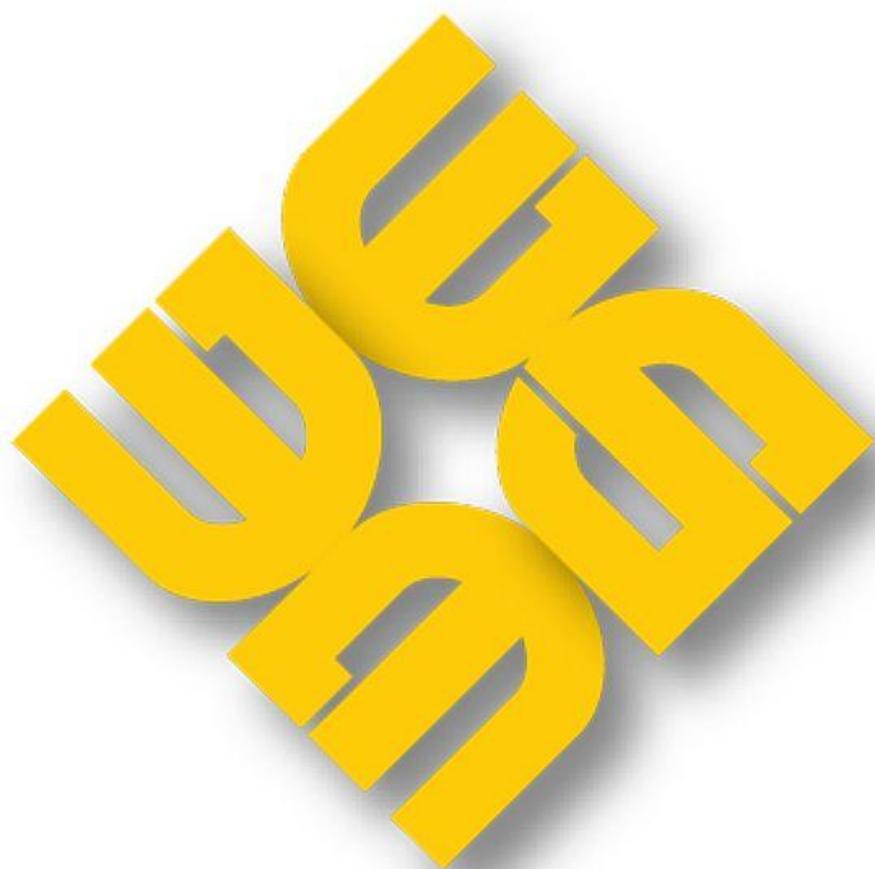


MAG-QMAR-2019-02

# QUARTERLY MARKET ASSESSMENT HIGHLIGHTS

For the Billing Period 26 March to 25 June 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 second billing quarter of 2019 (26 March to 25 June 2019) and how the market performed compared with the previous quarter and previous year.

The second quarter saw an increasing electricity demand as the hot summer season intensified during the period. Electricity demand grew notably by 18.2 percent, averaging 10,805 MW in the second quarter from 9,138 MW in the previous quarter. The highest system demand was recorded in June at 13,378 MW. Accordingly, the demand plus reserve schedule posted an increase of 14.8 percent, averaging 11,714 MW, from last quarter's 10,203 MW.

Similarly, total WESM registered capacity went up to 19,941 MW by the end of the second quarter with the entry of 933.1 MW additional capacities in the market. However, only 70 percent of the total registered capacity or an average of 13,846 MW was offered/nominated in the market. While total capacity on outage declined by 23.5 percent from the first quarter, the level of outage capacity is relatively high at 2,502 MW compared to previous year's 2,152 MW. Taking into account security limits and ramp rates, the effective supply went up by only 5.8 percent to 12,802 MW during the period.

Driven by the higher pace of demand growth relative to supply, the market experienced a tight supply margin, averaging 1,088 MW in the second quarter. Particularly in April, NGCP-SO issued yellow and red alerts due to insufficient reserve, and declared several market intervention events following the magnitude 6.1 earthquake that hit Luzon on 22 April, which resulted in the outage of several coal, oil, and geothermal plants, and manual load dropping.

Consequently, market prices in the second quarter hovered above PhP20,000/MWh at about 10 percent of the time, occurring mostly in April and June. The occurrence of sustained high prices during the period lead to the imposition of secondary price cap in 274 intervals or 12 percent of the time throughout the quarter, which mitigated the significant impact to WESM customers. Effectively, the average price was pegged at P7,288/MWh in the second quarter, up by 57.7 percent from PhP4,622/MWh of the previous 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 the market in terms of registered capacity, offered capacity, and actual generation.

Correspondingly, the Herfindahl-Hirschman Index (HHI) by major participant grouping indicated a moderately concentrated market based on registered capacity throughout the period.

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## QUARTERLY MARKET ASSESSMENT REPORT

