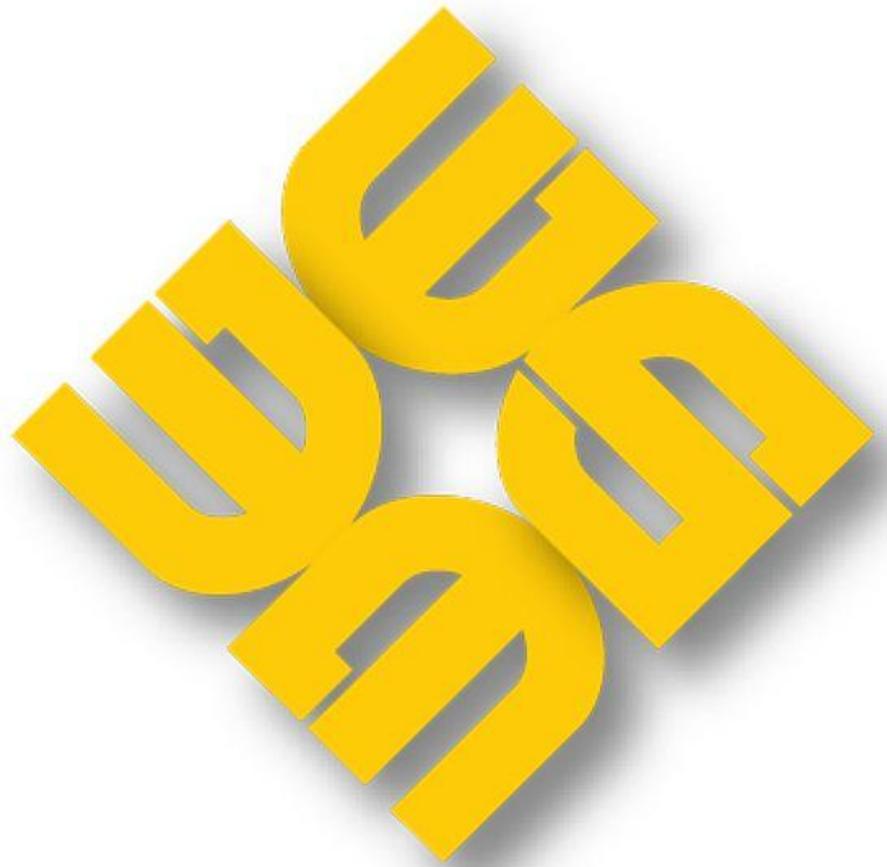


MAG-QMAR-2019-03

QUARTERLY MARKET ASSESSMENT HIGHLIGHTS

For the Billing Period 26 June to 25 September 2019



**PHILIPPINE
ELECTRICITY
MARKET
CORPORATION**

**MARKET ASSESSMENT GROUP
(MAG)**

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EXECUTIVE SUMMARY

This quarterly report assesses the results of the WESM operation for the third billing quarter of 2019 (26 June to 25 September 2019) and how the market performed compared with the previous quarter and previous year.

A slight increase was noted in total WESM registered capacity which stood at 19,967 MW by the end of the third quarter with the entry of 36.4 MW additional capacities in the market alongside other changes in the registered capacities of various plants. Of the total registered capacity, only 66 percent or an average of 13,261 MW was offered/nominated in the market.

The third quarter of 2019 welcomed an improved supply margin at 2,111 MW, which was 94 percent higher compared to 1,088 MW in the second quarter. This was driven by the 4.8 percent quarter-on-quarter increase in effective supply, from 12,802 MW to 13,419 MW attributable to the resumption of operations of plants on outage. It was noted that average outage capacity decreased by 5.7 percent, from 2,502 MW to 2,360 MW. On the other hand, the period experienced slight decrease in demand, including reserve schedule, from 11,714 MW in the second quarter to 11,307 MW in the third quarter, following the lower temperatures brought about by the onset of the rainy season.

Owing to the more comfortable supply margin, a substantial decline was noted in average market prices in the third quarter hovering at PhP3,272/MWh, which was 55.1 percent lower than previous quarter's PhP7,288/MWh. Prices fell below PhP5,000/MWh for 91 percent of the time. In addition, the secondary cap was not imposed and no price creep-up was recorded this billing quarter.

The market share based on registered capacity remained to be dominated by four (4) major participant groups, namely, San Miguel Corporation (SMC), Aboitiz Power (AP), First Gen Corporation (FGC), and Power Sector Asset and Liabilities Management (PSALM). On top is SMC with the highest share in terms of registered capacity, offered capacity, and actual generation. Notwithstanding, PSALM and Semirara Mining Power Corporation ranked as the highest market shareholders when calculated based on spot quantity and total trading amount.

Correspondingly, the Herfindahl-Hirschman Index (HHI) by major participant grouping indicated a moderately concentrated market based on registered capacity, spot quantity and total trading amount while HHI calculation based on offered capacity and actual generation indicated a concentrated market.

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QUARTERLY MARKET ASSESSMENT REPORT

This quarterly report assesses the results of the WESM operation for the Third Billing Quarter of 2019 (26 June to 25 September 2019) and how the market performed compared with the previous quarter and previous year.

I. Capacity Profile

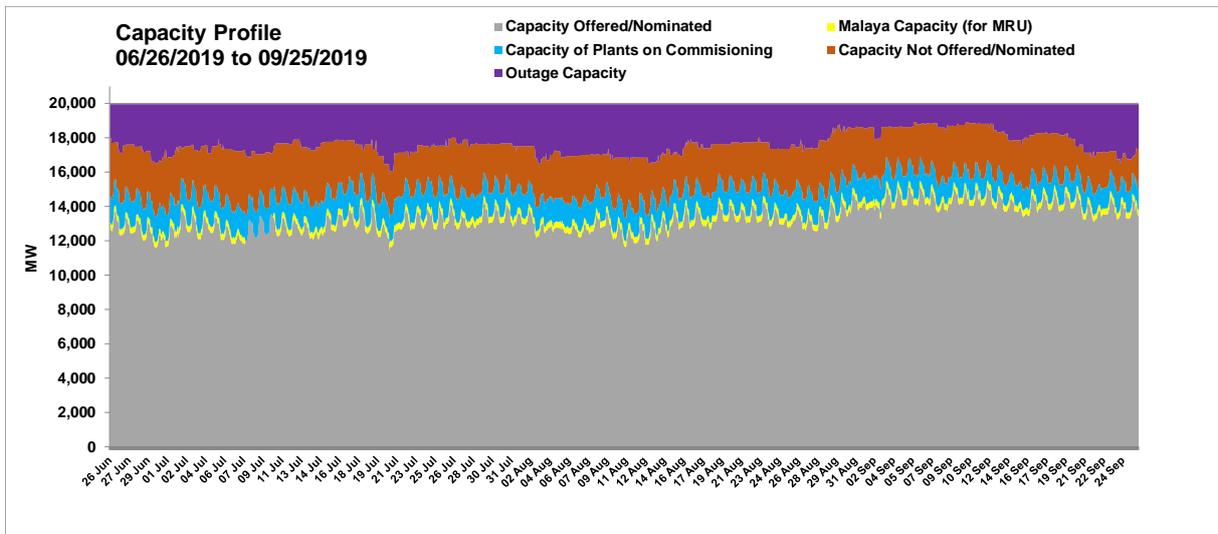
The total WESM registered capacity stood at 19,967.3 MW by the end of the third billing quarter of 2019, recording a 25.9-MW increase from 19,941.4 MW in 25 June 2019. The increase was attributed to the entry of (i) 19.2-MW Hedcor, Inc. La Trinidad HEP on 16 July, (ii) 2.2-MW Majayjay HEP on 8 August and (iii) 15-MW Cagayan Biomass on 21 September. In addition, PPC DPP, which disaggregated to three units, recorded an increase in registered capacity from 72 MW to 79 MW as well as PB 104 from 26 MW to 28 MW.

On the other hand, decreases in registered capacities were recorded involving HEDCOR HEP, which disaggregated to two units, from 30 MW to 24.9 MW as well as TVI CFTPP, from 352.4 to 338 MW.

Of the total registered capacity, only 66 percent was offered in the market, averaging 13,261 MW during the quarter. On top of which, about 2 percent or an average of 350 MW was related to the capacity designation of Malaya TPP as Must Run Unit (MRU)¹ while 7 percent or an average of 1,380 MW were related to the registered capacities of plants which were still undergoing testing and commissioning.

The rest of the 25 percent of the registered capacity was unavailable comprising of 2,360 MW or 12 percent which were on outage and 2,617 MW or 13 percent which was not offered in the market².

Figure 1. Capacity Profile (Ex-ante), 3rd Quarter 2019



¹ Per DOE Department Circular 2014-01-0003, designating the 650-MW Malaya Thermal Plant as a Must-Run Unit in the Wholesale Electricity Spot Market in cases of supply shortfall and to address system security

² Subject to compliance monitoring or investigation for possible non-compliance with the submission of offers under the WESM Rules

Table 1. Capacity Profile (Ex-ante), 3rd Quarter 2019, 2nd Quarter 2019, and 3rd Quarter 2018

	3rd Quarter 2019 (26 Jun to 25 Sep 2019)		2nd Quarter 2019 (26 Mar to 25 Jun 2019)		3rd Quarter 2018 (26 Jun to 25 Sep 2018)		% Q-on-Q Change (2Q 2019 - 3Q 2019)	% Y-on-Y Change (3Q 2018 - 3Q 2019)
	Avg MW	% of RegCap	Avg MW	% of RegCap	Avg MW	% of RegCap		
Outage Capacity	2,360	12%	2,489	13%	2,267	12%	(5.2)	4.1
Capacity Not Offered/Nominated	2,617	13%	3,048	16%	2,685	14%	(14.1)	(2.5)
Capacity of Plants on Commissioning	1,380	7%	1,374	7%	588	3%	0.4	134.6
Malaya Capacity (for MRU)	350	2%	304	1%	300	1%	15.0	16.7
Capacity Offered/Nominated	13,261	66%	12,261	64%	13,042	69%	8.2	1.7
Registered Capacity (by the end of the billing month)	19,967	100%	19,941		18,888	100%	0.1	5.7

Table 2. Monthly Capacity Profile (Ex-ante), 3rd Quarter 2019

	July 2019 (26 Jun to 25 Jul 2019)		August 2019 (26 Jul to 25 Aug 2019)		September 2019 (26 Aug to 25 Sep 2019)	
	Avg MW	% of RegCap	Avg MW	% of RegCap	Avg MW	% of RegCap
Outage Capacity	2,596	13%	2,652	13%	1,838	9%
Capacity Not Offered/Nominated	2,780	14%	2,567	13%	2,509	13%
Capacity of Plants on Commissioning	1,505	8%	1,369	7%	1,270	6%
Malaya Capacity (for MRU)	350	2%	350	2%	350	2%
Capacity Offered/Nominated	12,748	64%	13,027	65%	13,993	70%
Registered Capacity (by the end of the billing month)	19,964	100%	19,967	100%	19,967	100%

II. Power Plant Outages

a. Outage Capacity by Outage Plant Type

Lower level of outage capacity was noted this quarter at an average of 2,360 MW coming from previous quarter's 2,502 MW attributable to the resumption of operations of major plants on outage namely Malaya TPP unit 2 which underwent deactivated shutdown from 19 May 2018 to 22 June 2019 and Pagbilao 1 which underwent planned outage from 30 March 2019 to 24 April 2019 as well as forced outage from 2 to 14 May.

Outage capacity generally decreased towards the end of the quarter from an average of 2,596 MW in July down to 1,838 MW in September. This was primarily driven by the decline in coal plants' outage from 1,493 MW in July to 743 MW in September.

Among plant types, coal plants recorded the highest level of outage capacity which averaged at 1,095 MW, accounting for the 46 percent of the total outage during the quarter. This mainly involved the forced outages of Calaca CFTPP unit 1 (300 MW), Masinloc CFTPP unit 3 (335 MW), Mariveles CFTPP unit 2 (316 MW), and maintenance outages of Pagbilao CFTPP unit 2 (382 MW) and SLTEC CFTPP unit 1 (121 MW).

Meanwhile, natural gas plants accounted for 16 percent, an average of 389 MW, of this quarter's outage capacity. Notably, natural gas plants' average outage capacity was only at 166 MW in July. This rose to 708 MW in August following the planned outages of Ilijan NGPP Block B (600 MW) from 25 July to 30 August and Sta. Rita NGPP unit 3 (266 MW) from 10 to 16 August, and forced outages of Avion NGPP units 1 and 2 (101 MW) from 16 August until the end of the billing quarter.

This quarter's outage involving oil-based plants averaged at 363 MW or 15 percent of the total outage capacity due to the forced outage of Malaya TPP unit 1 (300 MW) since 3 May 2019 rendering it unavailable for the entire third quarter.

On the other hand, geothermal plants' outage averaged at 269 MW which still involved Tiwi GPP unit A (59 MW) and Makban GPP unit C (110 MW) while hydro plants' average outage

capacity at 244 MW was attributed to the planned outages of Kalayaan PSPP unit 3 (180 MW) and San Roque HEP unit 2 (145 MW).

Provided in Appendix A is the list of major plant outages.

Figure 2. Plant Outage Capacity (by Plant Type), 3rd Quarter 2019

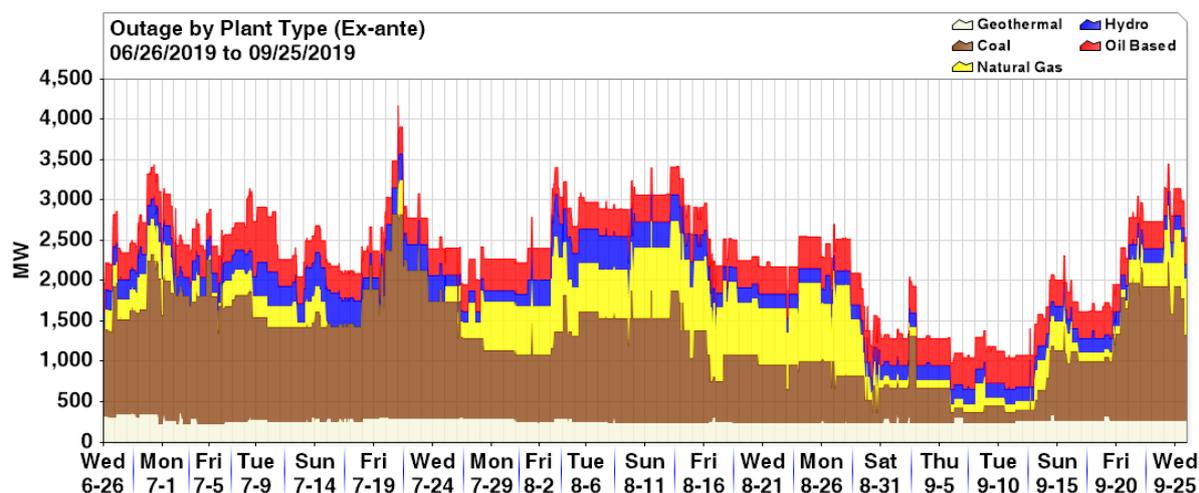


Table 3. Outage Summary (Ex-ante), 3rd Quarter 2019, 2nd Quarter 2019, and 3rd Quarter 2018

	3rd Quarter 2019 (26 Jun to 25 Sep 2019)			2nd Quarter 2019 (26 Mar to 25 Jun 2019)			3rd Quarter 2018 (26 Jun to 25 Sep 2018)			% Q-on-Q Change (2Q 2019 - 3Q 2019)			% Y-on-Y Change (3Q 2018 - 3Q 2019)		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Coal	2,532	135	1,095	2,561	300	1,273	2,122	273	992	(1.1)	(55.0)	(14.0)	19.3	(50.5)	10.4
Natural Gas	1,176	0	389	527	0	54	677	0	139	123.3		621.8	73.6		179.1
Geothermal	381	231	269	530	265	324	641	273	361	(28.1)	(12.7)	(17.1)	(40.6)	(15.3)	(25.6)
Hydro	527	145	244	645	145	293	580	50	198	(18.3)	0.0	(16.7)	(9.1)	190.0	23.2
Oil Based	745	331	363	915	331	557	855	410	577	(18.6)	0.0	(34.9)	(12.9)	(19.3)	(37.1)
TOTAL	4,172	1,053	2,360	4,069	1,495	2,502	3,920	1,293	2,267	2.5	(29.6)	(5.7)	6.4	(18.6)	4.1

Table 4. Monthly Outage Summary (Ex-ante), 3rd Quarter 2019

	July 2019 (26 Jun to 25 Jul 2019) in MW			August 2019 (26 Jul to 25 Aug 2019) in MW			September 2019 (26 Aug to 25 Sep 2019) in MW		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Coal	2,532	1,074	1,493	1,694	479	1,062	1,959	135	743
Natural Gas	685	0	166	1,176	190	708	1,121	101	286
Geothermal	381	231	281	313	246	260	363	246	265
Hydro	422	145	282	527	145	269	360	180	184
Oil Based	745	331	374	451	331	354	451	331	360
TOTAL	4,172	1,970	2,596	3,471	1,942	2,652	3,453	1,053	1,838

b. Outage Capacity by Outage Category

Bulk of this quarter's outage capacity were forced outages which recorded an average of 1,246 MW. This was largely attributable to Malaya TPP unit 1 (300 MW) due to its quarter-long outage. On top of which, other major coal plants namely Calaca CFTPP unit 1 (300 MW), Masinloc CFTPP unit 3 (335 MW) and Mariveles CFTPP unit 2 (316 MW) as well as Makban GPP unit C went on forced outages.

On the other hand, planned outage capacity accounted for 28 percent of this quarter's outage at an average of 672 MW which was attributed to Ilijan NGPP Block B (600 MW), Kalayaan PSPP unit 3 (180 MW), and San Roque HEP unit 2 (145 MW).

Meanwhile, maintenance outage comprised 16 percent or an average of 386 MW of the period's outage involving Pagbilao CFTPP unit 2 (382 MW), SLTEC CFTPP unit 1 (121 MW), and Tiwi GPP unit A (59 MW). This quarter's average was significantly higher compared to previous quarter's average at 171 MW.

Lastly, deactivated shutdown outage capacity recorded a lower average at 55 MW, which solely involved Makban GPP unit C (55 MW), from 347 MW in the second quarter. It may be recalled that the forced outage of Malaya TPP unit 2 (350 MW) was reclassified as deactivated shutdown category in the previous quarter.

