Base Load Power Hub (BLPH)

Electrical System Study Report - Load Flow

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1 INTRODUCTION

1.1 PROJECT OVERVIEW

Crosswind, a Shell and Eneco joint venture, was awarded the tender to develop the offshore Hollandse Kust Noord (HKN) wind farm, located 18.5km off the coast of Netherlands near the town of Egmond aan Zee. The consortium plans to have HKN operational in 2023 with an installed capacity of 759MW generating at least 3.3TWh per year. This is sufficient renewable power to supply more than 1 million Dutch households with green electricity.

Offshore wind farms produce intermittent electricity and balancing these dips and peaks and integrating this electricity into the national energy system requires new technologies. For this reason, the offshore wind farm will include several new technologies that could be implemented at full-scale in the future. The new technologies being explored include a floating solar park, a short-duration battery storage as well as long-term storage via green hydrogen produced by water electrolysis and subsequently consumed in a fuel cell. The combination of these individual measures, herein referred to as the Base Load Power Hub (BLPH) will ensure a continuous power supply regardless of the wind situation.

1.1.1 Project Location

The Hollandse Kust Noord (HKN) wind farm is located 18.5km off the coast of the Netherlands near the town of Egmond aan Zee.

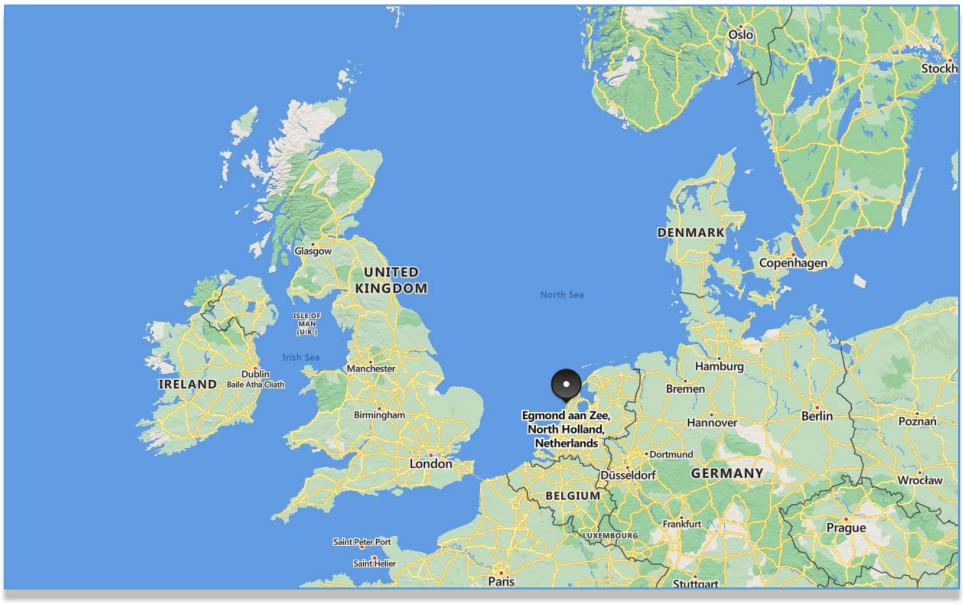


Figure 1 HOLLANDSE KUST NOORD WIND PARK Location Map

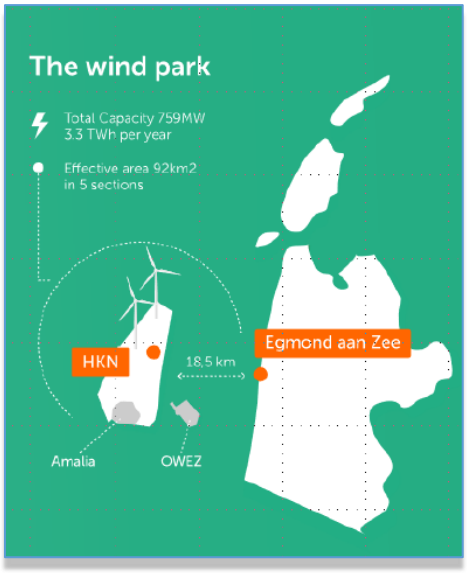


Figure 2 - Wind Park Details

The wind farm will consist of No. 69 x 11.5MW wind turbine generators each to be installed on a dedicated monopile structure. A 70th monopile located on coordinates E 590719.1, N 5841602.3 is reserved for installing the platform accommodating the BLPH. The monopile structure was designed and installed by Van Oord Offshore Wind (VooW) and therefore not part of the BLPH scope.

1.1.2 Project Concept

All components included in the BLPH will be integrated onshore on a topsides and installed in an offshore location within the boundaries of the HKN wind farm. At its simplest, the BLPH will store energy during periods of high electricity generation from renewable sources (a wind turbine generator and the floating solar PV farm) and release it during periods of low generation. In practice, it is expected that the energy stored will supplement generation from renewable sources to ensure that at least 1.0MW of power is exported to the electrical grid regardless of wind/solar availability.

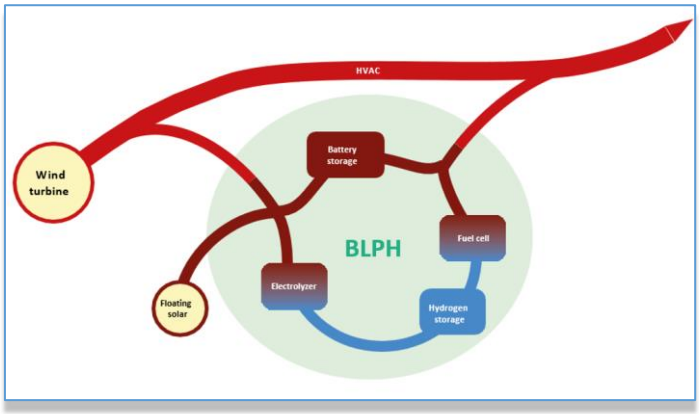


Figure 3 – BLPH Concept

Electricity in the BLPH will be stored in the form of electrons in a battery energy storage system (BESS) as well as converted into green hydrogen via water electrolysis. When the power output from the connecting wind turbine drops to below 1 MWe, the BLPH will return its stored energy to supplement the remaining power output. This will be by discharging the BESS, while stored hydrogen will be converted back into electricity using a fuel cell to extend the discharge duration.

The purpose of the BLPH s to function as a testbed for the integration of energy storage technologies with renewable generation. It is expected that equipment installed on the BLPH will operate as Normally Unmanned Installation for at least two (2) years with no or minimal maintenance and it will have its own independent control room with the ability to communicate with Crosswind's control room.

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2 DOCUMENT SCOPE

The scope of this study report is to present the results of the load flow analysis of the BLPH system for the 5 different modes of operation, and to present the input data used for carrying out the analysis.

2.1 REFERENCES

Doc. No.	Description
123A90-DDL-EL-LIS-20148 Rev 00	Electrical Power and Control Cable Schedule
123A90-DDL-EL-LIS-20016 Rev. 2	Electrical Load List & Balance (CCS Mode 'Import)
123A90-PML-PM-TQ-00033	Technical Query – Electrical data of WTG-57
123A90-DDL-EL-RE-20170 Rev. 0	Electrical System Study Report – Load Flow
123A90-DDL-EL-DG-20158 Rev. 1	Overall Single Line Diagram
144671-TKF-IAC-INS-SPE-0001	Technical specification – 66 kV Al 3X400 CONF143350 specification (incl. Drain wire)
IEC-60092-352 (2005-09)	Electrical installations in ships – Part 352: Choice and installation of electrical cables
2XS(FL)2Y HDPE High Voltage 36/60 (72.5) kV Cable	Cable catalogue for HV cable
123A90-PML-PM-TQ-00033_REPLY	Technical Query N. 33
123A90-DDL-EL-LIS-20143_ATT1	CCS MODE 3: HOT STANDBY
123A90-DDL-EL-LIS-20144_ATT1	CCS MODE 2: EXPORT
123A90-DDL-EL-LIS-20145_ATT1	CCS MODE 4: COLD STANDBY
123A90-DDL-EL-LIS-20146_ATT1	CCS MODE 5 : EMERGENCY MODE (Island)
123A90-DDL-EL-LIS-20147_ATT1	CCS MODE 6: POWER OUT (Blackout)
123A90-DDL-EL-LIS-20016_ATT1	CCS MODE 1: Import Charging

Table 1 - Reference Documents

2.2 DEFINITIONS AND ABBREVIATIONS

Al	Aluminium
AN	Air Natural
BESS	Battery Energy Storage System
BLPH	Base Load Power Hub
Cu	Copper
COMPANY or Client (CPY):	Crosswind
CONTRACTOR (CTR):	ROSETTI MARINO S.p.A.
HV	High Voltage
KNAN	Non mineral oil natural Air Natural
LV	Low Voltage
MV	Medium Voltage
N/A	Not Applicable
NER	Neutral Earthing Resistor
OCTC	Off Circuit Tap Changer
OLTC	On Load Tap Changer
PROJECT:	HOLLANDSE KUST NOORD WIND PARK Project
U_k	Short-circuit impedance
WTG	Wind Turbine Generator
XLPE	Cross-linked PolyEthylene

Table 2 - Definitions and Abbreviations

3 DESIGN BASIS

This section presents the details of all the input data, as well as assumptions used for the system studies for BLPH.

3.1 SYSTEM OVERVIEW

The system studied in this report is based on the single line diagram, 123A90-DDL-EL-DG-20158 Rev. 1. The WTG-57 is the wind turbine being connected to the BLPH. It is connected to the rest of the Crosswind offshore windfarm at the end of string A at a 66 kV busbar. The BLPH is also connected to this busbar via a 66/6.9 kV transformer. At the BLPH 6.6 kV BLPH busbar the BESS, electrolyser, fuel cell and solar farm is connected. There is also a 6.6/0.42 kV transformer supplying different loads at the BLPH.

3.2 MODEL OVERVIEW

WTG-57 is connected to the Crosswind offshore windfarm, via string A. WTG-57 is at the end of this string A.

BLPH is connected to the Crosswind offshore windfarm at the common 66 kV busbar with the WTG-57.

At this 66 kV busbar, the rest of the components in the string A is modelled as the supply network. This is termed as "windfarm" in the model.

Other electrical components connected to this 66 kV busbar, 6.6 kV busbar and 400 V busbar are in accordance with the single line diagram in 123A90-DDL-EL-DG-20158 Rev. 1, as well as datasheets of transformers.

Data provided in the single line diagram 123A90-DDL-EL-DG-20158 Rev. 1 were used to model these transformers.

The study has been performed using ETAP (Electrical Transient Analyzer Program) Version 22.0.5.

3.3 SYSTEM STUDIES BACKGROUND

According to the design philosophy, 9 operation modes are defined. Load flow shall be performed for only 5 operation modes and the results are presented in chapter 4.

These modes of operation are as listed below:

1. CCS MODE 1: Import Charging (corresponding to project IDLE and IMPORT modes)
   - Power generation from WTG-57 is greater than 1 MW. Surplus power is available for import to BLPH from wind farm for charging BESS, running the electrolyser and feeding the BLPH loads.
2. CCS MODE 2: EXPORT
   - Power generation from WTG-57 has dropped below 1 MW, so there is export of power from BLPH from power sources available, i.e. BESS, Fuel Cell and solar farm.
3. CCS MODE 3: Hot standby
   - Power generation from WTG-57 is greater than 1 MW, and either the solar farm, fuel cell or BESS are synchronized and connected to the 6.6 kV power system, ready to generate power. Surplus power is available for import to BLPH from wind farm for feeding the BLPH loads.
4. CCS MODE 4: Cold standby
   - Power generation from WTG-57 has dropped below 1 MW, the solar farm is not generating power, BESS and fuel cell are 'NOT READY'. Power is imported to BLPH from wind farm for feeding the BLPH loads
5. CCS MODE 5: Emergency/Island
   - Windfarm is no longer connected.

3.4 ANALYSIS DESIGN DATA

In the following paragraphs, a brief summary of BLPH Platform main equipment data is presented.

More details are available in the attached ETAP calculations reports.

3.4.1 Supply network

ITEM	3-PH SCC Max [kA]	X/R	3-PH SCC Min [kA]	X/R [pu]
66kV Network 3Ph	15.5	10.0	8.7	10.0
66kV Network 1Ph	7.10	10.0	6.3	10.0

Table 3 - Data for External Network

3.4.2 Power Sources

ITEM	Rated Power [kVA]	Vn [kV]	In [A]	Maximum Generated Active Power [kW]	Sustained SCC [% In]
A-85000 BESS package	1250.0	6.6	109.3	1000.0	150.0
A-80000 Fuel cell package	1250.0	6.6	109.3	1000.0	150.0
PV_Plant	660.0	0.8	476.3	480.0	100.0

Table 4 - Data for Internal Power Sources

3.4.3 Transformers

ITEM	An [kVA]	V1n/V2n [kV]	I1n/I2n [A]	Zcc [%]	X/R [pu]	Vector Group
TR-100AD1	7000.0	66.0+/-8x1.25%/0.69	61.2/585.7	8.0	16.01	Dyn11
TR-200DE1	1600.0	6.6/0.42	139.9/2199.5	6.0	7.94	Dyn11
TR-200ED1	500.0	6.6/0.8	43.7/360.8	6.0	7.63	Dyn11

Table 5 - Data for Main Transformers

3.4.4 Bulk Load 0.4kV

ITEM	An [kVA]	Vn [kV]	In [A]	PF [%]
DC-Battery-System_SWGR	11.5	0.4	16.6	100.0
NAVAID_System	3.16	0.4	4.6	100.0
AC_UPS_F&G	12.5	0.4	18.0	80.0
AC_UPS_PAS	32.5	0.4	46.9	80.0
BL_SG-200N1	982.4	0.4	1418.0	87.78
DB-L&SP-BoP	37.3	0.4	53.8	88.4
DB-L&SP-HVMV	1.7	0.4	2.5	80.0
DB-L&SP-Inst.	1.7	0.4	2.5	80.0
DB-L&SP-LV	1.7	0.4	2.5	80.0
DB-L&SP-UPS	1.7	0.4	2.5	80.0

Table 6 - Data for Bulk Load 0.4kV

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3.4.5 Bulk Load 6.6kV

ITEM	An [kVA]	Vn [kV]	In [A]	PF [%]
A-20000 Electroliser	3.2	6.6	279.9	96.0

Table 7 - Data for Bulk Load 0.4kV

3.4.6 Switchgear Data

ITEM	Rated Voltage [kV]	Rated Ampacity [A]	Short Circuit Rating [kA - s]
HNA6-AFA70	66.0	1250.0	31.5 - 1s
SG-100D1	6.6	630.0	25.0 – 1s
SG-200N1	0.4	2500.0	50.0 – 1s

Table 8 – Data for Main Switchgears

3.4.7 Cables Data

Main cables data are as per 123A90-DDL-EL-LIS-20148 Rev 00 - Electrical Power and Control Cable Schedule.