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

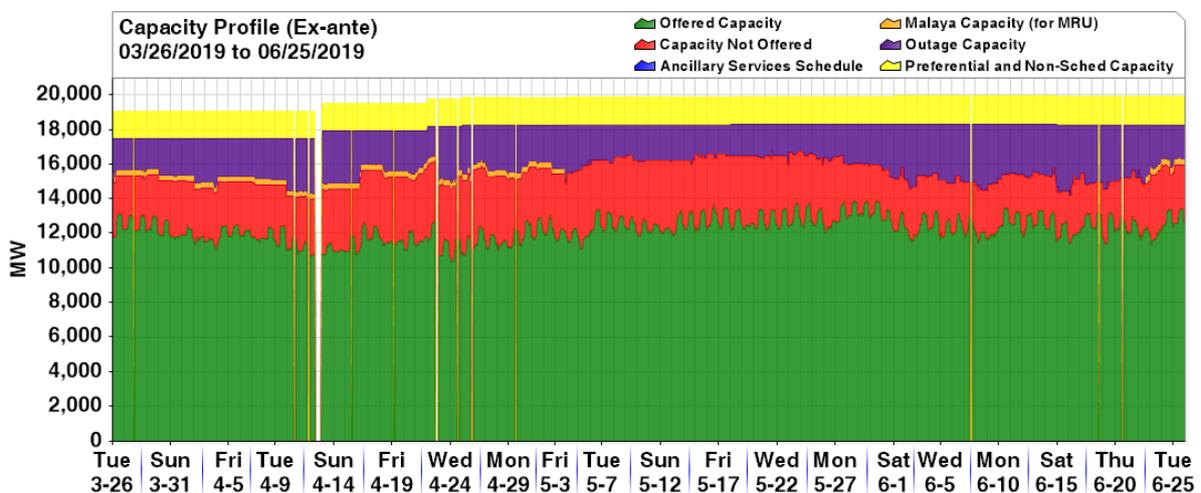
### I. Capacity Profile

Total WESM registered capacity increased to 19,941 MW by the end of the second billing quarter of 2019 from 19,062 MW in 25 March 2019. This was attributed to the entry of additional 933.1 MW capacity in the market, which include: (i) 455-MW San Buenaventura Power Ltd. Co. (SBPL) CFTPP on 13 April, (ii) 242.2-MW Therma Mobile, Inc. Navotas DPP, (iii) 16.5-MW PetroSolar Corporation on 22 April, (iv) 100-MW Millenium GTPP on 25 April, (v) 44.4-MW Naga DPP on 04 May, and (vi) 75-MW Tarlac Solar on 01 June.

While there were new entries, there were two (2) plants that deregistered in the market, totaling 46.7 MW, which consist of the following: (i) 3-MW Guimaras DPP on 14 May, and (ii) 43.7-MW Tiwi B GPP 15 June. Changes in the registered capacity of three plants were likewise recorded during the period: (i) a decrease to 213 MW from 242.2 MW of Therma Mobile, Inc. Navotas DPP on 30 April, (ii) increase to 120.5 MW from 107 MW of Tongonan GPP, and (iii) an increase to 388 MW from 380 MW of Magat HEPP on 15 June.

Of the total registered capacity, only 62 percent was offered in the market, averaging 12,257 MW during the quarter. A significant level of 2,489 MW on the average or 13 percent was on outage during the same period. Meanwhile, 8 percent or an average of 1,589 MW comprised of preferential<sup>1</sup> and non-scheduled capacities, and 1 percent or an average of 304 MW was Malaya’s capacity designation as Must Run Unit (MRU)<sup>2</sup>. Notable is the 16 percent of the registered capacity or equivalent to 3,240 MW that was not offered in the market<sup>3</sup>. In relation to this, it was determined that 3,030 MW average capacity was not offered, which was mainly attributed to testing and commissioning, and deration of plants due to resource constraints (e.g. hydro plants with low water supply). The remaining 212 MW on the average was subject to investigation.

**Figure 1. Capacity Profile (Ex-ante), 2<sup>nd</sup> Quarter 2019**



<sup>1</sup> Preferential capacity refers to the combined registered capacities of priority dispatch and must dispatch generating units.  
<sup>2</sup> 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  
<sup>3</sup> 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), 2<sup>nd</sup> Quarter 2019, 1<sup>st</sup> Quarter 2019, and 2<sup>nd</sup> Quarter 2018**

	2nd Quarter 2019 (26 Mar to 25 Jun 2019)		1st Quarter 2019 (26 Dec 2018 to 25 Mar 2019)		2nd Quarter 2018 (26 Mar to 25 Jun 2018)		% Q-on-Q Change (1Q 2019 - 2Q 2019)	% Y-on-Y Change (2Q 2018 - 2Q 2019)
	Avg MW	% of RegCap	Avg MW	% of RegCap	Avg MW	% of RegCap		
Preferential and Non-Sched Capacity	1,589	8%	1,533	8%	1,500	8%	3.6	5.9
Outage Capacity	2,489	13%	3,269	17%	2,151	11%	(23.9)	15.7
Malaya Capacity (for MRU)	304	1%	300	1%	391	2%	1.4	(22.3)
Capacity Not Offered	3,240	16%	2,233	12%	2,272	12%	45.1	42.6
Offered Capacity	12,257	62%	11,698	62%	12,552	67%	4.8	(2.4)
Registered Capacity (by the end of the billing month)	19,941		19,062		18,774		4.6	6.2

**Table 2. Monthly Capacity Profile (Ex-ante), 2<sup>nd</sup> Quarter 2019**

	April 2019 (26 Mar to 25 Apr 2019)		May 2019 (26 Apr to 25 May 2019)		June 2019 (26 May to 25 Jun 2019)	
	Avg MW	% of RegCap	Avg MW	% of RegCap	Avg MW	% of RegCap
Preferential and Non-Sched Capacity	1,560	8%	1,573	8%	1,632	8%
Outage Capacity	2,414	13%	2,111	11%	2,931	15%
Malaya Capacity (for MRU)	300	2%	300	0%	350	0%
Capacity Not Offered	3,259	17%	3,687	19%	2,784	14%
Offered Capacity	11,752	61%	12,438	63%	12,564	63%
Registered Capacity (by the end of the billing month)	19,876		19,902		19,941	

## II. Power Plant Outages

### a. Outage Capacity by Outage Plant Type

Outage capacity decreased to an average of 2,502 MW from previous quarter's 3,270 MW, particularly during the May billing month, which recorded an average outage capacity at 2,114 MW. The resumption of major power plants that went on outage the past quarter contributed to the decrease in the quarter-on-quarter figures. Nonetheless, total outage capacity this year was higher relative to previous year's 2,152 MW.

