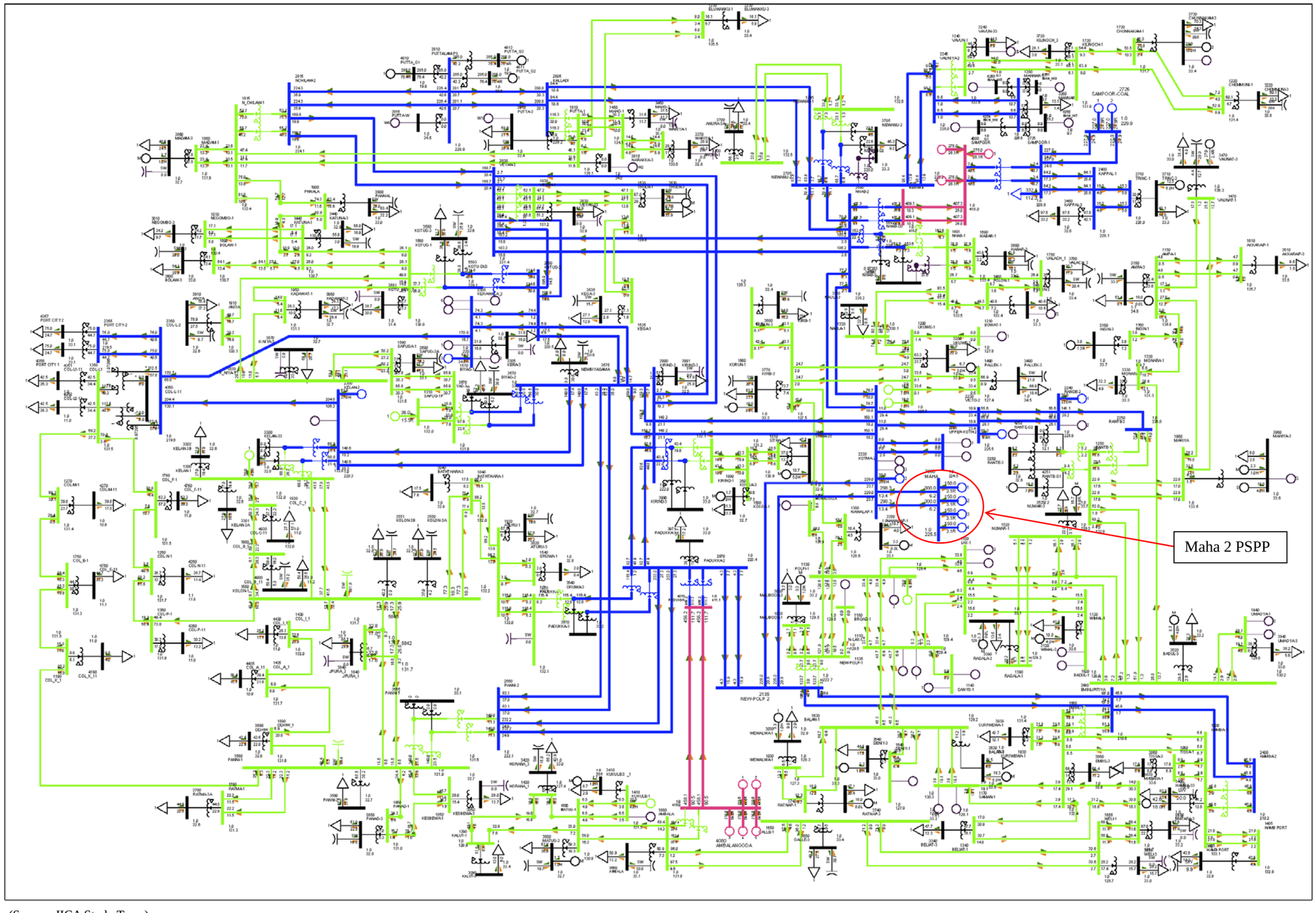
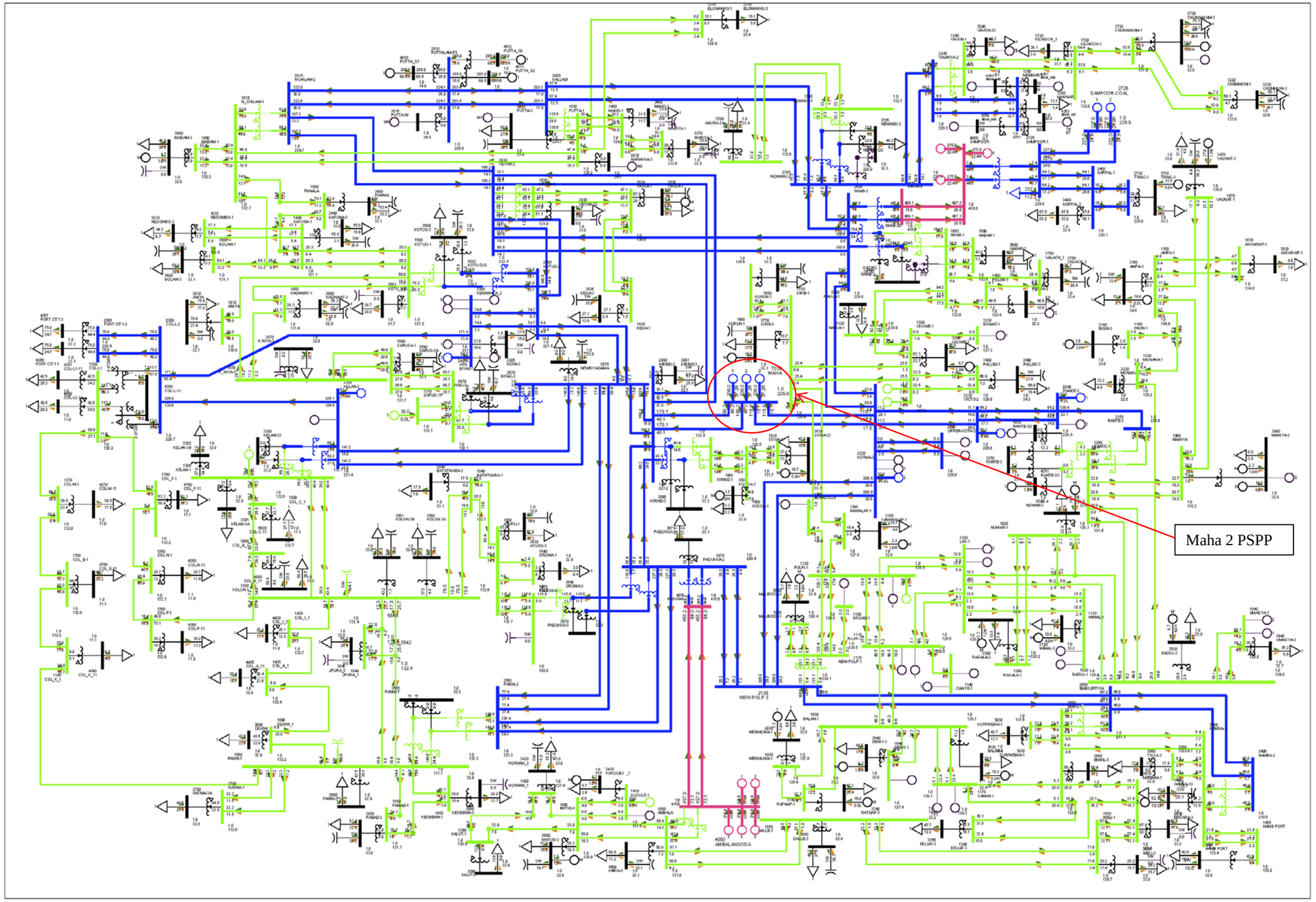


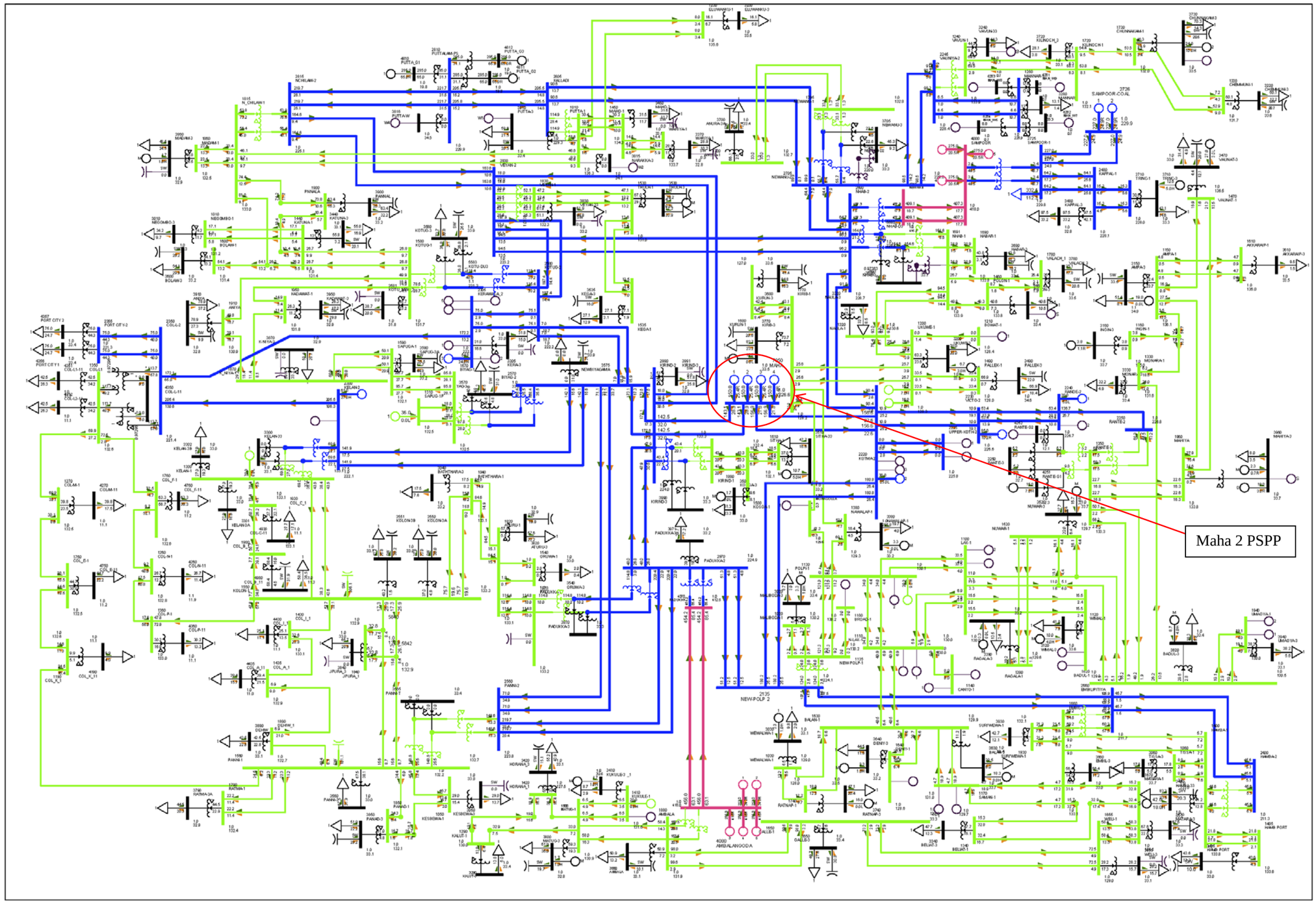
(Source: JICA Study Team)