Cable electrical parameters are as per 123A90-DDL-EL-RE-20151.

3.5 SYSTEM REQUIREMENT

During normal system operation and under steady state conditions, following shall be accomplished:

- Allowed voltage deviation: ±5% from the rated equipment voltage.

Normal system operation covers full load, minimum load and no load in all operating modes.

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4 LOAD FLOW ANALYSIS

Purpose of load flow study is the calculation of minimum, normal and maximum steady state voltage profile at network buses under different operating loading conditions and the loading of the equipment; in order to check compliance with par. 3.5.

4.1 ETAP STUDY ASSUMPTIONS

calculation method:	Newton Raphson.
initial voltage conditions:	bus initial voltages.
update:	initial bus voltages, transformers LTCs, cable load amp.
adjustments:	transformer impedance tolerance: +/-10% - IEC Tolerance.

4.2 CASE 1: IMPORT CHARGING

- Generation Category: Import Charging
- Loading Category: Import Charging
- Load Diversity Factor: None.
- Power Grid 66kV in service, with minimum short circuit power.
- resistance temperature correction: Global 90°C.
- A-85000 Bess Package in service – in charging condition.
- A-20000 Electrolyser Package in service
- A-80000 Fuel Cell Package in standby
- PV Solar Package considered not generating power (in order to identify the maximum load demand from the 66 kV grid)
- LV loads stated as “continuous and intermittent operation” in service and loaded according to load schedule usage factor.
- LV loads stated as “stand-by operation” in standby.

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4.3 CASE 2: EXPORT

- Generation Category: Export
- Loading Category: Export
- Load Diversity Factor: None.
- Power Grid 66kV in service, with minimum short circuit power.
- resistance temperature correction: Global 90°C.
- A-85000 Bess Package in service – in discharging condition.
- A-20000 Electrolyser Package in standby
- A-80000 Fuel Cell Package in service – in discharging condition
- PV Solar Package in service, generating maximum power (to identify the maximum possible export to the 66 kV grid)
- LV loads stated as "continuous and intermittent operation" in service and loaded according to load schedule usage factor.
- LV loads stated as "stand-by operation" in standby.

4.4 CASE 3: HOT STANDBY

- Generation Category: Hot standby
- Loading Category: Hot standby
- Load Diversity Factor: None.
- Power Grid 66kV in service, with minimum short circuit power.
- resistance temperature correction: Global 90°C.
- A-85000 Bess Package full charged, in standby, ready to export
- A-20000 Electrolyser Package not in service (since H_2 tanks are full)
- A-80000 Fuel Cell Package in standby, ready to export
- PV Solar Package not in service
- LV loads stated as "continuous and intermittent operation" in service and loaded according to load schedule usage factor.
- LV loads stated as "stand-by operation" in standby.

4.5 CASE 4: COLD STANDBY

- Generation Category: Cold standby
- Loading Category: Cold standby
- Load Diversity Factor: None.
- Power Grid 66kV in service, with minimum short circuit power.
- resistance temperature correction: Global 90°C.
- A-85000 Bess Package not in service (batteries discharged)
- A-20000 Electrolyser Package in standby
- A-80000 Fuel Cell Package not in service (H_2 tanks are empty)
- PV Solar Package not in service
- LV loads stated as "continuous and intermittent operation" in service and loaded according to load schedule usage factor.
- LV loads stated as "stand-by operation" in standby.

4.6 CASE 5: EMERGENCY

- Generation Category: Emergency
- Loading Category: Emergency
- Load Diversity Factor: None.
- Power Grid 66kV disconnected.
- Resistance temperature correction: Global 90°C.
- A-85000 Bess Package in service – in discharging condition and in grid forming
- A-20000 Electrolyser Package not in service
- A-80000 Fuel Cell Package not considered in service (in order to consider the worst scenario)
- PV Solar Package not considered in service (in order to consider the worst scenario)
- LV loads stated as "continuous and intermittent operation" in service and loaded according to load schedule usage factor.
- LV loads stated as "stand-by operation" not in service.

4.7 LF STUDY RESULTS

BUS ID	RATED VOLTAGE [kV]	CALCULATED SYSTEM VOLTAGES [%Vn]				
		Case 1	Case 2	Case 3	Case 4	Case 5
HKN57	66.000	100.00	100.00	100.00	100.00	
HNA6-AFA70	66.000	99.98	100.01	100.00	100.00	
SG-100D1	6.600	100.67	100.47	100.24	100.26	99.97
SG-200N1	0.400	100.40	101.28	100.77	100.87	100.76

Table 9: Voltage Profile

BUS ID	RATED VOLTAGE [kV]	RATED AMPACITY [A]	CALCULATED OPERATING LOADING CONDITIONS									
			Case 1		Case 2		Case 3		Case 4		Case 5	
			[A]	[%]	[A]	[%]	[A]	[%]	[A]	[%]	[A]	[%]
HKN57	66.000	1250.0	44.8	3.6	17.2	1.4	5.3	0.4	5.2	0.4		
HNA6-AFA70	66.000	1250.0	46.0	3.7	17.5	1.4	5.9	0.5	5.7	0.5		
SG-100D1	6.600	630.0	446.1	70.8	217.3	34.5	59.3	9.4	56.9	9.0	51.3	8.1
SG-200N1	0.400	2500.0	1348.7	53.9	823.7	32.9	954.8	38.2	917.0	36.7	825.8	33.0

Table 10: Bus Loading Factor

Transformer ID	RATED POWER [kVA]	PRIMARY RATED VOLTAGE [kV]	SECONDARY RATED VOLTAGE [kV]	CALCULATED OPERATING LOADING CONDITIONS								
				Case 1			Case 2			Case 3		
				[kVA]	[%]	TAP [%]	[kVA]	[%]	TAP [%]	[kVA]	[%]	TAP [%]
TR-100AD1	7000.00	66.000	6.900	5264.83	75.21	1.25 (*)	1998.29	28.55	3.75 (*)	682.52	9.75	3.75 (*)
TR-200DE1	1600.00	6.600	0.420	963.23	60.20	2.50	587.26	36.70	2.50	679.07	42.44	2.50
TR-200ED1	500.00	6.600	0.800				480.00	96.00	0.0			

(*) On load Tap changer

Transformer ID	RATED POWER [kVA]	PRIMARY RATED VOLTAGE [kV]	SECONDARY RATED VOLTAGE [kV]	CALCULATED OPERATING LOADING CONDITIONS					
				Case 4			Case 5		
				[kVA]	[%]	TAP [%]	[kVA]	[%]	TAP [%]
TR-100AD1	7000.00	66.000	6.900	655.50	9.36	3.75 (*)			
TR-200DE1	1600.00	6.600	0.420	652.35	40.77	2.50	585.80	36.61	2.50
TR-200ED1	500.00	6.600	0.800						

(*) On load Tap changer

Table 11: Transformer Loading Factor

Cable ID	RATED VOLAGE [kV]	AMPACITY [A]	CALCULATED OPERATING LOADING CONDITIONS									
			Case 1		Case 2		Case 3		Case 4		Case 5	
			[A]	[%]	[A]	[%]	[A]	[%]	[A]	[%]	[A]	[%]
0.4kV_cable	0.40	2764.800	1348.69	48.78	823.73	29.79	954.75	34.53	916.97	33.17	825.79	29.87
6.6kV_Cable1	6.66	691.600	446.13	64.51	173.47	25.08	59.27	8.57	56.92	8.23		
6.6kV_Cable2	6.66	246.800	83.73	33.93	51.14	20.72	59.27	24.02	56.93	23.07	51.27	20.77
6.6kV_Cable3	6.66	246.800			87.01	35.26						
6.6kV_Cable4	6.66	345.800	281.59	81.43								
6.6kV_Cable5	6.66	246.800	86.94	35.23	87.03	35.26					51.26	20.77
6.6kV_Cable6	6.66	246.800			41.53	16.83						
66kV_Cable1	66.00	613.000	46.06	7.51	17.48	2.85	5.97	0.97	5.73	0.94		
66kV_Cable2	66.00	613.000	46.04	7.51	17.47	2.85	5.94	0.97	5.70	0.93		
66kV_Cable3	66.00	459.200	46.01	10.02	17.45	3.80	5.89	1.28	5.66	1.23		

Table 12: Cables Loading Factor

Total Demand Power	LOAD FLOW CALCULATION RESULTS				
	LF CASE 1	LF CASE 2	LF CASE 3	LF CASE 4	LF CASE 5
kW Demand [kW]	4931.00	507.00	584.00	562.00	506.00
kVAr Demand [kVAr]	1342.00	279.00	321.00	309.00	278.00
kVA Demand [kVA]	5110.35	578.70	666.41	641.35	577.34
PF [%]	96.49	87.61	87.63	87.63	87.64

Table 13: Summary Total Load Demand

Total Generation Power	LOAD FLOW CALCULATION RESULTS				
	LF CASE 1	LF CASE 2	LF CASE 3	LF CASE 4	LF CASE 5
kW Generation [kW]		2480.00			508.00
kVAr Generation [kVAr]					292.00
kVA Generation [kVA]		2480.00			585.94
PF [%]		100.00			86.70

Table 14: Summary Total Power Generated

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Total Power Exchanged with External Grid	LOAD FLOW CALCULATION RESULTS				
	LF CASE 1	LF CASE 2	LF CASE 3	LF CASE 4	LF CASE 5
kW Exchanged [kW]	4964.00 (*)	-1962.00 (**)	588.00 (*)	565.00 (*)	
kVAr Exchanged [kVAr]	1247.00 (*)	-134.00 (**)	-163.00 (*)	-178.00 (*)	
kVA Exchanged [kVA]	5118.23 (*)	1966.57 (**)	610.17 (*)	592.38 (*)	
PF [%]	96.99 (*)	99.77 (**)	96.37 (*)	95.38 (*)	

(*) Adosorbed
(**) Generated

Table 15: Summary total Excenged Power with External Grid

Total Losses	LOAD FLOW CALCULATION RESULTS				
	LF CASE 1	LF CASE 2	LF CASE 3	LF CASE 4	LF CASE 5
kW Losses [kW]	33.00	11.00	4.00	3.00	3.00
kVAr Losses [kVAr]	-111.00	-412.00	-484.00	-486.00	15.00