Figure 3. Plant Outage Capacity (by Outage Category), 3rd Quarter 2019

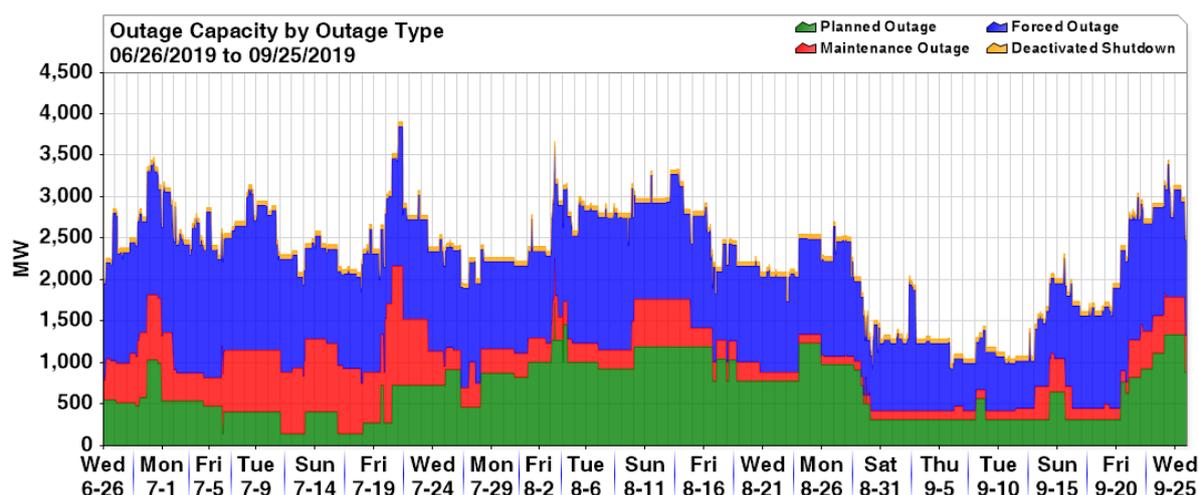


Table 5. Outage Summary, by Outage Category, 3rd Quarter 2019, 2nd Quarter 2019, and 3rd Quarter 2018

	3rd Quarter 2019 (26 Jun to 25 Sep 2019)			2nd Quarter 2019 (26 Mar to 25 Jun 2019)			3rd Quarter 2018 (26 Jun to 25 Sep 2018)			% Q-on-Q Change (2Q 2019 - 3Q 2019)			% Y-on-Y Change (3Q 2018 - 3Q 2019)		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Planned	1,726	145	672	1,410	445	782	1,053	255	583	22.4	(67.4)	(14.1)	64.0	(43.1)	15.3
Maintenance	1,439	104	386	886	84	171	1,380	0	289	62.5	23.8	125.7	4.3		33.3
Forced	1,999	579	1,246	2,371	210	1,190	2,565	836	1,302	(15.7)	175.5	4.7	(22.1)	(30.8)	(4.3)
Deactivated Shutdown	55	55	55	449	55	347	99	99	99	(87.7)	0.0	(84.1)	(44.3)	(44.3)	(44.3)

Table 6. Monthly Outage Summary, by Outage Category, 3rd Quarter 2019

	July 2019 (26 Jun to 25 Jul 2019) in MW			August 2019 (26 Jul to 25 Aug 2019) in MW			September 2019 (26 Aug to 25 Sep 2019) in MW		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Planned	1,036	145	489	1,726	465	975	1,338	315	545
Maintenance	1,439	230	679	574	104	287	534	104	201
Forced	1,999	862	1,397	1,780	885	1,295	1,782	579	1,051
Deactivated Shutdown	55	55	55	55	55	55	55	55	55

c. Outage Capacity by Major Participant

Among the major participant groups, San Miguel Corporation (SMC) recorded the highest average outage capacity at 614 MW or 26 percent of this quarter's outage attributable to Ilijan NGPP Block B (600 MW), Masinloc CFTPP unit 3 (335 MW), and San Roque HEP (145 MW). Power Sector Asset and Liabilities Management (PSALM) followed with 21 percent of this quarter's system-wide outage capacity or an average of 492 MW which involved Malaya TPP unit 1 (300 MW) and Kalayaan PSPP unit 3 (180 MW). Meanwhile, Aboitiz Power recorded an average outage capacity at 409 MW or 17 percent which involved Pagbilao CFTPP unit 2 (382 MW) and Mariveles CFTPP unit 2 (316 MW).

The outage capacity involving First Gen Corporation (FGC) averaged at 176 MW or 7 percent which involved Avion NGPP (101 MW), Palinpinon GPP II unit 4 (20 MW), and Sta. Rita NGPP unit 3 (265.5 MW).

Figure 4. Plant Outage Capacity (by Major Participant Grouping), 3rd Quarter 2019

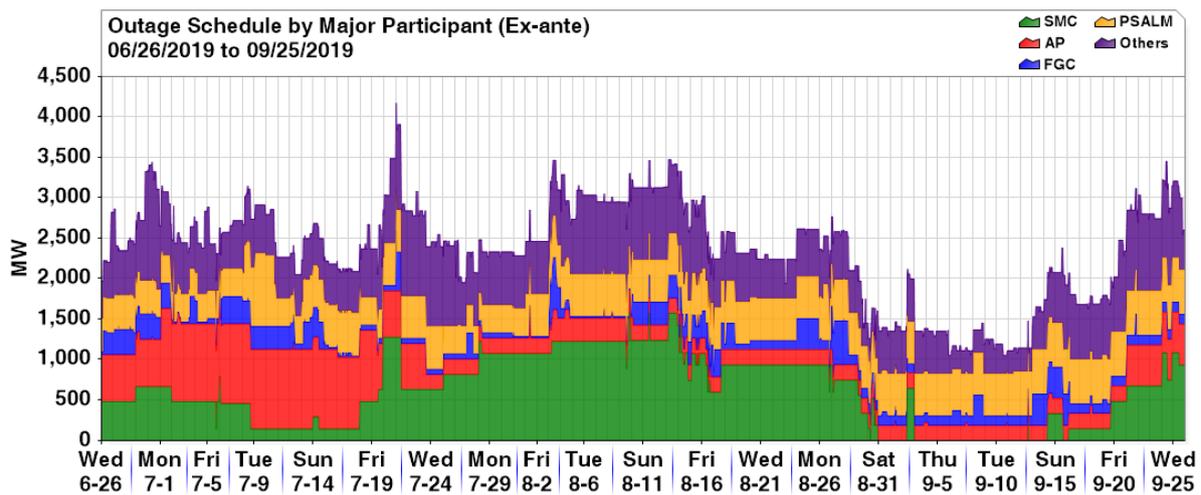


Table 7. Outage Summary, by Major Participant Grouping, 3rd Quarter, 2nd Quarter 2019, and 3rd Quarter 2018

	3rd Quarter 2019 (26 Jun to 25 Sep 2019)			2nd Quarter 2019 (26 Mar to 25 Jun 2019)			3rd Quarter 2018 (26 Jun to 25 Sep 2018)			% Q-on-Q Change (2Q 2019 - 3Q 2019)			% Y-on-Y Change (3Q 2018 - 3Q 2019)		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
SMC	1,574	0	614	1,427	145	400	1,394	50	485	10.3	(100.0)	53.2	12.9	(100.0)	26.4
AP	1,384	189	409	1,512	308	752	1,175	233	519	(8.4)	(38.6)	(45.6)	17.8	(18.8)	(21.2)
FGC	753	20	176	567	20	87	697	20	175	32.9	0.0	102.6	8.0	0.0	0.4
PSALM	904	342	492	862	382	573	861	350	532	4.9	(10.5)	(14.1)	5.1	(2.3)	(7.4)
Others	1,425	181	669	1,579	335	690	1,133	187	555	(9.8)	(46.1)	(3.0)	25.8	(3.4)	20.4
TOTAL	4,172	1,053	2,360	4,069	1,495	2,502	3,920	1,293	2,267	2.5	(29.6)	(5.7)	6.4	(18.6)	4.1

Table 8. Monthly Outage Summary, by Major Participant Grouping, 3rd Quarter 2019

	July 2019 (26 Jun to 25 Jul 2019) in MW			August 2019 (26 Jul to 25 Aug 2019) in MW			September 2019 (26 Aug to 25 Sep 2019) in MW		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
SMC	1,277	145	470	1,574	600	1,069	1,085	0	297
AP	1,384	189	782	571	189	215	505	189	242
FGC	753	20	184	644	20	166	561	121	180
PSALM	904	342	455	522	342	485	697	517	534
Others	1,425	454	705	1,133	181	718	1,249	226	585

d. Outage Factor

As seen in Table 9 below, the system-wide total outage factor declined from 13.4 percent in July to 13.2 percent in August and eventually to 9.4 percent in September. Forced outage factor was consistently the largest component of the total outage factor in all the billing months. Total forced outage factor ranged from 5.4 percent in September to 7.3 percent in July.

Meanwhile, among the various resource types, it was noted that geothermal and oil-based plants regularly observed high outage factor.

Figure 5. Outage Factor (by Plant Type), 3rd Quarter 2019

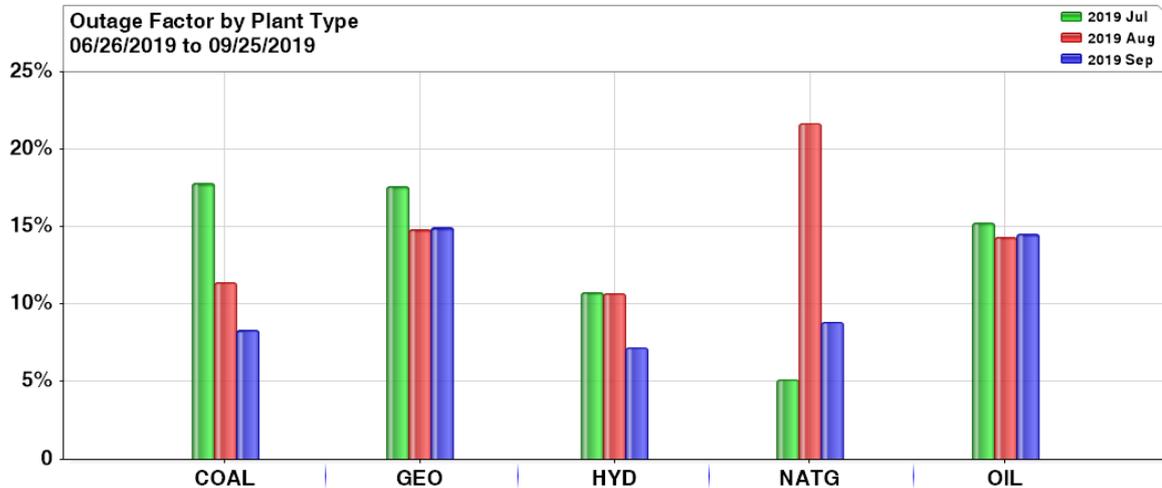


Figure 6. Outage Factor (by Outage Type), 3rd Quarter 2019



Table 9. Outage Factor, 3rd Quarter 2019

Plant Type	Total Outage Factor			Forced Outage Factor			Maintenance Outage Factor			Planned Outage Factor			D/S Outage Factor		
	Jul 2019	Aug 2019	Sep 2019	Jul 2019	Aug 2019	Sep 2019	Jul 2019	Aug 2019	Sep 2019	Jul 2019	Aug 2019	Sep 2019	Jul 2019	Aug 2019	Sep 2019
BAT															
BIOF	12.9	13.0	16.7	12.9	13.0	15.5			1.2						
COAL	17.8	11.4	8.3	10.5	9.0	5.1	4.4	1.9	0.6	2.9	0.6	2.6			
GEO	17.6	14.8	14.9	7.6	6.5	6.2	5.8	4.7	5.6	1.1	0.4		3.1	3.1	3.1
HYD	10.7	10.7	7.2	0.5	1.0	0.1	4.5			5.8	9.8	7.1			
NATG	5.1	21.6	8.9	0.7	1.0	3.8	2.2	0.3	0.8	2.2	20.3	4.2			
OIL	15.3	14.3	14.5	13.8	12.7	13.3	1.0	1.5	1.0	0.4	0.2	0.2			
SOLR	2.9	6.0	5.7	2.9	6.0	5.7									
WIND															
Total	13.4	13.2	9.4	7.3	6.6	5.4	3.4	1.4	1.0	2.4	4.9	2.7	0.3	0.3	0.3

III. Demand and Supply Situation

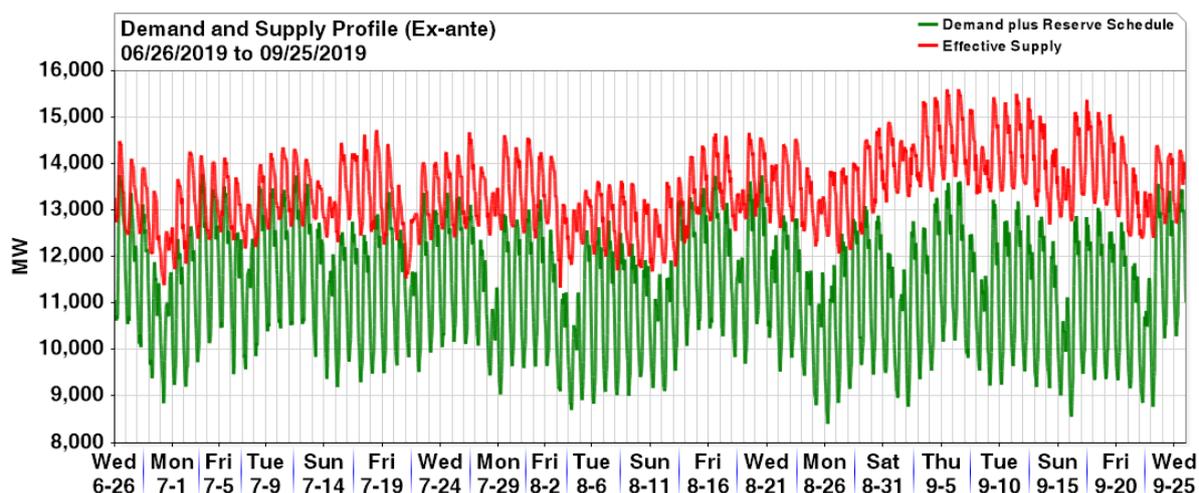
System demand generally decreased towards the end of the third quarter of 2019. Quarterly comparison indicated a lower average at 10,228 MW following the cooler temperatures this period with the onset of the rainy season. This demonstrated a 5.3 percent decrease from 10,805 MW during the previous quarter which was the height of the summer season. Year-on-year, this quarter's figures was 6.7 percent higher compared to 9,589 MW in third quarter of 2018.

Meanwhile, the reserve schedule averaged at 1,079 MW. Correspondingly, the demand plus reserve schedule averaged at 11,307 MW, demonstrated a 3.5 percent increase from last quarter's 11,714 MW.

On the other hand, effective supply³ increased by 4.8 percent increase at an average of 13,419 MW coming from 12,802 MW during the second quarter following the resumption of operations of plants on outage. Moreover, monthly averages of effective supply increased from 13,167 MW in July to 13,894 MW in September. Yearly comparison likewise showed an increase, at 6.3 percent, from previous year's 12,626 MW.

As a result of the decline in demand and growth in supply, quarterly supply margin⁴ substantially improved by 94 percent. This quarter's average grew to 2,111 MW coming from previous quarter's 1,088 MW. It likewise followed that the September billing month observed the widest monthly average supply margin, at 2,739 MW, during the quarter. This quarter's average, however, was still lower compared to previous year's 2,168 MW.

Figure 7. Demand and Effective Supply (Ex-ante), 3rd Quarter 2019



³The system effective supply is equal to the offered capacity of all scheduled generator resources, nominated loading level of non-scheduled generating units and projected output of preferential dispatch generating units adjusted for any security limit and ramp rates. Scheduled output of plants on testing and commissioning, through the imposition of security limit by SO, are accounted for in the effected supply. Likewise included is the scheduled output of Malaya plant when it is called to run as Must Run Unit (MRU).

⁴The supply margin is equal to the effective supply less system demand requirement plus reserve schedule.

Table 10. Demand and Supply Summary (Ex-ante), 3rd Quarter, 2nd Quarter 2019, , and 3rd Quarter 2018

	3rd Quarter 2019 (26 Jun to 25 Sep 2019)			2nd Quarter 2019 (26 Mar to 25 Jun 2019)			3rd Quarter 2018 (26 Jun to 25 Sep 2018)			% Q-on-Q Change (2Q 2019 - 3Q 2019)			% Y-on-Y Change (3Q 2018 - 3Q 2019)		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Demand	12,946	7,499	10,228	13,378	6,986	10,805	11,932	6,443	9,589	(3.2)	7.3	(5.3)	8.5	16.4	6.7
Reserve Schedule	1,466	627	1,079	1,402	156	908	1,274	358	869	4.5	301.0	18.8	15.1	75.0	24.2
Demand plus R/S	13,779	8,414	11,307	14,289	7,855	11,714	12,975	7,143	10,457	(3.6)	7.1	(3.5)	6.2	17.8	8.1
Effective Supply	15,605	11,341	13,419	14,925	10,736	12,802	14,418	10,688	12,626	4.6	5.6	4.8	8.2	6.1	6.3
Supply Margin	4,529	168	2,111	3,540	0	1,088	4,606	199	2,168	27.9	47,917.1	94.0	(1.7)	(15.4)	(2.6)

Note: The derived values were non-coincident.

Table 11. Monthly Demand and Supply Summary (Ex-ante), 3rd Quarter 2019

	July 2019 (26 Jun to 25 Jul 2019) in MW			August 2019 (26 Jul to 25 Aug 2019) in MW			September 2019 (26 Aug to 25 Sep 2019) in MW		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Demand	12,946	7,793	10,520	12,589	7,615	10,128	12,351	7,499	10,046
Reserve Schedule	1,466	627	1,052	1,382	756	1,077	1,405	754	1,109
Demand plus R/S	13,779	8,858	11,572	13,753	8,714	11,205	13,626	8,414	11,154
Effective Supply	14,728	11,396	13,167	14,681	11,341	13,187	15,605	12,072	13,894
Supply Margin	3,279	168	1,596	3,641	368	1,982	4,529	539	2,739

IV. Market Price Outcome⁵

a. Market Prices

Corresponding to the improved level of supply margin, average market prices went down by 55.1 percent at PhP3,272/MWh this quarter from previous quarter's PhP7,288/MWh. Yet, this quarter's average was still higher compared to PhP3,152/MWh average in the third quarter of 2018.

The monthly average prices similarly noted a decline from PhP4,657/MWh in July, to PhP3,004/MWh in August, down to PhP2,139/MWh in September consistent with the growing level of supply margin throughout the quarter.

Despite the general decrease in prices, price spikes above PhP20,000/MWh were still observed in some trading intervals as a result of relatively narrow supply margin observed. Also, market triggers were breached on the following intervals, 13 July at 2200H, 20 July at 2200H and 21 July at 0100H and 0200H, which recorded prices exceeding the PhP16,000/MWh reference level for off-peak hours. These trading intervals saw high level of outage capacity which resulted in relatively narrow supply margin. Observations on the market trigger events as above discussed have been provided to the Energy Regulatory Commission (ERC).

It is important to note that the secondary cap was not imposed and no price creep-up was recorded during this quarter.

⁵The market prices were represented by the following: (i) ex-ante load weighted average price (LWAP) for trading intervals without pricing error during ex-ante, (ii) ex-post LWAP for trading intervals with pricing error during ex-ante but without pricing error during ex-post, (iii) LWAP based on the market re-run result for trading intervals with pricing error both during ex-ante and ex-post, and (iv) estimated load reference price (ELRP) for trading intervals where the ERC-approved Price Substitution Mechanism (PSM) was applied.