Figure 10.4.5-6 Power Flow Diagram (Thermal Maximum Night Peak in 2025, Generating Operation, Connected to Kotmale, Maha Unit Capacity 150MW)



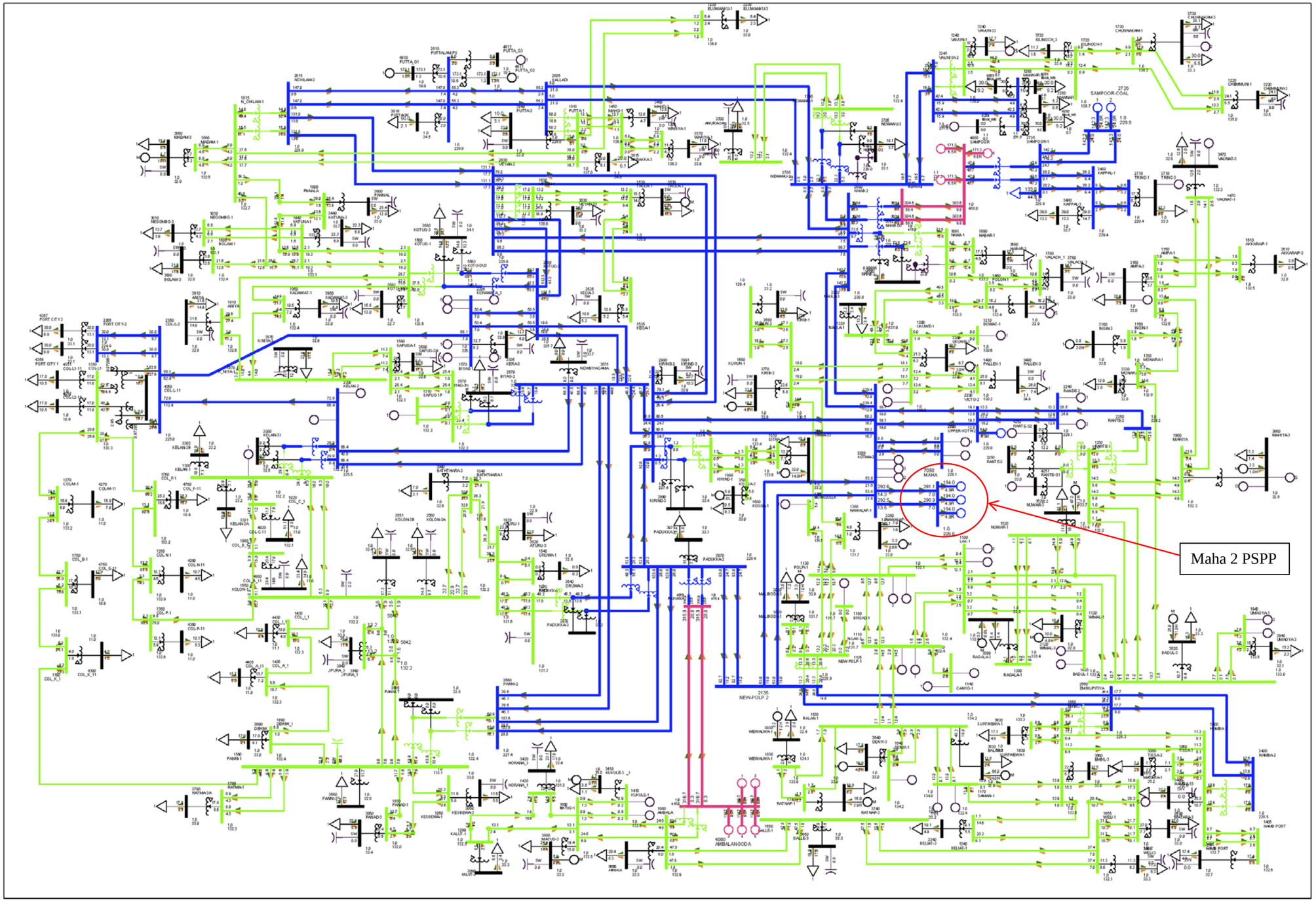
(Source: JICA Study Team)

Figure 10.4.5-7 Power Flow Diagram (Thermal Maximum Night Peak in 2025, Generating Operation, Connected to Kotmale and Kirindiwela, Maha Unit Capacity 200MW)



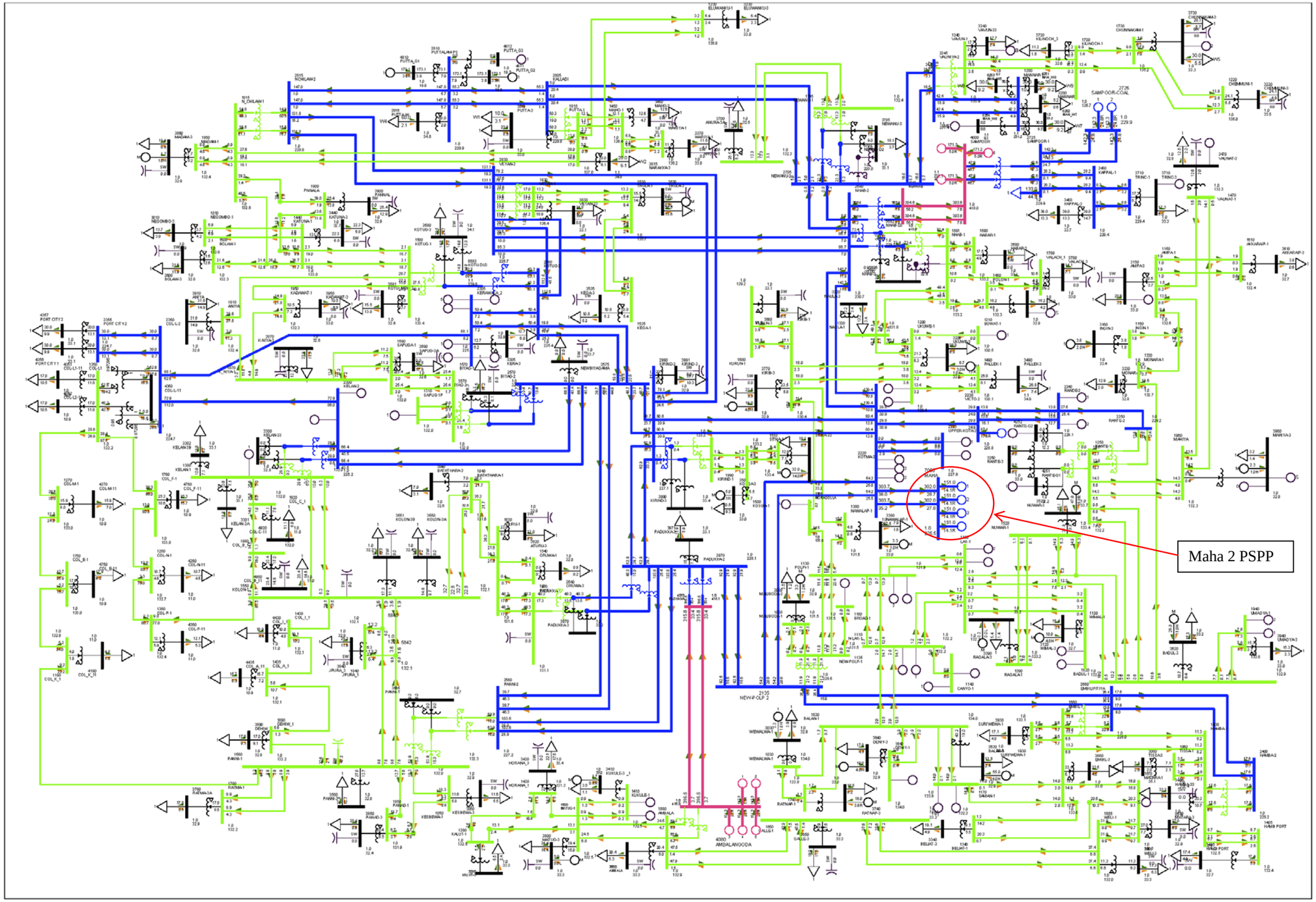
(Source: JICA Study Team)

Figure 10.4.5-8 Power Flow Diagram (Thermal Maximum Night Peak in 2025, Generating Operation, Connected to Kotmale and Kirindiwela, Maha Unit Capacity 150MW)