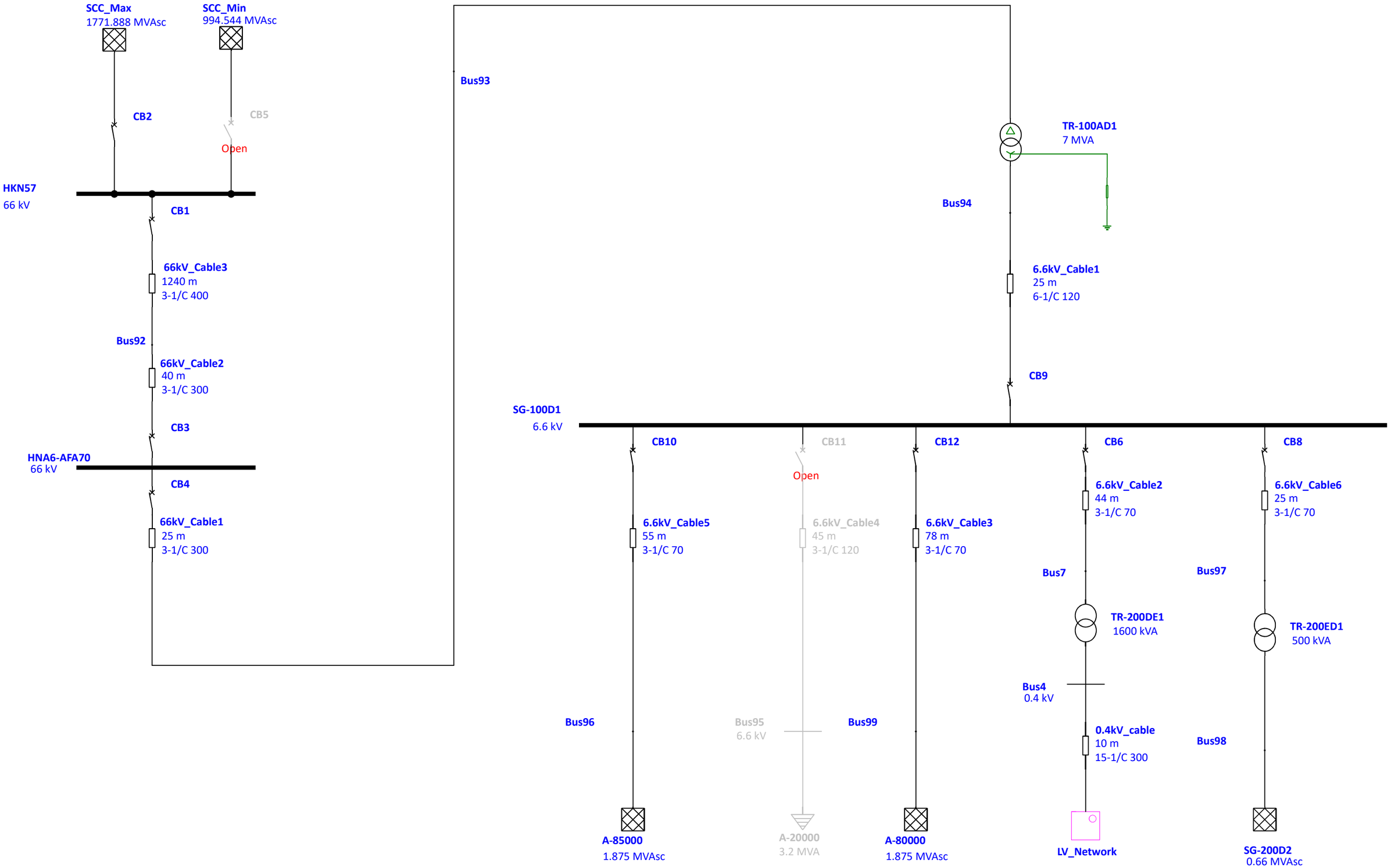
Table 16: Summary Total Losses

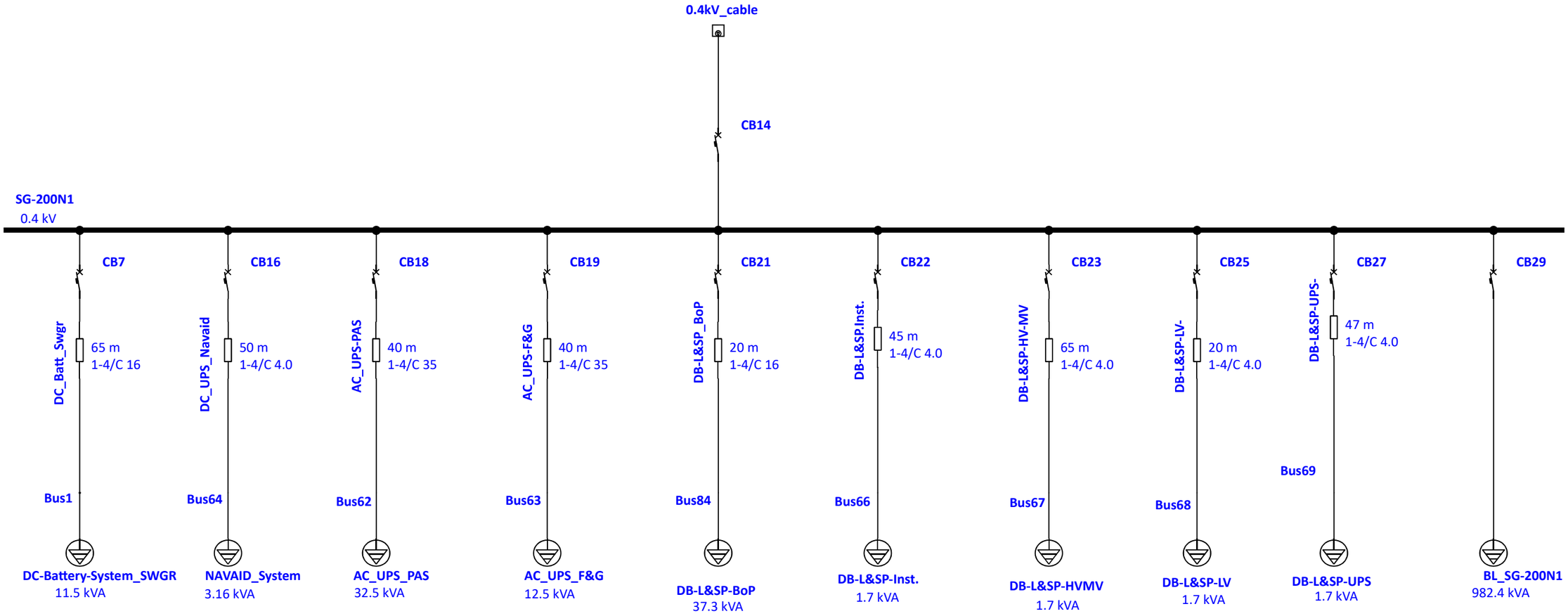
5 CONCLUSION

Based on results in chapter 4, there is no violation of the voltage in any of the 5 modes of operations. The results also verify that the power cables have minimum 20% spare capacity, and the transformers are not overloaded (>100%) in any of the 5 modes of operations.

ATTACHMENTS

Attachment 7 Electrical system model in Etap


SCC_Max
1771.888 MVAsc
SCC_Min
994.544 MVAsc
CB2
CB5
Open
HKN57
66 kV
CB1
66kV_Cable3
1240 m
3-1/C 400
Bus92
66kV_Cable2
40 m
3-1/C 300
CB3
HNA6-AFA70
66 kV
CB4
66kV_Cable1
25 m
3-1/C 300
Bus93
TR-100AD1
7 MVA
Bus94
6.6kV_Cable1
25 m
6-1/C 120
CB9
SG-100D1
6.6 kV
CB10
CB11
Open
CB12
CB6
CB8
6.6kV_Cable5
55 m
3-1/C 70
6.6kV_Cable4
45 m
3-1/C 120
6.6kV_Cable3
78 m
3-1/C 70
6.6kV_Cable2
44 m
3-1/C 70
6.6kV_Cable6
25 m
3-1/C 70
Bus7
Bus97
TR-200DE1
1600 kVA
TR-200ED1
500 kVA
Bus4
0.4 kV
Bus96
Bus95
6.6 kV
Bus99
0.4kV_cable
10 m
15-1/C 300
Bus98
A-85000
1.875 MVAsc
A-20000
3.2 MVA
A-80000
1.875 MVAsc
LV_Network
SG-200D2
0.66 MVAsc


0.4kV_cable
CB14
SG-200N1
0.4 kV
CB7
CB16
CB18
CB19
CB21
CB22
CB23
CB25
CB27
CB29
DC_Batt_Swgr
65 m
1-4/C 16
DC_UPS_Navaid
50 m
1-4/C 4.0
AC_UPS-PAS
40 m
1-4/C 35
AC_UPS-F&G
40 m
1-4/C 35
DB-L&SP_BoP
20 m
1-4/C 16
DB-L&SP.Inst.
45 m
1-4/C 4.0
DB-L&SP-HV-MV
65 m
1-4/C 4.0
DB-L&SP-LV-
20 m
1-4/C 4.0
DB-L&SP-UPS-
47 m
1-4/C 4.0
Bus1
Bus64
Bus62
Bus63
Bus84
Bus66
Bus67
Bus68
Bus69
DC-Battery-System_SWGR
11.5 kVA
NAVAID_System
3.16 kVA
AC_UPS_PAS
32.5 kVA
AC_UPS_F&G
12.5 kVA
DB-L&SP-BoP
37.3 kVA
DB-L&SP-Inst.
1.7 kVA
DB-L&SP-HVMV
1.7 kVA
DB-L&SP-LV
1.7 kVA
DB-L&SP-UPS
1.7 kVA
BL_SG-200N1
982.4 kVA

Attachment 8 Etap Report LF Case 1

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Electrical Transient Analyzer Program

Load Flow Analysis

Loading Category (5): CCS_Mode1_Import_Charging

Generation Category (5): CCS_Mode1_Import_Charging

Load Diversity Factor: None

	Swing	V-Control	Load	Total
Number of Buses:	1	0	19	20

	XFMR2	XFMR3	Reactor	Line/Cable/ Busway	Impedance	Tie PD	Total
Number of Branches:	2	0	0	17	0	0	19

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:	BLPH-LV-SCstudy
Output Filename:	C:\Users\Stefano Puddu\Desktop\0396S_Crosswind\ETAP_15-Mar-2024\LFCASE1.lfr

Adjustments

Tolerance	Apply Adjustments	Individual /Global	Percent
Transformer Impedance:	Yes	Global	10.0
Reactor Impedance:	No		
Overload Heater Resistance:	No		
Transmission Line Length:	No		
Cable / Busway Length:	No		

Temperature Correction	Apply Adjustments	Individual /Global	Degree C
Transmission Line Resistance:	Yes	Global	90
Cable / Busway Resistance:	Yes	Global	90

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
Bus1	0.400	2	100.3	-4.1	0.002	0.000						
Bus4	0.400	2	100.5	-4.0								
Bus7	6.600	2	100.6	-2.1								
Bus62	0.400	2	100.1	-4.0	0.013	0.010						
Bus63	0.400	2	100.3	-4.0	0.004	0.003						
Bus64	0.400	2	99.8	-4.1	0.003	0.000						
Bus66	0.400	2	100.3	-4.0								
Bus67	0.400	2	100.3	-4.0								
Bus68	0.400	2	100.3	-4.0								
Bus69	0.400	2	100.3	-4.0								
Bus84	0.400	2	100.3	-4.0	0.006	0.003						
Bus92	66.000	2	100.0	0.0								
Bus93	66.000	2	100.0	0.0								
Bus94	6.900	2	96.3	-2.1								
Bus95	6.600	2	100.0	-3.8			3.072	0.896				
Bus96	6.600	2	100.6	-2.1								
HKN57	66.000	2	100.0	0.0								
HNA6-AFA70	66.000	2	100.0	0.0								
SG-100D1	6.600	2	100.6	-2.1								
SG-200N1	0.400	2	100.4	-4.0	0.008	0.004	0.779	0.427				
Total Number of Buses: 20					0.037	0.021	3.851	1.323	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
Bus96	6.600	Mvar/PF Control	2	100.6	-2.1	-1.000	0.000	100.0		
HKN57	66.000	Swing	2	100.0	0.0					
						-1.000	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)	% Tol.	#/Phase	T (°C)	R	X	Y
0.4kV_cable	1.0NCUN1	300	10.0	0.0	5	90	0.080000	0.089000	0.0001854
6.6kV_Cable1	6.6NCUN1	120	25.0	0.0	2	90	0.196000	0.113000	0.0001400
6.6kV_Cable2	6.6NCUN1	70	44.0	0.0	1	90	0.342000	0.130000	0.0001100
6.6kV_Cable4	6.6NCUN1	120	45.0	0.0	1	90	0.196000	0.113000	0.0001400
6.6kV_Cable5	6.6NCUN1	70	55.0	0.0	1	90	0.342000	0.130000	0.0001100
66kV_Cable1	66NALS1	300	25.0	0.0	1	90	0.078100	0.120000	0.0000644
66kV_Cable2	66NALS1	300	40.0	0.0	1	90	0.078100	0.120000	0.0000644
66kV_Cable3	66NALS1	400	1240.0	0.0	1	90	0.101800	0.098700	0.0000911
AC_UPS-F&G	1.0MCUN4	35	40.0	0.0	1	90	0.669000	0.080000	0.0001015
AC_UPS-PAS	1.0MCUN4	35	40.0	0.0	1	90	0.669000	0.080000	0.0001015
DB-L&SP-HV-MV	1.0MCUN4	4.0	65.0	0.0	1	90	5.870000	0.093000	0.0000575
DB-L&SP-LV-	1.0MCUN4	4.0	20.0	0.0	1	90	5.870000	0.093000	0.0000575
DB-L&SP-UPS-	1.0MCUN4	4.0	47.0	0.0	1	90	5.870000	0.093000	0.0000575
DB-L&SP.Inst.	1.0MCUN4	4.0	45.0	0.0	1	90	5.870000	0.093000	0.0000575
DB-L&SP_BoP	1.0NCUN4	16	20.0	0.0	1	90	1.467000	0.080000	0.0000597
DC_Batt_Swgr	1.0MCUN4	16	65.0	0.0	1	90	1.460000	0.080000	0.0000971
DC_UPS_Navaid	1.0MCUN4	4.0	50.0	0.0	1	90	5.870000	0.093000	0.0000575

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
TR-100AD1	3-Phase	7.000	66.000	6.900	8.00	16.06	0	0	10.0	0	0	8.8000	Dyn	0.000
TR-200DE1	3-Phase	1.600	6.600	0.420	6.00	7.94	0	0	10.0	2.500	0	6.6000	Dyn	0.000

2-Winding Transformer Load Tap Changer (LTC) Settings

Transformer	Connected Buses ("*" LTC Side)		Transformer Load Tap Changer Setting					
ID	Primary Bus ID	Secondary Bus ID	% Min. Tap	% Max. Tap	% Step	Regulated Bus ID	% V	kV
TR-100AD1	* Bus93	Bus94	-10.00	10.00	1.250	SG-100D1	100.00	6.600

Branch Connections

CKT/Branch		Connected Bus ID		% Impedance, Pos. Seq., 100 MVA Base			
ID	Type	From Bus	To Bus	R	X	Z	Y
TR-100AD1	2W XFMR	Bus93	Bus94	7.91	127.04	127.29	
TR-200DE1	2W XFMR	Bus7	Bus4	48.34	383.81	386.85	
0.4kV_cable	Cable	Bus4	SG-200N1	8.30	9.23	12.41	0.0000018
6.6kV_Cable1	Cable	Bus94	SG-100D1	0.51	0.30	0.59	0.0003333
6.6kV_Cable2	Cable	SG-100D1	Bus7	3.16	1.20	3.38	0.0002304
6.6kV_Cable4	Cable	SG-100D1	Bus95	1.85	1.07	2.14	0.0002999
6.6kV_Cable5	Cable	SG-100D1	Bus96	3.95	1.50	4.23	0.0002880
66kV_Cable1	Cable	HNA6-AFA70	Bus93	0.00	0.01	0.01	0.0070134
66kV_Cable2	Cable	Bus92	HNA6-AFA70	0.01	0.01	0.01	0.0112215
66kV_Cable3	Cable	HKN57	Bus92	0.29	0.28	0.40	0.4921036
AC_UPS-F&G	Cable	SG-200N1	Bus63	1387.96	165.97	1397.85	0.0000008
AC_UPS-PAS	Cable	SG-200N1	Bus62	1387.96	165.97	1397.85	0.0000008
DB-L&SP-HV-MV	Cable	SG-200N1	Bus67	19789.85	313.54	19792.34	0.0000007
DB-L&SP-LV-	Cable	SG-200N1	Bus68	6089.19	96.47	6089.95	0.0000002
DB-L&SP-UPS-	Cable	SG-200N1	Bus69	14309.59	226.71	14311.38	0.0000005
DB-L&SP.Inst.	Cable	SG-200N1	Bus66	13700.67	217.06	13702.39	0.0000005
DB-L&SP_BoP	Cable	SG-200N1	Bus84	1521.78	82.99	1524.04	0.0000002
DC_Batt_Swgr	Cable	SG-200N1	Bus1	4922.18	269.71	4929.56	0.0000012
DC_UPS_Navaid	Cable	SG-200N1	Bus64	15222.96	241.18	15224.87	0.0000006

LOAD FLOW REPORT

Bus		Voltage		Generation		Load		Load Flow					XFMR
ID	kV	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	%PF	%Tap
Bus1	0.400	100.307	-5.6	0.000	0.000	0.002	0.000	SG-200N1	-0.002	0.000	2.3	100.0	
Bus4	0.400	100.532	-5.6	0.000	0.000	0.000	0.000	SG-200N1	0.823	0.452	1348.7	87.6	
								Bus7	-0.823	-0.452	1348.7	87.6	
Bus7	6.600	100.631	-3.7	0.000	0.000	0.000	0.000	SG-100D1	-0.828	-0.492	83.7	86.0	
								Bus4	0.828	0.492	83.7	86.0	2.500
Bus62	0.400	100.165	-5.5	0.000	0.000	0.013	0.010	SG-200N1	-0.013	-0.010	23.2	80.0	
Bus63	0.400	100.331	-5.6	0.000	0.000	0.004	0.003	SG-200N1	-0.004	-0.003	6.8	80.0	
Bus64	0.400	99.819	-5.6	0.000	0.000	0.003	0.000	SG-200N1	-0.003	0.000	4.6	100.0	
Bus66	0.400	100.340	-5.6	0.000	0.000	0.000	0.000	SG-200N1	0.000	0.000	0.6	80.0	
Bus67	0.400	100.313	-5.6	0.000	0.000	0.000	0.000	SG-200N1	0.000	0.000	0.6	80.0	
Bus68	0.400	100.373	-5.6	0.000	0.000	0.000	0.000	SG-200N1	0.000	0.000	0.6	80.0	
Bus69	0.400	100.337	-5.6	0.000	0.000	0.000	0.000	SG-200N1	0.000	0.000	0.6	80.0	
Bus84	0.400	100.285	-5.6	0.000	0.000	0.006	0.003	SG-200N1	-0.006	-0.003	9.9	88.4	
Bus92	66.000	99.981	0.0	0.000	0.000	0.000	0.000	HNA6-AFA70	4.963	1.738	46.0	94.4	
								HKN57	-4.963	-1.738	46.0	94.4	
Bus93	66.000	99.981	0.0	0.000	0.000	0.000	0.000	HNA6-AFA70	-4.963	-1.756	46.1	94.3	
								Bus94	4.963	1.756	46.1	94.3	1.250
Bus94	6.900	96.319	-3.7	0.000	0.000	0.000	0.000	SG-100D1	4.941	1.400	446.1	96.2	
								Bus93	-4.941	-1.400	446.1	96.2	
Bus95	6.600	100.592	-3.7	0.000	0.000	3.109	0.907	SG-100D1	-3.109	-0.907	281.6	96.0	
Bus96	6.600	100.623	-3.7	-1.000	0.000	0.000	0.000	SG-100D1	-1.000	0.000	86.9	100.0	
* HKN57	66.000	100.000	0.0	4.964	1.247	0.000	0.000	Bus92	4.964	1.247	44.8	97.0	
HNA6-AFA70	66.000	99.981	0.0	0.000	0.000	0.000	0.000	Bus93	4.963	1.749	46.0	94.3	
								Bus92	-4.963	-1.749	46.0	94.3	
SG-100D1	6.600	100.665	-3.7	0.000	0.000	0.000	0.000	Bus94	-4.940	-1.399	446.1	96.2	
								Bus7	0.829	0.492	83.7	86.0	
								Bus95	3.111	0.908	281.6	96.0	
								Bus96	1.000	0.000	86.9	100.0	
SG-200N1	0.400	100.400	-5.6	0.000	0.000	0.793	0.435	Bus4	-0.822	-0.451	1348.7	87.7	
								Bus63	0.004	0.003	6.8	80.0	
								Bus62	0.013	0.010	23.2	80.1	