Among the plant types, coal plants posted the highest average outage capacity at 1,273 MW, which comprised 51 percent of the total outages in the second quarter. Coal plants on outage include the planned outages of SBPL CFTPP (455 MW), Pagbilao CFTPP unit 1 (382 MW), Masinloc CFTPP unit 3 (335 MW), Calaca CFTPP unit 1 (300 MW), and SMC CFTPP unit 4 (150 MW). The magnitude 6.1 earthquake that hit Luzon on 22 April resulted in the outage of the following coal plants: Mariveles CFTPP units 1 and 2 (632 MW), SMC Limay CFTPP units 1 - 4 (600 MW), and Anda CFTPP (72 MW).

Next to coal at 22 percent, oil-based plants recorded a 557-MW outage capacity. Designated to run as MRU in cases of supply shortfall and to address system security, Malaya TPP unit 2 was on deactivated shutdown from 19 May 2018 to 22 June 2019, and Malaya TPP unit 1 on forced outage since 03 May. Also on forced outage was Limay CCGT units 1-8 (540 MW), which tripped during the magnitude 6.1 earthquake in April.

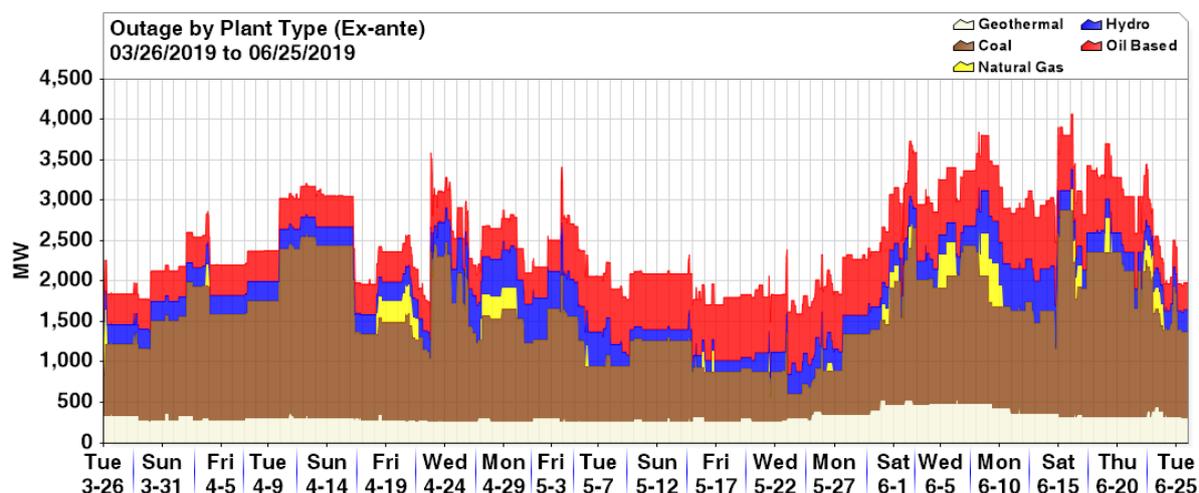
Geothermal plants' average outage capacity was recorded at 324 MW (13 percent) with the maintenance outage of Tiwi GPP unit A (59 MW), and forced outage of Upper Mahiao unit A (32 MW) on top of the deactivated shutdown of Makban GPP unit 6 (55 MW) and Tiwi GPP unit B (44 MW). In relation to the magnitude 6.1 earthquake, Bacman GPP unit 1 (60 MW) also went on outage.

Lastly at 12 percent, hydro plants' outage capacity averaged 293 MW, relating to the planned outages of San Roque HEP unit 2 (145 MW) and Magat HEP unit 1 (95 MW), and maintenance outage of Magat HEP unit 2 (95 MW).

Lastly, natural gas plants recorded the lowest outage capacity at an average of 54 MW (2 percent) related to the maintenance outage of San Gabriel NGPP (420 MW) from 22 to 26 March 2019.

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

**Figure 2. Plant Outage Capacity (by Plant Type), 2<sup>nd</sup> Quarter 2019**



**Table 3. Outage Summary (Ex-ante), 2<sup>nd</sup> Quarter 2019, 1<sup>st</sup> Quarter 2019, and 2<sup>nd</sup> Quarter 2018**

	2nd Quarter 2019 (26 Mar to 25 Jun 2019)			1st Quarter 2019 (26 Dec 2018 to 25 Mar 2019)			2nd Quarter 2018 (26 Mar to 25 Jun 2018)			% Q-on-Q Change (1Q 2019 - 2Q 2019)			% Y-on-Y Change (2Q 2018 - 2Q 2019)		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Coal	2,561	300	1,273	3,018	421	1,809	2,412	150	777	(15.1)	(28.7)	(29.6)	6.2	100.0	64.0
Natural Gas	527	0	54	950	0	211	1,020	0	229	(44.6)		(74.4)	(48.4)		(76.5)
Geothermal	530	265	324	572	287	403	534	285	354	(7.3)	(7.7)	(19.5)	(0.7)	(7.0)	(8.4)
Hydro	645	145	293	900	50	248	815	195	391	(28.3)	190.0	18.0	(20.9)	(25.6)	(25.1)
Oil Based	915	331	557	1,054	375	599	804	4	401	(13.2)	(11.7)	(7.0)	13.8	7,781.0	38.9
<b>TOTAL</b>	<b>4,069</b>	<b>1,495</b>	<b>2,502</b>	<b>4,764</b>	<b>1,704</b>	<b>3,270</b>	<b>3,652</b>	<b>995</b>	<b>2,152</b>	<b>(14.6)</b>	<b>(12.3)</b>	<b>(23.5)</b>	<b>11.4</b>	<b>50.3</b>	<b>16.3</b>