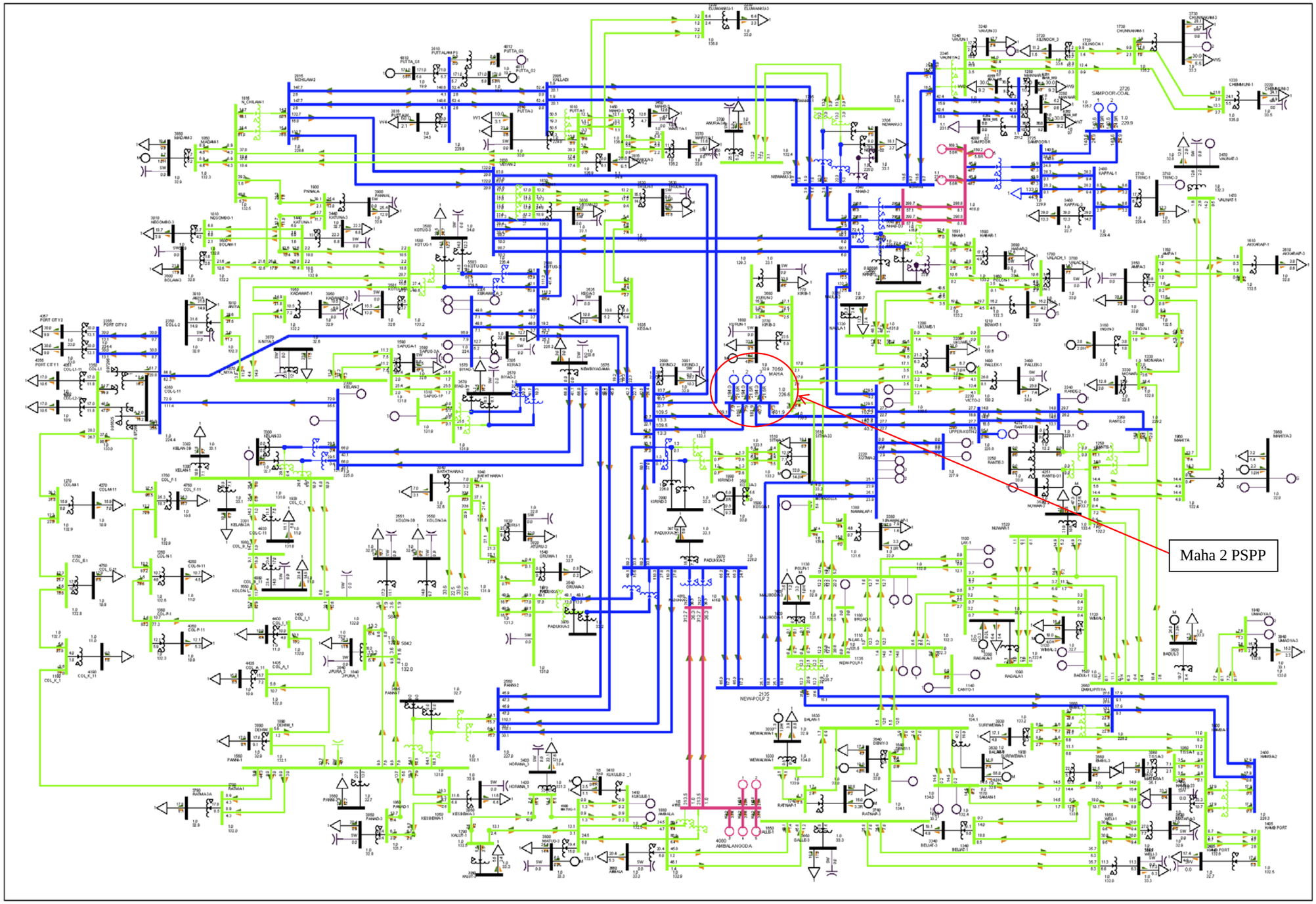
(Source: JICA Study Team)

Figure 10.4.5-9 Power Flow Diagram (Thermal Maximum Night Peak in 2025, Generating Operation, Connected to Kotmale and Kirindiwela, Maha Unit Capacity 200MW)



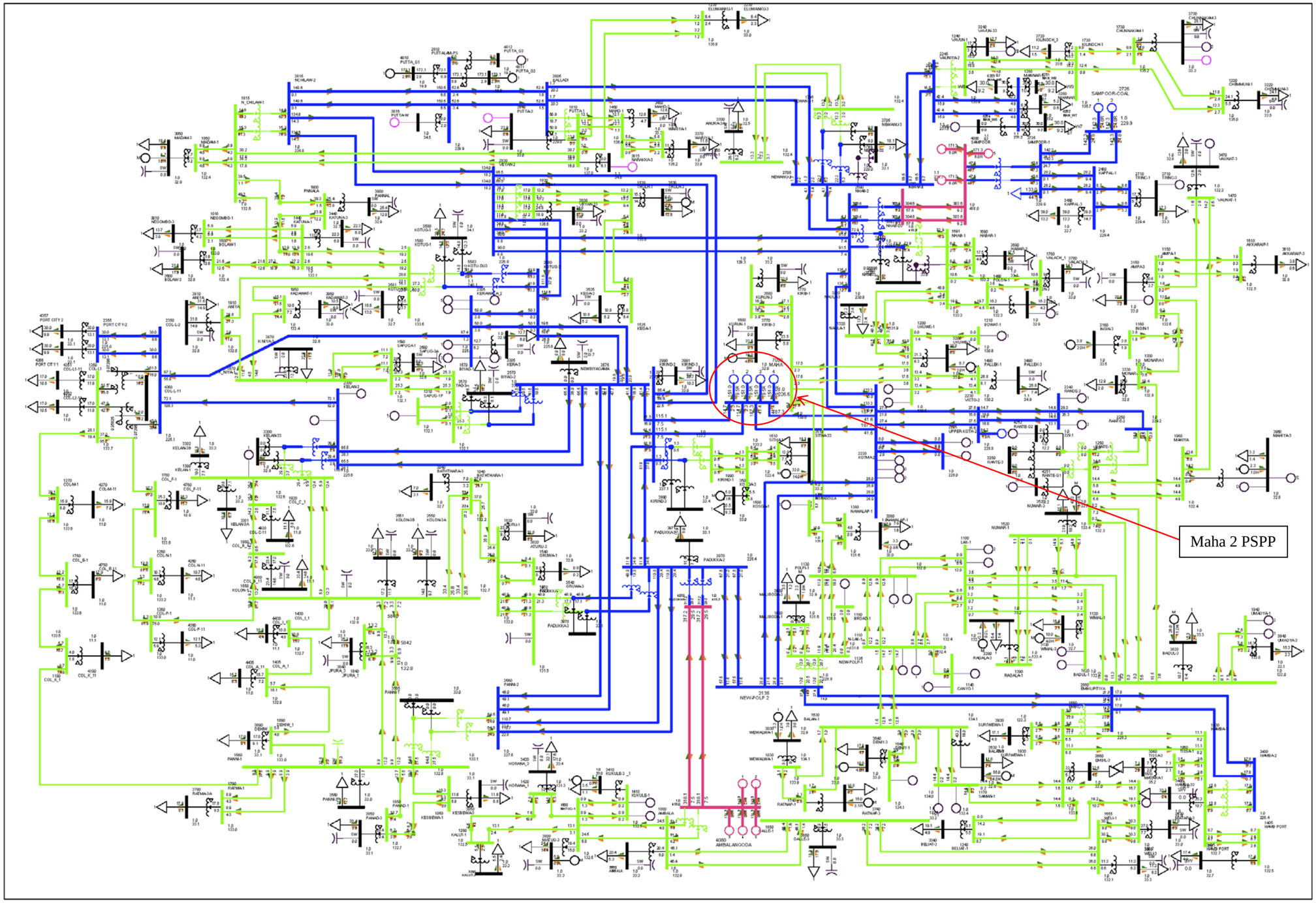
(Source: JICA Study Team)

Figure 10.4.5-10 Power Flow Diagram (Thermal Maximum Night Peak in 2025, Generating Operation, Connected to Kotmale, Maha Unit Capacity 150MW)



(Source: JICA Study Team)

Figure 10.4.5-11 Power Flow Diagram (Thermal Maximum Night Peak in 2025, Generating Operation, Connected to Kotmale, Maha Unit Capacity 200MW)



(Source: JICA Study Team)

Figure 10.4.5-12 Power Flow Diagram (Thermal Maximum Night Peak in 2025, Generating Operation, Connected to Kotmale and Kirindiwela, Maha Unit Capacity 150MW)

(2) Short Circuit Current Analysis

The three phase fault current analyses at bus conductours of Maha 2 PSPP, Kotmale P/S, and Kirindiwela are carried out for Hydro Maximum Night Peak cases and Thermal Maximum Night Peak cases, as the most severe loading cases. As shwon in Table 10.4.5-1, it is confirmed that the currents satisfies the criteria for all cases.

Table 10.4.5-1 The Three Phase Short Circuit Currents (in 2025)

Loading Scenario	Connection	Unit Capacity of PSPP	P/S, S/S		Current
Hydro Maximum Night Peak	Kotmale P/S	200MW	Kotmale	220kV	25.6kA
			Maha	220kV	17.7kA
		150MW	Kotmale	220kV	25.5kA
			Maha	220kV	17.7kA
	PI Connection to T/L between Kotmale and Kirindiwela	200MW	Kotmale	220kV	25.1kA
			Maha	220kV	22.1kA
			Kirindiwela	220kV	24.0kA
		150MW	Kotmale	220kV	25.0kA
			Maha	220kV	22.1kA
			Kirindiwela	220kV	23.9kA
Thermal Maximum Night Peak	Kotmale P/S	200MW	Kotmale	220kV	21.6kA
			Maha	220kV	15.8kA
		150MW	Kotmale	220kV	21.5kA
			Maha	220kV	15.8kA
	PI Connection to T/L between Kotmale and Kirindiwela	200MW	Kotmale	220kV	21.0kA
			Maha	220kV	19.8kA
			Kirindiwela	220kV	23.7kA
		150MW	Kotmale	220kV	22.8kA
			Maha	220kV	20.2kA
			Kirindiwela	220kV	24.8kA

(Source: JICA Study Team)

(3) Transient Stability Analysis

1) Three phase line fault

In case of PI Connection to T/L between Kotmale P/S and KirindiwelaS/S, it is set that three phase line fault occurs at a point on T/L from Maha 2 PSPP to Kirindiwela since the load seems to be heavier than that on T/L from Maha PSPP to Kotmale for the simulation.

The results of transient stability analysis of three phase line fault are shown in Figure 10.4.5-13 to Figure 10.4.5-24.

Results show that network is stable for all cases.

2) One Unit Tripping at Maha 2 PSPP

a) Frequency drop followed by loss of generator

The results of the dynamic simulation for one unit tripping Maha PSPP are shown in Figure 10.4.5-25 to Figure 10.4.5-32.

The results of study show that the system frequency did not drop to 48.75Hz which is criteria; load shedding is carried out.

In this regard, it is calculated that the system frequency dropping in Thermal maximum scenario is larger than that in Hydro maximum scenario. This is because there is difference of the number of power plants operated with free governor mode in Hydro Maximum cases (HMNP) and in Thermal Maximum cases (TMNP).

HMNP: Samanalawewa, Bowathenna, Kotmale, Upper Kotmale, Victoria, Puttalam, Ambalangoda, Sampoor

TMNP: Victoria, Kotmale, Kelanitissa

Considered the above-mentioned calculation results, it is assumed that the mumber of power plants with governor free mode has considerable impact on the power system stability. Therefore, it is suggested that free governor operation system should be considered for relatively large plants to be constructed in the future.