Bus		Voltage		Generation		Load		Load Flow					XFMR
ID	kV	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	%PF	%Tap
								Bus67	0.000	0.000	0.6	80.1	
								Bus68	0.000	0.000	0.6	80.0	
								Bus69	0.000	0.000	0.6	80.1	
								Bus66	0.000	0.000	0.6	80.1	
								Bus84	0.006	0.003	9.9	88.4	
								Bus1	0.002	0.000	2.3	100.0	
								Bus64	0.003	0.000	4.6	100.0	

* 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
Bus1	0.400		0.002								0.002	100.0	2.3	
Bus4	0.400										0.939	87.6	1348.7	
Bus7	6.600										0.963	86.0	83.7	
Bus62	0.400		0.013	0.010							0.016	80.0	23.2	
Bus63	0.400		0.004	0.003							0.005	80.0	6.8	
Bus64	0.400		0.003								0.003	100.0	4.6	
Bus66	0.400		0.000	0.000							0.000	80.0	0.6	
Bus67	0.400		0.000	0.000							0.000	80.0	0.6	
Bus68	0.400		0.000	0.000							0.000	80.0	0.6	
Bus69	0.400		0.000	0.000							0.000	80.0	0.6	
Bus84	0.400		0.006	0.003							0.007	88.4	9.9	
Bus92	66.000										5.259	94.4	46.0	
Bus93	66.000										5.265	94.3	46.1	
Bus94	6.900										5.135	96.2	446.1	
Bus95	6.600				3.109	0.907					3.238	96.0	281.6	
Bus96	6.600										1.000	100.0	86.9	
HKN57	66.000	1250.0									5.118	97.0	44.8	3.6
HNA6-AFA70	66.000	1250.0									5.263	94.3	46.0	3.7
SG-100D1	6.600	630.0									5.134	96.2	446.1	70.8
SG-200N1	0.400	2500.0	0.008	0.004	0.785	0.430					0.938	87.7	1348.7	53.9

* 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		Busway / Cable & Reactor			Transformer				
		Ampacity (Amp)	Loading Amp		Capability (MVA)	Loading (input)		Loading (output)	
ID	Type			%		MVA	%	MVA	%
0.4kV_cable	Cable	2764.80	1348.69	48.78					
6.6kV_Cable1	Cable	691.60	446.13	64.51					
6.6kV_Cable2	Cable	246.80	83.73	33.93					
6.6kV_Cable4	Cable	345.80	281.59	81.43					
6.6kV_Cable5	Cable	246.80	86.94	35.23					
66kV_Cable1	Cable	613.00	46.06	7.51					
66kV_Cable2	Cable	613.00	46.04	7.51					
66kV_Cable3	Cable	459.20	46.01	10.02					
AC_UPS-F&G	Cable	136.89	6.78	4.95					
AC_UPS-PAS	Cable	136.89	23.23	16.97					
DB-L&SP-HV-MV	Cable	37.25	0.65	1.74					
DB-L&SP-LV-	Cable	37.25	0.65	1.74					
DB-L&SP-UPS-	Cable	37.25	0.65	1.74					
DB-L&SP.Inst.	Cable	37.25	0.65	1.74					
DB-L&SP_BoP	Cable	89.40	9.90	11.07					
DC_Batt_Swgr	Cable	89.40	2.26	2.53					
DC_UPS_Navaid	Cable	37.25	4.57	12.27					
TR-100AD1	Transformer				7.000	5.265	75.2	5.135	73.4
TR-200DE1	Transformer				1.600	0.963	60.2	0.939	58.7

* 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
0.4kV_cable	0.823	0.452	-0.822	-0.451	0.9	1.0	100.5	100.4	0.13
6.6kV_Cable1	4.941	1.400	-4.940	-1.399	1.5	0.5	96.3	100.7	0.03
6.6kV_Cable2	-0.828	-0.492	0.829	0.492	0.3	-0.1	100.6	100.7	0.03
6.6kV_Cable4	-3.109	-0.907	3.111	0.908	2.1	0.9	100.6	100.7	0.07
6.6kV_Cable5	-1.000	0.000	1.000	0.000	0.4	-0.1	100.6	100.7	0.04
66kV_Cable1	-4.963	-1.756	4.963	1.749	0.0	-7.0	100.0	100.0	0.00
66kV_Cable2	4.963	1.738	-4.963	-1.749	0.0	-11.2	100.0	100.0	0.00
66kV_Cable3	-4.963	-1.738	4.964	1.247	0.8	-491.3	100.0	100.0	0.02
AC_UPS-F&G	-0.004	-0.003	0.004	0.003	0.0	0.0	100.3	100.4	0.07
AC_UPS-PAS	-0.013	-0.010	0.013	0.010	0.0	0.0	100.2	100.4	0.23
DB-L&SP.Inst.	0.000	0.000	0.000	0.000	0.0	0.0	100.3	100.4	0.06
DB-L&SP_BoP	-0.006	-0.003	0.006	0.003	0.0	0.0	100.3	100.4	0.11
DB-L&SP-HV-MV	0.000	0.000	0.000	0.000	0.0	0.0	100.3	100.4	0.09
DB-L&SP-LV-	0.000	0.000	0.000	0.000	0.0	0.0	100.4	100.4	0.03
DB-L&SP-UPS-	0.000	0.000	0.000	0.000	0.0	0.0	100.3	100.4	0.06
DC_Batt_Swgr	-0.002	0.000	0.002	0.000	0.0	0.0	100.3	100.4	0.09
DC_UPS_Navaid	-0.003	0.000	0.003	0.000	0.0	0.0	99.8	100.4	0.58
TR-100AD1	4.963	1.756	-4.941	-1.400	22.2	356.7	100.0	96.3	3.66
TR-200DE1	-0.823	-0.452	0.828	0.492	5.0	39.4	100.5	100.6	4.89
					33.2	-111.1			

* 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	

Marginal Report

Device ID	Type	Condition	Rating/Limit	Unit	Operating	% Operating	Phase Type
Bus94	Bus	Under Voltage	6.900	kV	6.646	96.3	3-Phase

SUMMARY OF TOTAL GENERATION , LOADING & DEMAND

	MW	Mvar	MVA	% PF
Source (Swing Buses):	4.964	1.247	5.118	96.99 Lagging
Source (Non-Swing Buses):	-1.000	0.000	1.000	100.00 Lagging
Total Demand:	3.964	1.247	4.156	95.39 Lagging
Total Motor Load:	0.037	0.021	0.042	86.74 Lagging
Total Static Load:	3.894	1.337	4.117	94.58 Lagging
Total Constant I Load:	0.000	0.000	0.000	
Total Generic Load:	0.000	0.000	0.000	
Apparent Losses:	0.033	-0.111		
System Mismatch:	0.000	0.000		

Number of Iterations: 3

Attachment 9 Etap Report LF Case 2

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Electrical Transient Analyzer Program

Load Flow Analysis

Loading Category (1): CCS_Mode2_Export

Generation Category (1): CCS_Mode2_Export

Load Diversity Factor: None

	Swing	V-Control	Load	Total
Number of Buses:	1	0	21	22

	XFMR2	XFMR3	Reactor	Line/Cable/ Busway	Impedance	Tie PD	Total
Number of Branches:	3	0	0	18	0	0	21

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:	BLPH-LV-SCstudy
Output Filename:	C:\Users\Stefano Puddu\Desktop\0396S_Crosswind\ETAP_15-Mar-2024\LFCASE2.lfr

Adjustments

Tolerance	Apply Adjustments	Individual /Global	Percent
Transformer Impedance:	Yes	Global	10.0
Reactor Impedance:	No		
Overload Heater Resistance:	No		
Transmission Line Length:	No		
Cable / Busway Length:	No		

Temperature Correction	Apply Adjustments	Individual /Global	Degree C
Transmission Line Resistance:	Yes	Global	90
Cable / Busway Resistance:	Yes	Global	90

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
Bus1	0.400	2	100.3	-5.6	0.002	0.000						
Bus4	0.400	2	100.5	-5.6								
Bus7	6.600	2	100.6	-3.7								
Bus62	0.400	2	100.2	-5.5	0.013	0.010						
Bus63	0.400	2	100.3	-5.6	0.003	0.002						
Bus64	0.400	2	99.8	-5.6	0.003	0.000						
Bus66	0.400	2	100.3	-5.6								
Bus67	0.400	2	100.3	-5.6								
Bus68	0.400	2	100.4	-5.6								
Bus69	0.400	2	100.3	-5.6								
Bus84	0.400	2	100.3	-5.6	0.006	0.003						
Bus92	66.000	2	100.0	0.0								
Bus93	66.000	2	100.0	0.0								
Bus94	6.900	2	96.3	-3.7								
Bus96	6.600	2	100.6	-3.7								
Bus97	6.600	2	100.6	-2.1								
Bus98	0.800	2	101.3	1.4								
Bus99	6.600	2	100.5	-2.1								
HKN57	66.000	2	100.0	0.0								
HNA6-AFA70	66.000	2	100.0	0.0								
SG-100D1	6.600	2	100.7	-3.7								
SG-200N1	0.400	2	100.4	-5.6	0.005	0.003	0.462	0.253				
Total Number of Buses: 22					0.033	0.019	0.462	0.253	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
Bus96	6.600	Mvar/PF Control	2	100.6	-3.7	1.000	0.000	100.0		
Bus98	0.800	Mvar/PF Control	2	101.3	1.4	0.480	0.000	100.0		
Bus99	6.600	Mvar/PF Control	2	100.5	-2.1	1.000	0.000	100.0		
HKN57	66.000	Swing	2	100.0	0.0					
						2.480	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)	% Tol.	#/Phase	T (°C)	R	X	Y
0.4kV_cable	1.0NCUN1	300	10.0	0.0	5	90	0.080000	0.089000	0.0001854
6.6kV_Cable1	6.6NCUN1	120	25.0	0.0	2	90	0.196000	0.113000	0.0001400
6.6kV_Cable2	6.6NCUN1	70	44.0	0.0	1	90	0.342000	0.130000	0.0001100
6.6kV_Cable3	6.6NCUN1	70	78.0	0.0	1	90	0.342000	0.130000	0.0001100
6.6kV_Cable5	6.6NCUN1	70	55.0	0.0	1	90	0.342000	0.130000	0.0001100
6.6kV_Cable6	6.6NCUN1	70	25.0	0.0	1	90	0.342000	0.130000	0.0001100
66kV_Cable1	66NALS1	300	25.0	0.0	1	90	0.078100	0.120000	0.0000644
66kV_Cable2	66NALS1	300	40.0	0.0	1	90	0.078100	0.120000	0.0000644
66kV_Cable3	66NALS1	400	1240.0	0.0	1	90	0.101800	0.098700	0.0000911
AC_UPS-F&G	1.0MCUN4	35	40.0	0.0	1	90	0.669000	0.080000	0.0001015
AC_UPS-PAS	1.0MCUN4	35	40.0	0.0	1	90	0.669000	0.080000	0.0001015
DB-L&SP-HV-MV	1.0MCUN4	4.0	65.0	0.0	1	90	5.870000	0.093000	0.0000575
DB-L&SP-LV-	1.0MCUN4	4.0	20.0	0.0	1	90	5.870000	0.093000	0.0000575
DB-L&SP-UPS-	1.0MCUN4	4.0	47.0	0.0	1	90	5.870000	0.093000	0.0000575
DB-L&SP.Inst.	1.0MCUN4	4.0	45.0	0.0	1	90	5.870000	0.093000	0.0000575
DB-L&SP_BoP	1.0NCUN4	16	20.0	0.0	1	90	1.467000	0.080000	0.0000597
DC_Batt_Swgr	1.0MCUN4	16	65.0	0.0	1	90	1.460000	0.080000	0.0000971
DC_UPS_Navaid	1.0MCUN4	4.0	50.0	0.0	1	90	5.870000	0.093000	0.0000575

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
TR-100AD1	3-Phase	7.000	66.000	6.900	8.00	16.06	0	0	10.0	0	0	8.8000	Dyn	0.000
TR-200DE1	3-Phase	1.600	6.600	0.420	6.00	7.94	0	0	10.0	2.500	0	6.6000	Dyn	0.000
TR-200ED1	3-Phase	0.500	6.600	0.800	6.00	7.63	0	0	10.0	0	0	6.6000	Dyn	0.000

2-Winding Transformer Load Tap Changer (LTC) Settings

Transformer	Connected Buses ("*" LTC Side)		Transformer Load Tap Changer Setting					
ID	Primary Bus ID	Secondary Bus ID	% Min. Tap	% Max. Tap	% Step	Regulated Bus ID	% V	kV
TR-100AD1	* Bus93	Bus94	-10.00	10.00	1.250	SG-100D1	100.00	6.600