**Table 4. Monthly Outage Summary (Ex-ante), 2<sup>nd</sup> Quarter 2019**

	April 2019 (26 Mar to 25 Apr 2019) in MW			May 2019 (26 Apr to 25 May 2019) in MW			June 2019 (26 May to 25 Jun 2019) in MW		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Coal	2,252	503	1,469	1,813	300	871	2,561	544	1,468
Natural Gas	420	0	38	266	0	32	527	0	91
Geothermal	369	265	298	384	265	280	530	303	392
Hydro	465	240	257	645	145	307	565	240	317
Oil Based	915	375	383	835	375	624	841	331	667
<b>TOTAL</b>	<b>3,591</b>	<b>1,665</b>	<b>2,444</b>	<b>3,412</b>	<b>1,495</b>	<b>2,114</b>	<b>4,069</b>	<b>1,841</b>	<b>2,935</b>

**b. Outage Capacity by Outage Category**

Forced outages accounted for about half of this quarter's system-wide outage capacity at 1,190 MW on the average. Multiple forced outage events were recorded in April and June, which lead to the frequent issuance of yellow/red alerts and declaration of Market Intervention by NGCP-SO. Further, the magnitude 6.1 earthquake that hit Luzon on 22 April resulted in the tripping of major power plants located in Regions 3 and 4A, namely: Mariveles CFTPP units 1 and 2 (632 MW), SMC Limay CFTPP units 1 - 4 (600 MW), Anda CFTPP (72 MW), Limay CCGT units 1-

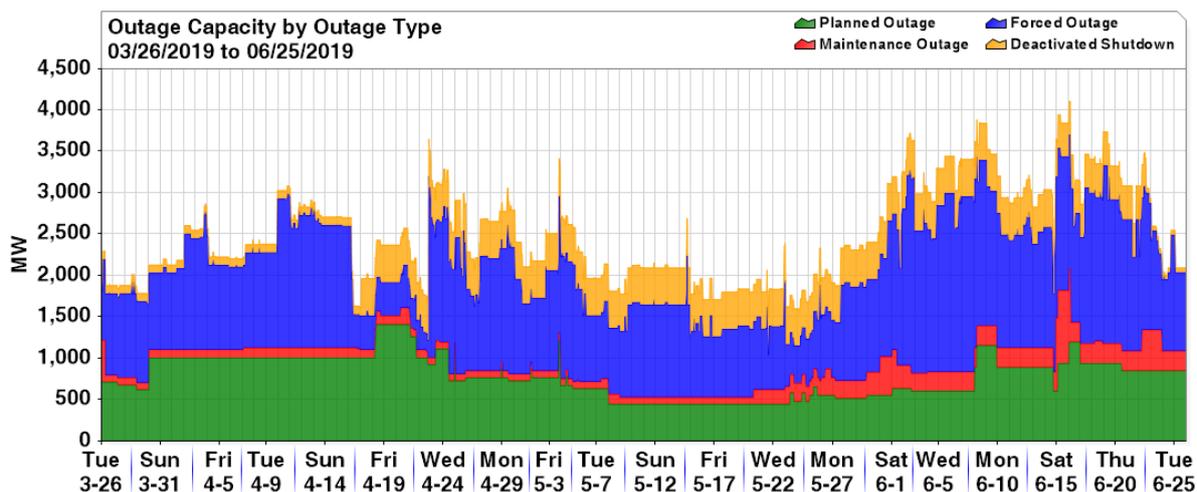
8 (540 MW), and Bacman GPP unit 1 (60 MW). Forced outages, which continued until the end of the quarter, posted highest at 1,507 MW in June.

Comprising about one third of the system outage, planned outage capacity averaged 782 MW, a substantial reduction from previous quarter's 1,546 MW (see Table 5). Following the government's directive to minimize outages in May due to the conduct of the Philippine midterm election, major power plants that went on planned outage the previous quarter resumed normal operation in the second quarter. Planned outage capacity registered lowest in May at 566 MW. This quarter's planned outage capacity involved Calaca CFTPP unit 1 (300 MW), and San Roque HEP unit 2 (145 MW), which underwent planned maintenance since 30 December 2018 and 11 March 2019, respectively. Likewise, the 382-MW Pagbilao CFTPP unit 1 went on planned outage during the quarter from 30 March to 24 April.

Deactivated shutdown outage capacity, which constituted 14 percent of the system outage, posted an average of 347 MW from previous quarter's 112 MW. The increase in quarter-on-quarter figure was on account of the reclassification of Malaya TPP unit 2 (350 MW) from forced outage to deactivated shutdown category, and the shutdown of Makban GPP unit C (55 MW) starting 04 April.

Meanwhile, maintenance outage registered 7 percent of the total outage capacity, a decrease from previous quarter's 362 MW to 171 MW, attributable to the short span of maintenance outages of Sual CFTPP (647 MW) from 14 to 16 June, and Sta. Rita NGPP unit 1 (257 MW).