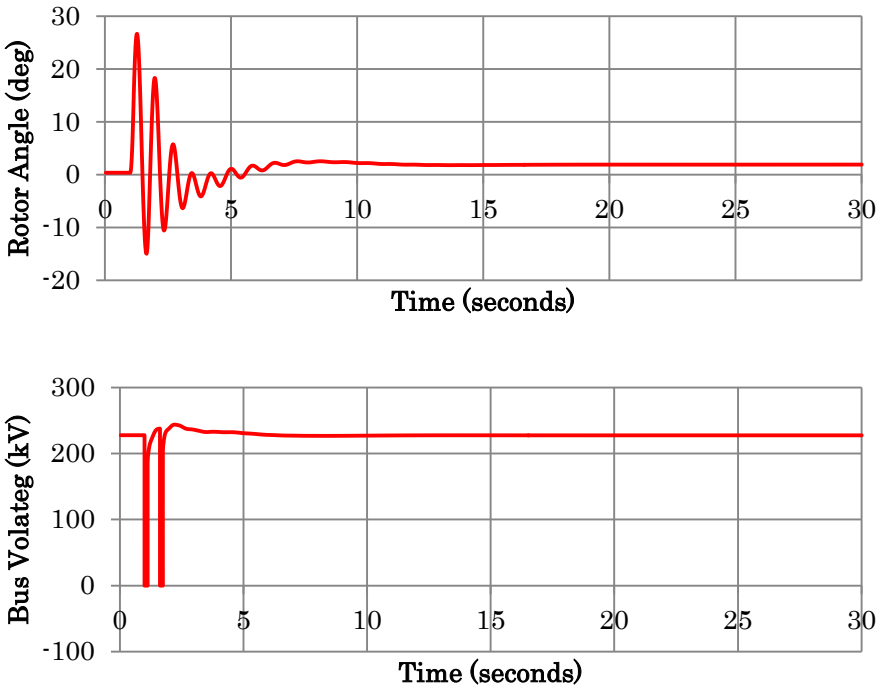
b) Frequency rise by loss of generator of pumping operation

The results of the dynamic simulation for one unit tripping Maha PSPP are shown in Figure 10.4.5-33 to Figure 10.4.5-36.

The results show that in very case, the system frequency does not excess 51.5Hz which is the criteria; the alarm of thermal power plants occurs for the system frequency rising.

In this regard, in the simulation, it is set that the coal power plants in the power grid (Puttalam, Ambalangoda, and Sampoor) are operated with free governor mode in the same manner as “a) Frequency drops followed by loss of generator”.

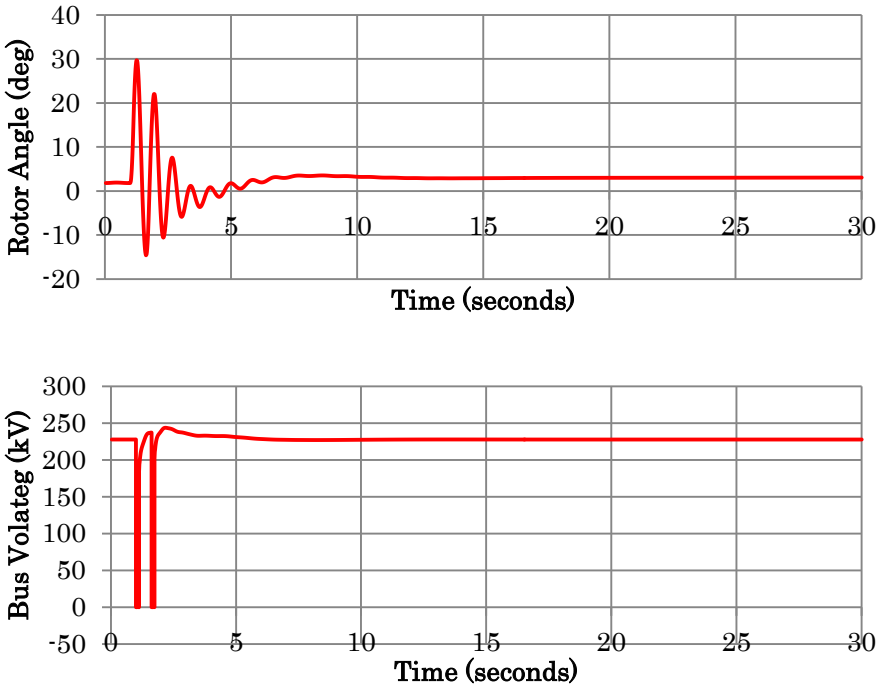
Therefore, it is suggested that free governor operation system should be considered for relatively large plants to be constructed in the future.



(Hydro Maximum Night Peak in 2025, Generating Operation, Connected to Kotmale, Maha Unit Capacity 200MW)

(Source: JICA Study Team)

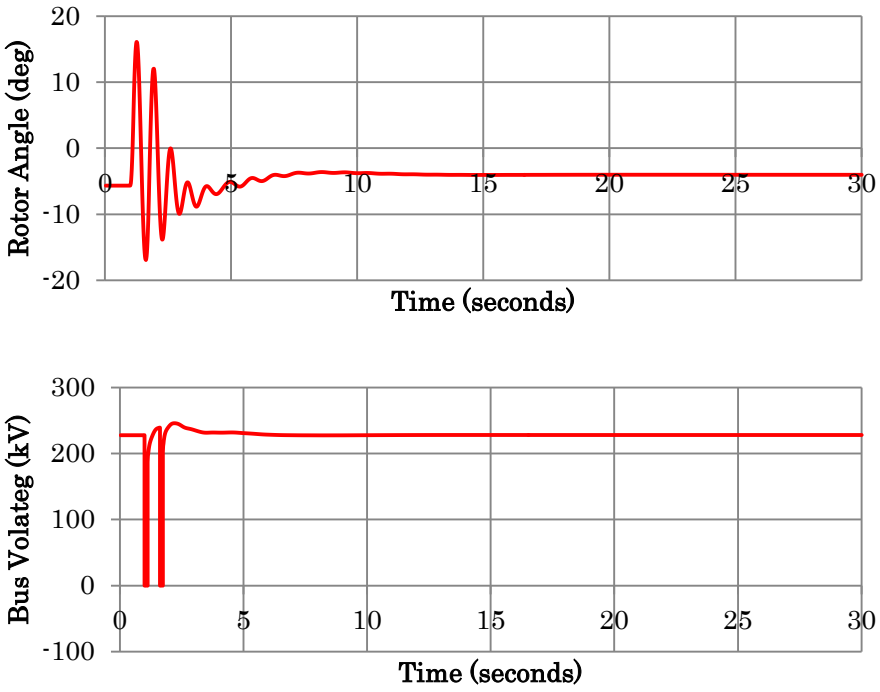
Figure 10.4.5-13 Three-phase Fault at Maha end of Maha-Kotmale 220kV Line-USR



(Hydro Maximum Night Peak in 2025, Generating Operation, Connected to Kotmale, Maha Unit Capacity 150MW)

(Source: JICA Study Team)

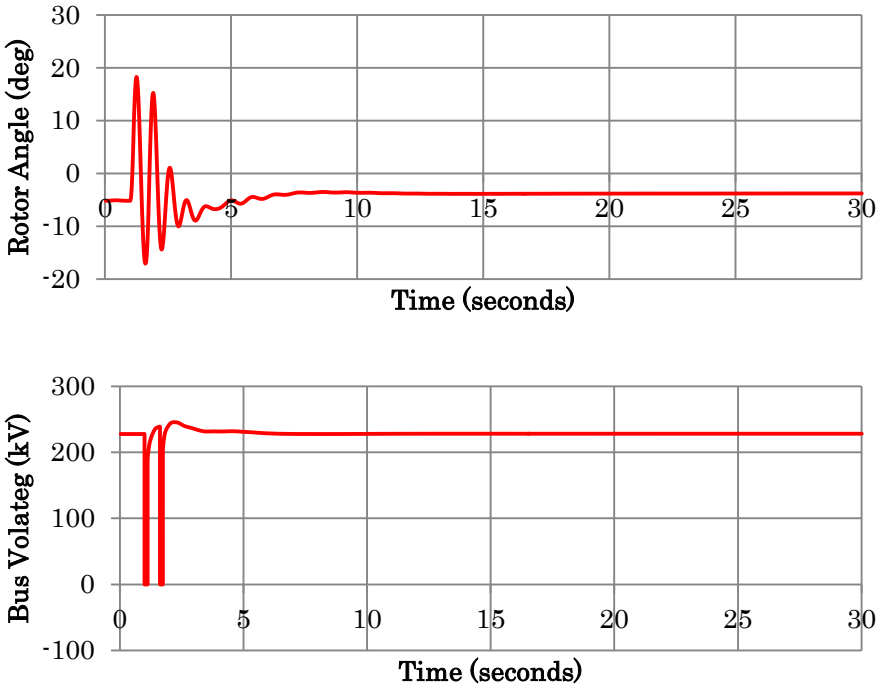
Figure 10.4.5-14 Three-phase Fault at Maha end of Maha-Kotmale 220kV Line-USR



(Hydro Maximum Night Peak in 2025, Generating Operation, Connected to Kotmale and Kirindiwela, Maha Unit Capacity 200MW)

(Source: JICA Study Team)

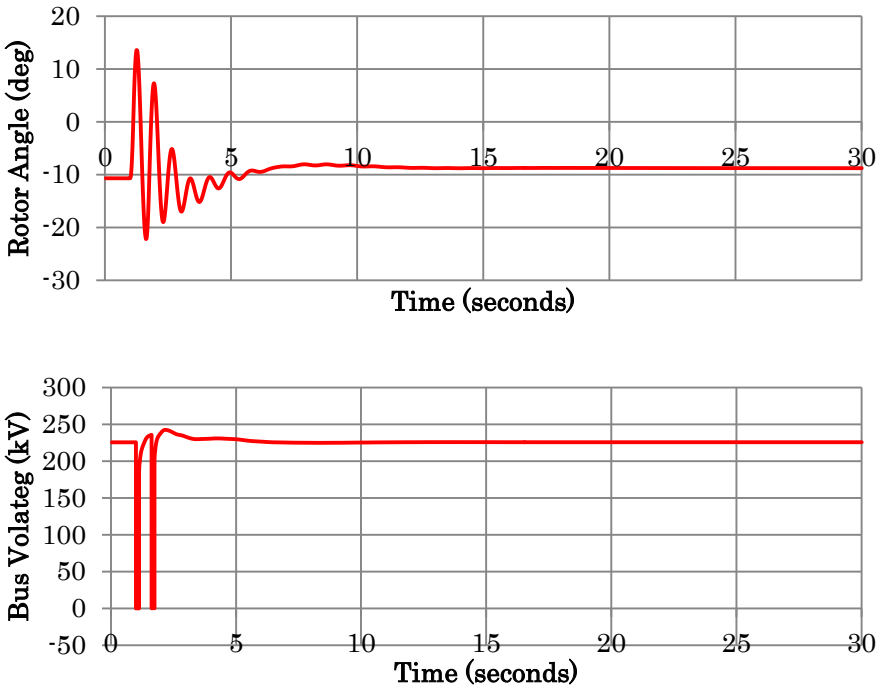
Figure 10.4.5-15 Three-phase Fault at Maha end of Maha-Kirindiwela 220kV Line-USR



(Hydro Maximum Night Peak in 2025, Generating Operation, Connected to Kotmale and Kirindiwela, Maha Unit Capacity 150MW)

(Source: JICA Study Team)

