11.64	3,05,89,920	4,20,39,920	Yes	0	No	4
38	MANGO138 to CEDAR138 TULIP69 to MANGO138 TULIP to CEDAR69 OLIVE69 to CEDAR69	1,07,50,000	13.76	3,61,61,280	4,69,11,280	Yes	0	No	2
39	MANGO138 to CEDAR138 TULIP69 to MANGO138 TULIP69 to OLIVE69 OLIVE69 to CEDAR69	1,03,50,000	14.05	3,69,23,400	4,72,73,400	Yes	0	No	7
40	TULIP69 to CEDAR69 TULIP69 to OLIVE69 OLIVE69 to CEDAR69	71,00,000	14.76	3,87,89,280	4,58,89,280	Yes	0	No	9

Two Incomer line at MANGO138 substation and One Incomer line at TULIP69									
41	MANGO138 to PLUM138 TULIP69 to MANGO138 MANGO138 to CEDAR138 TULIP69 to CEDAR69	1,17,40,000	12.49	3,28,23,720	4,45,63,720	Yes	0	No	7
42	MANGO138 to PLUM138 TULIP69 to MANGO138 MANGO138 to CEDAR138 TULIP69 to OLIVE69	1,13,40,000	12.48	3,27,97,440	4,41,37,440	Yes	0	No	7
43	MANGO138 to ELM138 TULIP69 to MANGO138 MANGO138 to CEDAR138 TULIP69 to CEDAR69	1,24,00,000	12.03	3,16,14,840	4,40,14,840	Yes	0	No	8
44	MANGO138 to ELM138 TULIP69 to MANGO138 MANGO138 to CEDAR138 TULIP69 to OLIVE69	1,20,00,000	11.30	2,96,96,400	4,16,96,400	Yes	0	No	7
45	MANGO138 to ELM138 TULIP69 to MANGO138 MANGO138 to PLUM138 TULIP69 to CEDAR69	1,28,40,000	11.73	3,08,26,440	4,36,66,440	Yes	0	No	7
46	MANGO138 to ELM138 TULIP69 to MANGO138 MANGO138 to PLUM138 TULIP69 to OLIVE69	1,24,40,000	11.42	3,00,11,760	4,24,51,760	Yes	0	No	3

Note: the total cost in this section is comprised of the cost of new expansions plus the cost of transmission line losses over the next 5 years

2.4 Identify the lowest cost option from 2.3 and specify if your preferred low-cost design is complaint with TPL-001 and TPL-002 standards.

7	MANGO138 to ELM138 TULIP69 to MANGO138 TULIP69 to OLIVE69	89,50,000	11.91	3,12,99,480	4,02,49,480	Yes	0	No	9

If there are any violations in the lowest cost option, report the details of such violations in below table Add rows to the table if necessary.