**Figure 3. Plant Outage Capacity (by Outage Category), 2<sup>nd</sup> Quarter 2019**



**Table 5. Outage Summary, by Outage Category, 2<sup>nd</sup> Quarter 2019, 1<sup>st</sup> Quarter 2019, and 2<sup>nd</sup> Quarter 2018**

	2nd Quarter 2019 (26 Mar to 25 Jun 2019) in MW			1st Quarter 2019 (26 Dec 2018 to 25 Mar 2019) in MW			2nd Quarter 2018 (26 Mar to 25 Jun 2018) in MW			% Q-on-Q Change (1Q 2019 - 2Q 2019)			% Y-on-Y Change (2Q 2018 - 2Q 2019)		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Planned	1,410	445	782	2,715	263	1,546	1,493	195	699	(48.1)	69.2	(49.4)	(5.6)	128.2	11.9
Maintenance	886	84	171	1,042	84	362	1,064	57	447	(15.0)	0.0	(52.8)	(16.8)	47.4	(61.7)
Forced	2,371	210	1,190	2,268	598	1,254	1,978	272	850	4.6	(64.9)	(5.1)	19.9	(22.9)	40.0
Deactivated Shutdown	449	55	347	148	99	112	158	99	145	203.8	(44.3)	208.6	184.5	(44.3)	139.6

**Table 6. Monthly Outage Summary, by Outage Category, 2<sup>nd</sup> Quarter 2019**

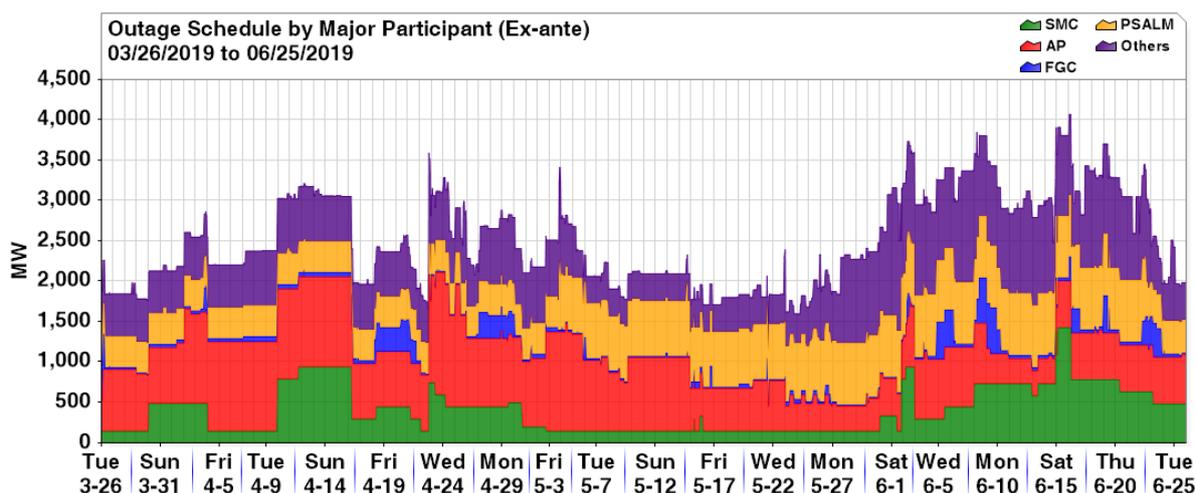
	April 2019 (26 Mar to 25 Apr 2019) in MW			May 2019 (26 Apr to 25 May 2019) in MW			June 2019 (26 May to 25 Jun 2019) in MW		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
<b>Planned</b>	1,410	622	993	1,220	445	566	1,199	517	779
<b>Maintenance</b>	504	84	113	217	84	107	886	179	291
<b>Forced</b>	2,196	210	1,078	1,760	422	978	2,371	696	1,507
<b>Deactivated Shutdown</b>	449	99	200	449	449	449	449	55	395

**c. Outage Capacity by Major Participant**

In terms of major participant, about 30 percent of this quarter’s system-wide outage capacity or an average of 752 MW was attributed to Aboitiz Power (AP) with the maintenance outage of Pagbilao CFTPP unit 1 (382 MW) and forced outage of Pagbilao CFTPP unit 3 (420 MW). On the other hand, Power Sector Asset and Liabilities Management (PSALM) accounted for 23 percent or an average of 573 MW with the outage of Malaya TPP units 1 and 2 (650 MW).

San Miguel Corporation’s (SMC) outage capacity averaged at 400 MW or 16 percent attributable to the planned outages of Sual CFTPP units 1 and 2 (647 MW each) and SMC Limay CFTPP units 1 and 2 (150 MW each). Meanwhile, the outage capacity involving First Gen Corporation (FGC) averaged at 87 MW or 3 percent during the billing quarter, which was mainly related to the planned and forced outage of Sta Rita NGPP unit 2 (256 MW) and Sta Rita NGPP unit 3 (266 MW), respectively.

**Figure 4. Plant Outage Capacity (by Major Participant Grouping), 2<sup>nd</sup> Quarter 2019**



**Table 7. Outage Summary, by Major Participant Grouping, 2<sup>nd</sup> Quarter 2019, 1<sup>st</sup> Quarter 2019, and 2<sup>nd</sup> Quarter 2018**