Figure 8. Market Price Trend vs. Supply Margin, 3rd Quarter 2019

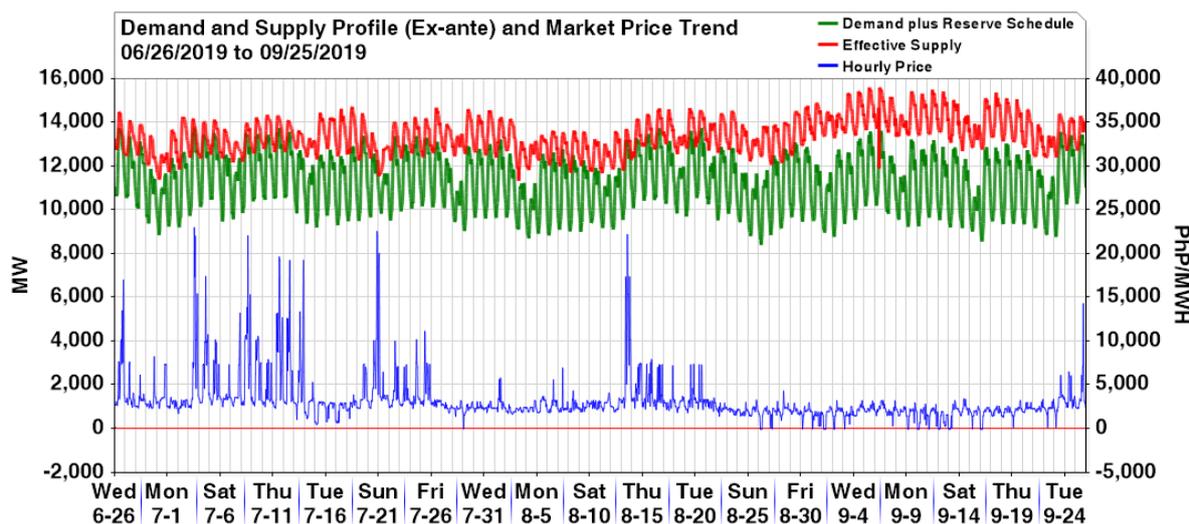


Table 12. Market Price Summary, 3rd Quarter, 2nd Quarter 2019, and 3rd Quarter 2018

System	3rd Quarter 2019 (26 Jun to 25 Sep 2019) in PhP/MWh			2nd Quarter 2019 (26 Mar to 25 Jun 2019) in PhP/MWh			3rd Quarter 2018 (26 Jun to 25 Sep 2018) in PhP/MWh			% Q-on-Q Change (2Q 2019 - 3Q 2019)			% Y-on-Y Change (3Q 2018 - 3Q 2019)		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
System	23,008	0	3,272	35,803	1,054	7,288	21,453	-1,737	3,152	(35.7)	(100.0)	(55.1)	7.2	(160.7)	3.8

Table 13. Monthly Market Price Summary, 3rd Quarter 2019

System	July 2019 (26 Jun to 25 Jul 2019) in PhP/MWh			August 2019 (26 Jul to 25 Aug 2019) in PhP/MWh			September 2019 (26 Aug to 25 Sep 2019) in PhP/MWh		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
System	23,008	488	4,657	22,224	0	3,004	14,330	0	2,139

Frequent occurrence of price separation between Luzon and Visayas was noted during the July billing month related to the unavailability of the HVDC link from 11 to 18 July. Other instances of price separation between Luzon and Visayas occurred following the unavailability of the HVDC link between the region is unavailable or its maximum capacity is reached.

Figure 9. Market Price Trend - Luzon, 3rd Quarter 2019

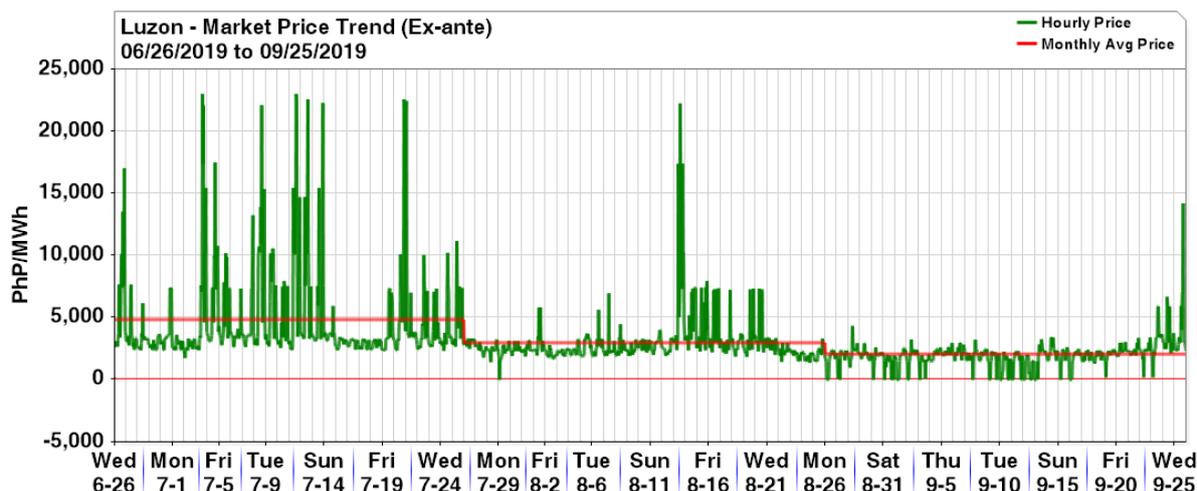


Figure 10. Market Price Trend - Visayas, 3rd Quarter 2019

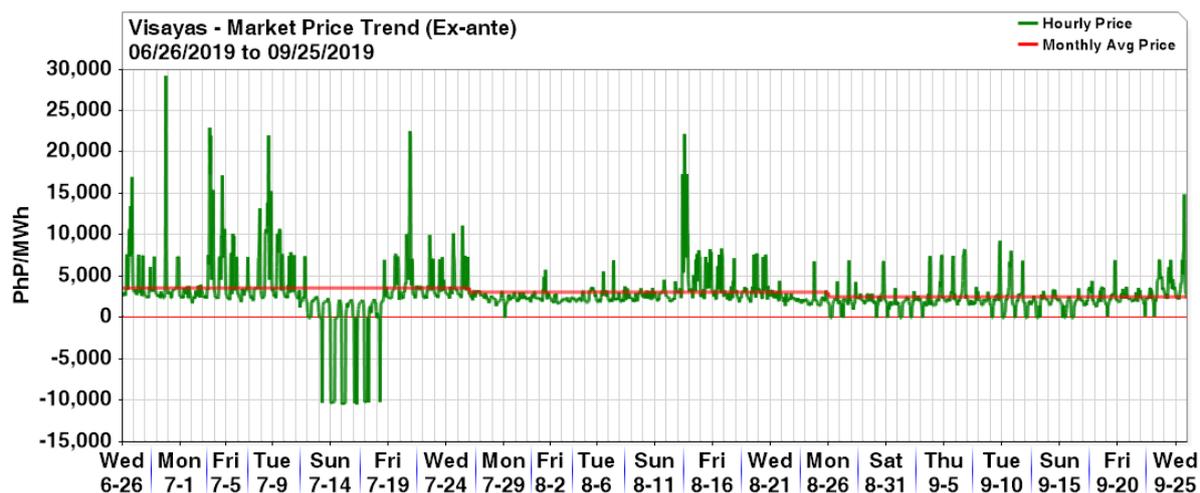


Table 14. Monthly Regional Price Summary – 3rd Quarter 2019

	Luzon in PhP/MWh			Visayas in PhP/MWh			% Difference		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
July 2019	23,008	1,759	4,853	29,268	-10,488	3,622	(21.4)	(116.8)	34.0
August 2019	22,224	0	2,986	22,224	0	3,095	0.0		(3.5)
September 2019	14,204	0	2,057	14,914	0	2,554	(4.8)		(19.4)

b. Price Distribution

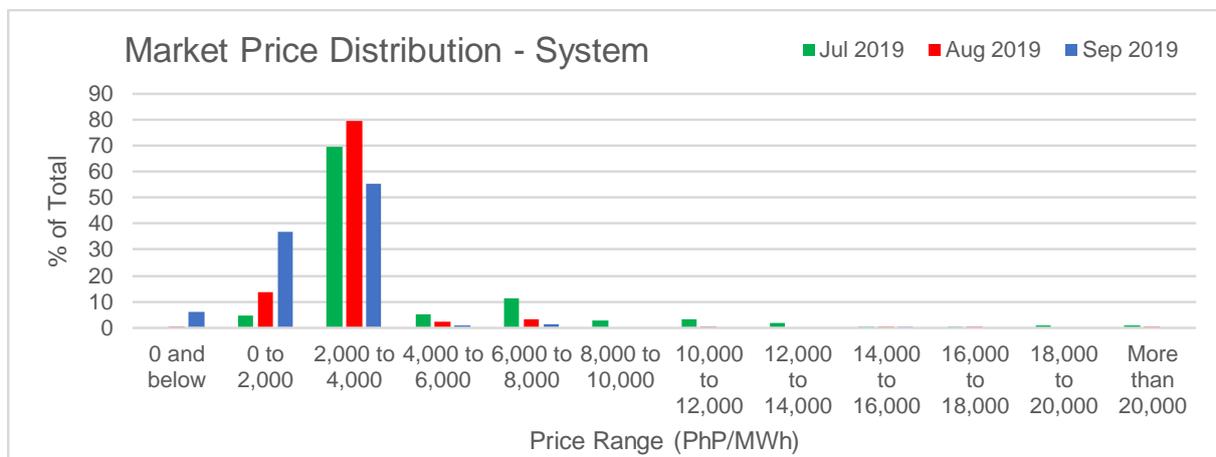
Consistent with the declined in the monthly average market price this quarter, the frequency of prices below PhP4,000/MWh grew in September at 98.1 percent from 73.9 percent in July and 93.3 percent in August.

Furthermore, no price was recorded above PhP16,000/MWh in September from about 1.9 percent or 14 trading intervals in July and 0.4 percent or 3 trading intervals in August.

Figure 11. Price Distribution, 3rd Quarter 2019

Price Range (PhP/MWh)	% Distribution		
	Jul 2019	Aug 2019	Sep 2019
0 and below	0.0	0.1	5.9
0 to 2,000	4.4	13.7	37.0
2,000 to 4,000	69.4	79.4	55.2
4,000 to 6,000	5.0	2.3	0.7
6,000 to 8,000	11.3	3.2	1.1
8,000 to 10,000	2.8	0.0	0.0
10,000 to 12,000	3.2	0.4	0.0
12,000 to 14,000	1.7	0.0	0.0
14,000 to 16,000	0.3	0.4	0.1
16,000 to 18,000	0.4	0.3	0.0
18,000 to 20,000	0.7	0.0	0.0
More than 20,000	0.8	0.1	0.0
	100.0	100.0	100.0

Table 15. Monthly Price Distribution – 3rd Quarter 2019



c. Price Duration Curve

The price duration curves demonstrate the higher market prices during peak⁶ hours compared to off-peak⁷ hours.

As seen in Figure 13 below, bulk of the market prices during the off-peak hours of the billing month, at 97 percent was at PhP4,000/MWh and below. About 2 percent ranged from above PhP4,000/MWh up to PhP10,000/MWh while the remaining 1 percent were above PhP10,000/MWh up to PhP32,000/MWh.

On the other hand, about 78 percent of the prices during the peak hours were below PhP4,000/MWh as shown in Figure 12. About 17 percent fell within PhP4,000/MWh up to PhP10,000/MWh while 5 percent was above PhP10,000/MWh up to PhP32,000/MWh.

Figure 12. Price Duration Curve (Peak Period), 3rd Quarter 2019

⁶Peak hours include 1000H-2100H from Mondays to Saturdays and 1900H-2000H on Sundays and Holidays

⁷Off-peak hours include 0100H to 0900H and 2200H to 2400H from Mondays to Saturdays and 0100H to 1800H and 2100H to 2400H on Sundays and Holidays

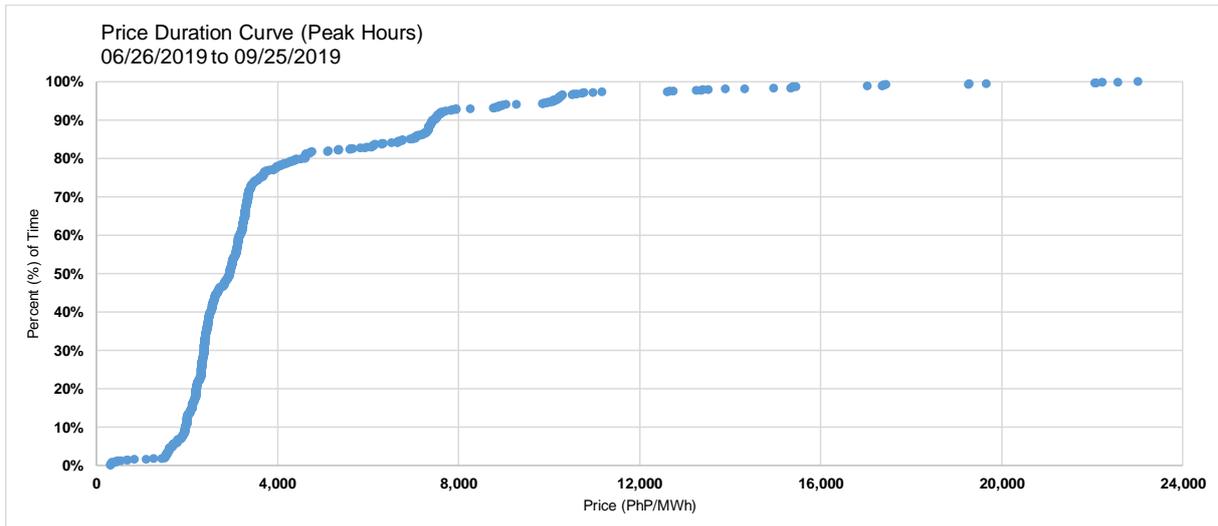
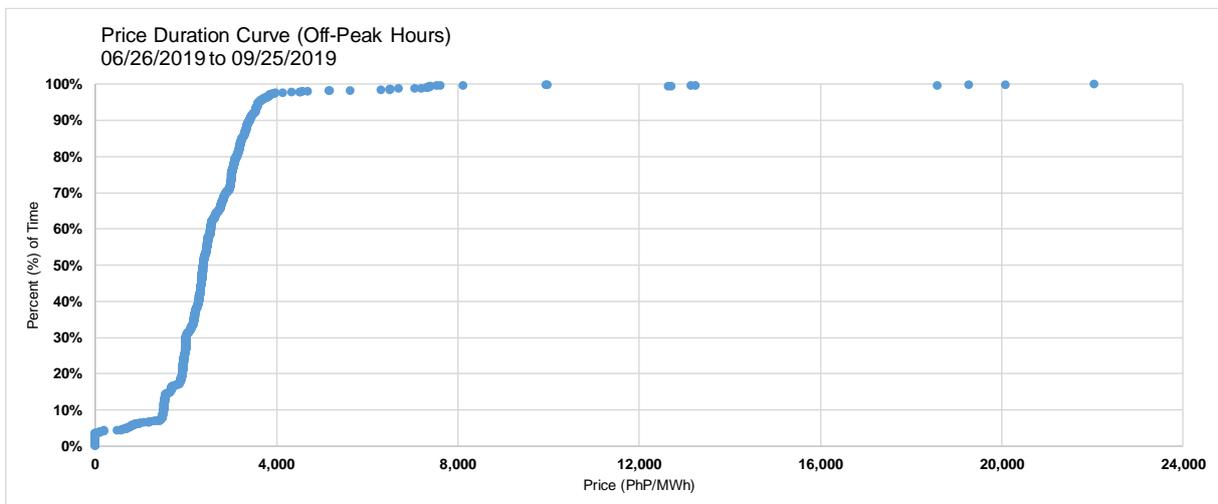


Figure 13. Price Duration Curve (Off-Peak Period), 3rd Quarter 2019



d. Interesting Pricing Event

Interesting pricing events refer to intervals determined to have price outliers based on the relationship of market price and supply margin. Prices within the upper and lower reference price thresholds are considered as “normal prices”, while prices outside or beyond the thresholds are tagged as “interesting pricing events”. Appendix B provides details on the MSC-approved methodology in determining interesting pricing events.

A total of 11 trading intervals in July and 1 trading intervals in August recorded market prices higher than the upper price threshold corresponding to the supply margin. On the other hand, no recorded trading interval had market prices falling below the lower price threshold corresponding to their supply margin.

Provided in Table 16 are the details on the market price and supply margin during the said trading intervals and the corresponding reference price threshold for each interesting pricing event.

Figure 14. Supply Margin and Market Price, 3rd Quarter 2019

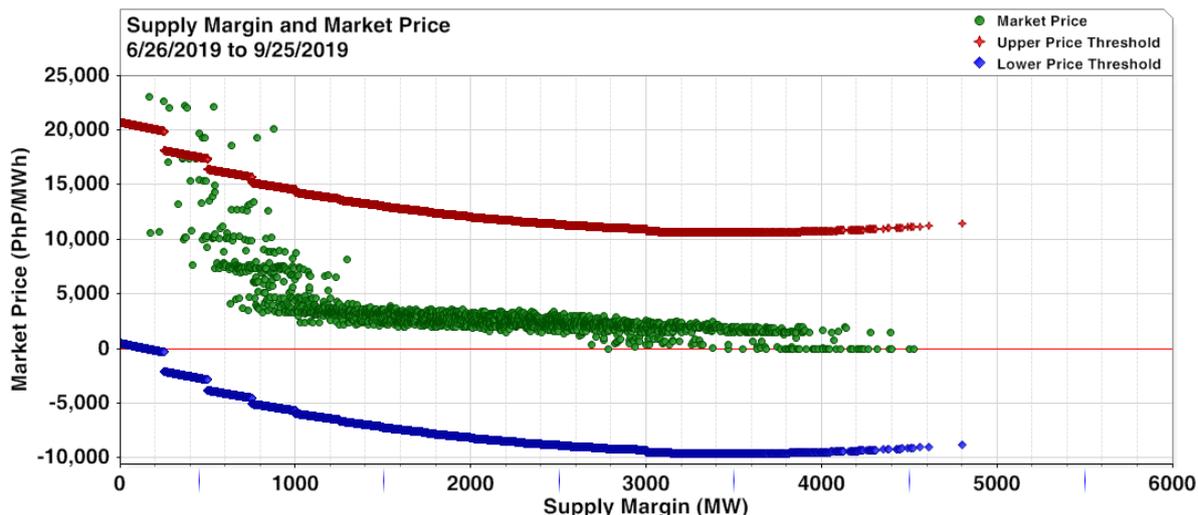


Table 16. Interesting Pricing Events (Exceeding the Upper Threshold) – 3rd Quarter 2019

Month	Day	Trading Interval	Supply Margin	Market Price	Upper Price Threshold	Lower Price Threshold
July	3	14	168	23,008	515	20,733
	3	16	279	22,054	-2,072	18,146
	8	16	538	22,088	-3,794	16,424
	11	15	451	19,659	-2,072	18,146
	11	16	470	19,283	-2,072	18,146
	12	15	483	19,263	-2,072	18,146
	13	22	779	19,266	-5,017	15,201
	20	21	252	22,573	-2,072	18,146
	20	22	386	22,041	-2,072	18,146
	21	1	636	18,580	-3,794	16,424
21	2	877	20,080	-5,017	15,201	
August	13	14	368	22,224	-2,072	18,146

V. Pricing Errors, Market Intervention, and Secondary Cap

System-wide non-congestion pricing errors in the ex-ante affected 22 trading intervals in the ex-ante and 16 trading intervals in the ex-post during the third quarter which were related to inappropriate input data which affected the generation of prices and schedules.