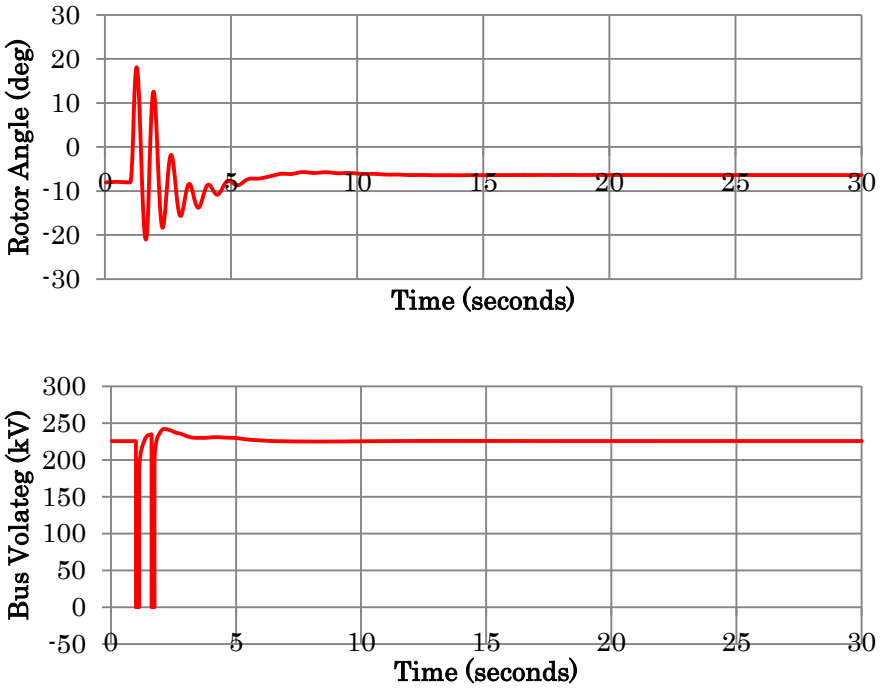
Figure 10.4.5-16 Three-phase Fault at Maha end of Maha-Kirindiwela 220kV Line-USR



(Thermal Maximum Night Peak in 2025, Generating Operation, Connected to Kotmale, Maha Unit Capacity 200MW)

(Source: JICA Study Team)

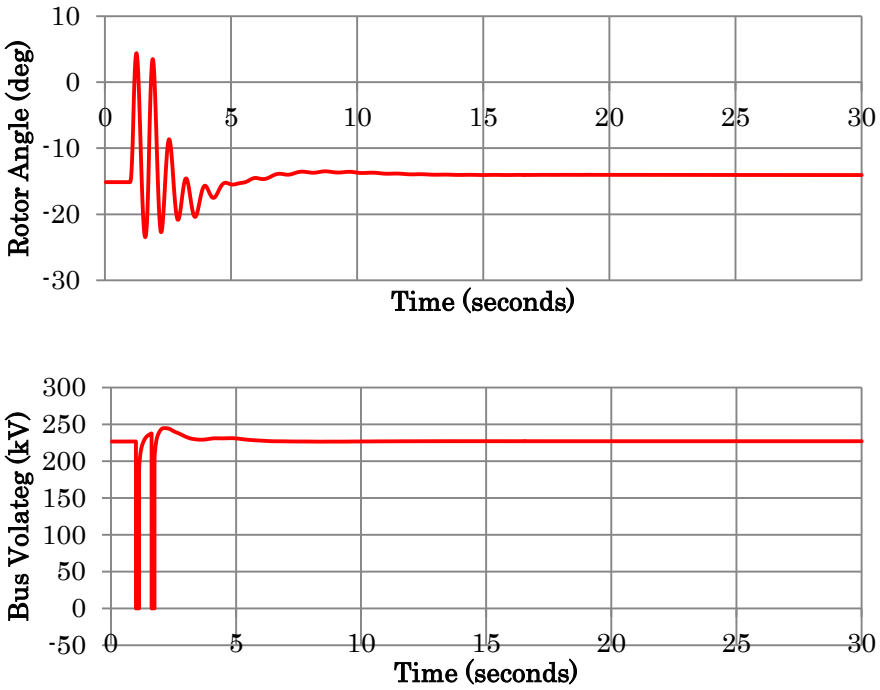
Figure 10.4.5-17 Three-phase Fault at Maha end of Maha-Kotmale 220kV Line-USR



(Thermal Maximum Night Peak in 2025, Generating Operation, Connected to Kotmale, Maha Unit Capacity 150MW)

(Source: JICA Study Team)

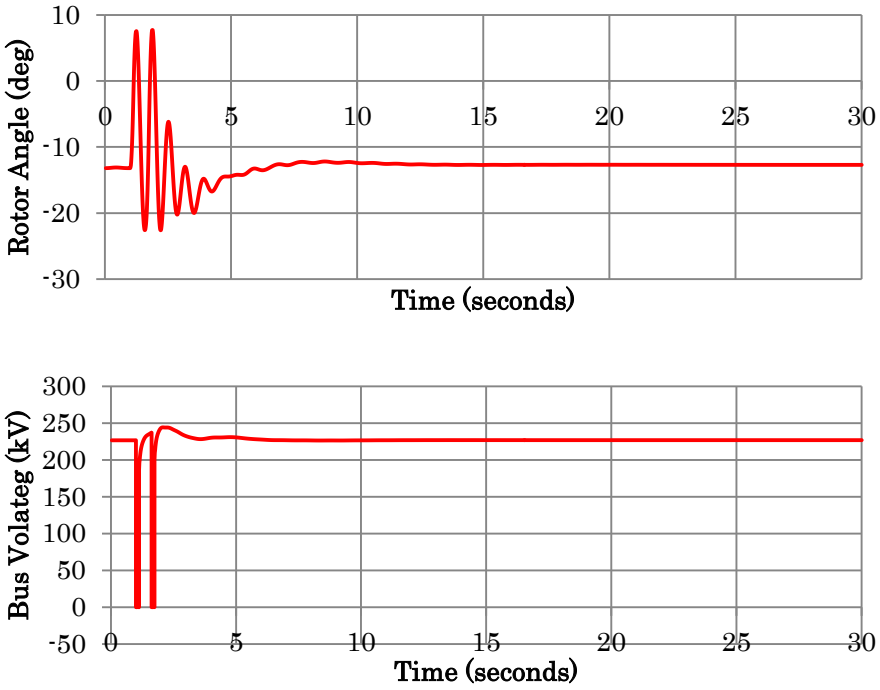
Figure 10.4.5-18 Three-phase Fault at Maha end of Maha-Kotmale 220kV Line-USR



(Thermal Maximum Night Peak in 2025, Generating Operation, Connected to Kotmale and Kirindiwela, Maha Unit Capacity 200MW)

(Source: JICA Study Team)

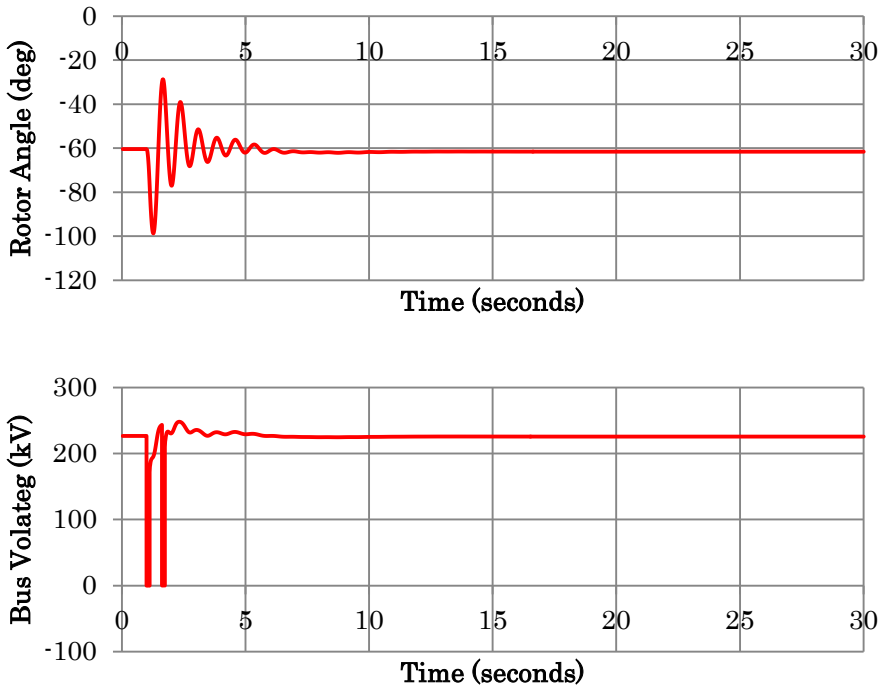
Figure 10.4.5-19 Three-phase Fault at Maha end of Maha-Kirindiwela 220kV Line-USR



(Thermal Maximum Night Peak in 2025, Generating Operation, Connected to Kotmale and Kirindiwela, Maha Unit Capacity 150MW)

(Source: JICA Study Team)

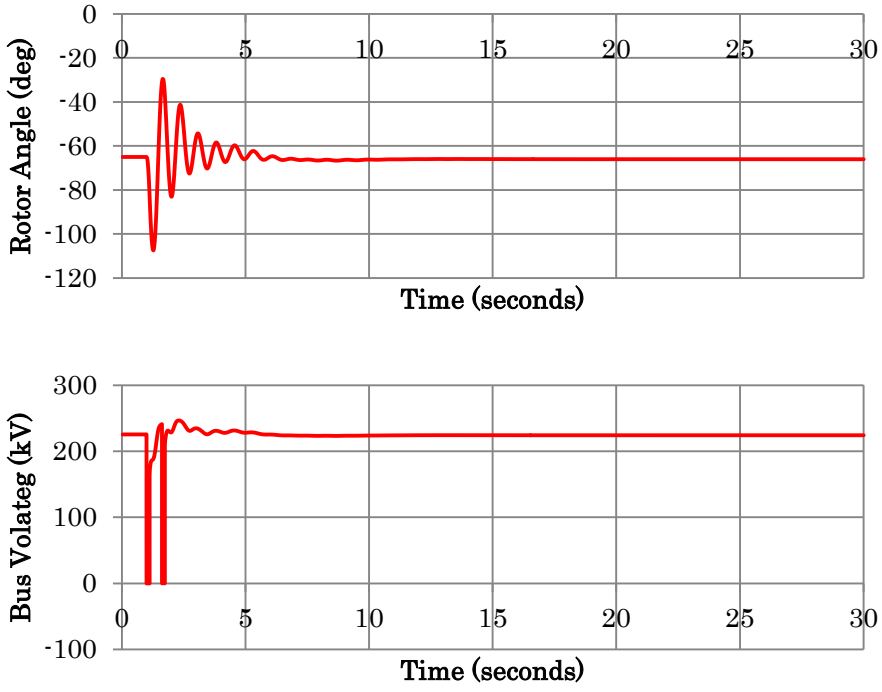
Figure 10.4.5-20 Three-phase Fault at Maha end of Maha-Kirindiwela 220kV Line-USR