	2nd Quarter 2019 (26 Mar to 25 Jun 2019) in MW			1st Quarter 2019 (26 Dec 2018 to 25 Mar 2019) in MW			2nd Quarter 2018 (26 Mar to 25 Jun 2018) in MW			% Q-on-Q Change (1Q 2019 - 2Q 2019)			% Y-on-Y Change (2Q 2018 - 2Q 2019)		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
<b>SMC</b>	1,427	145	400	947	50	408	1,472	195	517	50.7	190.0	(1.8)	(3.1)	(25.6)	(22.6)
<b>AP</b>	1,512	308	752	1,458	290	820	1,374	233	608	3.7	6.2	(8.3)	10.0	32.2	23.8
<b>FGC</b>	567	20	87	970	20	241	647	20	123	(41.6)	0.0	(64.0)	(12.5)	0.0	(29.2)
<b>PSALM</b>	862	382	573	1,096	382	655	960	32	459	(21.3)	0.0	(12.6)	(10.2)	1,093.8	24.7
<b>Others</b>	1,579	335	690	1,903	413	1,145	1,127	150	445	(17.0)	(18.8)	(39.8)	40.1	123.5	55.0
<b>TOTAL</b>	4,069	1,495	2,502	4,764	1,704	3,270	3,652	995	2,152	(14.6)	(12.3)	(23.5)	11.4	50.3	16.3

**Table 8. Monthly Outage Summary, by Major Participant Grouping, 2<sup>nd</sup> Quarter 2019**

	April 2019 (26 Mar to 25 Apr 2019) in MW			May 2019 (26 Apr to 25 May 2019) in MW			June 2019 (26 May to 25 Jun 2019) in MW		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
<b>SMC</b>	942	145	438	495	145	199	1,427	145	558
<b>AP</b>	1,512	385	962	1,336	308	768	934	308	527
<b>FGC</b>	440	20	79	323	20	61	567	20	119
<b>PSALM</b>	454	382	383	862	382	610	836	414	726
<b>Others</b>	1,122	428	582	1,154	335	476	1,579	454	1,004

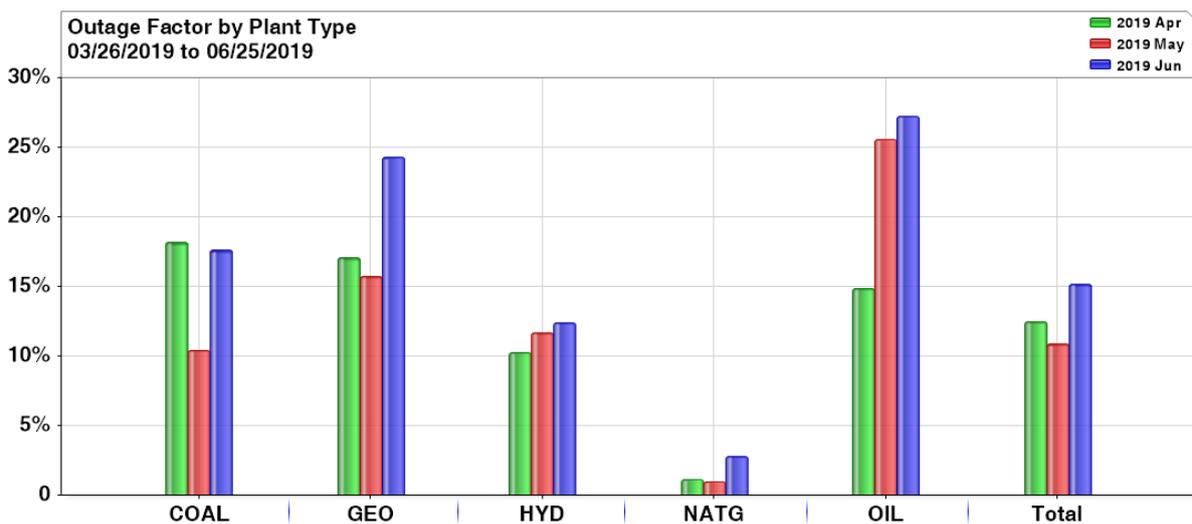
**d. Outage Factor**

Consistent with the discussion on outage capacity in the preceding sections and as seen in Table 9 below, the system-wide total outage factor during the quarter peaked in June at 15.2 percent from 12.5 percent in April and 10.8 percent in May.

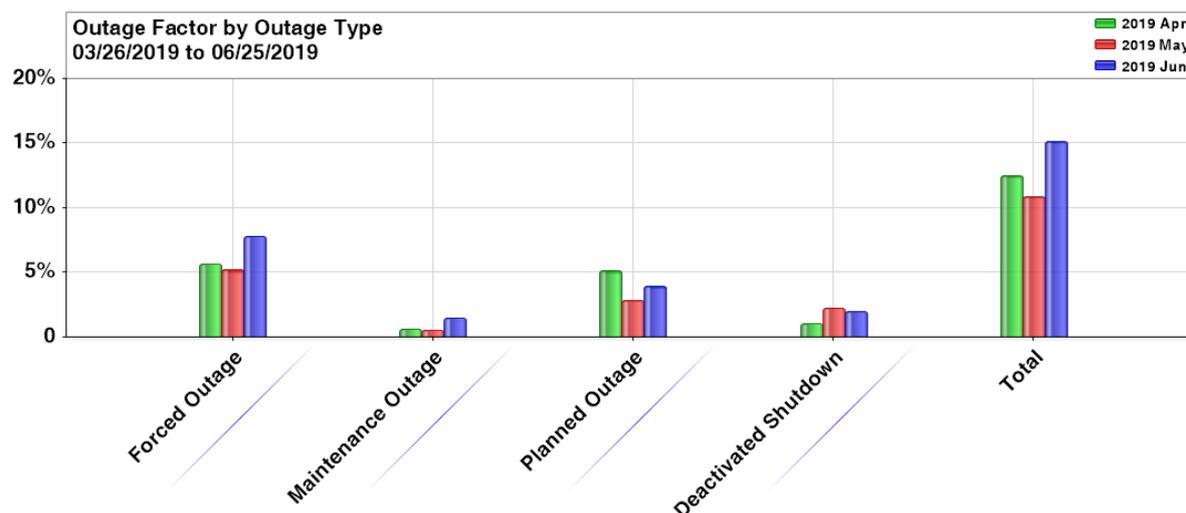
Forced outage factor was particularly high during the June billing month at 7.8 percent followed by April at 5.6 percent and May at 5.2 percent.