Branch Connections

CKT/Branch		Connected Bus ID		% Impedance, Pos. Seq., 100 MVA Base			
ID	Type	From Bus	To Bus	R	X	Z	Y
TR-100AD1	2W XFMR	Bus93	Bus94	7.91	127.04	127.29	
TR-200DE1	2W XFMR	Bus7	Bus4	48.34	383.81	386.85	
TR-200ED1	2W XFMR	Bus97	Bus98	156.94	1197.47	1207.71	
0.4kV_cable	Cable	Bus4	SG-200N1	8.30	9.23	12.41	0.0000018
6.6kV_Cable1	Cable	Bus94	SG-100D1	0.51	0.30	0.59	0.0003333
6.6kV_Cable2	Cable	SG-100D1	Bus7	3.16	1.20	3.38	0.0002304
6.6kV_Cable3	Cable	SG-100D1	Bus99	5.60	2.13	5.99	0.0004085
6.6kV_Cable5	Cable	SG-100D1	Bus96	3.95	1.50	4.23	0.0002880
6.6kV_Cable6	Cable	SG-100D1	Bus97	1.80	0.68	1.92	0.0001309
66kV_Cable1	Cable	HNA6-AFA70	Bus93	0.00	0.01	0.01	0.0070134
66kV_Cable2	Cable	Bus92	HNA6-AFA70	0.01	0.01	0.01	0.0112215
66kV_Cable3	Cable	HKN57	Bus92	0.29	0.28	0.40	0.4921036
AC_UPS-F&G	Cable	SG-200N1	Bus63	1387.96	165.97	1397.85	0.0000008
AC_UPS-PAS	Cable	SG-200N1	Bus62	1387.96	165.97	1397.85	0.0000008
DB-L&SP-HV-MV	Cable	SG-200N1	Bus67	19789.85	313.54	19792.34	0.0000007
DB-L&SP-LV-	Cable	SG-200N1	Bus68	6089.19	96.47	6089.95	0.0000002
DB-L&SP-UPS-	Cable	SG-200N1	Bus69	14309.59	226.71	14311.38	0.0000005
DB-L&SP.Inst.	Cable	SG-200N1	Bus66	13700.67	217.06	13702.39	0.0000005
DB-L&SP_BoP	Cable	SG-200N1	Bus84	1521.78	82.99	1524.04	0.0000002
DC_Batt_Swgr	Cable	SG-200N1	Bus1	4922.18	269.71	4929.56	0.0000012
DC_UPS_Navaid	Cable	SG-200N1	Bus64	15222.96	241.18	15224.87	0.0000006

LOAD FLOW REPORT

Bus		Voltage		Generation		Load		Load Flow					XFMR
ID	kV	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	%PF	%Tap
Bus1	0.400	101.183	0.4	0.000	0.000	0.002	0.000	SG-200N1	-0.002	0.000	2.2	100.0	
Bus4	0.400	101.356	0.4	0.000	0.000	0.000	0.000	SG-200N1	0.507	0.279	823.7	87.6	
								Bus7	-0.507	-0.279	823.7	87.6	
Bus7	6.600	100.452	1.6	0.000	0.000	0.000	0.000	SG-100D1	-0.509	-0.293	51.1	86.6	
								Bus4	0.509	0.293	51.1	86.6	2.500
Bus62	0.400	101.043	0.4	0.000	0.000	0.013	0.010	SG-200N1	-0.013	-0.010	23.0	80.0	
Bus63	0.400	101.227	0.4	0.000	0.000	0.003	0.002	SG-200N1	-0.003	-0.002	4.8	80.0	
Bus64	0.400	100.700	0.4	0.000	0.000	0.003	0.000	SG-200N1	-0.003	0.000	4.5	100.0	
Bus66	0.400	101.216	0.4	0.000	0.000	0.000	0.000	SG-200N1	0.000	0.000	0.6	80.0	
Bus67	0.400	101.189	0.4	0.000	0.000	0.000	0.000	SG-200N1	0.000	0.000	0.6	80.0	
Bus68	0.400	101.249	0.4	0.000	0.000	0.000	0.000	SG-200N1	0.000	0.000	0.6	80.0	
Bus69	0.400	101.213	0.4	0.000	0.000	0.000	0.000	SG-200N1	0.000	0.000	0.6	80.0	
Bus84	0.400	101.162	0.4	0.000	0.000	0.006	0.003	SG-200N1	-0.006	-0.003	9.8	88.4	
Bus92	66.000	100.005	0.0	0.000	0.000	0.000	0.000	HNA6-AFA70	-1.963	0.358	17.5	-98.4	
								HKN57	1.963	-0.358	17.5	-98.4	
Bus93	66.000	100.006	0.0	0.000	0.000	0.000	0.000	HNA6-AFA70	1.963	-0.376	17.5	-98.2	
								Bus94	-1.963	0.376	17.5	-98.2	3.750
Bus94	6.900	96.095	1.5	0.000	0.000	0.000	0.000	SG-100D1	-1.966	0.322	173.5	-98.7	
								Bus93	1.966	-0.322	173.5	-98.7	
Bus96	6.600	100.516	1.6	1.000	0.000	0.000	0.000	SG-100D1	1.000	0.000	87.0	100.0	
Bus97	6.600	100.482	1.6	0.000	0.000	0.000	0.000	SG-100D1	0.476	-0.029	41.5	-99.8	
								Bus98	-0.476	0.029	41.5	-99.8	
Bus98	0.800	101.104	5.1	0.480	0.000	0.000	0.000	Bus97	0.480	0.000	342.6	100.0	
Bus99	6.600	100.534	1.6	1.000	0.000	0.000	0.000	SG-100D1	1.000	0.000	87.0	100.0	
* HKN57	66.000	100.000	0.0	-1.962	-0.134	0.000	0.000	Bus92	-1.962	-0.134	17.2	99.8	
HNA6-AFA70	66.000	100.005	0.0	0.000	0.000	0.000	0.000	Bus93	-1.963	0.369	17.5	-98.3	
								Bus92	1.963	-0.369	17.5	-98.3	
SG-100D1	6.600	100.473	1.5	0.000	0.000	0.000	0.000	Bus94	1.966	-0.322	173.5	-98.7	
								Bus7	0.509	0.293	51.1	86.7	
								Bus99	-0.999	0.000	87.0	100.0	
								Bus96	-1.000	0.000	87.0	100.0	

Bus		Voltage		Generation		Load		Load Flow					XFMR
ID	kV	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	%PF	%Tap
								Bus97	-0.476	0.029	41.5	-99.8	
SG-200N1	0.400	101.275	0.4	0.000	0.000	0.479	0.262	Bus4	-0.507	-0.278	823.7	87.6	
								Bus63	0.003	0.002	4.8	80.0	
								Bus62	0.013	0.010	23.0	80.1	
								Bus67	0.000	0.000	0.6	80.1	
								Bus68	0.000	0.000	0.6	80.0	
								Bus69	0.000	0.000	0.6	80.1	
								Bus66	0.000	0.000	0.6	80.1	
								Bus84	0.006	0.003	9.8	88.4	
								Bus1	0.002	0.000	2.2	100.0	
								Bus64	0.003	0.000	4.5	100.0	

* 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
Bus1	0.400		0.002								0.002	100.0	2.2	
Bus4	0.400										0.578	87.6	823.7	
Bus7	6.600										0.587	86.6	51.1	
Bus62	0.400		0.013	0.010							0.016	80.0	23.0	
Bus63	0.400		0.003	0.002							0.003	80.0	4.8	
Bus64	0.400		0.003								0.003	100.0	4.5	
Bus66	0.400		0.000	0.000							0.000	80.0	0.6	
Bus67	0.400		0.000	0.000							0.000	80.0	0.6	
Bus68	0.400		0.000	0.000							0.000	80.0	0.6	
Bus69	0.400		0.000	0.000							0.000	80.0	0.6	
Bus84	0.400		0.006	0.003							0.007	88.4	9.8	
Bus92	66.000										1.995	98.4	17.5	
Bus93	66.000										1.998	98.2	17.5	
Bus94	6.900										1.992	98.7	173.5	
Bus96	6.600										1.000	100.0	87.0	
Bus97	6.600										0.477	99.8	41.5	
Bus98	0.800										0.480	100.0	342.6	
Bus99	6.600										1.000	100.0	87.0	
HKN57	66.000	1250.0									1.967	99.8	17.2	1.4
HNA6-AFA70	66.000	1250.0									1.997	98.3	17.5	1.4
SG-100D1	6.600	630.0									2.496	99.2	217.3	34.5
SG-200N1	0.400	2500.0	0.005	0.003	0.474	0.260					0.578	87.6	823.7	32.9

* 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		Busway / Cable & Reactor			Transformer				
		Ampacity	Loading		Capability	Loading (input)		Loading (output)	
ID	Type	(Amp)	Amp	%	(MVA)	MVA	%	MVA	%
0.4kV_cable	Cable	2764.80	823.73	29.79					
6.6kV_Cable1	Cable	691.60	173.47	25.08					
6.6kV_Cable2	Cable	246.80	51.14	20.72					
6.6kV_Cable3	Cable	246.80	87.01	35.26					
6.6kV_Cable5	Cable	246.80	87.03	35.26					
6.6kV_Cable6	Cable	246.80	41.53	16.83					
66kV_Cable1	Cable	613.00	17.48	2.85					
66kV_Cable2	Cable	613.00	17.47	2.85					
66kV_Cable3	Cable	459.20	17.45	3.80					
AC_UPS-F&G	Cable	136.89	4.83	3.53					
AC_UPS-PAS	Cable	136.89	23.03	16.82					
DB-L&SP-HV-MV	Cable	37.25	0.64	1.73					
DB-L&SP-LV-	Cable	37.25	0.64	1.72					
DB-L&SP-UPS-	Cable	37.25	0.64	1.72					
DB-L&SP.Inst.	Cable	37.25	0.64	1.72					
DB-L&SP_BoP	Cable	89.40	9.81	10.98					
DC_Batt_Swgr	Cable	89.40	2.24	2.50					
DC_UPS_Navaid	Cable	37.25	4.53	12.16					
TR-100AD1	Transformer				7.000	1.998	28.5	1.992	28.5
TR-200DE1	Transformer				1.600	0.587	36.7	0.578	36.2
TR-200ED1	Transformer				0.500	0.480	96.0	0.477	95.4

* 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 in Vmag
	MW	Mvar	MW	Mvar	kW	kvar	From	To	
0.4kV_cable	0.507	0.279	-0.507	-0.278	0.3	0.4	101.4	101.3	0.08
6.6kV_Cable1	-1.966	0.322	1.966	-0.322	0.2	-0.2	96.1	100.5	0.01
6.6kV_Cable2	-0.509	-0.293	0.509	0.293	0.1	-0.2	100.5	100.5	0.02
6.6kV_Cable3	1.000	0.000	-0.999	0.000	0.6	-0.1	100.5	100.5	0.06
6.6kV_Cable5	1.000	0.000	-1.000	0.000	0.4	-0.1	100.5	100.5	0.04
6.6kV_Cable6	0.476	-0.029	-0.476	0.029	0.0	-0.1	100.5	100.5	0.01
66kV_Cable1	1.963	-0.376	-1.963	0.369	0.0	-7.0	100.0	100.0	0.00
66kV_Cable2	-1.963	0.358	1.963	-0.369	0.0	-11.2	100.0	100.0	0.00
66kV_Cable3	1.963	-0.358	-1.962	-0.134	0.1	-492.0	100.0	100.0	0.01
AC_UPS-F&G	-0.003	-0.002	0.003	0.002	0.0	0.0	101.2	101.3	0.05
AC_UPS-PAS	-0.013	-0.010	0.013	0.010	0.0	0.0	101.0	101.3	0.23
DB-L&SP.Inst.	0.000	0.000	0.000	0.000	0.0	0.0	101.2	101.3	0.06
DB-L&SP_BoP	-0.006	-0.003	0.006	0.003	0.0	0.0	101.2	101.3	0.11
DB-L&SP-HV-MV	0.000	0.000	0.000	0.000	0.0	0.0	101.2	101.3	0.09
DB-L&SP-LV-	0.000	0.000	0.000	0.000	0.0	0.0	101.2	101.3	0.03
DB-L&SP-UPS-	0.000	0.000	0.000	0.000	0.0	0.0	101.2	101.3	0.06
DC_Batt_Swgr	-0.002	0.000	0.002	0.000	0.0	0.0	101.2	101.3	0.09
DC_UPS_Navaid	-0.003	0.000	0.003	0.000	0.0	0.0	100.7	101.3	0.58
TR-100AD1	-1.963	0.376	1.966	-0.322	3.4	53.9	100.0	96.1	3.91
TR-200DE1	-0.507	-0.279	0.509	0.293	1.9	14.7	101.4	100.5	3.92
TR-200ED1	-0.476	0.029	0.480	0.000	3.9	29.5	100.5	101.1	0.62
					11.0	-412.5			

* 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	

Marginal Report

Device ID	Type	Condition	Rating/Limit	Unit	Operating	% Operating	Phase Type
Bus94	Bus	Under Voltage	6.900	kV	6.631	96.1	3-Phase
TR-200ED1	Transformer	Overload	0.500	MVA	0.480	96.0	3-Phase

SUMMARY OF TOTAL GENERATION , LOADING & DEMAND

	MW	Mvar	MVA	% PF
Source (Swing Buses):	-1.962	-0.134	1.967	99.77 Lagging
Source (Non-Swing Buses):	2.480	0.000	2.480	100.00 Lagging
Total Demand:	0.518	-0.134	0.535	96.80 Leading
Total Motor Load:	0.033	0.019	0.037	86.86 Lagging
Total Static Load:	0.474	0.260	0.540	87.70 Lagging
Total Constant I Load:	0.000	0.000	0.000	
Total Generic Load:	0.000	0.000	0.000	
Apparent Losses:	0.011	-0.412		
System Mismatch:	0.000	0.000		

Number of Iterations: 3

Attachment 10 Etap Report LF Case 3

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Electrical Transient Analyzer Program

Load Flow Analysis

Loading Category (4): CCS_Mode3_Hot_Standby

Generation Category (4): CCS_Mode3_Hot_Standby

Load Diversity Factor: None

	Swing	V-Control	Load	Total
Number of Buses:	1	0	17	18

	XFMR2	XFMR3	Reactor	Line/Cable/ Busway	Impedance	Tie PD	Total
Number of Branches:	2	0	0	15	0	0	17

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:	BLPH-LV-SCstudy
Output Filename:	C:\Users\Stefano Puddu\Desktop\0396S_Crosswind\ETAP_15-Mar-2024\LFCASE3.lfr

Adjustments

Tolerance	Apply Adjustments	Individual /Global	Percent
Transformer Impedance:	Yes	Global	10.0
Reactor Impedance:	No		
Overload Heater Resistance:	No		
Transmission Line Length:	No		
Cable / Busway Length:	No		

Temperature Correction	Apply Adjustments	Individual /Global	Degree C
Transmission Line Resistance:	Yes	Global	90
Cable / Busway Resistance:	Yes	Global	90