(Off Peak in 2025, Pumping Operation, Connected to Kotmale, Maha Unit Capacity 200MW)

(Source: JICA Study Team)

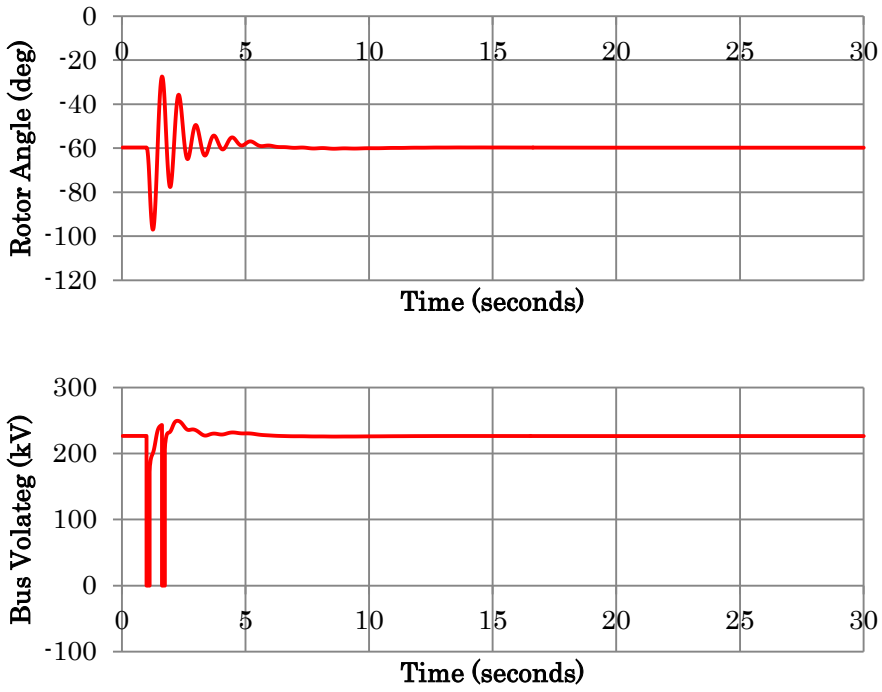
Figure 10.4.5-21 Three-phase Fault at Maha end of Maha-Kotmale 220kV Line-USR



(Off Peak in 2025, Pumping Operation, Connected to Kotmale, Maha Unit Capacity 150MW)

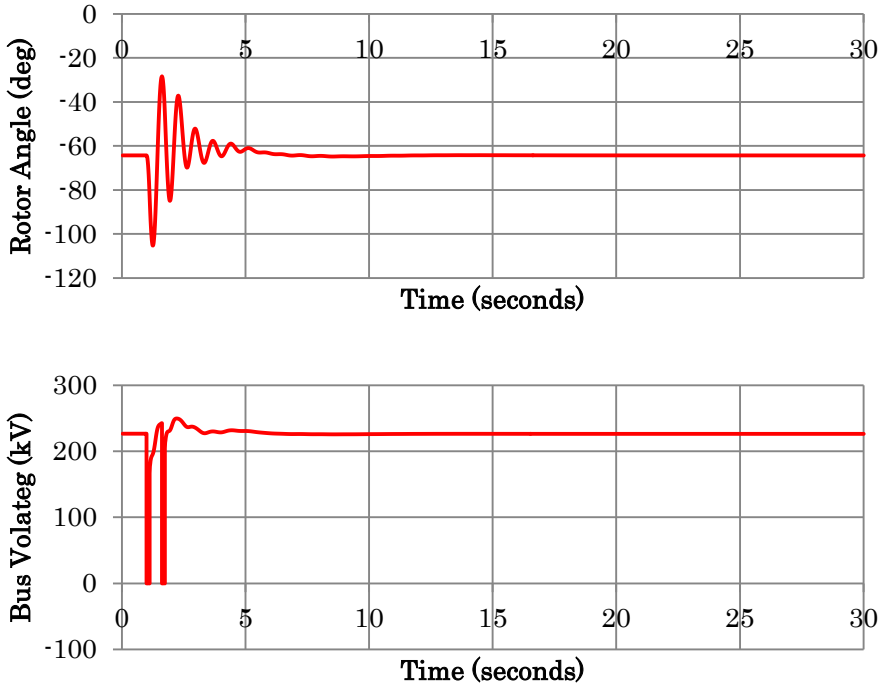
(Source: JICA Study Team)

Figure 10.4.5-22 Three-phase Fault at Maha end of Maha-Kotmale 220kV Line-USR



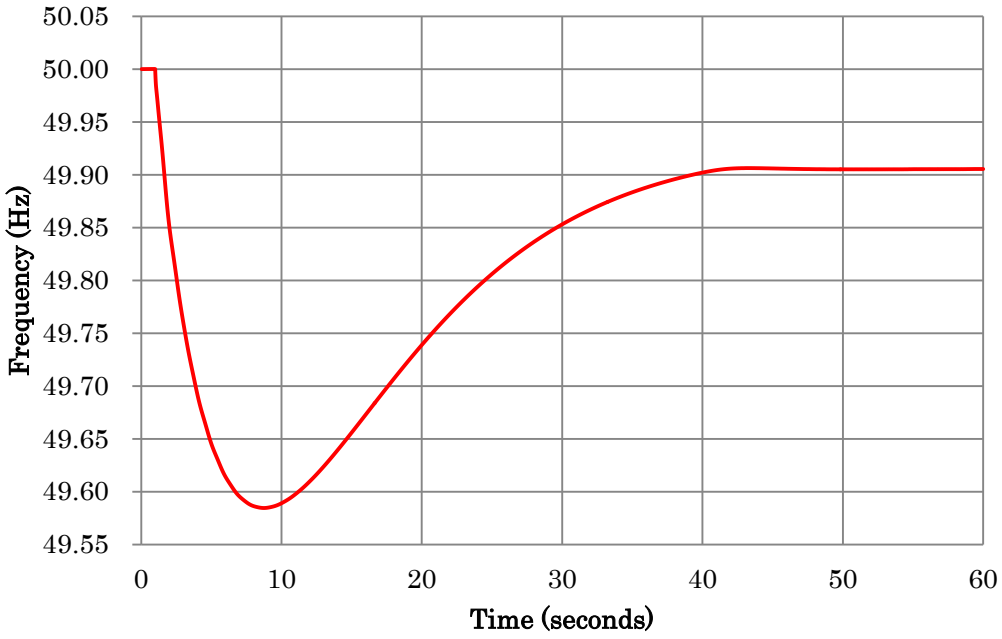
(Off Peak in 2025, Pumping Operation, Connected to Kotmale and Kirindiwela, Maha Unit Capacity 200MW)
(Source: JICA Study Team)

Figure 10.4.5-23 Three-phase Fault at Maha end of Maha-Kirindiwela 220kV Line-USR



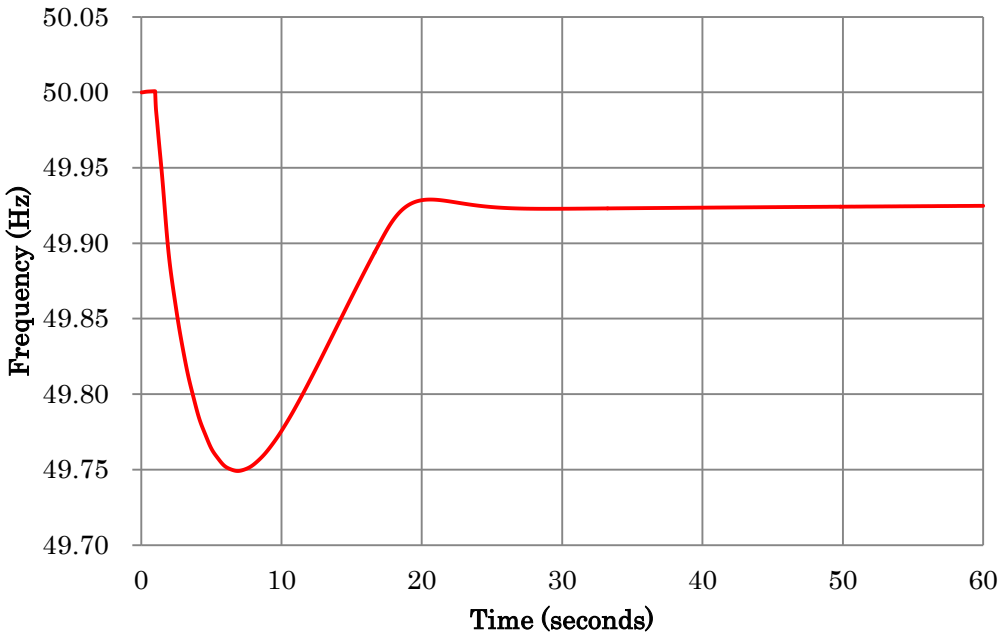
(Off Peak in 2025, Pumping Operation, Connected to Kotmale and Kirindiwela, Maha Unit Capacity 150MW)
(Source: JICA Study Team)

Figure 10.4.5-24 Three-phase Fault at Maha end of Maha-Kirindiwela 220kV Line-USR



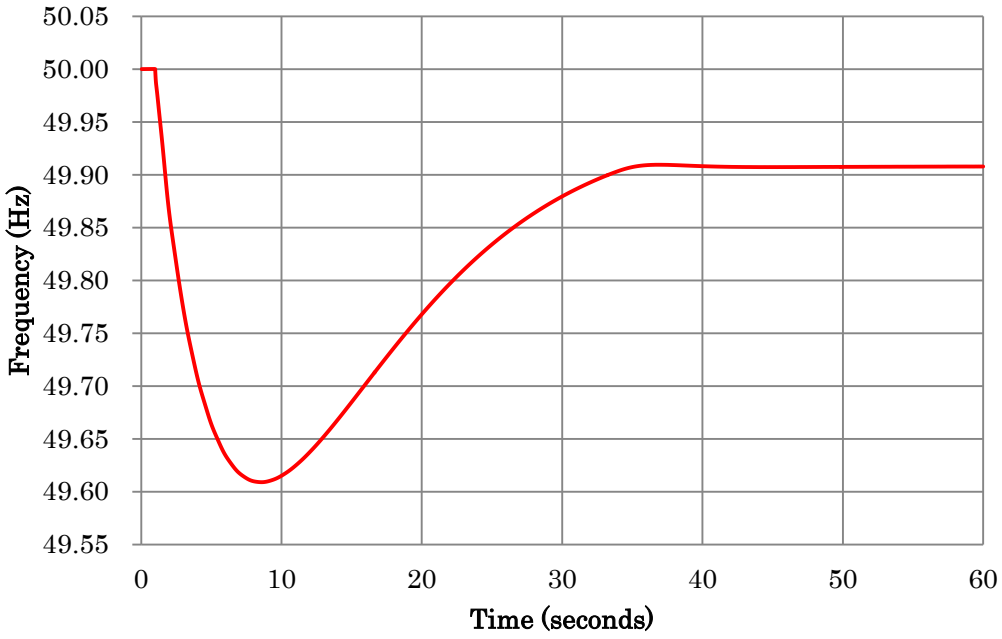
(Hydro Maximum Night Peak in 2025、Generating Operation, Connected to Kotmale)
(Source: JICA Study Team)