Meanwhile, based on resource type, oil-based plants obtained the highest outage factor at 27.2 percent followed by geothermal and coal plants at 24.3 and 17.6 percent, respectively.

**Figure 5. Outage Factor (by Plant Type), 2<sup>nd</sup> Quarter 2019**



**Figure 6. Outage Factor (by Outage Type), 2<sup>nd</sup> Quarter 2019**



**Table 9. Outage Factor, 2<sup>nd</sup> Quarter 2019**

Plant Type	Total Outage Factor			Forced Outage Factor			Maintenance Outage Factor			Planned Outage Factor			D/S Outage Factor		
	Apr 2019	May 2019	Jun 2019	Apr 2019	May 2019	Jun 2019	Apr 2019	May 2019	Jun 2019	Apr 2019	May 2019	Jun 2019	Apr 2019	May 2019	Jun 2019
BAT															
BIOF	5.2	16.7	15.6	2.7	16.6	15.6	2.5	0.1							
COAL	18.2	10.4	17.6	9.5	6.8	11.6			0.3	8.7	3.6	5.6			
GEO	17.1	15.7	24.3	6.6	6.6	8.9	4.6	3.5	6.7	0.4	0.1	4.0	5.5	5.5	4.7
HYD	10.3	11.7	12.4	0.0	0.4	0.0		0.8	3.8	10.3	10.5	8.5			
NATG	1.1	1.0	2.8	0.1	1.0	1.3	0.2		0.7	0.9		0.7			
OIL	14.9	25.6	27.2	8.9	10.3	13.5	1.2	1.0	1.0				4.8	14.3	12.7
SOLR	0.1	0.3	0.2	0.1	0.3	0.2									
WIND															
Total	12.5	10.8	15.2	5.6	5.2	7.8	0.6	0.5	1.5	5.2	2.8	3.9	1.0	2.3	2.0

### III. Demand and Supply Situation

The 2<sup>nd</sup> quarter of 2019 recorded a high system demand growth of 18.2 percent at 10,805 MW from 9,138 MW in the 1<sup>st</sup> quarter. As the summer season intensified during the quarter, average system demand<sup>4</sup> peaked to 11,080 MW in June from 10,294 MW in April and 11,027 MW in May.

For this quarter, the reserve schedule averaged at 908 MW. Consequently, the demand plus reserve schedule, averaging 11,714 MW, demonstrated a 14.8 percent increase from last quarter's 10,203 MW.

Similarly, effective supply<sup>5</sup> posted a higher average this quarter at 12,802 MW from previous quarter's 12,098 MW attributable to the lower level of outage capacity. Monthly average effective supply ranged from 12,363 MW in April, when the outage capacity was the highest, up to 13,033 MW in May.

Driven by the significant growth in system demand, supply margin<sup>6</sup> narrowed by 42.5 percent this quarter at 1,088 MW coming from previous quarter's 1,895 MW. Moreover, month-on-month comparison indicated that June had the lowest average supply margin as a

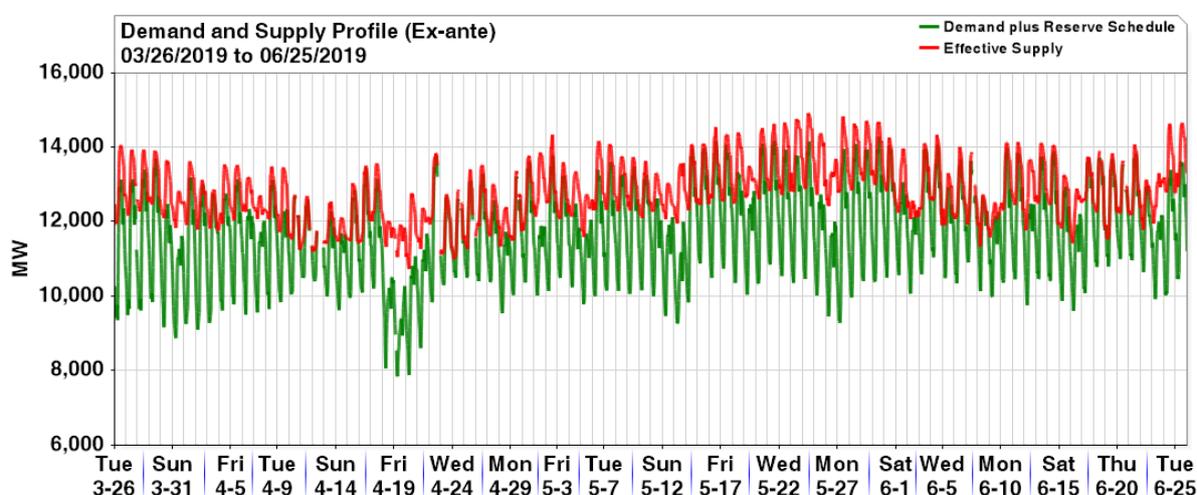
<sup>5</sup>The system effective supply is equal to the offered capacity of all scheduled generator resources, nominated loading level of non-scheduled generating units and projected output of preferential dispatch generating units adjusted for any security limit and ramp rates. Scheduled output of plants 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).

<sup>6</sup>The supply margin is equal to the effective supply less system demand requirement plus reserve schedule.

consequence of having the highest outage capacity and highest system demand due to the summer season.