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
Bus1	0.400	2	101.6	0.7	0.002	0.000						
Bus4	0.400	2	101.8	0.8								
Bus7	6.600	2	100.8	1.9								
Bus62	0.400	2	101.4	0.8	0.013	0.010						
Bus63	0.400	2	101.6	0.8	0.003	0.002						
Bus64	0.400	2	101.1	0.7	0.003	0.000						
Bus66	0.400	2	101.6	0.8								
Bus67	0.400	2	101.6	0.8								
Bus68	0.400	2	101.6	0.8								
Bus69	0.400	2	101.6	0.8								
Bus84	0.400	2	101.6	0.8	0.006	0.003						
Bus92	66.000	2	100.0	0.0								
Bus93	66.000	2	100.0	0.0								
Bus94	6.900	2	96.5	1.9								
HKN57	66.000	2	100.0	0.0								
HNA6-AFA70	66.000	2	100.0	0.0								
SG-100D1	6.600	2	100.9	1.9								
SG-200N1	0.400	2	101.7	0.7	0.005	0.003	0.542	0.297				
Total Number of Buses: 18					0.033	0.019	0.542	0.297	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
HKN57	66.000	Swing	2	100.0	0.0					
						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			Length						
ID	Library	Size	Adj. (m)	% Tol.	#/Phase	T (°C)	R	X	Y
0.4kV_cable	1.0NCUN1	300	10.0	0.0	5	90	0.080000	0.089000	0.0001854
6.6kV_Cable1	6.6NCUN1	120	25.0	0.0	2	90	0.196000	0.113000	0.0001400
6.6kV_Cable2	6.6NCUN1	70	44.0	0.0	1	90	0.342000	0.130000	0.0001100
66kV_Cable1	66NALS1	300	25.0	0.0	1	90	0.078100	0.120000	0.0000644
66kV_Cable2	66NALS1	300	40.0	0.0	1	90	0.078100	0.120000	0.0000644
66kV_Cable3	66NALS1	400	1240.0	0.0	1	90	0.101800	0.098700	0.0000911
AC_UPS-F&G	1.0MCUN4	35	40.0	0.0	1	90	0.669000	0.080000	0.0001015
AC_UPS-PAS	1.0MCUN4	35	40.0	0.0	1	90	0.669000	0.080000	0.0001015
DB-L&SP-HV-MV	1.0MCUN4	4.0	65.0	0.0	1	90	5.870000	0.093000	0.0000575
DB-L&SP-LV-	1.0MCUN4	4.0	20.0	0.0	1	90	5.870000	0.093000	0.0000575
DB-L&SP-UPS-	1.0MCUN4	4.0	47.0	0.0	1	90	5.870000	0.093000	0.0000575
DB-L&SP.Inst.	1.0MCUN4	4.0	45.0	0.0	1	90	5.870000	0.093000	0.0000575
DB-L&SP_BoP	1.0NCUN4	16	20.0	0.0	1	90	1.467000	0.080000	0.0000597
DC_Batt_Swgr	1.0MCUN4	16	65.0	0.0	1	90	1.460000	0.080000	0.0000971
DC_UPS_Navaid	1.0MCUN4	4.0	50.0	0.0	1	90	5.870000	0.093000	0.0000575

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
TR-100AD1	3-Phase	7.000	66.000	6.900	8.00	16.06	0	0	10.0	0	0	8.8000	Dyn	0.000
TR-200DE1	3-Phase	1.600	6.600	0.420	6.00	7.94	0	0	10.0	2.500	0	6.6000	Dyn	0.000

2-Winding Transformer Load Tap Changer (LTC) Settings

Transformer	Connected Buses ("*" LTC Side)		Transformer Load Tap Changer Setting					
			% Min.	% Max.				
ID	Primary Bus ID	Secondary Bus ID	Tap	Tap	% Step	Regulated Bus ID	% V	kV
TR-100AD1	* Bus93	Bus94	-10.00	10.00	1.250	SG-100D1	100.00	6.600

Branch Connections

CKT/Branch		Connected Bus ID		% Impedance, Pos. Seq., 100 MVA Base			
ID	Type	From Bus	To Bus	R	X	Z	Y
TR-100AD1	2W XFMR	Bus93	Bus94	8.20	131.74	132.00	
TR-200DE1	2W XFMR	Bus7	Bus4	48.34	383.81	386.85	
0.4kV_cable	Cable	Bus4	SG-200N1	8.30	9.23	12.41	0.0000018
6.6kV_Cable1	Cable	Bus94	SG-100D1	0.51	0.30	0.59	0.0003333
6.6kV_Cable2	Cable	SG-100D1	Bus7	3.16	1.20	3.38	0.0002304
66kV_Cable1	Cable	HNA6-AFA70	Bus93	0.00	0.01	0.01	0.0070134
66kV_Cable2	Cable	Bus92	HNA6-AFA70	0.01	0.01	0.01	0.0112215
66kV_Cable3	Cable	HKN57	Bus92	0.29	0.28	0.40	0.4921036
AC_UPS-F&G	Cable	SG-200N1	Bus63	1387.96	165.97	1397.85	0.0000008
AC_UPS-PAS	Cable	SG-200N1	Bus62	1387.96	165.97	1397.85	0.0000008
DB-L&SP-HV-MV	Cable	SG-200N1	Bus67	19789.85	313.54	19792.34	0.0000007
DB-L&SP-LV-	Cable	SG-200N1	Bus68	6089.19	96.47	6089.95	0.0000002
DB-L&SP-UPS-	Cable	SG-200N1	Bus69	14309.59	226.71	14311.38	0.0000005
DB-L&SP.Inst.	Cable	SG-200N1	Bus66	13700.67	217.06	13702.39	0.0000005
DB-L&SP_BoP	Cable	SG-200N1	Bus84	1521.78	82.99	1524.04	0.0000002
DC_Batt_Swgr	Cable	SG-200N1	Bus1	4922.18	269.71	4929.56	0.0000012
DC_UPS_Navaid	Cable	SG-200N1	Bus64	15222.96	241.18	15224.87	0.0000006

LOAD FLOW REPORT

Bus		Voltage		Generation		Load		Load Flow					XFMR
ID	kV	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	%PF	%Tap
Bus1	0.400	100.679	-1.8	0.000	0.000	0.002	0.000	SG-200N1	-0.002	0.000	2.3	100.0	
Bus4	0.400	100.865	-1.8	0.000	0.000	0.000	0.000	SG-200N1	0.585	0.321	954.8	87.6	
								Bus7	-0.585	-0.321	954.8	87.6	
Bus7	6.600	100.217	-0.4	0.000	0.000	0.000	0.000	SG-100D1	-0.587	-0.341	59.3	86.5	
								Bus4	0.587	0.341	59.3	86.5	2.500
Bus62	0.400	100.538	-1.7	0.000	0.000	0.013	0.010	SG-200N1	-0.013	-0.010	23.1	80.0	
Bus63	0.400	100.723	-1.8	0.000	0.000	0.003	0.002	SG-200N1	-0.003	-0.002	4.9	80.0	
Bus64	0.400	100.193	-1.8	0.000	0.000	0.003	0.000	SG-200N1	-0.003	0.000	4.6	100.0	
Bus66	0.400	100.712	-1.8	0.000	0.000	0.000	0.000	SG-200N1	0.000	0.000	0.6	80.0	
Bus67	0.400	100.685	-1.8	0.000	0.000	0.000	0.000	SG-200N1	0.000	0.000	0.6	80.0	
Bus68	0.400	100.745	-1.8	0.000	0.000	0.000	0.000	SG-200N1	0.000	0.000	0.6	80.0	
Bus69	0.400	100.709	-1.8	0.000	0.000	0.000	0.000	SG-200N1	0.000	0.000	0.6	80.0	
Bus84	0.400	100.658	-1.8	0.000	0.000	0.006	0.003	SG-200N1	-0.006	-0.003	9.9	88.4	
Bus92	66.000	99.998	0.0	0.000	0.000	0.000	0.000	HNA6-AFA70	0.588	0.329	5.9	87.3	
								HKN57	-0.588	-0.329	5.9	87.3	
Bus93	66.000	99.998	0.0	0.000	0.000	0.000	0.000	HNA6-AFA70	-0.588	-0.347	6.0	86.1	
								Bus94	0.588	0.347	6.0	86.1	3.750
Bus94	6.900	95.887	-0.4	0.000	0.000	0.000	0.000	SG-100D1	0.587	0.341	59.3	86.5	
								Bus93	-0.587	-0.341	59.3	86.5	
* HKN57	66.000	100.000	0.0	0.588	-0.163	0.000	0.000	Bus92	0.588	-0.163	5.3	-96.3	
HNA6-AFA70	66.000	99.998	0.0	0.000	0.000	0.000	0.000	Bus93	0.588	0.340	5.9	86.6	
								Bus92	-0.588	-0.340	5.9	86.6	
SG-100D1	6.600	100.241	-0.4	0.000	0.000	0.000	0.000	Bus94	-0.587	-0.341	59.3	86.5	
								Bus7	0.587	0.341	59.3	86.5	
SG-200N1	0.400	100.772	-1.8	0.000	0.000	0.556	0.305	Bus4	-0.584	-0.321	954.8	87.7	
								Bus63	0.003	0.002	4.9	80.0	
								Bus62	0.013	0.010	23.1	80.1	
								Bus67	0.000	0.000	0.6	80.1	
								Bus68	0.000	0.000	0.6	80.0	
								Bus69	0.000	0.000	0.6	80.1	
								Bus66	0.000	0.000	0.6	80.1	

Bus		Voltage		Generation		Load		Load Flow					XFMR
ID	kV	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	%PF	%Tap
								Bus84	0.006	0.003	9.9	88.4	
								Bus1	0.002	0.000	2.3	100.0	
								Bus64	0.003	0.000	4.6	100.0	

* 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
Bus1	0.400		0.002								0.002	100.0	2.3	
Bus4	0.400										0.667	87.6	954.8	
Bus7	6.600										0.679	86.5	59.3	
Bus62	0.400		0.013	0.010							0.016	80.0	23.1	
Bus63	0.400		0.003	0.002							0.003	80.0	4.9	
Bus64	0.400		0.003								0.003	100.0	4.6	
Bus66	0.400		0.000	0.000							0.000	80.0	0.6	
Bus67	0.400		0.000	0.000							0.000	80.0	0.6	
Bus68	0.400		0.000	0.000							0.000	80.0	0.6	
Bus69	0.400		0.000	0.000							0.000	80.0	0.6	
Bus84	0.400		0.006	0.003							0.007	88.4	9.9	
Bus92	66.000										0.673	87.3	5.9	
Bus93	66.000										0.683	86.1	6.0	
Bus94	6.900										0.679	86.5	59.3	
HKN57	66.000	1250.0									0.610	96.3	5.3	0.4
HNA6-AFA70	66.000	1250.0									0.679	86.6	5.9	0.5
SG-100D1	6.600	630.0									0.679	86.5	59.3	9.4
SG-200N1	0.400	2500.0	0.005	0.003	0.551	0.302					0.667	87.7	954.8	38.2

* 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				
		Ampacity (Amp)	Loading Amp		Capability (MVA)	Loading (input)		Loading (output)	
ID	Type			%		MVA	%	MVA	%
0.4kV_cable	Cable	2764.80	954.75	34.53					
6.6kV_Cable1	Cable	691.60	59.27	8.57					
6.6kV_Cable2	Cable	246.80	59.27	24.02					
66kV_Cable1	Cable	613.00	5.97	0.97					
66kV_Cable2	Cable	613.00	5.94	0.97					
66kV_Cable3	Cable	459.20	5.89	1.28					
AC_UPS-F&G	Cable	136.89	4.85	3.55					
AC_UPS-PAS	Cable	136.89	23.14	16.91					
DB-L&SP-HV-MV	Cable	37.25	0.65	1.73					
DB-L&SP-LV-	Cable	37.25	0.65	1.73					
DB-L&SP-UPS-	Cable	37.25	0.65	1.73					
DB-L&SP.Inst.	Cable	37.25	0.65	1.73					
DB-L&SP_BoP	Cable	89.40	9.86	11.03					
DC_Batt_Swgr	Cable	89.40	2.25	2.52					
DC_UPS_Navaid	Cable	37.25	4.55	12.22					
TR-100AD1	Transformer				7.000	0.683	9.8	0.679	9.7
TR-200DE1	Transformer				1.600	0.679	42.4	0.667	41.7

* 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 in Vmag
	MW	Mvar	MW	Mvar	kW	kvar	From	To	
0.4kV_cable	0.585	0.321	-0.584	-0.321	0.4	0.5	100.9	100.8	0.09
6.6kV_Cable1	0.587	0.341	-0.587	-0.341	0.0	-0.3	95.9	100.2	0.00
6.6kV_Cable2	-0.587	-0.341	0.587	0.341	0.2	-0.2	100.2	100.2	0.02
66kV_Cable1	-0.588	-0.347	0.588	0.340	0.0	-7.0	100.0	100.0	0.00
66kV_Cable2	0.588	0.329	-0.588	-0.340	0.0	-11.2	100.0	100.0	0.00
66kV_Cable3	-0.588	-0.329	0.588	-0.163	0.0	-492.1	100.0	100.0	0.00
AC_UPS-F&G	-0.003	-0.002	0.003	0.002	0.0	0.0	100.7	100.8	0.05
AC_UPS-PAS	-0.013	-0.010	0.013	0.010	0.0	0.0	100.5	100.8	0.23
DB-L&SP.Inst.	0.000	0.000	0.000	0.000	0.0	0.0	100.7	100.8	0.06
DB-L&SP_BoP	-0.006	-0.003	0.006	0.003	0.0	0.0	100.7	100.8	0.11
DB-L&SP-HV-MV	0.000	0.000	0.000	0.000	0.0	0.0	100.7	100.8	0.09
DB-L&SP-LV-	0.000	0.000	0.000	0.000	0.0	0.0	100.7	100.8	0.03
DB-L&SP-UPS-	0.000	0.000	0.000	0.000	0.0	0.0	100.7	100.8	0.06
DC_Batt_Swgr	-0.002	0.000	0.002	0.000	0.0	0.0	100.7	100.8	0.09
DC_UPS_Navaid	-0.003	0.000	0.003	0.000	0.0	0.0	100.2	100.8	0.58
TR-100AD1	0.588	0.347	-0.587	-0.341	0.4	6.3	100.0	95.9	4.11
TR-200DE1	-0.585	-0.321	0.587	0.341	2.5	19.7	100.9	100.2	4.15
					3.6	-484.2			

* 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	

Marginal Report

Device ID	Type	Condition	Rating/Limit	Unit	Operating	% Operating	Phase Type
Bus94	Bus	Under Voltage	6.900	kV	6.616	95.9	3-Phase