Figure 10.4.5-25 200MW Unit Tripping at Maha PSPP



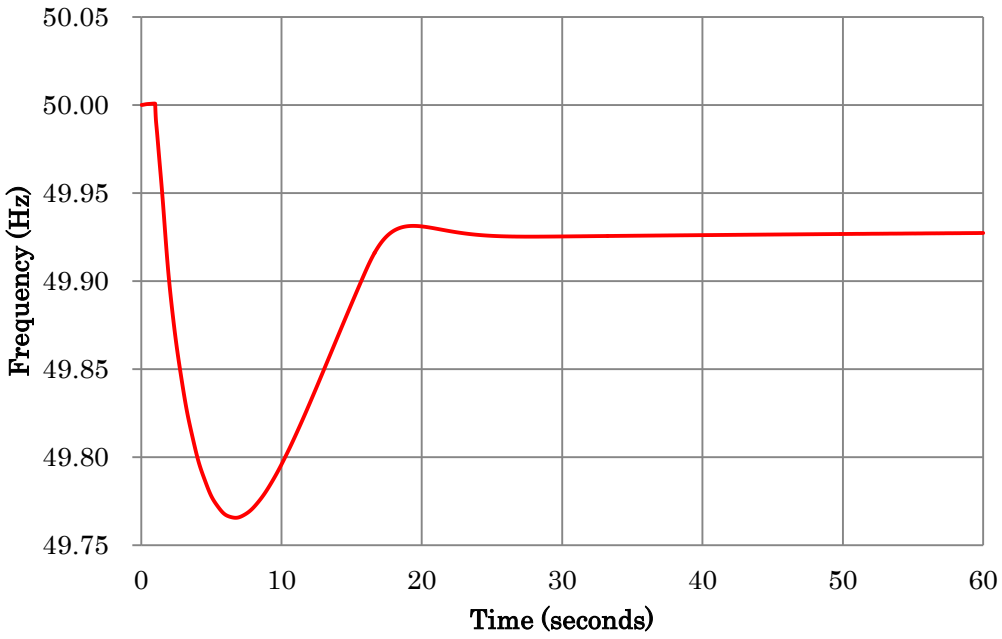
(Hydro Maximum Night Peak in 2025、Generating Operation, Connected to Kotmale)
(Source: JICA Study Team)

Figure 10.4.5-26 150MW Unit Tripping at Maha PSPP



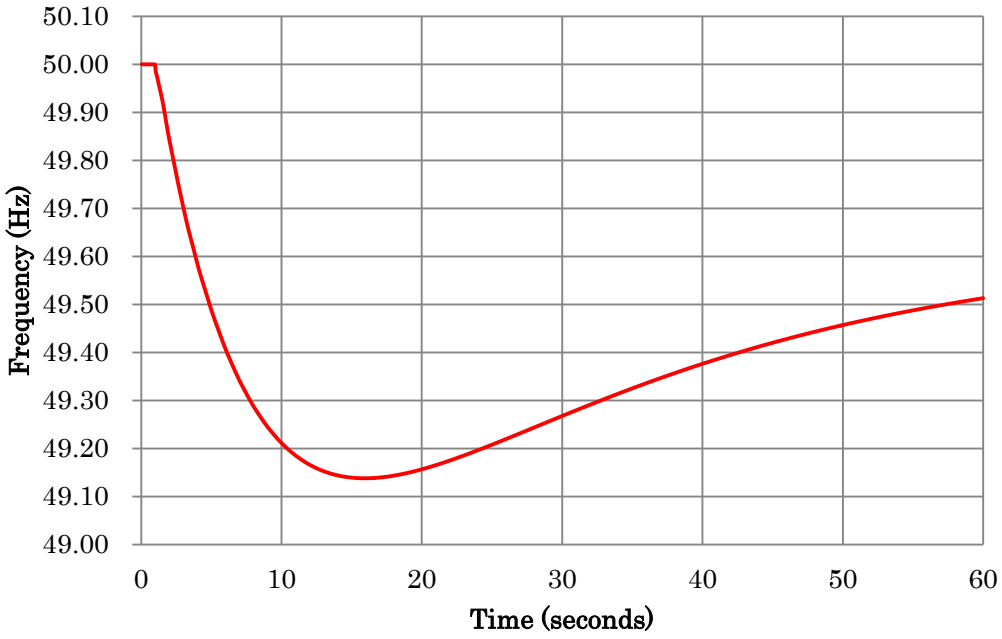
(Hydro Maximum Night Peak in 2025、Generating Operation, Connected to Kotmale and Kirindiwela)
(Source: JICA Study Team)

Figure 10.4.5-27 200MW Unit Tripping at Maha PSPP



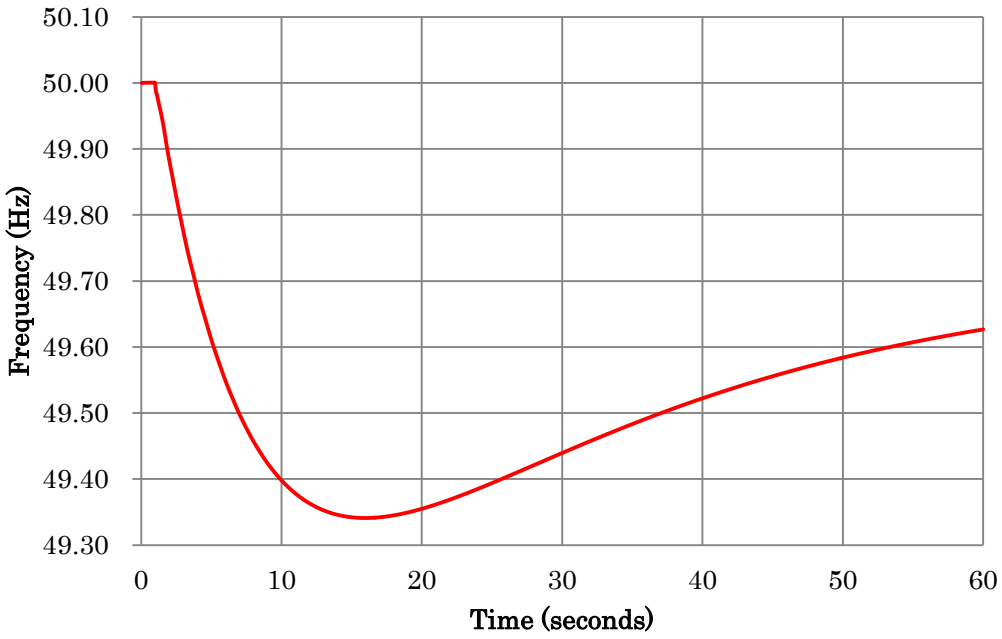
(Hydro Maximum Night Peak in 2025, Generating Operation, Connected to Kotmale and Kirindiwela)
(Source: JICA Study Team)

Figure 10.4.5-28 150MW Unit Tripping at Maha PSPP



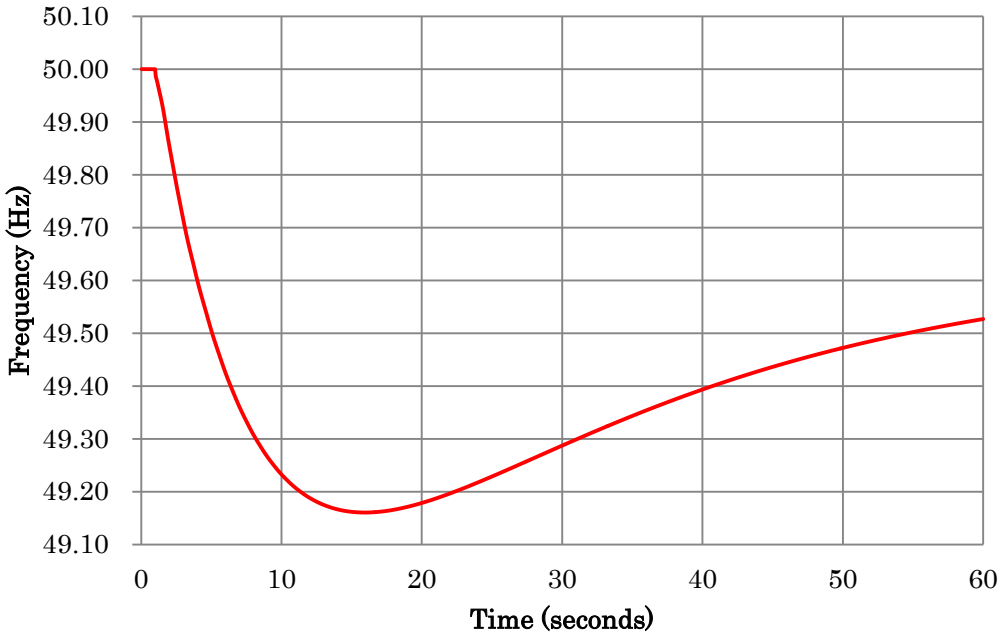
(Thermal Maximum Night Peak in 2025、Generating Operation, Connected to Kotmale)
(Source: JICA Study Team)