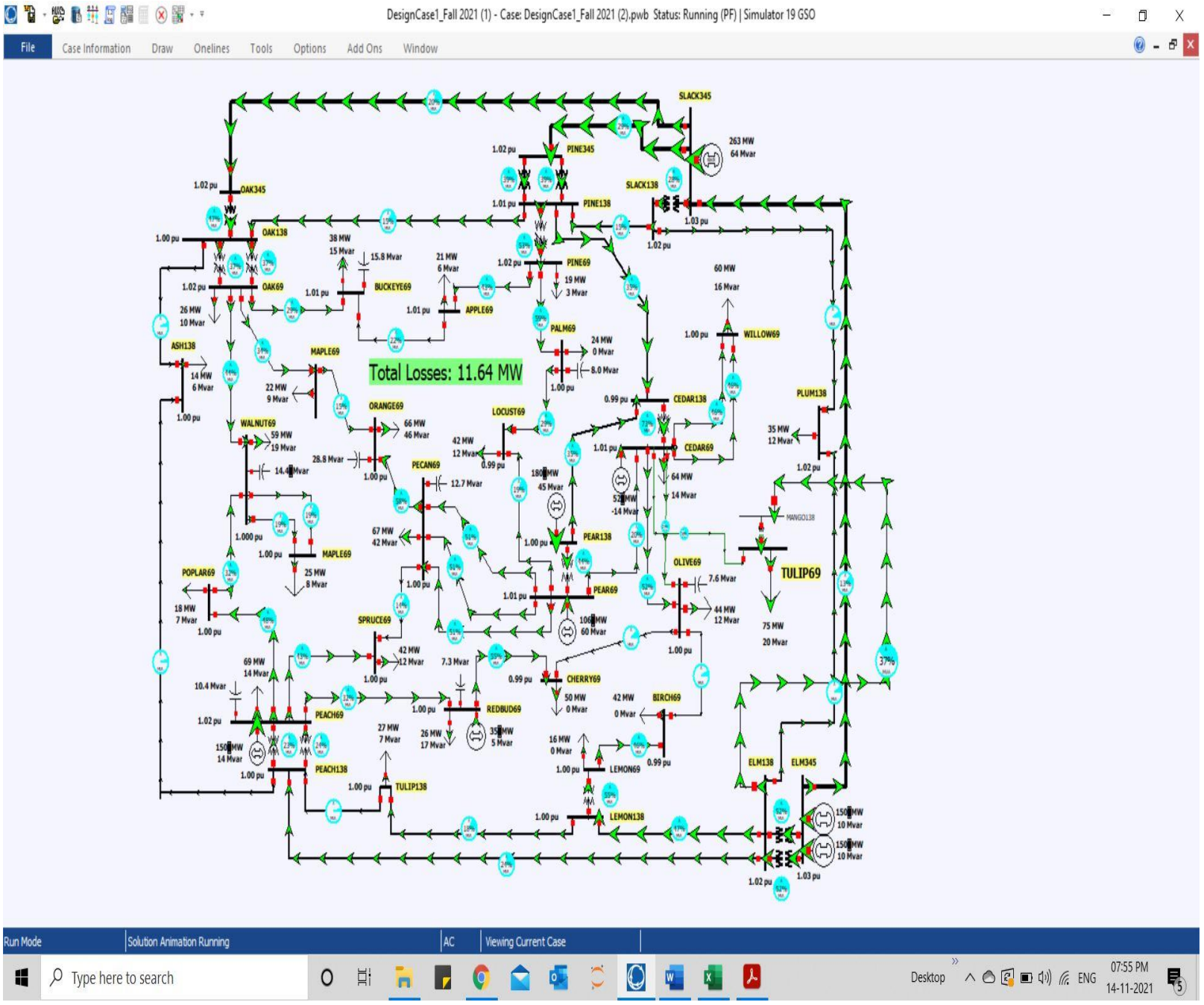
#	Loss of a BES element	Category	Element	Value	Limit	[%]
1	REDBUD69-CHERRY69	Branch Amp	CEDAR69-OLIVE69	657.87	585.72	112.32
2	REDBUD69-PEACH69	Branch Amp	CEDAR69-OLIVE69	620.23	585.72	105.89
3	ELM138-MANGO138	Bus Low Volts	TULIP69	0.9327	0.95	98.18
	ELM138-MANGO138	Branch Amp	CEDAR69-OLIVE69	834.94	585.72	142.55
4	LEMON69-BIRCH69	Branch Amp	CEDAR69-OLIVE69	606.22	585.72	103.5
5	LEMON69-LEMON138	Bus Low Volts	LEMON69	0.9476	0.95	99.75
	LEMON69-LEMON138	Branch Amp	CEDAR69-OLIVE69	682.13	585.72	116.46
6	TULIP69-MANGO138	Bus Low Volts	TULIP69	0.9327	0.95	98.18
	TULIP69-MANGO138	Branch Amp	CEDAR69-OLIVE69	834.82	585.72	142.53

2.5 If your design is not complaint with the standards, you need to revise your design. The options are to go for other higher cost alternatives for interconnecting the load. Also, you may use the right-of-ways provided between CEDAR and OLIVE and CEDAR and PLUM to add a third line into your design. Using more than three new lines in your proposal is not allowed. Iteratively change your design and determine the final design that makes the system complaint with the standards. If there are more than one alternative, choose the lowest cost.