In Luzon, the frequency of issuances of non-congestion pricing errors affected 30 trading intervals in the ex-ante during the third quarter related to the inappropriate input data which affected the generation of Luzon prices and schedules as well as localized contingency constraint violation on Paco SS transformers. Meanwhile, in Visayas, non-congestion pricing errors affected 15 trading intervals during the ex-ante in the third quarter related to the over-generation in Visayas.

Meanwhile, the system-wide application of Price Substitution Methodology (PSM) affected a total of 171 trading intervals in the ex-ante. PSM application this month was mainly due to

constraint on New Naga-Quiot line with 70 affected trading intervals and on Samboan-Amlan Line 1 (Cebu-Negros submarine cable) with 58 affected trading intervals.

No market intervention declaration was recorded this quarter. Also, the secondary cap was not imposed during the quarter.

Table 17. PEN, PSM, MI, and Sec Cap Summary, 3rd Quarter 2019

	Luz-Vis						Luzon						Visayas						Total					
	July 2019		August		September		July 2019		August		September		July 2019		August		September		July 2019		August		September	
	Freq.	% of Time	Freq.	% of Time	Freq.	% of Time	Freq.	% of Time	Freq.	% of Time	Freq.	% of Time	Freq.	% of Time	Freq.	% of Time	Freq.	% of Time	Freq.	% of Time	Freq.	% of Time	Freq.	% of Time
PEN (RTD)	6	0.8	8	1.1	8	1.1	17	2.4	6	0.8	7	0.9	31	4.3	1	0.1	5	0.7	54	7.5	15	2.0	20	2.7
PEN (RTX)	3	0.4	4	0.5	9	1.2	7	1.0	5	0.7	6	0.8	40	5.6	-	-	5	0.7	50	6.9	9	1.2	20	2.7
PSM (RTD)	92	12.8	44	5.9	35	4.7	3	0.4	-	-	-	-	-	-	-	-	-	-	95	13.2	44	5.9	35	4.7
PSM (RTX)	97	13.5	37	5.0	35	4.7	-	-	3	0.4	-	-	-	-	3	0.4	-	-	97	13.5	43	5.8	35	4.7
MI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Secondary Cap	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note: The column "Total" refers to the total number of trading intervals with PEN, PSM or MI (system-wide or regional)

Shown in Table 18 below are the non-congestion pricing errors by type during the quarter. It was noted that system-wide non-congestion pricing errors were mostly related to inappropriate input data. Meanwhile, pricing errors due to over-generation affected 26 trading intervals in Visayas.

Table 18. PEN Type Summary, 3rd Quarter 2019

	Luz-Vis						Luzon						Visayas						Total					
	July 2019		August 2019		September		July 2019		August 2019		September		July 2019		August 2019		September		July 2019		August 2019		September	
	Freq.	% of Time	Freq.	% of Time	Freq.	% of Time	Freq.	% of Time	Freq.	% of Time	Freq.	% of Time	Freq.	% of Time	Freq.	% of Time	Freq.	% of Time	Freq.	% of Time	Freq.	% of Time	Freq.	% of Time
PEN (RTD)	6	0.8	8	1.1	8	1.1	24	3.3	12	1.6	7	0.9	31	4.3	2	0.3	10	1.3	61	8.5	22	3.0	25	3.4
Contingency	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Base Case	-	-	-	-	-	-	9	1.3	2	0.3	-	-	3	0.4	-	-	-	-	12	1.7	2	0.3	-	-
Over-generation	-	-	-	-	-	-	-	-	-	-	-	-	26	3.6	-	-	-	-	26	3.6	-	-	-	-
VoLL	-	-	-	-	-	-	7	1.0	4	0.5	-	-	2	0.3	1	0.1	5	0.7	9	1.3	5	0.7	5	0.7
Inappropriate Input Data	6	0.8	8	1.1	8	1.1	8	1.1	6	0.8	7	0.9	-	-	1	0.1	5	0.7	14	1.9	15	2.0	20	2.7
PEN (RTX)	3	0.4	4	0.5	9	1.2	13	1.8	10	1.3	6	0.8	40	5.6	-	-	10	1.3	56	7.8	14	1.9	25	3.4
Contingency	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Base Case	-	-	-	-	-	-	-	-	1	0.1	-	-	3	0.4	-	-	-	-	3	0.4	1	0.1	-	-
Over-generation	-	-	-	-	-	-	-	-	-	-	-	-	35	4.9	-	-	-	-	35	4.9	-	-	-	-
VoLL	-	-	-	-	-	-	6	0.8	4	0.5	-	-	2	0.3	-	-	5	0.7	8	1.1	4	0.5	5	0.7
Inappropriate Input Data	3	0.4	4	0.5	9	1.2	7	1.0	5	0.7	6	0.8	-	-	-	-	5	0.7	10	1.4	9	1.2	20	2.7

VI. HVDC Scheduling

Power flow through the HVDC Interconnection was generally directed towards the Luzon region in the ex-ante, for 1,493 trading intervals, during the billing quarter, with schedules ranging from 0.05 MW to 427 MW.

On the other hand, the HVDC power flow was directed towards the Visayas for 528 trading intervals in the ex-ante during the quarter, with schedules ranging from 0.9 MW to 250 MW.

Power flow was unavailable from 11 July at 0900H to 19 July t 2300H affecting 179 trading intervals in July as well as on 15 September from 1000H to 1700H affecting 8 trading intervals in September.

Figure 15. Summary of HVDC Limits Imposed by NGCP-SO, 3rd Quarter 2019

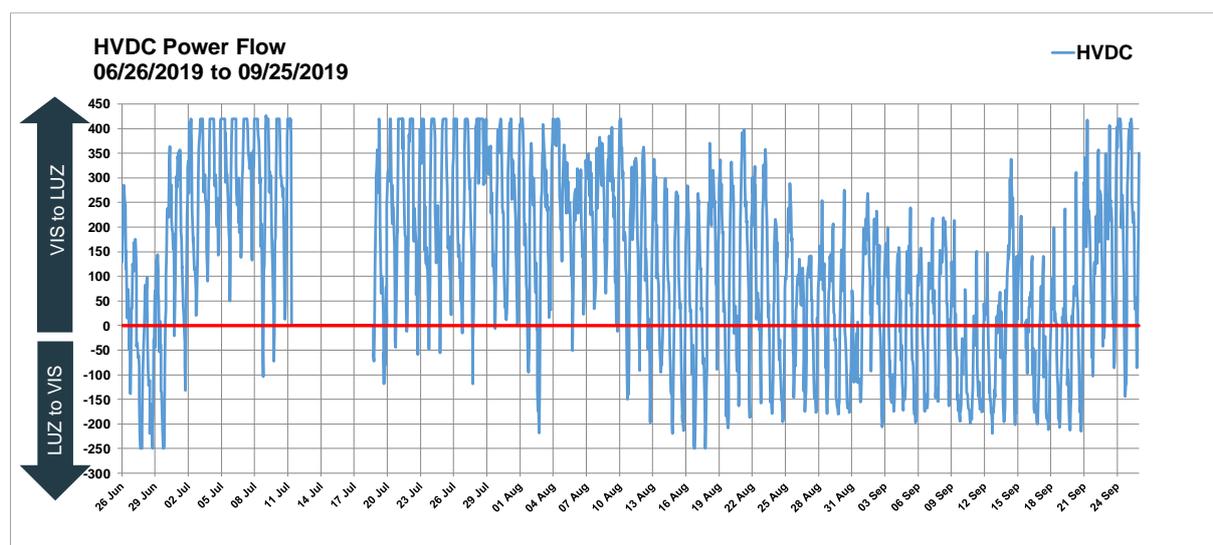


Table 19. Summary of HVDC Limits Imposed by NGCP-SO and Results of HVDC Schedules (Ex-ante and Ex-post), 3rd Quarter 2019

Results of HVDC Scheduling	HVDC Limit during Ex-ante (Visayas/Luzon)									
	(No. of Trading Intervals)									
	July 2019				August 2019			September 2019		
	0/0	250/420	440/440	Total	250/420	420/250	Total	0/0	250/420	Total
Visayas to Luzon	-	464	2	466	600	9	609	-	418	418
<i>Limit Not Maximized</i>		365	2	367	562	7	569		413	413
<i>Limit Maximized</i>		99		99	38	2	40		5	5
Luzon to Visayas	-	75	-	75	133	2	135	-	318	318
<i>Limit Not Maximized</i>		67		67	130	2	132		318	318
<i>Limit Maximized</i>		8		8	3		3			
No Flow	179			179			-	8		8
TOTAL	179	539	2	720	733	11	744	8	736	744

VII. Price Setting Plants⁸

Majority of the market prices, at 97 percent, during the billing quarter were below PhP10,000/MWh with coal plants as frequent price setters, namely PEDC CFTPP, Sual CFTPP, KSPC CFTPP, Pagbilao CFTPP, and CEDC CFTPP.

⁸ A generator trading node is considered as a price setter when its last accepted offer price is between 95% to 100% of its nodal price. A generating plant is considered as price setter if at least one of its trading nodes was price setter in a given trading hour. The determination of the price setter/s in a trading interval factors in the prevailing pricing condition for the same. The price setters are determined from: (i) ex-ante for trading intervals without pricing error during ex-ante, (ii) ex-post with pricing error during ex-ante but without pricing error during ex-post, (iii) market re-run results for trading intervals with pricing error both in ex-ante and ex-post, and (iv) trading intervals where the price substitution methodology (PSM) was applied. For trading intervals affected by PSM, the unconstrained marginal plants are considered price setters. Further, in instances of regional price separation, price setters are determined separately for each region.

Table 20. Price Setting Frequency Index at PhP10,000/MWh and below, 3rd Quarter 2019

Most Frequent Price Setters at prices PhP10,000/MWh and below	Frequency (Number of trading intervals)								
	PhP0/MWh and below			Above PhP0/MWh to PhP5,000/MWh			Above PhP5,000/MWh to PhP10,000/MWh		
	Jul	Aug	Sep	Jul	Aug	Sep	Jul	Aug	Sep
PEDC CFTPP		1	2	213	292	282			
SUAL CFTPP		1	46	193	252	269			
KSPC CFTPP	32			70	169	201			
PAGBILAO CFTPP			1	104	194	135			
CEDC CFTPP	31	1	42	82	108	119			
SAN GABRIEL NGPP		1	55	134	136	37			
QPPL CFTPP		1	56	134	125	26			
ILIJAN NGPP			3	238	74	18			
MASINLOC CFTPP			1	1	59	260			
TPC (SANGI) CFTPP	31			65	110	101			
PAGBILAO 3 CFTPP		1	5	1	51	156			
PCPC CFTPP	2			72	124	13			
MASINLOC BATTERY				43	102	43			
MARIVELES CFTPP			38		73	53			
APEC CFTPP				39	85	37			
ANDA CFTPP				54	50	28	16	11	
SAN LORENZO NGPP		4	56	54	33	5			
TVI CFTPP	2		2	45	54	37			
BACMAN GPP		1	56	5	23	29	8	7	1
MAGAT HEP		1	56		4	5	34	6	

Meanwhile, market prices above PhP10,000/MWh, at 21 percent, were set by oil-based and hydro plants led by PB 104, Bohol DPP, PPC DPP, San Roque HEP, and Limay CCGT.

Table 21. Price Setting Frequency Index Above PhP10,000/MWh, 3rd Quarter 2019

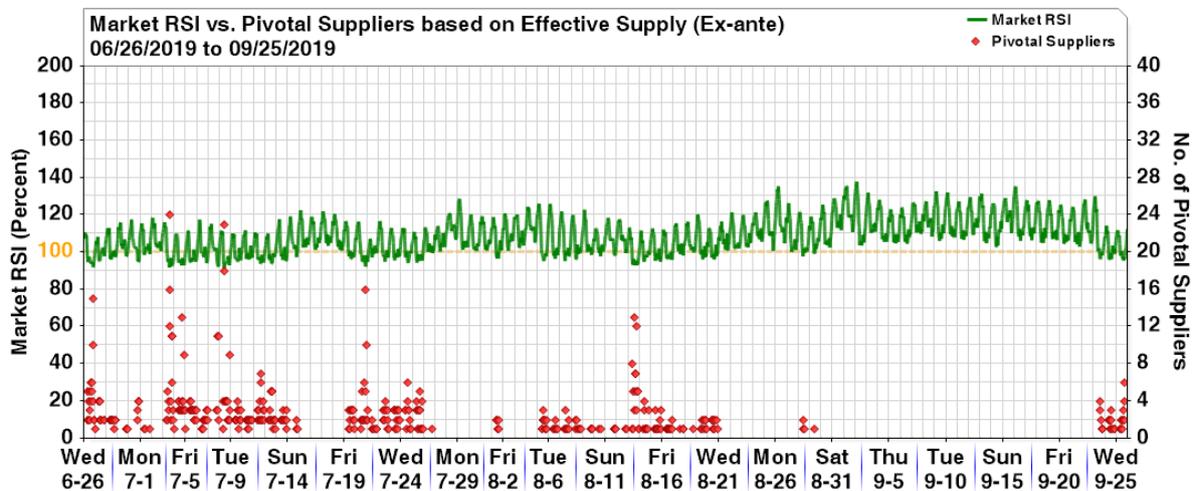
Most Frequent Price Setters at prices above PhP10,000/MWh	Frequency (Number of trading intervals)														
	Above PhP10,000/MWh to PhP15,000/MWh			Above PhP15,000/MWh to PhP20,000/MWh			Above PhP20,000/MWh to PhP25,000/MWh			Above PhP25,000/MWh to PhP30,000/MWh			Above PhP30,000/MWh to PhP32,000/MWh		
	Jul	Aug	Sep	Jul	Aug	Sep	Jul	Aug	Sep	Jul	Aug	Sep	Jul	Aug	Sep
PB 104				31	68	83	5			1					
BOHOL DPP															47
PPC DPP	4	5	7				2								
SAN ROQUE HEP	12	2													
LIMAY CCGT				1			10	1							
MILLENNIUM GTPP	8			2	2										
BAUANG DPP	9														
CIP DPP	5	1		1			1								
BACMAN GPP	2	2		1			3								
SLPGC GTPP	5	2													
ANDA CFTPP	1	1			1		3								
PANAY DPP III	2	1	2												
CALUMANGAN DPP				2											
TAPGC DPP	1			1											
NABAS DPP		1	1												
SUAL CFTPP							1								
CPPC DPP							1								
PANAY DPP I													1		

VIII. Residual Supply

The succeeding figure below shows the hourly trend of the Market Residual Supply Index (Market RSI)⁹ plotted against the number of pivotal supplier/s.

During the entire billing quarter, the market RSI was below the 100 percent mark for only 19 percent of the time compared to previous quarter's 64.9 percent of the time, indicating the relatively infrequent presence of pivotal suppliers this quarter.

Figure 16. Market RSI vs. Pivotal Suppliers (Ex-Ante), 3rd Quarter 2019



IX. Pivotal Suppliers¹⁰

Provided in Table 22 are the top 20 pivotal suppliers in the market during the billing quarter led by Sual CFTPP, Ilijan NGPP, Sta. Rita NGPP, Pagbilao CFTPP, Masinloc CFTPP, and San Lorenzo NGPP. In line with the RSI discussion above, presence of pivotal suppliers was observed to be more seldom totaling 1,151 generator-trading intervals this billing quarter compared to last quarter's 15,709 generator-trading intervals.

⁹ For a generator, the Residual Supply Index (RSI) is a dynamic continuous index measured as ratio of the available generation without that generator to the total generation required to supply the demand. The Market RSI is measured as the lowest RSI among all generators in the market. A Market RSI less 100% indicates the presence of pivotal generator/s or supplier/s.

¹⁰ The Pivotal Supply Index (PSI) measures how critical a particular generator is in meeting the total demand at a particular time. It is a binary variable (1 for pivotal and 0 for not pivotal) which measures the frequency that a generating is pivotal for a particular period.

Table 22. Pivotal Supplier Frequency Index, 3rd Quarter 2019

Top Pivotal Suppliers	Frequency (Number of trading intervals)		
	July	August	September
SUAL CFTPP	257	122	30
ILIJAN NGPP	233	9	3
STA RITA NGPP	138	42	16
PAGBILAO CFTPP	30	17	5
MASINLOC CFTPP	36	1	2
SAN LORENZO NGPP	27	5	
KALAYAAN PSPP	20	4	1
MARIVELES CFTPP	13	10	
QPPL CFTPP	18	3	
SMC LIMAY CFTPP	15	3	
SAN GABRIEL NGPP	16	2	
PAGBILAO 3 CFTPP	16	2	
LEYTE A GPP	13	2	
LIMAY CCGT	9	1	
SLPGC CFTPP	6		
PEDC CFTPP	6		
MAGAT HEP	4		
CEDC CFTPP	3		
CALACA CFTPP	2		
SAN ROQUE HEP	2		

X. Price-Setters and Pivotal Plants

Only Limay CCGT and Sual CFTPP were considered pivotal suppliers at the same time that they set prices at above PhP15,000/MWh. On the other hand, Sual CFTPP, Ilijan NGPP, Sta. Rita NGPP and Magat HEP were able to figure as pivotal suppliers and price setters at below PhP10,000/MWh-level during the same trading interval.