SUMMARY OF TOTAL GENERATION , LOADING & DEMAND

	MW	Mvar	MVA	% PF
Source (Swing Buses):	0.588	-0.163	0.610	96.35 Leading
Source (Non-Swing Buses):	0.000	0.000	0.000	
Total Demand:	0.588	-0.163	0.610	96.35 Leading
Total Motor Load:	0.033	0.019	0.038	86.88 Lagging
Total Static Load:	0.551	0.302	0.628	87.70 Lagging
Total Constant I Load:	0.000	0.000	0.000	
Total Generic Load:	0.000	0.000	0.000	
Apparent Losses:	0.004	-0.484		
System Mismatch:	0.000	0.000		

Number of Iterations: 3

Attachment 11 Etap Report LF Case 4

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Electrical Transient Analyzer Program

Load Flow Analysis

Loading Category (3): CCS_Mode4_Cold_Standby

Generation Category (3): CCS_Mode4_Cold_Standby

Load Diversity Factor: None

	Swing	V-Control	Load	Total
Number of Buses:	1	0	17	18

	XFMR2	XFMR3	Reactor	Line/Cable/ Busway	Impedance	Tie PD	Total
Number of Branches:	2	0	0	15	0	0	17

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:	BLPH-LV-SCstudy
Output Filename:	C:\Users\Stefano Puddu\Desktop\0396S_Crosswind\ETAP_15-Mar-2024\LFCASE4.lfr

Adjustments

Tolerance	Apply Adjustments	Individual /Global	Percent
Transformer Impedance:	Yes	Global	10.0
Reactor Impedance:	No		
Overload Heater Resistance:	No		
Transmission Line Length:	No		
Cable / Busway Length:	No		

Temperature Correction	Apply Adjustments	Individual /Global	Degree C
Transmission Line Resistance:	Yes	Global	90
Cable / Busway Resistance:	Yes	Global	90

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
Bus1	0.400	2	100.7	-1.8	0.002	0.000						
Bus4	0.400	2	100.9	-1.8								
Bus7	6.600	2	100.2	-0.4								
Bus62	0.400	2	100.5	-1.7	0.013	0.010						
Bus63	0.400	2	100.7	-1.8	0.003	0.002						
Bus64	0.400	2	100.2	-1.8	0.003	0.000						
Bus66	0.400	2	100.7	-1.8								
Bus67	0.400	2	100.7	-1.8								
Bus68	0.400	2	100.7	-1.8								
Bus69	0.400	2	100.7	-1.8								
Bus84	0.400	2	100.7	-1.8	0.006	0.003						
Bus92	66.000	2	100.0	0.0								
Bus93	66.000	2	100.0	0.0								
Bus94	6.900	2	95.9	-0.4								
HKN57	66.000	2	100.0	0.0								
HNA6-AFA70	66.000	2	100.0	0.0								
SG-100D1	6.600	2	100.2	-0.4								
SG-200N1	0.400	2	100.8	-1.8	0.005	0.003	0.519	0.285				
Total Number of Buses: 18					0.033	0.019	0.519	0.285	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
HKN57	66.000	Swing	2	100.0	0.0					
						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)	% Tol.	#/Phase	T (°C)	R	X	Y
0.4kV_cable	1.0NCUN1	300	10.0	0.0	5	90	0.080000	0.089000	0.0001854
6.6kV_Cable1	6.6NCUN1	120	25.0	0.0	2	90	0.196000	0.113000	0.0001400
6.6kV_Cable2	6.6NCUN1	70	44.0	0.0	1	90	0.342000	0.130000	0.0001100
66kV_Cable1	66NALS1	300	25.0	0.0	1	90	0.078100	0.120000	0.0000644
66kV_Cable2	66NALS1	300	40.0	0.0	1	90	0.078100	0.120000	0.0000644
66kV_Cable3	66NALS1	400	1240.0	0.0	1	90	0.101800	0.098700	0.0000911
AC_UPS-F&G	1.0MCUN4	35	40.0	0.0	1	90	0.669000	0.080000	0.0001015
AC_UPS-PAS	1.0MCUN4	35	40.0	0.0	1	90	0.669000	0.080000	0.0001015
DB-L&SP-HV-MV	1.0MCUN4	4.0	65.0	0.0	1	90	5.870000	0.093000	0.0000575
DB-L&SP-LV-	1.0MCUN4	4.0	20.0	0.0	1	90	5.870000	0.093000	0.0000575
DB-L&SP-UPS-	1.0MCUN4	4.0	47.0	0.0	1	90	5.870000	0.093000	0.0000575
DB-L&SP.Inst.	1.0MCUN4	4.0	45.0	0.0	1	90	5.870000	0.093000	0.0000575
DB-L&SP_BoP	1.0NCUN4	16	20.0	0.0	1	90	1.467000	0.080000	0.0000597
DC_Batt_Swgr	1.0MCUN4	16	65.0	0.0	1	90	1.460000	0.080000	0.0000971
DC_UPS_Navaid	1.0MCUN4	4.0	50.0	0.0	1	90	5.870000	0.093000	0.0000575

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
TR-100AD1	3-Phase	7.000	66.000	6.900	8.00	16.06	0	0	10.0	0	0	8.8000	Dyn	0.000
TR-200DE1	3-Phase	1.600	6.600	0.420	6.00	7.94	0	0	10.0	2.500	0	6.6000	Dyn	0.000

2-Winding Transformer Load Tap Changer (LTC) Settings

Transformer	Connected Buses ("*" LTC Side)		Transformer Load Tap Changer Setting					
ID	Primary Bus ID	Secondary Bus ID	% Min. Tap	% Max. Tap	% Step	Regulated Bus ID	% V	kV
TR-100AD1	* Bus93	Bus94	-10.00	10.00	1.250	SG-100D1	100.00	6.600

Branch Connections

CKT/Branch		Connected Bus ID		% Impedance, Pos. Seq., 100 MVA Base			
ID	Type	From Bus	To Bus	R	X	Z	Y
TR-100AD1	2W XFMR	Bus93	Bus94	8.11	130.18	130.43	
TR-200DE1	2W XFMR	Bus7	Bus4	48.34	383.81	386.85	
0.4kV_cable	Cable	Bus4	SG-200N1	8.30	9.23	12.41	0.0000018
6.6kV_Cable1	Cable	Bus94	SG-100D1	0.51	0.30	0.59	0.0003333
6.6kV_Cable2	Cable	SG-100D1	Bus7	3.16	1.20	3.38	0.0002304
66kV_Cable1	Cable	HNA6-AFA70	Bus93	0.00	0.01	0.01	0.0070134
66kV_Cable2	Cable	Bus92	HNA6-AFA70	0.01	0.01	0.01	0.0112215
66kV_Cable3	Cable	HKN57	Bus92	0.29	0.28	0.40	0.4921036
AC_UPS-F&G	Cable	SG-200N1	Bus63	1387.96	165.97	1397.85	0.0000008
AC_UPS-PAS	Cable	SG-200N1	Bus62	1387.96	165.97	1397.85	0.0000008
DB-L&SP-HV-MV	Cable	SG-200N1	Bus67	19789.85	313.54	19792.34	0.0000007
DB-L&SP-LV-	Cable	SG-200N1	Bus68	6089.19	96.47	6089.95	0.0000002
DB-L&SP-UPS-	Cable	SG-200N1	Bus69	14309.59	226.71	14311.38	0.0000005
DB-L&SP.Inst.	Cable	SG-200N1	Bus66	13700.67	217.06	13702.39	0.0000005
DB-L&SP_BoP	Cable	SG-200N1	Bus84	1521.78	82.99	1524.04	0.0000002
DC_Batt_Swgr	Cable	SG-200N1	Bus1	4922.18	269.71	4929.56	0.0000012
DC_UPS_Navaid	Cable	SG-200N1	Bus64	15222.96	241.18	15224.87	0.0000006

LOAD FLOW REPORT

Bus		Voltage		Generation		Load		Load Flow					XFMR
ID	kV	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	%PF	%Tap
Bus1	0.400	100.778	-1.7	0.000	0.000	0.002	0.000	SG-200N1	-0.002	0.000	2.2	100.0	
Bus4	0.400	100.960	-1.7	0.000	0.000	0.000	0.000	SG-200N1	0.562	0.309	917.0	87.6	
								Bus7	-0.562	-0.309	917.0	87.6	
Bus7	6.600	100.239	-0.4	0.000	0.000	0.000	0.000	SG-100D1	-0.564	-0.327	56.9	86.5	
								Bus4	0.564	0.327	56.9	86.5	2.500
Bus62	0.400	100.637	-1.7	0.000	0.000	0.013	0.010	SG-200N1	-0.013	-0.010	23.1	80.0	
Bus63	0.400	100.822	-1.7	0.000	0.000	0.003	0.002	SG-200N1	-0.003	-0.002	4.8	80.0	
Bus64	0.400	100.293	-1.7	0.000	0.000	0.003	0.000	SG-200N1	-0.003	0.000	4.5	100.0	
Bus66	0.400	100.811	-1.7	0.000	0.000	0.000	0.000	SG-200N1	0.000	0.000	0.6	80.0	
Bus67	0.400	100.784	-1.7	0.000	0.000	0.000	0.000	SG-200N1	0.000	0.000	0.6	80.0	
Bus68	0.400	100.844	-1.7	0.000	0.000	0.000	0.000	SG-200N1	0.000	0.000	0.6	80.0	
Bus69	0.400	100.808	-1.7	0.000	0.000	0.000	0.000	SG-200N1	0.000	0.000	0.6	80.0	
Bus84	0.400	100.757	-1.7	0.000	0.000	0.006	0.003	SG-200N1	-0.006	-0.003	9.9	88.4	
Bus92	66.000	99.998	0.0	0.000	0.000	0.000	0.000	HNA6-AFA70	0.565	0.314	5.7	87.4	
								HKN57	-0.565	-0.314	5.7	87.4	
Bus93	66.000	99.998	0.0	0.000	0.000	0.000	0.000	HNA6-AFA70	-0.565	-0.332	5.7	86.2	
								Bus94	0.565	0.332	5.7	86.2	3.750
Bus94	6.900	95.908	-0.4	0.000	0.000	0.000	0.000	SG-100D1	0.565	0.327	56.9	86.6	
								Bus93	-0.565	-0.327	56.9	86.6	
* HKN57	66.000	100.000	0.0	0.565	-0.178	0.000	0.000	Bus92	0.565	-0.178	5.2	-95.4	
HNA6-AFA70	66.000	99.998	0.0	0.000	0.000	0.000	0.000	Bus93	0.565	0.325	5.7	86.7	
								Bus92	-0.565	-0.325	5.7	86.7	
SG-100D1	6.600	100.263	-0.4	0.000	0.000	0.000	0.000	Bus94	-0.565	-0.327	56.9	86.5	
								Bus7	0.565	0.327	56.9	86.5	
SG-200N1	0.400	100.871	-1.7	0.000	0.000	0.534	0.292	Bus4	-0.562	-0.308	917.0	87.7	
								Bus63	0.003	0.002	4.8	80.0	
								Bus62	0.013	0.010	23.1	80.1	
								Bus67	0.000	0.000	0.6	80.1	
								Bus68	0.000	0.000	0.6	80.0	
								Bus69	0.000	0.000	0.6	80.1	
								Bus66	0.000	0.000	0.6	80.1	

Bus		Voltage		Generation		Load		Load Flow					XFMR
ID	kV	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	%PF	%Tap
								Bus84	0.006	0.003	9.9	88.4	
								Bus1	0.002	0.000	2.2	100.0	
								Bus64	0.003	0.000	4.5	100.0	

* 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
Bus1	0.400		0.002								0.002	100.0	2.2	
Bus4	0.400										0.641	87.6	917.0	
Bus7	6.600										0.652	86.5	56.9	
Bus62	0.400		0.013	0.010							0.016	80.0	23.1	
Bus63	0.400		0.003	0.002							0.003	80.0	4.8	
Bus64	0.400		0.003								0.003	100.0	4.5	
Bus66	0.400		0.000	0.000							0.000	80.0	0.6	
Bus67	0.400		0.000	0.000							0.000	80.0	0.6	
Bus68	0.400		0.000	0.000							0.000	80.0	0.6	
Bus69	0.400		0.000	0.000							0.000	80.0	0.6	
Bus84	0.400		0.006	0.003							0.007	88.4	9.9	
Bus92	66.000										0.646	87.4	5.7	
Bus93	66.000										0.656	86.2	5.7	
Bus94	6.900										0.652	86.6	56.9	
HKN57	66.000	1250.0									0.592	95.4	5.2	0.4
HNA6-AFA70	66.000	1250.0									0.652	86.7	5.7	0.5
SG-100D1	6.600	630.0									0.652	86.5	56.9	9.0
SG-200N1	0.400	2500.0	0.005	0.003	0.529	0.290					0.641	87.7	917.0	36.7

* 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				
		Ampacity	Loading		Capability	Loading (input)		Loading (output)	
ID	Type	(Amp)	Amp	%	(MVA)	MVA	%	MVA	%
0.4kV_cable	Cable	2764.80	916.97	33.17					
6.6kV_Cable1	Cable	691.60	56.92	8.23					
6.6kV_Cable2	Cable	246.80	56.93	23.07					
66kV_Cable1	Cable	613.00	5.73	0.94					
66kV_Cable2	Cable	613.00	5.70	0.93					
66kV_Cable3	Cable	459.20	5.66	1.23					
AC_UPS-F&G	Cable	136.89	4.85	3.54					
AC_UPS-PAS	Cable	136.89	23.12	16.89					
DB-L&SP-HV-MV	Cable	37.25	0.65	1.73					
DB-L&SP-LV-	Cable	37.25	0.64	1.73					
DB-L&SP-UPS-	Cable	37.25	0.65	1.73					
DB-L&SP.Inst.	Cable	37.25	0.64	1.73					
DB-L&SP_BoP	Cable	89.40	9.85	11.02					
DC_Batt_Swgr	Cable	89.40	2.25	2.51					
DC_UPS_Navaid	Cable	37.25	4.55	12.21					
TR-100AD1	Transformer				7.000	0.656	9.4	0.652	9.3
TR-200DE1	Transformer				1.600	0.652	40.8	0.641	40.1