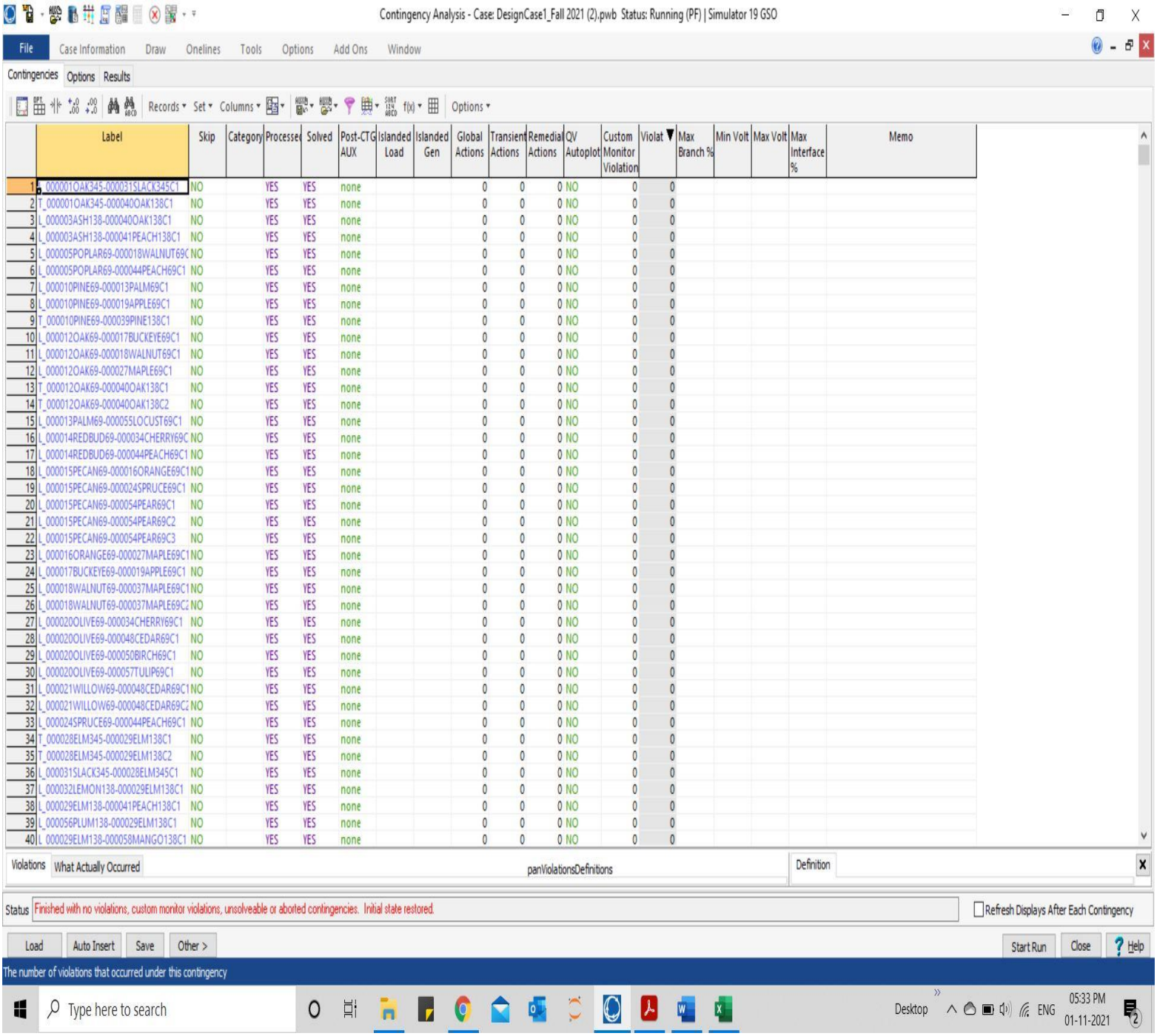
a) Report the specifications of your final design in below table.