Table 23. PSI vs PSFI, 3rd Quarter 2019

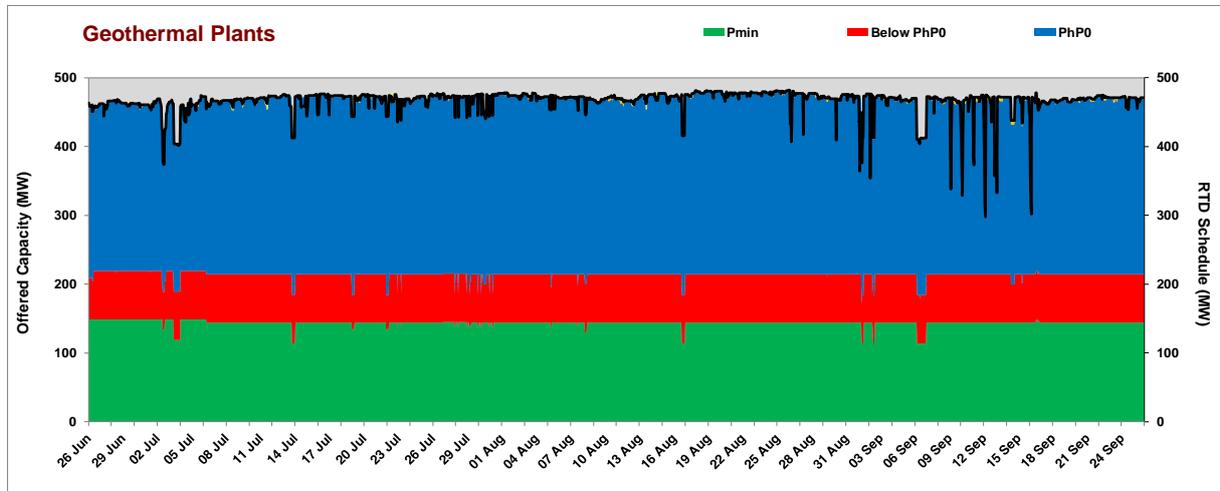
Pivotal Supplier and Price Setters	Frequency (Number of trading intervals)											
	Above PhP0/MWh to PhP5,000/MWh			Above PhP5,000/MWh to PhP10,000/MWh			Above PhP15,000/MWh to PhP20,000/MWh			Above PhP20,000/MWh to PhP25,000/MWh		
	Jul	Aug	Sep	Jul	Aug	Sep	Jul	Aug	Sep	Jul	Aug	Sep
SUAL CFTPP	16	16	9							1		
ILIJAN NGPP	19											
STA RITA NGPP	5											
LIMAY CCGT							1			3	1	
MAGAT HEP				1								

XI. Generator Offer Pattern

Luzon geothermal plants offered almost its entire capacity (99.7 percent) at PhP0/MWh and below during the billing quarter. In particular, about 54 percent was priced at exactly PhP0/MWh while the remaining 45.6 percent was priced below PhP0/MWh as seen in Figure 17. The remaining 0.3 percent was offered at PhP0/MWh to PhP10,000/MWh.

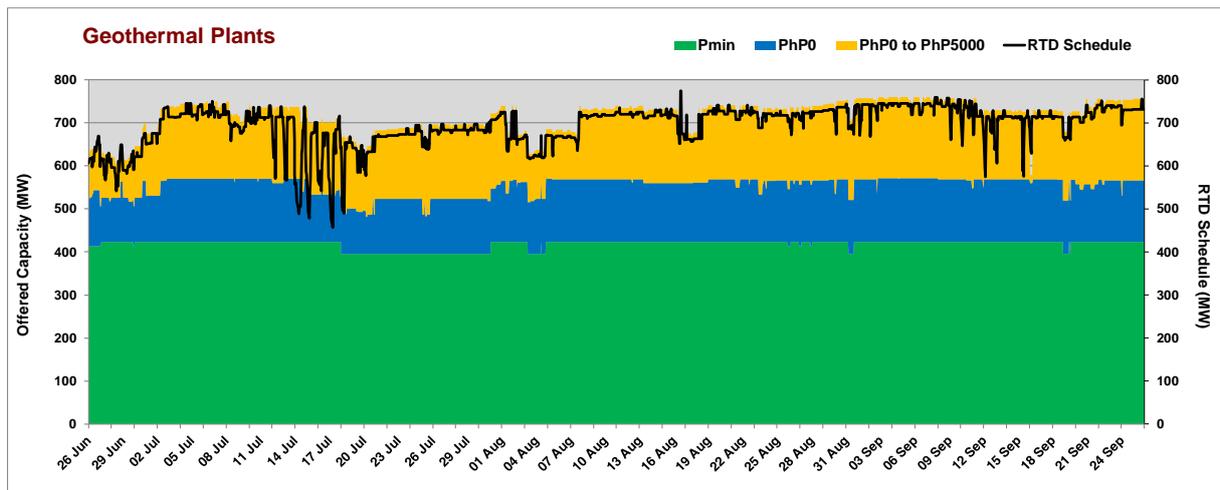
Accordingly, all of its submitted capacity offers, at 99.4 percent, were scheduled for dispatch in the market.

Figure 17. Geothermal Plants Offer Pattern, Luzon – 3rd Quarter 2019



On the other hand, Visayas geothermal plants had slightly higher-priced offers compared to Luzon geothermal plants. About 22.5 percent of Visayas geothermal plants’ offered capacity was priced at above PhP0/MWh up to PhP5,000/MWh while the remaining 77.4 percent was priced at PhP0/MWh and below as seen in Figure 18. It was noted that about 97.1 percent of these capacity offers were scheduled for dispatch.

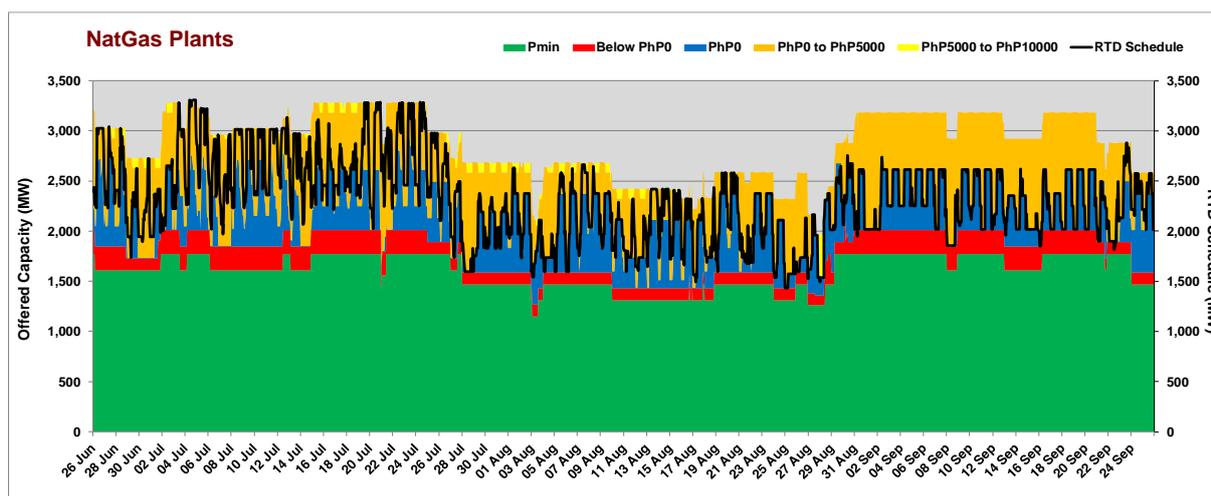
Figure 18. Geothermal Plants Offer Pattern, Visayas – 3rd Quarter 2019



As seen in Figure 19, about 75.5 percent of natural gas plants’ offered capacity was priced at PhP0/MWh and below, 23.9 percent was priced above PhP0/MWh to PhP5,000/MWh and 0.6 percent was priced at above PhP5,000/MWh to PhP10,000/MWh.

About 80.9 percent of the offers of natural gas plants were scheduled for dispatch during the billing quarter.

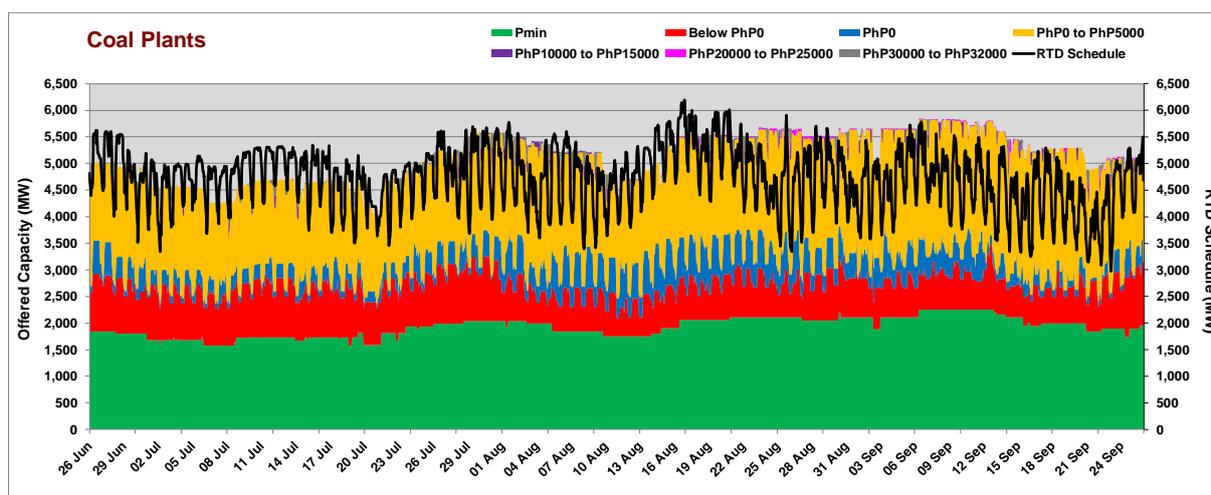
Figure 19. Natural Gas Plants Offer Pattern, Luzon – 3rd Quarter 2019



Luzon coal plants offered 60.4 percent of its capacity at prices ranging from PhP0/MWh and below while 37.8 percent was submitted at prices above PhP0/MWh to PhP5,000/MWh. As seen in Figure 20, a small percentage, at 1.8 percent, were priced between PhP10,000/MWh up to PhP32,000/MWh.

Instances of higher RTD schedule than offered capacity were noted during the quarter following the imposition of over-riding constraints on Luzon coal plants namely Masinloc CFTPP unit 3, SMC Limay CFTPP unit 4, and SBPL CFTPP which underwent commissioning tests during the period.

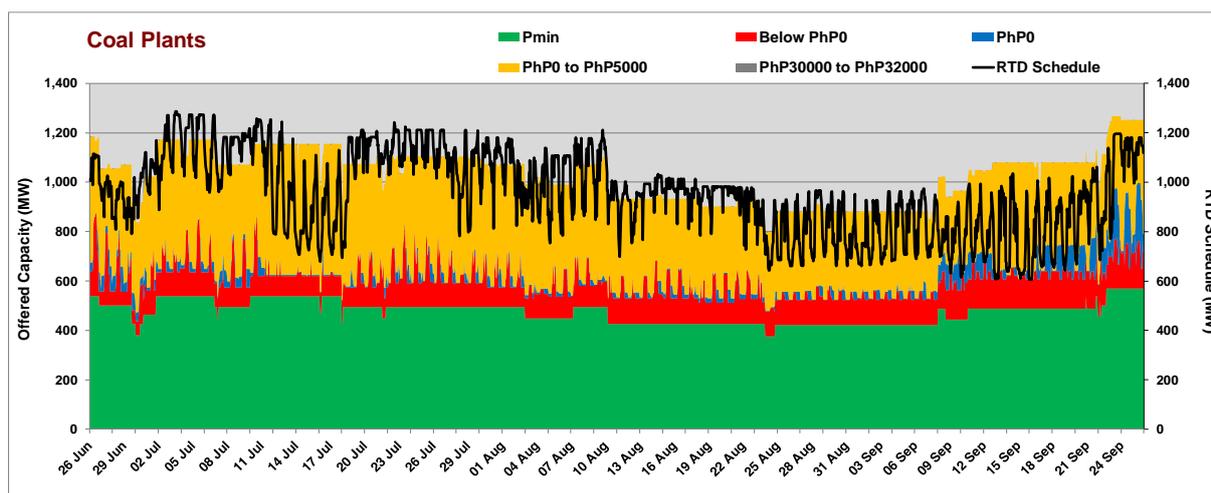
Figure 20. Coal Plants Offer Pattern – Luzon, 3rd Quarter 2019



About 61.2 percent of Visayas coal plants’ capacity offers were priced at PhP0/MWh and below, 38.7 percent at PhP0/MWh to PhP5,000/MWh as seen in Figure 21. A minimal percentage, at 0.1 percent, was offered at prices above PhP30,000/MWh up to PhP32,000/MWh.

Similar to the Luzon region, the imposition of over-riding constraints on TVI CFTPP unit 2 due to conduct of commissioning tests resulted in higher coal plants’ RTD schedule than offered capacity in some trading intervals.

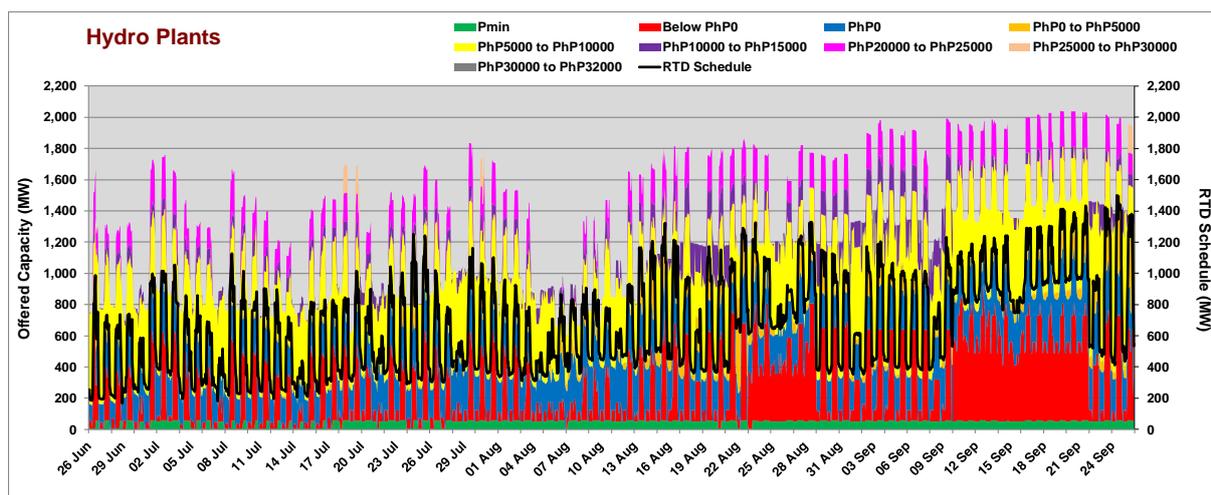
Figure 21. Coal Plants Offer Pattern, Visayas – 3rd Quarter 2019



Luzon hydro plants offered 45.1 percent of their capacity at PhP0/MWh and below and 4.9 percent at PhP0/MWh up to PhP5,000/MWh. About 38.4 percent was priced at PhP5,000/MWh up to PhP10,000/MWh, 5.4 percent was priced at PhP10,000/MWh up to PhP15,000/MWh and 6.1 percent was priced at PhP20,000/MWh up to PhP30,000/MWh. A minimal percentage, at 0.1 percent, was priced at PhP30,000/MWh up to PhP32,000/MWh.

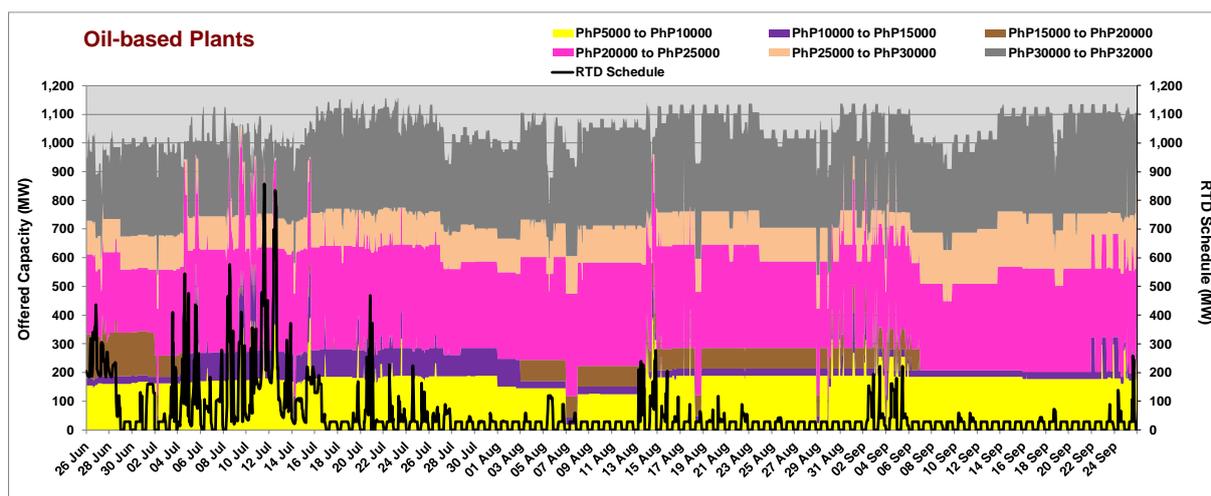
The RTD schedule of Luzon hydro plants include the over-riding constraints imposed on Uddiawan HEP related to its conduct of commissioning tests.

Figure 22. Hydro Plants Offer Pattern, Luzon – 3rd Quarter 2019



As seen in Figure 22, Luzon oil-based plants submitted the highest offer prices with 31.9 percent at prices above PhP20,000/MWh up to PhP25,000/MWh, 11.9 percent at above PhP25000/MWh up to PhP30,000/MWh, and 30.2 percent at above PhP30,000/MWh up to PhP32,000/MWh. Moreover, 8.9 percent at PhP10,000/MWh to PhP20,000/MWh and only 17 percent was priced at above PhP5,000/MWh up to PhP10,000/MWh. The improved supply and demand condition this quarter led to the drop in percentage of offered capacity scheduled for dispatch from 34.4 percent in the second quarter to 5 percent this quarter.

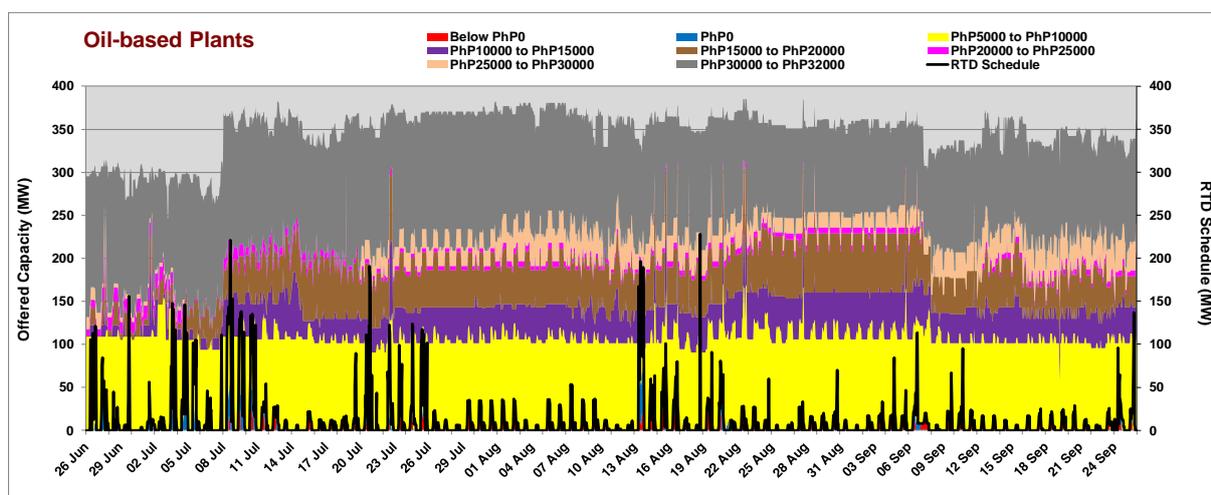
Figure 23. Oil-based Plants Offer Pattern, Luzon – 3rd Quarter 2019



On a similar note, Visayas oil-based plants offered their capacities at relatively higher prices when compared with other plant types with 37 percent priced above PhP30,000/MWh up to PhP32,000/MWh as seen in Figure 24. Moreover, about 7.8 percent was offered at above PhP20,000/MWh up to PhP30,000/MWh, 23.8 percent at above PhP10,000/MWh to PhP20,000/MWh, and 29.7 percent at above PhP5,000/MWh to PhP10,000/MWh. Only 1.7 percent of their capacity offers were priced at PhP0/MWh and below.