Figure 10.4.5-29 200MW Unit Tripping at Maha PSPP



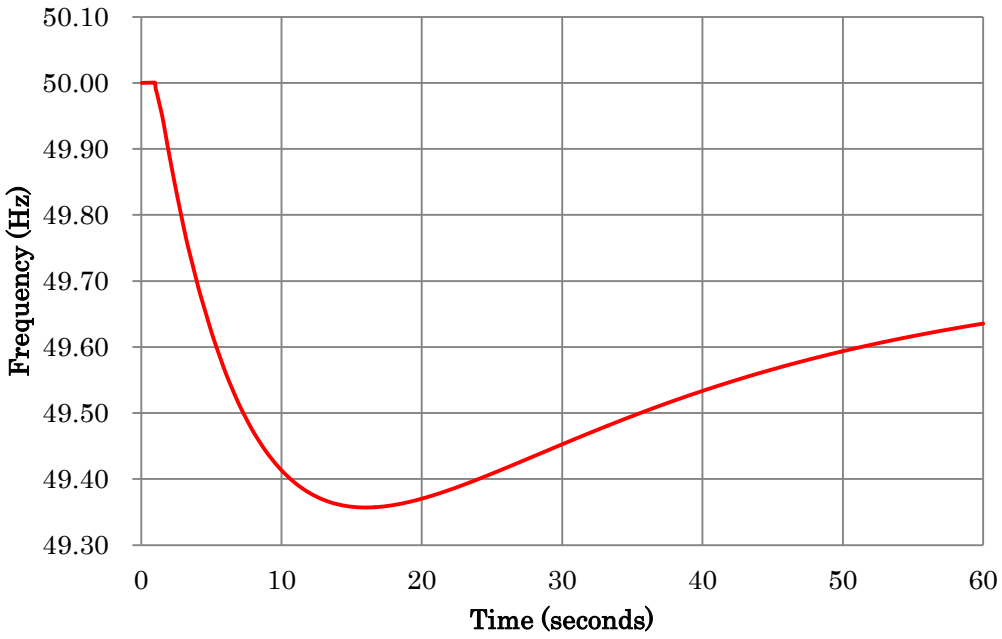
(Thermal Maximum Night Peak in 2025、Generating Operation, Connected to Kotmale)
(Source: JICA Study Team)

Figure 10.4.5-30 150MW Unit Tripping at Maha PSPP



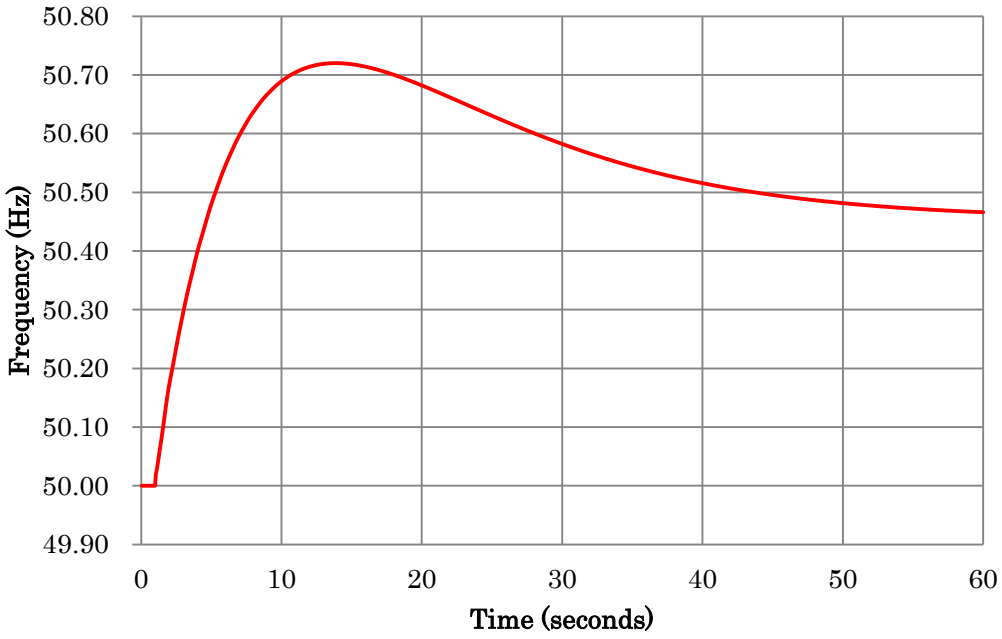
(Thermal Maximum Night Peak in 2025、Generating Operation, Connected to Kotmale and Kirindiwela)
(Source: JICA Study Team)

Figure 10.4.5-31 200MW Unit Tripping at Maha PSPP



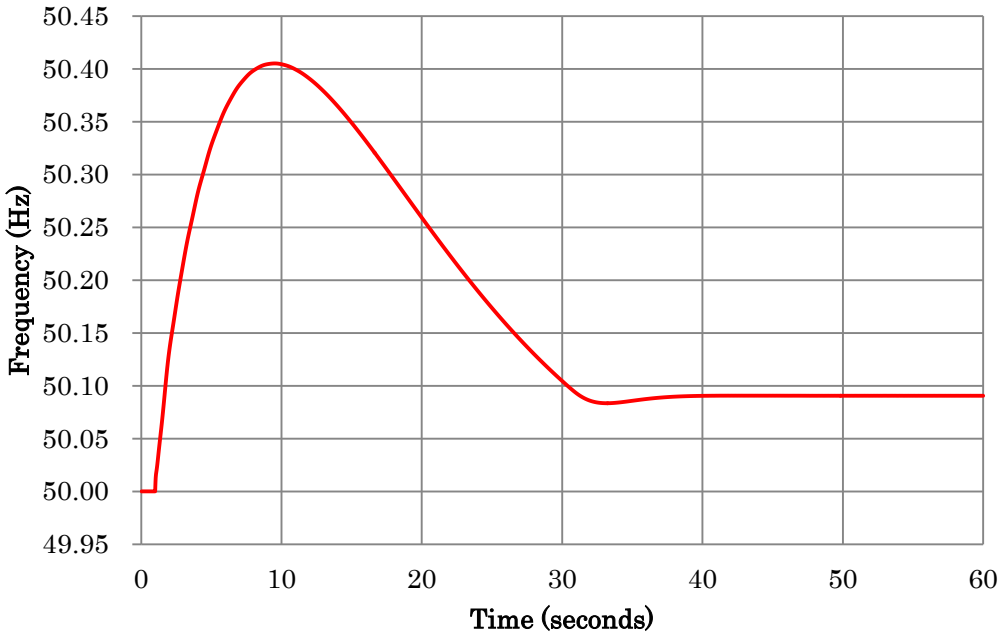
(Thermal Maximum Night Peak in 2025、Generating Operation, Connected to Kotmale and Kirindiwela)
(Source: JICA Study Team)

Figure 10.4.5-32 150MW Unit Tripping at Maha PSPP



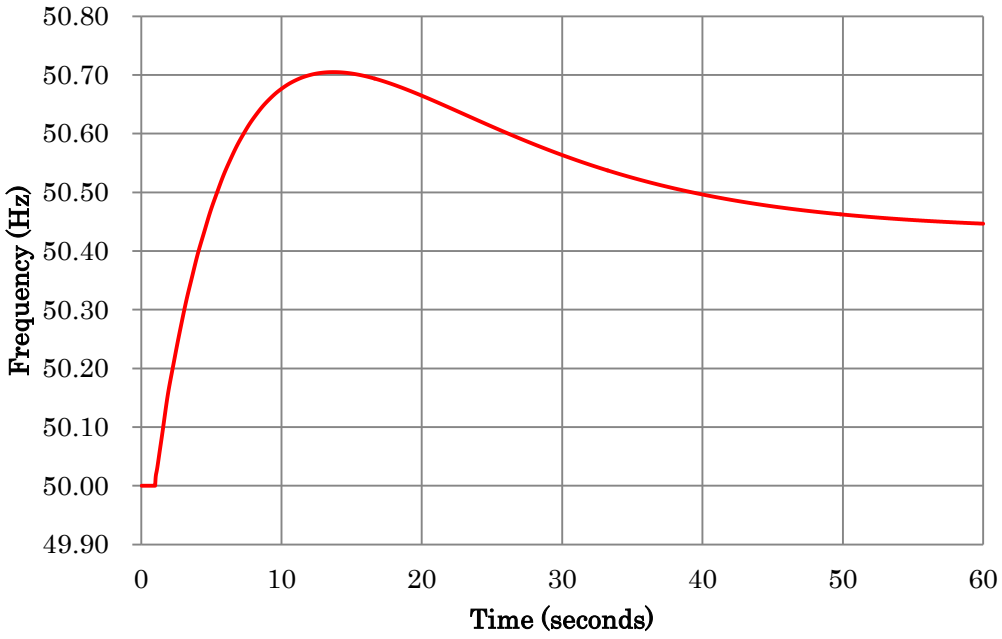
(Off Peak in 2025, Pumping Operation, Connected to Kotmale)
(Source: JICA Study Team)

Figure 10.4.5-33 200MW Unit Tripping at Maha PSPP



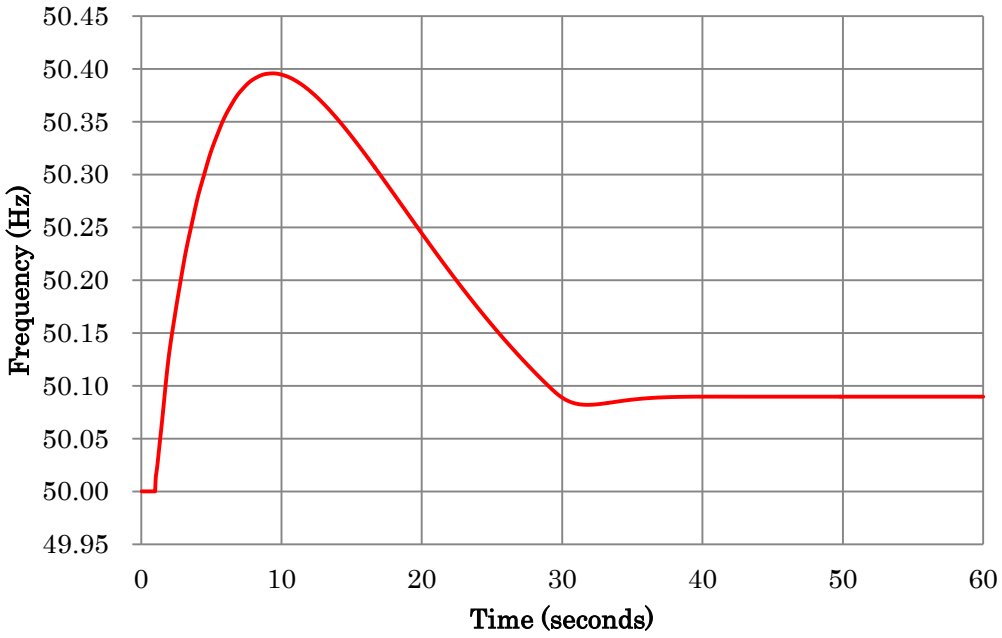
(Off Peak in 2025, Pumping Operation, Connected to Kotmale)
(Source: JICA Study Team)

Figure 10.4.5-34 150MW Unit Tripping at Maha PSPP



(Off Peak in 2025, Pumping Operation, Connected to Kotmale and Kirindiwela)
(Source: JICA Study Team)

Figure 10.4.5-35 200MW Unit Tripping at Maha PSPP



(Off Peak in 2025, Pumping Operation, Connected to Kotmale and Kirindiwela)
(Source: JICA Study Team)

Figure 10.4.5-36 150MW Unit Tripping at Maha PSPP