#	Transmission line/ Transformers	Line characteristic	Length [km]	R [pu]	X [pu]	B [pu]	Thermal limit [MVA]
1	MANGO138 to ELM138	CROW-138 kV	15	0.01279	0.0846	0.004409	198.39
2	TULIP69 to CEDAR69	ROOK-69 kV	10	0.01764	0.1054	0.001571	92.02
3	CEDAR69 to OLIVE69	ROOK-69 kV	10	0.017639	0.1054	0.001571	92.02
4	MANGO138 to TULIP69	TR	138/69KV	0.0025	0.07	---	168

b) **Copy-paste a snapshot of the power flow run for the final design here.**



c) **Copy-paste a snapshot of the contingency analysis for the final design here.**



d) Calculate and report the total cost of the final design here.

Total cost of the final design is given below…

Total Cost = Fixed cost + Variable cost + Transmission losses over the next 5 years

For MANGO138 to ELM138 transmission line

- **Fixed cost** = $8,50,000
- **Variable cost** = length of transmission line*cost per KM
  = 15 * 2,20,000
  = $33,00,000

For TULIP69 to CEDAR69 transmission line

- **Fixed cost** = $5,00,000
- **Variable cost** = length of transmission line*cost per KM
  = 10 * 2,00,000
  = $20,00,000

For CEDAR69 to OLIVE69 transmission line

- **Fixed cost** = $5,00,000
- **Variable cost** = length of transmission line*cost per KM
  = 10 * 2,00,000
  = $20,00,000

For MANGO138 to TULIP69 requires 138/69KV transformer

- **Fixed cost** = $18,00,000 + $9,00,000
  = $27,00,000

❖ **Total cost of the expansion** = $33,00,000 + $20,00,000 + $20,00,000 + $27,00,000 + $50,000 + $50,000 + $8,50,000
= $ 1,18,50,000

For the selected optimum choice, the total losses are 11.64MW for the system.

❖ **Cost of total losses in the system after expansion** = 11.64 MW * $60/MWh * 24 hours * 365 Days * 5 years
= $ 3,05,89,980

❖ **Total cost** = $1,18,50,000 + $3,05,63,640
= $4,24,39,920

e) Report all the scenarios that showed 0 category A and B violations in below table. Add as many rows to the table as necessary.

Scenario #	Transmission line/Transformer	Final cost of components [$]	Total losses in the system after expansion [MW]	Cost of total losses in the system after expansion [$]	Total cost of expansion [$]	compliant with TPL-001	Number of violations (Category A)	compliant with TPL-002	Number of violations (Category B)
36	MANGO138 to ELM138 TULIP69 to MANGO138 TULIP69 to CEDAR69 OLIVE69 to CEDAR69	1,18,50,000	11.64	3,05,89,920	4,24,39,920	Yes	0	Yes	0
33	MANGO138 to PLUM138 TULIP69 to MANGO138 MANGO138 to ELM138 OLIVE69 to CEDAR69	1,28,40,000	11.53	3,01,43,160	4,29,83,160	Yes	0	Yes	0
31	MANGO138 to PLUM138 TULIP69 to MANGO138 TULIP69 to CEDAR69 OLIVE69 to CEDAR69	1,11,90,000	12.25	3,20,35,320	4,32,25,320	Yes	0	Yes	0
26	MANGO138 to ELM138 TULIP69 to MANGO138 TULIP69 to CEDAR69 OLIVE138 to CEDAR138 OLIVE69 to OLIVE138	1,57,60,000	11.64	2,98,01,520	4,55,61,520	Yes	0	Yes	0
23	MANGO138 to PLUM138 TULIP69 to MANGO138 MANGO138 to ELM138 OLIVE138 to CEDAR138 OLIVE69 to OLIVE138	1,67,50,000	11.53	2,93,02,200	4,60,52,200	Yes	0	Yes	0
21	MANGO138 to PLUM138 TULIP69 to MANGO138 TULIP69 to CEDAR69 OLIVE138 to CEDAR138 OLIVE69 to OLIVE138	1,51,00,000	12.25	3,11,15,520	4,62,15,520	Yes	0	Yes	0