The RTD schedule of Visayas oil-based plants include the imposition of over-riding constraints on Therna DPP units 1 to 6 which underwent commissioning tests during the period.

Figure 24. Oil-based Plants Offer Pattern, Visayas – 3rd Quarter 2019



XII. Capacity Factor

In Luzon, natural gas plants observed the highest utilization during the quarter when measured in terms of registered capacity, among resource types with capacity factor reaching 70 percent in July. Coal and geothermal plants followed with capacity factors ranging from 61 to 66 percent and 50 to 51 percent, respectively. Hydro came next reaching 36 percent in September. Oil-based plants had the lowest utilization ranging from 2 to 6 percent.

Utilization among lower-priced plants was highest when measured in terms of offered capacity, indicating that capacities, when offered, are generally scheduled for dispatch. Geothermal plants' capacity factor was consistently at the 92 percent-mark. Coal and natural gas plants similarly posted high capacity factors up to 96 percent and 85 percent in July, respectively. Oil-based plants recorded the lowest utilization in terms of offered capacity at only 3 percent in August and September.

Meanwhile, preferential dispatch plants – biomass plants' capacity factors were recorded at 42 to 50 percent range when measured based on registered capacity and at 44 to 50 percent when based on registered less outage capacity. Wind plants' capacity factors were recorded at 15 to 27 percent. On the other hand, lower utilization level was noted for Luzon solar plants with their capacity factors ranging from 12 to 14 percent.

On the other hand, sole battery energy storage facility in the WESM, Masinloc Battery, posted a capacity factor of 1 percent each when measured in terms of registered capacity, registered capacity net of outage, and offered capacity in July.

Table 24. Capacity Factor – Luzon Plants, 3rd Quarter 2019

Plant Type	RTD Sched. vs Registered Cap.			RTD Sched. vs Registered less Out. Cap.			RTD Sched. vs Offered Cap.		
	Jul 2019	Aug 2019	Sep 2019	Jul 2019	Aug 2019	Sep 2019	Jul 2019	Aug 2019	Sep 2019
Coal	64%	66%	61%	80%	76%	66%	96%	86%	77%
Natural Gas	80%	62%	69%	84%	79%	75%	85%	80%	76%
Geothermal	50%	51%	51%	64%	66%	65%	92%	92%	92%
Hydro	22%	28%	36%	25%	32%	39%	53%	59%	58%
Oil-based	6%	2%	2%	8%	2%	2%	12%	3%	3%
Wind	15%	27%	22%	15%	27%	22%	0%	0%	0%
Solar	14%	11%	12%	14%	11%	12%	0%	0%	0%
Biomass	50%	49%	42%	50%	49%	44%	0%	0%	0%
Battery	1%	0%	0%	1%	0%	0%	1%	0%	0%

In Visayas, geothermal plants obtained the highest utilization among resource types in terms of registered capacity with capacity factors ranging from 73 to 77 percent. Coal and hydro plants then followed with capacity factors ranging from 47 to 61 percent and from 47 to 48 percent, respectively. Lastly, oil-based plants observed the lowest capacity factors from 3 to 7 percent.

In terms of offered capacity, geothermal plants recorded high capacity factors at 93 to 95 percent while coal plants' capacity factors were at 65 to 79 percent. Meanwhile, oil-based plants posted the lowest capacity factors among the scheduled resources at only 4 to 10 percent.

Wind plants' capacity factors based on registered capacity and based on registered capacity net of outage in the region ranged from 16 to 33 percent while solar plants' capacity factors ranged from 16 to 19 percent. Biomass plants recorded the lowest capacity factor among the non-scheduled and preferential resources with only 3 percent in September.

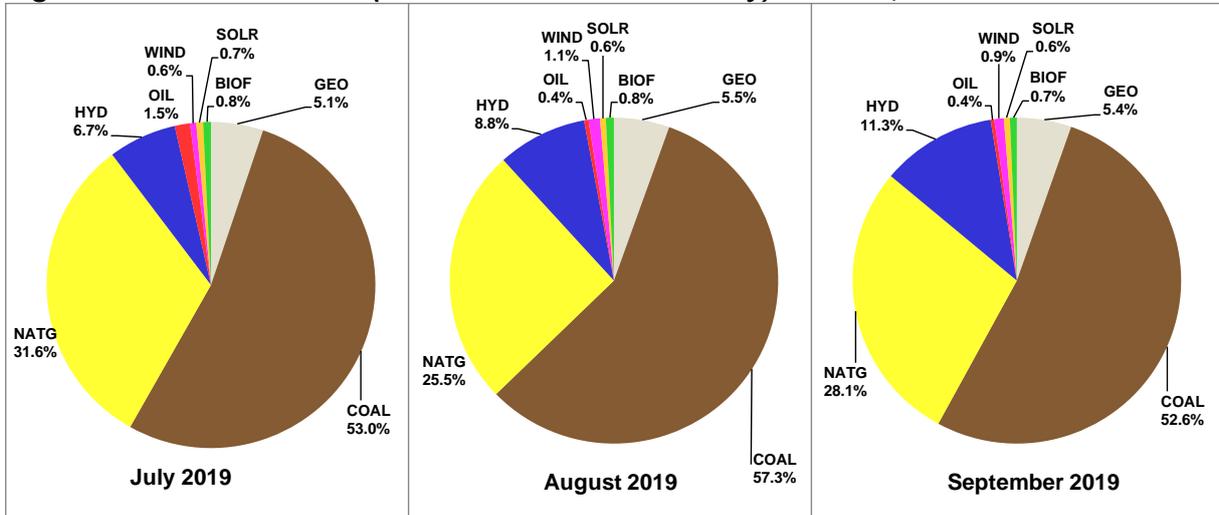
Table 25. Capacity Factor, Visayas Plants – 3rd Quarter 2019

Plant Type	RTD Sched. vs Registered Cap.			RTD Sched. vs Registered less Out. Cap.			RTD Sched. vs Offered Cap.		
	Jul 2019	Aug 2019	Sep 2019	Jul 2019	Aug 2019	Sep 2019	Jul 2019	Aug 2019	Sep 2019
Coal	61%	56%	47%	65%	60%	52%	77%	79%	65%
Geothermal	73%	75%	77%	81%	81%	83%	94%	95%	93%
Hydro	47%	48%	48%	47%	48%	48%	0%	0%	0%
Oil-based	7%	3%	6%	7%	3%	6%	10%	4%	8%
Wind	16%	33%	25%	16%	33%	25%	0%	0%	0%
Solar	16%	17%	18%	16%	18%	19%	0%	0%	0%
Biofuel	0%	0%	3%	0%	0%	3%	0%	0%	0%

XIII. Generation Mix

In the Luzon region, coal plants consistently contributed the largest chunk of the metered quantity in all billing months ranging from 53 percent to 57.3 percent. Natural gas plants followed comprising about 25.5 to 31.6 percent of the generation mix. Hydro plants and geothermal plants came next accounting for 6.7 percent to 11.3 percent and 5.1 percent to 5.5 percent, respectively. Oil-based plants' contribution was the lowest at 0.4 percent to 1.5 percent. Meanwhile, the contribution of preferential and must-dispatch generating units ranged from 2 to 2.5 percent.

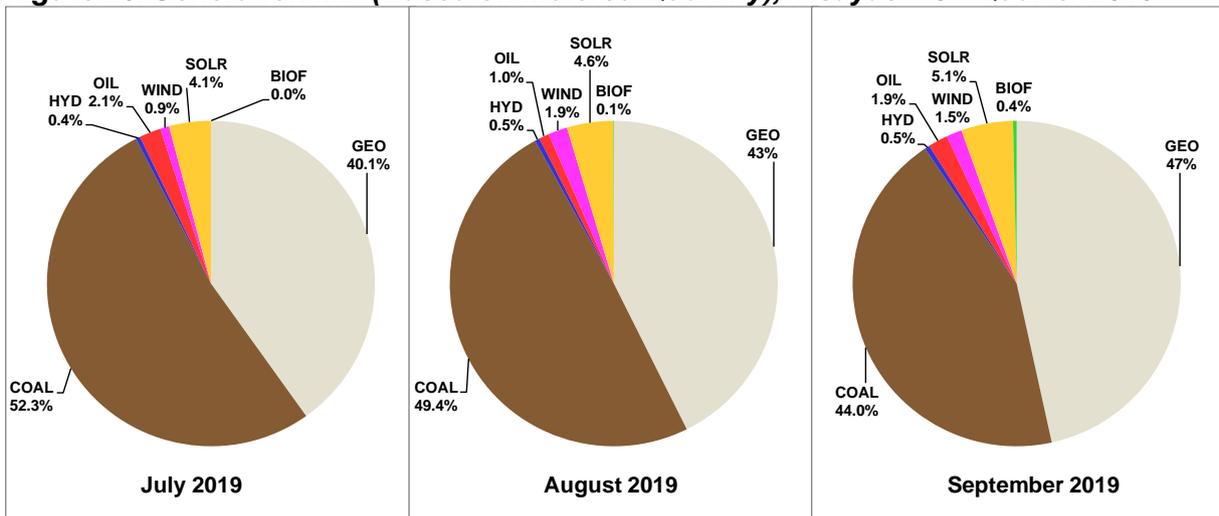
Figure 25. Generation Mix (Based on Metered Quantity) – Luzon, 3rd Quarter 2019



Similarly, in the Visayas region, coal plants had the highest contribution in the generation mix during the billing quarter ranging from 44 to 52.3 percent. Geothermal plants followed with shares ranging from 40.1 to 47 percent. Meanwhile, oil-based plants' contribution ranged from 1 to 2.1 percent and hydro plants had the least contribution at 0.4 to 0.5 percent all throughout the quarter.

On the other hand, preferential and must-dispatch generating units had higher contribution at about 5 to 7 percent in Visayas compared to about 2 percent in Luzon.

Figure 26. Generation Mix (Based on Metered Quantity), Visayas – 3rd Quarter 2019



XIV. Market Concentration

a. Market Share

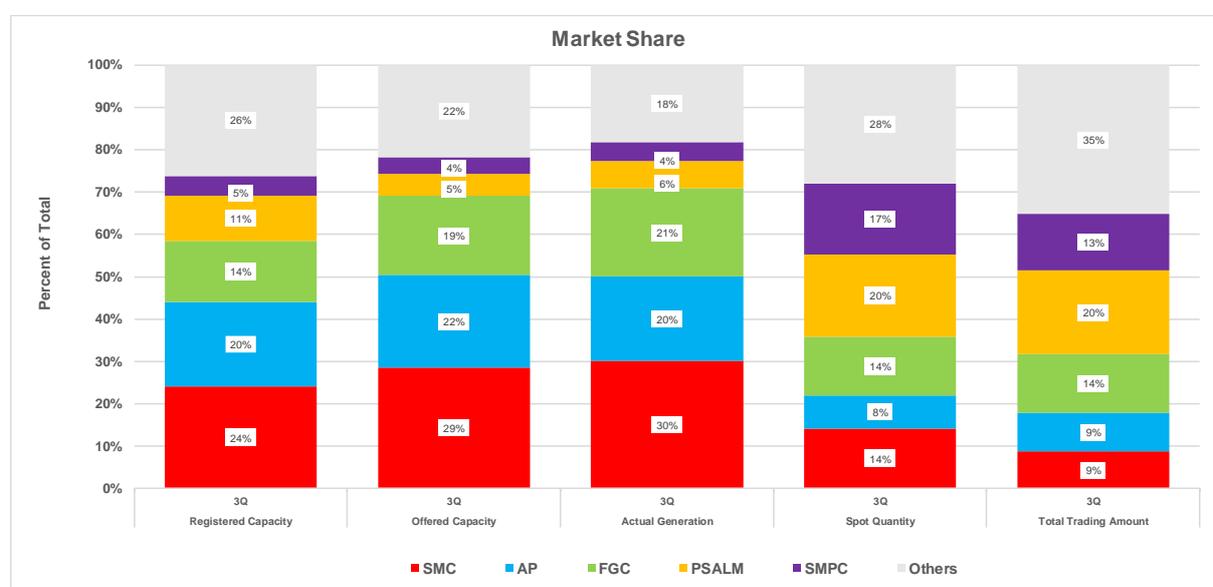
The integrated Luzon and Visayas market remained to be dominated by four (4) major participant groups based on registered capacity led by SMC with a market share of 24 percent by the end of the billing quarter. AP came next with market share of about 20 percent followed by FGC and PSALM at 14 percent and 11 percent, respectively.

It may be noted that higher market shares were recorded for SMC at 29 percent when based on offered capacity and 30 percent when based on actual generation as well as for FGC at 20 percent and 21 percent, respectively, compared to their share based on registered capacity given that their portfolios were mostly base-load plants, such as coal and natural gas plants, which were usually offered at low prices and frequently dispatched in the market. This may likewise be partly attributed to the lower share of PSALM at 5 percent based on offered capacity and at 6 percent based on actual generation considering that one of PSALM's plant Malaya TPP, which is a designated MRU¹¹, do not offer its capacity in the market and do not regularly generate.

Meanwhile, lower market shares were recorded with the top three major participant groups namely SMC (with 14 percent), AP (with 8 percent), and FGC (with 14 percent) given that their transactions are mostly covered by bilateral contracts. On the other hand, PSALM and Semirara Mining Power Corporation (SMPC), observed higher market shares in spot quantities, at 20 percent and 17 percent respectively, demonstrating their high spot market exposure.

Correspondingly, PSALM held the highest Total Trading Amount (TTA)¹² share with about 20 percent. FGC then followed with 14 percent and SMPC with 13 percent. SMC and AP came next with 9 percent each.

Figure 27. Market Share by Major Participant Group based on Registered Capacity, Offered Capacity, Actual Generation, Spot Quantity, and Total Trading Amount, 3rd Quarter of 2019



¹¹ Per DOE Department Circular 2014-01-0003, designating the 650-MW Malaya Thermal Plant as a Must-Run Unit in the Wholesale Electricity Spot Market in cases of supply shortfall and to address system security

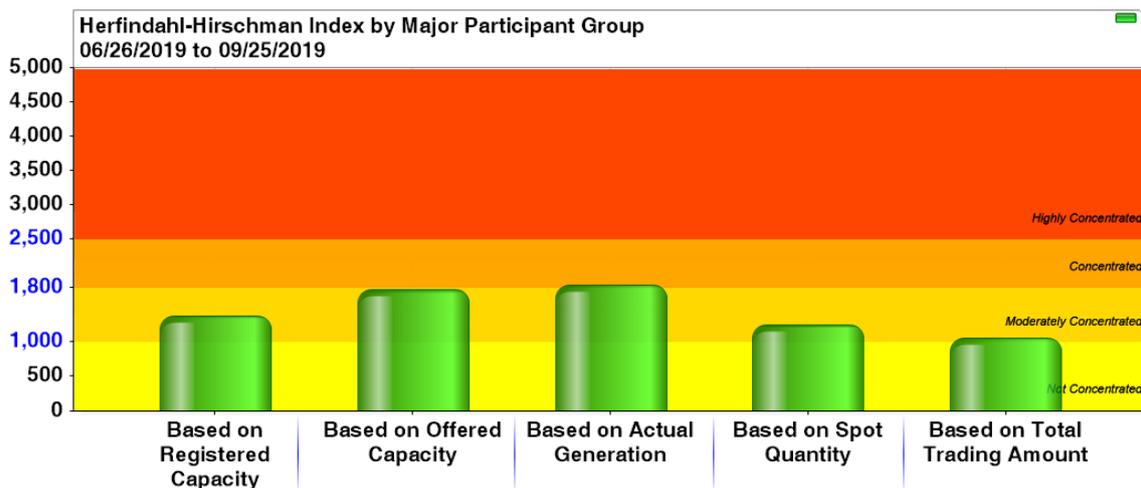
¹² Total Trading Amount (TTA) refers to the amount of revenue from spot market transactions excluding quantities that are declared by the generators as covered by bilateral power supply contracts, which are settled outside the WESM. Meanwhile, the TTA share of a major participant group is measured as a percentage of its TTA over the TTA of all participants during the period.

b. Herfindahl-Hirschman Index (HHI)

The Herfindahl-Hirschman Index (HHI)¹³ calculated based on registered capacity by major participant grouping indicated a moderately concentrated market during the third quarter of 2019. The HHI increased when measured in terms of offered capacity almost reaching the concentrated-level mark. Meanwhile, the HHI based on actual generation indicated a concentrated market. Higher concentration was noted in these indices consistent with the above discussed increase in the shares of SMC and FGC in terms of capacities offered and quantity generated in the market and decrease in PSALM's market share.

On the other hand, HHI calculation based on the spot quantity and total trading amount both indicated a moderately concentrated market consistent with the lower shares of the top three major participant group, whose transactions are mostly covered by bilateral contracts, resulting in dilution of market shares to other market participants.

Figure 28. Hourly HHI based by Major Participant Grouping, 3rd Quarter 2019

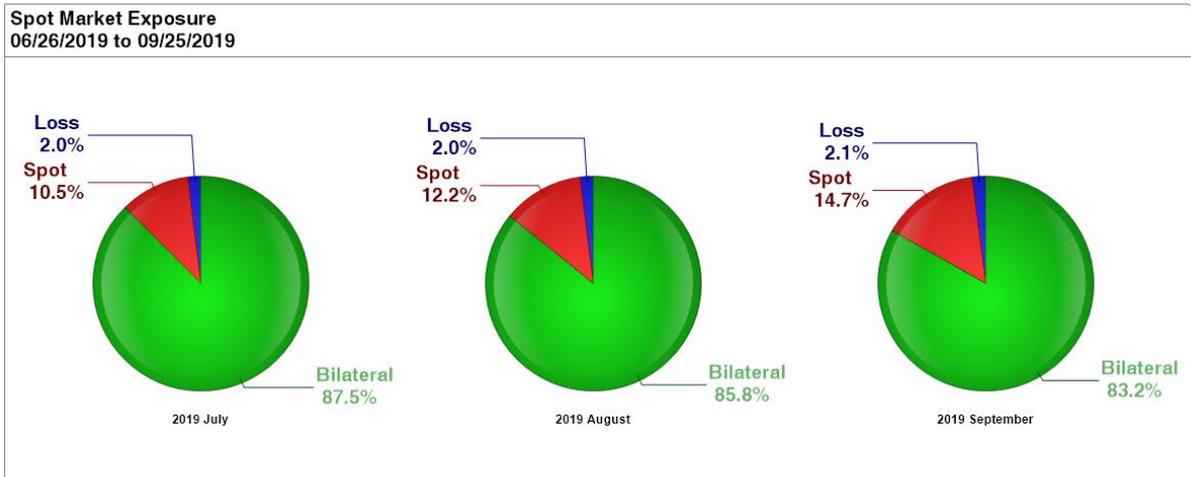


XV. Spot Exposure

Spot market transaction of generator-trading participants during the quarter ranged from 10.5 percent in July to 14.7 percent in September of the total energy transaction in the WESM. Still, majority of the total energy injected into the grid was covered by bilateral contracts.