* 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 in Vmag
	MW	Mvar	MW	Mvar	kW	kvar	From	To	
0.4kV_cable	0.562	0.309	-0.562	-0.308	0.4	0.4	101.0	100.9	0.09
6.6kV_Cable1	0.565	0.327	-0.565	-0.327	0.0	-0.3	95.9	100.3	0.00
6.6kV_Cable2	-0.564	-0.327	0.565	0.327	0.1	-0.2	100.2	100.3	0.02
66kV_Cable1	-0.565	-0.332	0.565	0.325	0.0	-7.0	100.0	100.0	0.00
66kV_Cable2	0.565	0.314	-0.565	-0.325	0.0	-11.2	100.0	100.0	0.00
66kV_Cable3	-0.565	-0.314	0.565	-0.178	0.0	-492.1	100.0	100.0	0.00
AC_UPS-F&G	-0.003	-0.002	0.003	0.002	0.0	0.0	100.8	100.9	0.05
AC_UPS-PAS	-0.013	-0.010	0.013	0.010	0.0	0.0	100.6	100.9	0.23
DB-L&SP.Inst.	0.000	0.000	0.000	0.000	0.0	0.0	100.8	100.9	0.06
DB-L&SP_BoP	-0.006	-0.003	0.006	0.003	0.0	0.0	100.8	100.9	0.11
DB-L&SP-HV-MV	0.000	0.000	0.000	0.000	0.0	0.0	100.8	100.9	0.09
DB-L&SP-LV-	0.000	0.000	0.000	0.000	0.0	0.0	100.8	100.9	0.03
DB-L&SP-UPS-	0.000	0.000	0.000	0.000	0.0	0.0	100.8	100.9	0.06
DC_Batt_Swgr	-0.002	0.000	0.002	0.000	0.0	0.0	100.8	100.9	0.09
DC_UPS_Navaid	-0.003	0.000	0.003	0.000	0.0	0.0	100.3	100.9	0.58
TR-100AD1	0.565	0.332	-0.565	-0.327	0.4	5.8	100.0	95.9	4.09
TR-200DE1	-0.562	-0.309	0.564	0.327	2.3	18.2	101.0	100.2	4.09
					3.3	-486.3			

* 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	

Marginal Report

Device ID	Type	Condition	Rating/Limit	Unit	Operating	% Operating	Phase Type
Bus94	Bus	Under Voltage	6.900	kV	6.618	95.9	3-Phase

SUMMARY OF TOTAL GENERATION , LOADING & DEMAND

	MW	Mvar	MVA	% PF
Source (Swing Buses):	0.565	-0.178	0.592	95.38 Leading
Source (Non-Swing Buses):	0.000	0.000	0.000	
Total Demand:	0.565	-0.178	0.592	95.38 Leading
Total Motor Load:	0.033	0.019	0.038	86.87 Lagging
Total Static Load:	0.529	0.290	0.603	87.70 Lagging
Total Constant I Load:	0.000	0.000	0.000	
Total Generic Load:	0.000	0.000	0.000	
Apparent Losses:	0.003	-0.486		
System Mismatch:	0.000	0.000		

Number of Iterations: 2

Attachment 12 Etap Report LF Case 5

Electrical Transient Analyzer Program

Load Flow Analysis

Loading Category (6): CCS_Mode5_Emergency

Generation Category (6): CCS_Mode5_Emergency

Load Diversity Factor: None

	Swing	V-Control	Load	Total
Number of Buses:	1	0	13	14

	XFMR2	XFMR3	Reactor	Line/Cable/ Busway	Impedance	Tie PD	Total
Number of Branches:	1	0	0	12	0	0	13

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:	BLPH-LV-SCstudy
Output Filename:	C:\Users\Stefano Puddu\Desktop\0396S_Crosswind\ETAP_15-Mar-2024\LFCASE5.lfr

Adjustments

Tolerance	Apply Adjustments	Individual /Global	Percent
Transformer Impedance:	Yes	Global	10.0
Reactor Impedance:	No		
Overload Heater Resistance:	No		
Transmission Line Length:	No		
Cable / Busway Length:	No		

Temperature Correction	Apply Adjustments	Individual /Global	Degree C
Transmission Line Resistance:	Yes	Global	90
Cable / Busway Resistance:	Yes	Global	90

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
Bus1	0.400	2	101.2	0.4	0.002	0.000						
Bus4	0.400	2	101.4	0.4								
Bus7	6.600	2	100.5	1.6								
Bus62	0.400	2	101.0	0.4	0.013	0.010						
Bus63	0.400	2	101.2	0.4	0.003	0.002						
Bus64	0.400	2	100.7	0.4	0.003	0.000						
Bus66	0.400	2	101.2	0.4								
Bus67	0.400	2	101.2	0.4								
Bus68	0.400	2	101.2	0.4								
Bus69	0.400	2	101.2	0.4								
Bus84	0.400	2	101.2	0.4	0.006	0.003						
Bus96	6.600	2	100.0	0.0								
SG-100D1	6.600	2	100.5	1.5								
SG-200N1	0.400	2	101.3	0.4	0.005	0.003	0.466	0.255				
Total Number of Buses: 14					0.033	0.019	0.466	0.255	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
Bus96	6.600	Swing	2	100.0	0.0					
						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)	% Tol.	#/Phase	T (°C)	R	X	Y
0.4kV_cable	1.0NCUN1	300	10.0	0.0	5	90	0.080000	0.089000	0.0001854
6.6kV_Cable2	6.6NCUN1	70	44.0	0.0	1	90	0.342000	0.130000	0.0001100
6.6kV_Cable5	6.6NCUN1	70	55.0	0.0	1	90	0.342000	0.130000	0.0001100
AC_UPS-F&G	1.0MCUN4	35	40.0	0.0	1	90	0.669000	0.080000	0.0001015
AC_UPS-PAS	1.0MCUN4	35	40.0	0.0	1	90	0.669000	0.080000	0.0001015
DB-L&SP-HV-MV	1.0MCUN4	4.0	65.0	0.0	1	90	5.870000	0.093000	0.0000575
DB-L&SP-LV-	1.0MCUN4	4.0	20.0	0.0	1	90	5.870000	0.093000	0.0000575
DB-L&SP-UPS-	1.0MCUN4	4.0	47.0	0.0	1	90	5.870000	0.093000	0.0000575
DB-L&SP.Inst.	1.0MCUN4	4.0	45.0	0.0	1	90	5.870000	0.093000	0.0000575
DB-L&SP_BoP	1.0NCUN4	16	20.0	0.0	1	90	1.467000	0.080000	0.0000597
DC_Batt_Swgr	1.0MCUN4	16	65.0	0.0	1	90	1.460000	0.080000	0.0000971
DC_UPS_Navaid	1.0MCUN4	4.0	50.0	0.0	1	90	5.870000	0.093000	0.0000575

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
TR-200DE1	3-Phase	1.600	6.600	0.420	6.00	7.94	0	0	10.0	2.500	0	6.6000	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
TR-200DE1	2W XFMR	Bus7	Bus4	52.83	419.50	422.81	
0.4kV_cable	Cable	Bus4	SG-200N1	9.07	10.09	13.57	0.0000016
6.6kV_Cable2	Cable	SG-100D1	Bus7	3.45	1.31	3.70	0.0002108
6.6kV_Cable5	Cable	SG-100D1	Bus96	4.32	1.64	4.62	0.0002635
AC_UPS-F&G	Cable	SG-200N1	Bus63	1517.01	181.41	1527.81	0.0000007
AC_UPS-PAS	Cable	SG-200N1	Bus62	1517.01	181.41	1527.81	0.0000007
DB-L&SP-HV-MV	Cable	SG-200N1	Bus67	21629.82	342.69	21632.53	0.0000007
DB-L&SP-LV-	Cable	SG-200N1	Bus68	6655.33	105.44	6656.16	0.0000002
DB-L&SP-UPS-	Cable	SG-200N1	Bus69	15640.02	247.79	15641.99	0.0000005
DB-L&SP.Inst.	Cable	SG-200N1	Bus66	14974.49	237.24	14976.37	0.0000005
DB-L&SP_BoP	Cable	SG-200N1	Bus84	1663.27	90.70	1665.74	0.0000002
DC_Batt_Swgr	Cable	SG-200N1	Bus1	5379.82	294.78	5387.89	0.0000011
DC_UPS_Navaid	Cable	SG-200N1	Bus64	16638.32	263.61	16640.41	0.0000005

LOAD FLOW REPORT

Bus		Voltage		Generation		Load		Load Flow					XFMR
ID	kV	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	%PF	%Tap
Bus1	0.400	100.666	-1.2	0.000	0.000	0.002	0.000	SG-200N1	-0.002	0.000	2.3	100.0	
Bus4	0.400	100.840	-1.2	0.000	0.000	0.000	0.000	SG-200N1	0.506	0.278	825.8	87.6	
								Bus7	-0.506	-0.278	825.8	87.6	
Bus7	6.600	99.952	0.0	0.000	0.000	0.000	0.000	SG-100D1	-0.507	-0.293	51.3	86.6	
								Bus4	0.507	0.293	51.3	86.6	2.500
Bus62	0.400	100.525	-1.1	0.000	0.000	0.013	0.010	SG-200N1	-0.013	-0.010	23.1	80.0	
Bus63	0.400	100.710	-1.2	0.000	0.000	0.003	0.002	SG-200N1	-0.003	-0.002	4.9	80.0	
Bus64	0.400	100.180	-1.2	0.000	0.000	0.003	0.000	SG-200N1	-0.003	0.000	4.6	100.0	
Bus66	0.400	100.699	-1.2	0.000	0.000	0.000	0.000	SG-200N1	0.000	0.000	0.6	80.0	
Bus67	0.400	100.673	-1.2	0.000	0.000	0.000	0.000	SG-200N1	0.000	0.000	0.6	80.0	
Bus68	0.400	100.732	-1.2	0.000	0.000	0.000	0.000	SG-200N1	0.000	0.000	0.6	80.0	
Bus69	0.400	100.696	-1.2	0.000	0.000	0.000	0.000	SG-200N1	0.000	0.000	0.6	80.0	
Bus84	0.400	100.645	-1.2	0.000	0.000	0.006	0.003	SG-200N1	-0.006	-0.003	9.9	88.4	
* Bus96	6.600	100.000	0.0	0.508	0.292	0.000	0.000	SG-100D1	0.508	0.292	51.2	86.7	
SG-100D1	6.600	99.973	0.0	0.000	0.000	0.000	0.000	Bus7	0.508	0.292	51.3	86.6	
								Bus96	-0.508	-0.292	51.3	86.6	
SG-200N1	0.400	100.759	-1.2	0.000	0.000	0.477	0.262	Bus4	-0.505	-0.278	825.8	87.6	
								Bus63	0.003	0.002	4.9	80.0	
								Bus62	0.013	0.010	23.1	80.1	
								Bus67	0.000	0.000	0.6	80.1	
								Bus68	0.000	0.000	0.6	80.0	
								Bus69	0.000	0.000	0.6	80.1	
								Bus66	0.000	0.000	0.6	80.1	
								Bus84	0.006	0.003	9.9	88.4	
								Bus1	0.002	0.000	2.3	100.0	
								Bus64	0.003	0.000	4.6	100.0	

* 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
Bus1	0.400		0.002								0.002	100.0	2.3	
Bus4	0.400										0.577	87.6	825.8	
Bus7	6.600										0.586	86.6	51.3	
Bus62	0.400		0.013	0.010							0.016	80.0	23.1	
Bus63	0.400		0.003	0.002							0.003	80.0	4.9	
Bus64	0.400		0.003								0.003	100.0	4.6	
Bus66	0.400		0.000	0.000							0.000	80.0	0.6	
Bus67	0.400		0.000	0.000							0.000	80.0	0.6	
Bus68	0.400		0.000	0.000							0.000	80.0	0.6	
Bus69	0.400		0.000	0.000							0.000	80.0	0.6	
Bus84	0.400		0.006	0.003							0.007	88.4	9.9	
Bus96	6.600										0.586	86.7	51.2	
SG-100D1	6.600	630.0									0.586	86.6	51.3	8.1
SG-200N1	0.400	2500.0	0.005	0.003	0.473	0.259					0.576	87.6	825.8	33.0

* 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				
		Ampacity (Amp)	Loading Amp		Capability (MVA)	Loading (input)		Loading (output)	
ID	Type			%		MVA	%	MVA	%
0.4kV_cable	Cable	2764.80	825.79	29.87					
6.6kV_Cable2	Cable	246.80	51.27	20.77					
6.6kV_Cable5	Cable	246.80	51.26	20.77					
AC_UPS-F&G	Cable	136.89	4.85	3.55					
AC_UPS-PAS	Cable	136.89	23.15	16.91					
DB-L&SP-HV-MV	Cable	37.25	0.65	1.73					
DB-L&SP-LV-	Cable	37.25	0.65	1.73					
DB-L&SP-UPS-	Cable	37.25	0.65	1.73					
DB-L&SP.Inst.	Cable	37.25	0.65	1.73					
DB-L&SP_BoP	Cable	89.40	9.86	11.03					
DC_Batt_Swgr	Cable	89.40	2.25	2.52					
DC_UPS_Navaid	Cable	37.25	4.55	12.22					
TR-200DE1	Transformer				1.600	0.586	36.6	0.577	36.1

* 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 in Vmag
	MW	Mvar	MW	Mvar	kW	kvar	From	To	
0.4kV_cable	0.506	0.278	-0.505	-0.278	0.3	0.4	100.8	100.8	0.08
6.6kV_Cable2	-0.507	-0.293	0.508	0.292	0.1	-0.2	100.0	100.0	0.02
6.6kV_Cable5	0.508	0.292	-0.508	-0.292	0.1	-0.2	100.0	100.0	0.03
AC_UPS-F&G	-0.003	-0.002	0.003	0.002	0.0	0.0	100.7	100.8	0.05
AC_UPS-PAS	-0.013	-0.010	0.013	0.010	0.0	0.0	100.5	100.8	0.23
DB-L&SP.Inst.	0.000	0.000	0.000	0.000	0.0	0.0	100.7	100.8	0.06
DB-L&SP_BoP	-0.006	-0.003	0.006	0.003	0.0	0.0	100.6	100.8	0.11
DB-L&SP-HV-MV	0.000	0.000	0.000	0.000	0.0	0.0	100.7	100.8	0.09
DB-L&SP-LV-	0.000	0.000	0.000	0.000	0.0	0.0	100.7	100.8	0.03
DB-L&SP-UPS-	0.000	0.000	0.000	0.000	0.0	0.0	100.7	100.8	0.06
DC_Batt_Swgr	-0.002	0.000	0.002	0.000	0.0	0.0	100.7	100.8	0.09
DC_UPS_Navaid	-0.003	0.000	0.003	0.000	0.0	0.0	100.2	100.8	0.58
TR-200DE1	-0.506	-0.278	0.507	0.293	1.9	14.8	100.8	100.0	3.91
					2.5	14.8			

* 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	

SUMMARY OF TOTAL GENERATION , LOADING & DEMAND

	MW	Mvar	MVA	% PF
Source (Swing Buses):	0.508	0.292	0.586	86.67 Lagging
Source (Non-Swing Buses):	0.000	0.000	0.000	
Total Demand:	0.508	0.292	0.586	86.67 Lagging
Total Motor Load:	0.033	0.019	0.037	86.86 Lagging
Total Static Load:	0.473	0.259	0.539	87.70 Lagging
Total Constant I Load:	0.000	0.000	0.000	
Total Generic Load:	0.000	0.000	0.000	
Apparent Losses:	0.003	0.015		
System Mismatch:	0.000	0.000		

Number of Iterations: 3