¹³ The HHI measures the degree of market concentration, taking into account the relative size and distribution of participants in the monitored market. It is calculated as the sum of squares of the participant's market share. The following are the widely-used HHI screening numbers: the HHI approaches zero when the market has very large number of participants with each having a relatively small market share. In contrary, the HHI increases as the number of participants in the market decreases, and the disparity in the market shares among the participants increases. The following are the widely-used HHI screening numbers: (1) when HHI is less than 1,000 the market is not concentrated; (2) in the range of 1,000 to 1,800 the market is moderately concentrated; (3) greater than 1,800 to 2,500 the market is concentrated; and (4) greater than 2,500 the market is highly concentrated and signals lack of competition in the market.

Figure 29. Spot Market Exposure, 3rd Quarter 2019



Appendix A. Major Plant Outages

Region	Plant Type	Plant/ Unit Name	Capacity (MW)	Date Out	Date In	Duration (Days)	Outage Type	Remarks	Date Commissioned/ Commercial Operation
LUZON	GEO	Makban 6	55	04/11/2013 22:44			Deactivated Shutdown	Conducted gas compressor test	Apr 1979
VISAYAS	GEO	PGPP2 Unit 4	20	06/27/2014 6:07			Forced Outage	Steam being utilized by Nasulo plant	Aug 1983
VISAYAS	GEO	Upper Mahiao 2	32	09/03/2018 6:01			Forced Outage	Tripped	Jul 1997
LUZON	OIL	SLPGC 4	25	11/22/2018 11:56			Maintenance Outage	On extended maintenance shutdown until 24 April 2019	Mar 2017
LUZON	GEO	Tiwi 1	59	11/29/2018 13:31			Maintenance Outage	Maintenance Outage	Jan 1979
LUZON	GEO	Makban 5	55	02/08/2019 16:08			Forced Outage	Low Steam Supply. Divert Steam Supply to unit 3	Apr 1979
LUZON	HYD	San Roque 2	145	03/11/2019 15:01	08/16/2019 16:01	158.04	Planned Outage	Planned outage until September 11 2019	May 2003
VISAYAS	OIL	PB102 Unit 1	6	04/28/2019 18:16			Forced Outage	Internal fault	Apr 1981
LUZON	OIL	Malaya 1	300	05/03/2019 18:21			Forced Outage	Declared unavailable due to motorization of unit generator caused by the non-opening of phase B of PCB 8-05CB08MAL	Aug 1975
LUZON	HYD	Magat 2	97	05/20/2019 6:01	07/12/2019 22:18	53.68	Maintenance Outage	Maintenance outage until 18 July 2019	Aug 1983
VISAYAS	GEO	Mahanagdong A	5	05/21/2019 7:08	07/19/2019 0:12	58.71	Forced Outage	Emergency shutdown	Jul 1997
VISAYAS	GEO	Mahanagdong B	5	05/22/2019 12:45	08/01/2019 8:47	70.83	Forced Outage	AVR 24VDC power failure	Jul 1997
VISAYAS	GEO	Malitbog 3	72	05/25/2019 0:36	06/27/2019 1:32	33.04	Planned Outage	Annual PMS	Jul 1997
VISAYAS	GEO	PGPP1 Unit 1	37.5	05/25/2019 4:12	07/16/2019 7:51	52.15	Maintenance Outage	Offline to conduct repair of cooling tower leak at cooling tower hot distribution basin	Aug 1983
LUZON	COAL	SLTEC 2	122.9	05/25/2019 8:22	07/03/2019 7:21	38.96	Forced Outage	On emergency shutdown due to boiler tube leak	Aug 2015
VISAYAS	GEO	PGPP2 Unit 3	20	06/04/2019 0:06	06/26/2019 14:48	22.61	Maintenance Outage	Offline due to PMS	Aug 1983
LUZON	COAL	GN Power 2	316	06/14/2019 20:02	07/19/2019 9:17	34.55	Forced Outage	Loss of power supply of coal feeder	May 2013
LUZON	COAL	Masinloc 3	335	06/15/2019 1:35	07/06/2019 2:45	21.05	Planned Outage	On Commissioning Test	Mar 2019
LUZON	COAL	Calaca 1	300	06/26/2019 0:01	08/22/2019 23:21	57.97	Forced Outage	Extended outage until 30 July 2019	Sep 1984
LUZON	NATG	Sta. Rita 2	255.7	06/26/2019 4:37	07/01/2019 20:14	5.65	Maintenance Outage	Maintenance Outage until 30 June 2019	Jun 2000
LUZON	OIL	Limay 3	60	06/26/2019 18:15	06/27/2019 9:12	0.62	Forced Outage	Failed to start due to synchro tap problem	May 1993
LUZON	COAL	SBPL	455	06/26/2019 18:18	06/27/2019 4:06	0.41	Forced Outage	Emergency Shutdown due to Tube Leak. On Commissioning Test	Apr 2019
VISAYAS	COAL	Keppo Salcon 2	103	06/26/2019 19:36	06/30/2019 15:38	3.83	Forced Outage	Boiler tube leak	Mar 2011
VISAYAS	GEO	Malitbog 3	72	06/27/2019 15:09	06/30/2019 15:52	3.03	Forced Outage	Cut-out from the System	Jul 1997
LUZON	COAL	SLTEC 1	121	06/28/2019 5:35	08/20/2019 16:09	53.44	Maintenance Outage	Emergency Shutdown due to Boiler Tube Leak. On Maintenance Outage from 01 July - 07 August 2019.(RECLASSIFIED FROM FORCE. OMC OUTAGE)	Sep 2014
LUZON	NATG	Ilijan B2	190	06/28/2019 21:53	07/01/2019 22:50	3.04	Maintenance Outage	Maintenance Outage until 06 July 2019	Jun 2002
VISAYAS	OIL	Bohol 1	4	06/28/2019 22:44	06/29/2019 6:10	0.31	Forced Outage	Emergency out due to fuel oil leak	Sep 1978
LUZON	OIL	Limay 6	60	06/29/2019 0:01	07/04/2019 11:27	5.48	Planned Outage	Planned Outage until 05 July 2019	Dec 1994
VISAYAS	OIL	Bohol 2	4	06/29/2019 9:56	06/29/2019 11:12	0.05	Forced Outage	Due to air leak at air intake manifold in cylinder number 6.	Sep 1978
VISAYAS	COAL	PEDC 3	150	06/29/2019 16:31	07/01/2019 16:56	2.02	Forced Outage	Debris filter problem	Aug 2016
LUZON	COAL	SBPL	455	06/29/2019 16:33	06/30/2019 21:12	1.19	Planned Outage	On Commissioning Test	Apr 2019
VISAYAS	COAL	CEDC 1	82	06/30/2019 0:41	06/30/2019 7:27	0.28	Forced Outage	TO CONDUCT REPAIR OF HIGH PRESSURE HEATER 1	Apr 2010
LUZON	COAL	Pagbilao 2	382	07/01/2019 1:10	07/23/2019 12:12	22.46	Maintenance Outage	Boiler Tube Leak. On Maintenance outage from 06-30 July 2019.(RECLASSIFIED FROM FORCE. OMC OUTAGE)	Mar 1996
LUZON	COAL	Pagbilao 3	420	07/02/2019 1:27	07/02/2019 3:45	0.10	Forced Outage	Tripped with 261MW load	Jul 2017
VISAYAS	OIL	Bohol 4	4	07/02/2019 11:47	07/03/2019 19:06	1.30	Forced Outage	Defective cooling tower fan	Sep 1978
LUZON	NATG	Sta. Rita 4	264	07/03/2019 12:47	07/04/2019 3:49	0.63	Forced Outage	Tripped during changeover from gas to fuel oil	Oct 2001
LUZON	COAL	SLTEC 2	122.9	07/03/2019 20:36	07/05/2019 16:19	1.82	Forced Outage	Shutdown due to boiler water quality problem	Aug 2015
LUZON	COAL	SBPL	455	07/04/2019 17:58	07/05/2019 3:06	0.38	Forced Outage	On commissioning test	Apr 2019
VISAYAS	OIL	Bohol 2	4	07/05/2019 14:21	07/09/2019 18:35	4.18	Forced Outage	Emergency out due to cut off stud bolt at cylinder 11.	Sep 1978
LUZON	COAL	Masinloc 1	315	07/05/2019 23:48	07/08/2019 17:34	2.74	Forced Outage	Repair of electrostatic precipitator. air preheater and induced-draft fan.	Jun 1998
LUZON	NATG	Sta. Rita 4	264	07/06/2019 4:48	07/11/2019 0:01	4.80	Planned Outage	On maintenance outage until 10 July 2019(2400H)	Oct 2001
LUZON	GEO	Makban 7	20	07/06/2019 6:12			Maintenance Outage	Maintenance Outage	Apr 1979
VISAYAS	COAL	PEDC 2	83.7	07/06/2019 21:06	07/09/2019 21:33	3.02	Forced Outage	Tube leak	Apr 2011
VISAYAS	COAL	TPC Sangi 1	60	07/07/2019 3:21	07/19/2019 22:15	12.79	Forced Outage	Boiler 6 tube leak	Dec 2013
LUZON	OIL	Malaya 2	350	07/08/2019 3:04	07/10/2019 15:36	2.52	Forced Outage	Auxiliary steam line trouble	Apr 1979
LUZON	OIL	Limay 5	60	07/08/2019 7:15	07/08/2019 10:53	0.15	Forced Outage	Rotor barring problem	Dec 1994
LUZON	OIL	Limay 1	60	07/08/2019 11:56	07/08/2019 14:31	0.11	Forced Outage	Tripped due to excessive oil leak	May 1993
LUZON	OIL	Limay 5	60	07/10/2019 6:11	07/10/2019 15:03	0.37	Forced Outage	Starting Device prblem.As Regulating Unit	Dec 1994
VISAYAS	OIL	Bohol 1	4	07/10/2019 11:15	07/10/2019 13:05	0.08	Forced Outage	Fault in racker gear lubricating oil motor	Sep 1978
LUZON	NATG	Sta. Rita 4	264	07/11/2019 0:01	07/12/2019 10:01	1.42	Forced Outage	Delayed completion of Maintenance activities	Oct 2001
LUZON	NATG	Avion 2	50.3	07/12/2019 0:01	07/14/2019 21:20	2.89	Maintenance Outage	Maintenance outage until 15 July 2019	Aug 2015
LUZON	HYD	Kalayaan 1	180	07/13/2019 0:01	07/17/2019 20:24	4.85	Maintenance Outage	Maintenance Outage until 17 July 2019	Aug 1982
LUZON	NATG	Sta. Rita 3	265.5	07/13/2019 2:44	07/15/2019 20:24	2.74	Planned Outage	Maintenance Outage until 14 July 2019	Oct 2001
LUZON	COAL	SMC 1	150	07/13/2019 23:57	07/14/2019 10:51	0.45	Forced Outage	Rectification of stuck turbine	Nov 2016
VISAYAS	OIL	Bohol 2	4	07/16/2019 10:25	07/17/2019 23:34	1.55	Forced Outage	Smoke coming out from generator	Sep 1978
VISAYAS	OIL	Bohol 4	4	07/17/2019 10:47	07/17/2019 11:04	0.01	Forced Outage	Mechanical and electrical fault	Sep 1978
LUZON	COAL	Masinloc 3	335	07/17/2019 21:04	08/09/2019 12:34	22.65	Forced Outage	Tripped at 115MW. On Commissioning Test	Mar 2019
VISAYAS	GEO	Nasulo	48.3	07/18/2019 0:14	07/30/2019 20:12	12.83	Planned Outage	Offline due to maintenance activities	Apr 2014
VISAYAS	COAL	CEDC 2	82	07/18/2019 0:30	08/06/2019 23:59	19.98	Planned Outage	PMS	Jun 2010
LUZON	OIL	Limay 3	60	07/18/2019 8:06	07/18/2019 10:31	0.10	Forced Outage	Emergency shutdown due to smoke at combustor area.	May 1993
LUZON	COAL	Calaca 2	300	07/18/2019 13:44	07/18/2019 18:05	0.18	Forced Outage	Tripped at 200MW load.	Sep 1984
VISAYAS	GEO	Mahanagdong A	5	07/19/2019 0:12	08/20/2019 14:01	32.58	Maintenance Outage	scheduled until 30 July 2019	Jul 1997
LUZON	COAL	SMC 2	150	07/19/2019 11:35	07/28/2019 6:15	8.78	Forced Outage	Tripped at 120MW. Turbine Vibration.System Frequency is 59.53hz	Mar 2017
LUZON	COAL	SBPL	455	07/19/2019 12:59	07/19/2019 18:55	0.25	Planned Outage	On Commissioning Test	Apr 2019
LUZON	COAL	Sual 2	647	07/19/2019 21:36	07/21/2019 9:58	1.52	Maintenance Outage	On maintenance outage until 21 July 2019	Oct 1999
VISAYAS	COAL	TPC Sangi 1	60	07/19/2019 22:15	07/21/2019 10:46	1.52	Forced Outage	BOILER 7 TUBE LEAK	Dec 2013
LUZON	HYD	Kalayaan 2	180	07/20/2019 0:01	07/24/2019 20:22	4.85	Maintenance Outage	Maintenance Outage until 24 July 2019	Aug 1982
LUZON	COAL	SBPL	455	07/20/2019 11:48	07/26/2019 1:40	5.58	Planned Outage	On Commissioning Test	Apr 2019
LUZON	NATG	San Lorenzo 1	264.8	07/20/2019 23:50	07/21/2019 0:41	0.04	Forced Outage	Tripped during the process of fuel changed-ove from gas to oil.	Sep 2002
LUZON	NATG	San Gabriel	420	07/21/2019 0:54	07/21/2019 9:17	0.35	Forced Outage	On emergency shutdown until 1000H of 21 July 2019	Mar 2016
VISAYAS	COAL	TPC Sangi 2	85	07/21/2019 10:46	07/21/2019 17:19	0.27	Forced Outage	Affected by Carcon L12 tripping	Dec 2013
VISAYAS	COAL	TPC Sangi 1	60	07/21/2019 10:46	07/21/2019 17:19	0.27	Forced Outage	Affected by Carcon L12 tripping	Dec 2013
LUZON	COAL	Calaca 2	300	07/22/2019 16:28	07/22/2019 20:01	0.15	Forced Outage	Sudden closing of aux. steam isolating valve	Sep 1984
LUZON	COAL	SLPGC 1	150	07/24/2019 12:04	07/24/2019 17:10	0.21	Forced Outage	Reason still under investigation	Jan 2015
LUZON	NATG	Ilijan B1	190	07/25/2019 0:41	08/29/2019 6:14	35.23	Planned Outage	Maintenance Outage till 28 August 2019	Jun 2002
LUZON	COAL	SBPL	455	07/26/2019 1:54	07/26/2019 7:08	0.22	Planned Outage	Commissioning Test.(RECLASSIFIED FROM FORCE. OMC OUTAGE)	Apr 2019
LUZON	OIL	Limay 3	60	07/27/2019 0:01	08/02/2019 12:06	6.50	Maintenance Outage	Hot Gas path inspection	May 1993
LUZON	NATG	Sta. Rita 2	255.7	07/27/2019 0:25	07/27/2019 13:37	0.55	Maintenance Outage	For compressor washing	Jun 2000
VISAYAS	OIL	Bohol 3	4.2	07/27/2019 11:50	07/27/2019 19:05	0.30	Forced Outage	Emergency out due to severe water at TC A bank	Sep 1978
LUZON	NATG	Ilijan B3	220	07/28/2019 0:24	08/29/2019 11:32	32.46	Planned Outage	Maintenance Outage until 28 August 2019	Jun 2002
LUZON	NATG	Ilijan B2	190	07/28/2019 0:37	08/30/2019 1:41	33.04	Planned Outage	Maintenance Outage till 31 August 2019	Jun 2002
LUZON	HYD	Kalayaan 3	180	08/01/2019 0:01			Planned Outage	Planned Outage until 19 October 2019(GOMP).	May 2004
LUZON	COAL	Pagbilao 2	382	08/01/2019 7:20	08/01/2019 9:59	0.11	Forced Outage	Boiler Feed Pump trouble	Mar 1996
VISAYAS	GEO	Mahanagdong B	5	08/01/2019 23:20	08/07/2019 19:38	5.85	Forced Outage	Under assessment	Jul 1997
LUZON	HYD	Magat 3	97	08/03/2019 0:39	08/10/2019 2:40	7.08	Forced Outage	Suspected problem at generator transformer 3	Oct 1983
LUZON	NATG	Sta. Rita 4	264	08/03/2019 0:54	08/03/2019 23:45	0.95	Planned Outage	GT offline compressor washing	Oct 2001
LUZON	NATG	San Lorenzo 2	261.8	08/03/2019 2:30	08/03/2019 13:14	0.45	Maintenance Outage	Maintenance Outage	Sep 2002

Appendix A. Major Plant Outages

Region	Plant Type	Plant/ Unit Name	Capacity (MW)	Date Out	Date In	Duration (Days)	Outage Type	Remarks	Date Commissioned/ Commercial Operation
LUZON	NATG	Avion 1	50.3	08/03/2019 6:01	08/04/2019 18:45	1.53	Maintenance Outage	Maintenance outage until 04 August 2019	Aug 2015
LUZON	COAL	SBPL	455	08/03/2019 6:24	08/03/2019 7:26	0.04	Planned Outage	Conducted Load Rejection Test (LRT) at 455MW. System Frequency is 59.35hz.	Apr 2019
LUZON	COAL	SBPL	455	08/04/2019 0:14	08/04/2019 8:25	0.34	Planned Outage	On Commissioning Test	Apr 2019
VISAYAS	OIL	CENPRI 4	6.4	08/04/2019 7:10	08/04/2019 16:58	0.41	Forced Outage	Isolated due to PMS of 69kV Calumangan-San Enrique Line Section.	Mar 2016
VISAYAS	OIL	CENPRI 5	6.4	08/04/2019 7:10	08/04/2019 16:58	0.41	Forced Outage	Isolated due to PMS of 69kV Calumangan-San Enrique Line Section.	Mar 2016
VISAYAS	OIL	CENPRI 1	4.2	08/04/2019 7:10	08/04/2019 16:58	0.41	Forced Outage	Isolated due to PMS of 69kV Calumangan-San Enrique Line Section.	Mar 2016
VISAYAS	OIL	CENPRI 2	4.2	08/04/2019 7:10	08/04/2019 16:58	0.41	Forced Outage	Isolated due to PMS of 69kV Calumangan-San Enrique Line Section.	Mar 2016
VISAYAS	OIL	CENPRI 3	4.2	08/04/2019 7:10	08/04/2019 16:58	0.41	Forced Outage	Isolated due to PMS of 69kV Calumangan-San Enrique Line Section.	Mar 2016
LUZON	OIL	Limay 2	60	08/05/2019 6:52	08/05/2019 19:19	0.52	Forced Outage	Main fuel oil pump excessive leak.	May 1993
LUZON	COAL	Calaca 2	300	08/05/2019 7:12	08/16/2019 5:15	10.92	Forced Outage	Suspected boiler tube leak	Sep 1984
LUZON	OIL	Limay 1	60	08/05/2019 8:55	08/05/2019 9:09	0.01	Forced Outage	Flame off during start-up. Declared available at 0909H	May 1993
LUZON	OIL	Limay 6	60	08/05/2019 11:17	08/05/2019 12:45	0.06	Forced Outage	Main fuel oil pump drive-end side pressure leak	Dec 1994
LUZON	OIL	Limay 5	60	08/08/2019 7:19	08/08/2019 8:55	0.07	Forced Outage	Turning equipment failure	Dec 1994
VISAYAS	OIL	Bohol 3	4.2	08/08/2019 18:27	08/08/2019 22:12	0.16	Forced Outage	Turbocharger surging	Sep 1978
VISAYAS	OIL	Bohol 3	4.2	08/08/2019 22:43	08/09/2019 0:29	0.07	Forced Outage	Heavy vibration at Turbo Charger	Sep 1978
LUZON	COAL	Masinloc 3	335	08/09/2019 13:56	08/09/2019 22:01	0.34	Forced Outage	Tripped. On commissioning test	Mar 2019
VISAYAS	OIL	PDP3 C	12	08/09/2019 19:03	08/09/2019 22:08	0.13	Forced Outage	Tripped due to HT Cooling Water leak at detached fitting of surge pipe A-bank.	Mar 2005
LUZON	COAL	Masinloc 2	344	08/09/2019 19:41	08/14/2019 19:15	4.98	Maintenance Outage	Maintenance Outage	Jun 1998
LUZON	NATG	Sta. Rita 3	265.5	08/10/2019 0:47	08/16/2019 16:35	6.66	Planned Outage	Maintenance Outage till 14 August 2019	Oct 2001
LUZON	COAL	Masinloc 3	335	08/11/2019 10:04	08/11/2019 13:34	0.15	Forced Outage	Tripped at 160MW load. Turbine trip actuation. System Frequency is 59.54hz	Mar 2019
VISAYAS	OIL	Bohol 3	4.2	08/12/2019 14:42	08/13/2019 14:10	0.98	Forced Outage	High bearing temperature	Sep 1978
VISAYAS	OIL	PB101 Unit 1	6	08/12/2019 18:59	08/23/2019 18:23	10.97	Forced Outage	Excessive gas leak at manifold 2L	Jan 1978
LUZON	COAL	Masinloc 3	335	08/13/2019 2:22	08/14/2019 5:39	1.14	Forced Outage	Unit on commissioning test	Mar 2019
VISAYAS	OIL	CENPRI 1	4.2	08/13/2019 13:25	08/13/2019 15:08	0.07	Forced Outage	Offline due to Exhaust Gas leakage	Mar 2016
VISAYAS	OIL	PDP3 H	13	08/13/2019 15:05	08/13/2019 18:01	0.12	Forced Outage	Offline due to HT water leak at HT header Cyl. A1	Mar 2005
VISAYAS	OIL	PDP3 H	13	08/13/2019 19:46	08/14/2019 20:51	1.05	Forced Outage	Emergency shutdown due to water leak at HT header Cyl. A9	Mar 2005
LUZON	COAL	Masinloc 3	335	08/15/2019 0:37	08/16/2019 12:57	1.51	Forced Outage	Unit on commissioning test	Mar 2019
LUZON	NATG	Avion 1	50.3	08/16/2019 0:01			Forced Outage	Gas turbine trouble	Aug 2015
LUZON	NATG	Avion 2	50.3	08/16/2019 0:01			Forced Outage	Gas turbine trouble	Aug 2015
VISAYAS	GEO	Mahanagdong A	5	08/16/2019 8:22	08/18/2019 9:46	2.06	Forced Outage	Emergency shutdown	Jul 1997
VISAYAS	OIL	Bohol 4	4	08/16/2019 15:26	08/16/2019 17:09	0.07	Forced Outage	Fuel oil leak on cylinder 7.	Sep 1978
LUZON	NATG	Sta. Rita 3	265.5	08/16/2019 17:40	08/16/2019 22:37	0.21	Forced Outage	Fuel oil leak at gas turbine burner	Oct 2001
LUZON	NATG	Sta. Rita 4	264	08/17/2019 0:46	08/17/2019 20:55	0.84	Planned Outage	Planned Outage until 1400H 17 August 2019	Oct 2001
LUZON	COAL	Masinloc 3	335	08/17/2019 12:58	08/27/2019 2:29	9.56	Forced Outage	Emergency Shutdown. Under Commissioning Test	Mar 2019
VISAYAS	OIL	PDP3 E	12	08/17/2019 20:35	08/18/2019 7:25	0.45	Forced Outage	Turbo charger surging	Mar 2005
LUZON	NATG	Sta. Rita 2	255.7	08/18/2019 1:34	08/18/2019 17:52	0.68	Planned Outage	GT offline compressor washing	Jun 2000
VISAYAS	OIL	CENPRI 1	4.2	08/18/2019 18:25	08/18/2019 19:01	0.03	Forced Outage	Auto-tripped due to busted surge suppressor	Mar 2016
VISAYAS	OIL	Bohol 1	4	08/20/2019 13:36	08/20/2019 17:24	0.16	Forced Outage	Affected tripping of BDPP station service Transformer 1.	Sep 1978
VISAYAS	OIL	Bohol 4	4	08/20/2019 16:43	08/20/2019 22:08	0.23	Forced Outage	Fuel leak	Sep 1978
LUZON	OIL	Limay 1	60	08/21/2019 6:05	08/21/2019 13:47	0.32	Forced Outage	Defective motor of fan cooler 3	May 1993
LUZON	COAL	Calaca 1	300	08/23/2019 3:42	08/29/2019 14:40	6.46	Forced Outage	Tripped at 65MW load. System frequency at 59.82hz	Sep 1984
VISAYAS	OIL	PB102 Unit 3	6	08/23/2019 18:59	08/23/2019 19:11	0.01	Forced Outage	Fuel starvation	Apr 1981
VISAYAS	OIL	PB102 Unit 2	6	08/23/2019 19:15	08/24/2019 17:32	0.93	Forced Outage	Gas cutting at cylinder 3R	Apr 1981
VISAYAS	COAL	PALM 1	135	08/24/2019 0:01	09/20/2019 17:01	27.71	Planned Outage	PMS. ETR -- 9.22.2019 at 2400H	Mar 2016
LUZON	NATG	San Lorenzo 1	264.8	08/24/2019 0:01	08/25/2019 21:06	1.88	Planned Outage	GT Off Line Compressor Washing until 25 August 2019.	Sep 2002
LUZON	OIL	Limay 2	60	08/24/2019 0:01	08/28/2019 16:11	4.67	Planned Outage	Planned Outage until 30 August 2019	May 1993
LUZON	NATG	San Gabriel	420	08/26/2019 22:36	08/28/2019 10:18	1.49	Forced Outage	Restriction of Natural Gas Fuel Supply from SPEX Malampaya	Mar 2016
LUZON	COAL	SMC 1	150	08/27/2019 3:22	08/30/2019 5:11	3.08	Forced Outage	Low furnace temperature	Nov 2016
VISAYAS	OIL	PDP3 C	12	08/27/2019 16:30	08/27/2019 20:05	0.15	Forced Outage	Tripped due to high Torsional Vibration	Mar 2005
LUZON	NATG	Ilijan B3	220	08/29/2019 16:29	08/29/2019 17:25	0.04	Planned Outage	Conducted Mechanical Overspeed Test as part of their Maintenance Outage	Jun 2002
LUZON	COAL	Calaca 1	300	08/29/2019 19:16	08/29/2019 20:15	0.04	Forced Outage	Shutdown as part of their Commissioning Test after Overhauling	Sep 1984
LUZON	COAL	Masinloc 3	335	08/30/2019 6:07	08/30/2019 16:56	0.45	Forced Outage	On Commissioning Test	Mar 2019
LUZON	NATG	Ilijan B1	190	08/30/2019 8:52	08/30/2019 21:27	0.52	Forced Outage	High temperature at disc cavity	Jun 2002
LUZON	COAL	Calaca 1	300	08/30/2019 17:32	09/05/2019 19:53	6.10	Forced Outage	Instrument air pressure trouble	Sep 1984
LUZON	OIL	Limay 5	60	09/01/2019 9:16	09/01/2019 20:00	0.45	Forced Outage	Servo valve trouble	Dec 1994
LUZON	COAL	Sual 2	647	09/02/2019 8:40	09/02/2019 22:11	0.56	Forced Outage	Tripped at 480MW load. Generator stator cooling water level low.	Oct 1999
LUZON	OIL	Limay 5	60	09/02/2019 9:21	09/02/2019 14:42	0.22	Forced Outage	Fuel or water drain valve problem	Dec 1994
VISAYAS	OIL	PDP3 C	12	09/05/2019 16:31	09/05/2019 21:29	0.21	Forced Outage	AUTO TRIPPED (High torsional vibration)	Mar 2005
LUZON	OIL	Limay 1	60	09/06/2019 2:53	09/13/2019 17:01	7.59	Forced Outage	Affected by the tripping of Unit 1 Main Transformer.	May 1993
LUZON	NATG	Sta. Rita 2	255.7	09/08/2019 0:32	09/08/2019 20:31	0.83	Planned Outage	GT off line compressor washing	Jun 2000
LUZON	OIL	Limay 5	60	09/08/2019 7:51	09/09/2019 17:01	1.38	Forced Outage	Blow-OFF valve not opening	Dec 1994
VISAYAS	COAL	CEDC 3	82	09/08/2019 15:57	09/10/2019 11:56	1.83	Forced Outage	AFFECTED BY LINE TRIPPING. 138KV CEDC-MAGDUGO LINE. LI is 56MW	Jan 2011
VISAYAS	GEO	Upper Mahiao 3	32	09/11/2019 9:11			Maintenance Outage	To rectify Turbine bearing vibrations	Jul 1997
LUZON	COAL	Masinloc 3	335	09/12/2019 13:24	09/12/2019 15:43	0.10	Forced Outage	Tripped at 216MW. On Commissioning Test. System Frequency is 59.43hz	Mar 2019
LUZON	COAL	SLTEC 1	121	09/13/2019 0:33	09/15/2019 17:56	2.72	Forced Outage	Tripped at 5MW while on the process of lowering load for shutdown(Unplanned Outage). Requested shutdown of SLTEC for the correction of hotspot at 8A - 08DS03CLC of Calaca Substation	Sep 2014
LUZON	NATG	Sta. Rita 3	265.5	09/13/2019 0:42	09/16/2019 4:07	3.14	Maintenance Outage	Compressor washing and rectification of steam and lube oil leak	Oct 2001
LUZON	COAL	SLTEC 2	122.9	09/13/2019 6:54	09/16/2019 20:17	3.56	Forced Outage	Correction of hotspot at 8A - 08DS03CLC of Calaca Substation.(RECLASSIFIED FROM FORCE. OMC OUTAGE)	Aug 2015
LUZON	COAL	SLPGC 2	150	09/13/2019 23:59	09/21/2019 22:12	7.93	Forced Outage	Emergency Shutdown for Repair of Air Pre-heater Tube Leak	Jan 2015
LUZON	COAL	Masinloc 3	335	09/14/2019 6:35	09/15/2019 14:10	1.32	Planned Outage	Conducted Load Rejection Test at 335MW	Mar 2019
LUZON	COAL	Calaca 1	300	09/15/2019 11:53			Forced Outage	Boiler tube leak	Sep 1984
LUZON	COAL	SMC 3	150	09/16/2019 1:11	09/25/2019 10:25	9.38	Forced Outage	Suspected Boiler Tube Leak	Nov 2017
VISAYAS	OIL	Bohol 3	4.2	09/17/2019 13:28	09/18/2019 18:05	1.19	Forced Outage	Auto tripped. for maintenance check up.	Sep 1978
VISAYAS	OIL	Bohol 1	4	09/17/2019 16:36	09/17/2019 22:10	0.23	Forced Outage	Emergency cut-out due to tripping of lube oil radiator fan and high exhaust gas temperature at B-bank	Sep 1978
LUZON	OIL	Limay 1	60	09/18/2019 17:12	09/19/2019 11:05	0.75	Forced Outage	Excitation trouble	May 1993
VISAYAS	OIL	Bohol 2	4	09/18/2019 17:55	09/24/2019 9:34	5.65	Forced Outage	Emergency cut out due to excessive fuel oil leak	Sep 1978
LUZON	COAL	Masinloc 3	335	09/19/2019 15:00	09/24/2019 10:54	4.83	Forced Outage	Repair of HP heater 7 Bypass MOV. On Commissioning Test	Mar 2019
LUZON	COAL	SBPL	455	09/20/2019 7:04	09/25/2019 18:01	5.46	Planned Outage	Commissioning Test	Apr 2019
LUZON	COAL	GN Power 1	316	09/20/2019 23:18			Maintenance Outage	To facilitate correction of governor valves	May 2013
LUZON	NATG	Ilijan A2	190	09/21/2019 0:36			Planned Outage	Maintenance Outage until 19 October 2019	Jun 2002
LUZON	COAL	ANDA 1	72	09/21/2019 8:52	09/21/2019 9:44	0.04	Forced Outage	Actuation of differential relay due to fault along thier line (topple tree)	Apr 2015
LUZON	NATG	San Lorenzo 1	264.8	09/21/2019 17:18	09/21/2019 20:46	0.14	Forced Outage	Tripped due to pilot gas control valve trouble	Sep 2002
LUZON	COAL	SLPGC 2	150	09/21/2019 22:59	09/22/2019 5:10	0.26	Forced Outage	Tripped at 10MW load during load stabilization from start-up. Due to HP Turbine Differential expansion high	Jan 2015
VISAYAS	COAL	CEDC 3	82	09/21/2019 23:55	09/22/2019 4:29	0.19	Maintenance Outage	MANUALLY CUT-OUT FOR REPLACEMENT OF TURBINE GOVERNOR ACTUATOR	Jan 2011
VISAYAS	COAL	Keppo Salcon 1	103	09/22/2019 0:57			Planned Outage	APMS	Nov 2010
LUZON	NATG	Ilijan A1	190	09/23/2019 0:46			Planned Outage	Maintenance Outage until 06 October 2019	Jun 2002
VISAYAS	OIL	PDP3 G	13	09/23/2019 22:37	09/24/2019 2:31	0.16	Maintenance Outage	Test and Commissioning	Mar 2005
LUZON	NATG	Ilijan A3	220	09/24/2019 0:35			Planned Outage	Maintenance Outage	Jun 2002
LUZON	COAL	Calaca 2	300	09/24/2019 7:29	09/24/2019 13:51	0.27	Forced Outage	High turbine vibration	Sep 1984
LUZON	COAL	Masinloc 3	335	09/24/2019 19:35			Forced Outage	Steam leak at Main Steam Line	Mar 2019

Appendix B. Methodology in Determining Interesting Pricing Events

Methodology in Determining Interesting Pricing Events

Supply margin is defined as the MW difference between the system effective supply¹ and demand requirement plus reserve schedules².

The market price is represented by the load weighted average of the final prices (LWAP) used for settlements which could either be of the following: (i) ex-ante prices for trading intervals without pricing error during ex-ante, (ii) ex-post prices for trading intervals with pricing error during ex-ante but without pricing error during ex-post, (iii) market re-run prices for trading intervals with pricing error both during ex-ante and ex-post, and (iv) estimated load reference prices (ELRP) for trading intervals where the ERC-approved Price Substitution Mechanism (PSM) was applied.

To determine the interesting pricing events, a combination of statistical methods namely, bandwidth method, ordinary least squares (OLS) method and non-parametric method was used to create the upper and lower reference price thresholds³. Further, the following criteria were considered in the determination of thresholds:

1. Market prices and supply margin from 26 December 2013 to 25 December 2017 to only include the periods when the PhP32,000/MWh offer price cap was adopted;
2. Upper and lower reference price thresholds were computed using ± 3 percent standard deviations to provide a reasonable tolerance price levels;
3. Exclusion of intervals with market intervention and/or suspension and secondary price cap imposition; and
4. Exclusion of intervals with negative supply margin to ensure normal market conditions (e.g. no under-generation).

The resulting reference price thresholds corresponding to the supply margin range are provided in the Table 1.

Table 1: Fixed Reference Price Thresholds

Supply Margin Range (in MW)	Reference Price Threshold	
	Upper (PhP/MWh)	Lower (PhP/MWh)
0 to 250	20,733	515
250 to 500	18,146	(2,072)
500 to 750	16,424	(3,794)
750 to 1000	15,201	(5,017)
1,000 to 1,250	14,305	(5,913)
1,250 to 1,500	13,609	(6,609)
1,500 to 1,750	13,023	(7,195)
1,750 to 2,000	12,501	(7,717)
2,000 to 2,250	12,050	(8,167)
2,250 to 2,500	11,680	(8,538)
2,500 to 2,750	11,374	(8,720)
2,750 to 3,000	11,127	(8,844)
3,000 and above	11,504	(9,091)

Prices within the upper and lower reference price thresholds are considered as “normal prices”, while prices outside or beyond the thresholds are tagged as “interesting pricing events”.

¹ The system effective supply is equal to the offered capacity of all scheduled generator resources, nominated loading level of non-scheduled generating units and projected output of preferential dispatch generating units. Scheduled output of plants on testing and commissioning, through the imposition of security limit by SO, are accounted for in the effective supply. Likewise included is the scheduled output of Malaya plant when it is called to run as Must Run Unit (MRU).

² With the implementation of the central scheduling and dispatch of energy and contracted reserves in Luzon beginning 22 December 2015, and in Visayas beginning 07 October 2017, the level that the supply has to fill up is higher as it also has to sufficiently meet the hourly reserve schedule.

³ The methodology adopted in this report is closely similar to the methodology discussed by the Market Surveillance Administrator of the Alberta Electricity System Operator in their report entitled “Supply Cushion Methodology and Detection of Events of Interest” published at www.albertamsa.ca.