Meanwhile, as seen in Figure 7, there were few dips in system demand plus reserve schedule due to the onset of the Holy Week which ran from 14 April (Sunday) to 20 April (Saturday), conduct of Philippine local election on 13 May (Monday), and observance of Eid al-Fitr and Independence Day on 5 June and 12 June, respectively.

**Figure 7. Demand and Effective Supply (Ex-ante), 2<sup>nd</sup> Quarter 2019**



**Table 10. Demand and Supply Summary (Ex-ante), 2<sup>nd</sup> Quarter 2019, 1<sup>st</sup> Quarter 2019, and 2<sup>nd</sup> Quarter 2018**

	2nd Quarter 2019 (26 Mar to 25 Jun 2019) in MW			1st Quarter 2019 (26 Dec 2018 to 25 Mar 2019) in MW			2nd Quarter 2018 (26 Mar to 25 Jun 2018) in MW			% Q-on-Q Change (1Q 2019 - 2Q 2019)			% Y-on-Y Change (2Q 2018 - 2Q 2019)		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
<b>Demand</b>	13,378	6,986	10,805	12,050	5,167	9,138	12,751	6,024	9,933	11.0	35.2	18.2	4.9	16.0	8.8
<b>Reserve Schedule</b>	1,402	156	908	1,581	528	1,065	1,359	323	890	(11.3)	(70.4)	(14.7)	3.2	(51.5)	2.1
<b>Demand plus R/S</b>	14,289	7,855	11,714	13,322	5,758	10,203	13,862	6,676	10,823	7.3	36.4	14.8	3.1	17.7	8.2
<b>Effective Supply</b>	14,925	10,736	12,802	13,974	9,959	12,098	14,724	10,215	12,683	6.8	7.8	5.8	1.4	5.1	0.9
<b>Supply Margin</b>	3,540	0	1,088	5,690	4	1,895	4,290	23	1,860	(37.8)	(90.1)	(42.5)	(17.5)	(98.5)	(41.5)

Note: The derived values were non-coincident.

**Table 11. Monthly Demand and Supply Summary (Ex-ante), 2<sup>nd</sup> Quarter 2019**

	April 2019 (26 Mar to 25 Apr 2019) in MW			May 2019 (26 Apr to 25 May 2019) in MW			June 2019 (26 May to 25 Jun 2019) in MW		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
<b>Demand</b>	12,846	6,986	10,294	13,321	8,342	11,027	13,378	8,437	11,080
<b>Reserve Schedule</b>	1,402	156	911	1,304	281	863	1,399	180	951
<b>Demand plus R/S</b>	13,794	7,855	11,205	14,185	9,274	11,890	14,289	9,294	12,030
<b>Effective Supply</b>	14,064	10,736	12,363	14,925	11,351	13,033	14,839	11,349	12,998
<b>Supply Margin</b>	3,389	0	1,159	3,242	14	1,143	3,540	2	968

## IV. Market Price Outcome<sup>7</sup>

### a. Market Prices

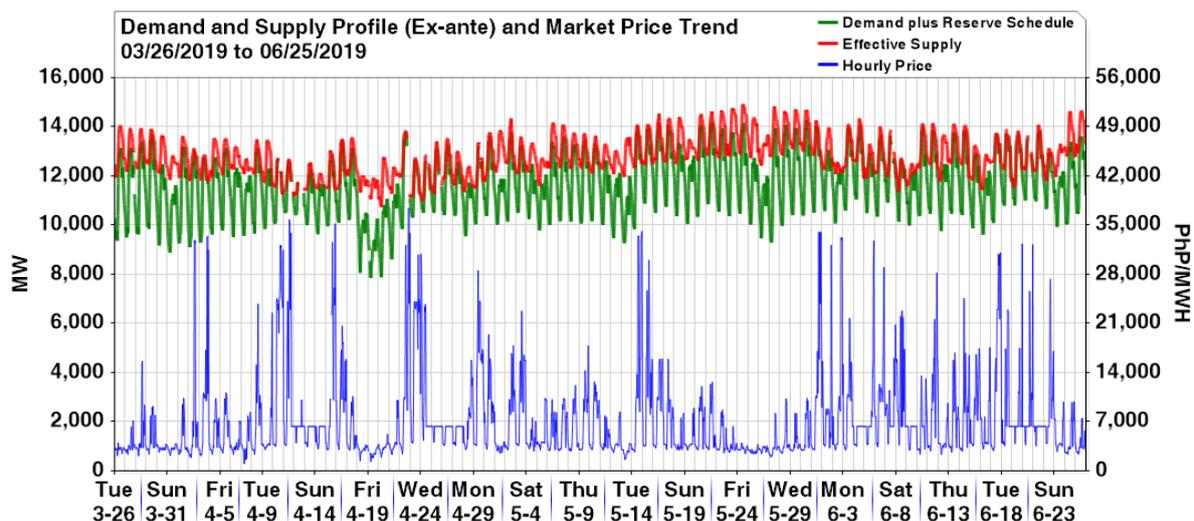
Consistent with the quarter-on-quarter decrease in average supply margin, average market prices grew by 57.7 percent from previous quarter's PhP4,622/MWh to current quarter's PhP7,288/MWh. The year-on-year figures likewise demonstrated an increase of 76.8 percent from PhP4,122/MWh in the 2<sup>nd</sup> quarter of 2018.

As seen in Figure 8, frequent price spikes above PhP20,000/MWh were mostly noted during the April billing month with market price for the month averaging PhP7,315/MWh. The May billing month, on the other hand, recorded a lower market price at PhP6,707/MWh despite the increasing system demand due to the availability of more plants with lower price offers.

Noted in June was the occurrence of maximum demand for the year as the hot season prevailed, which further tightened the supply margin even with almost the same level of effective supply as May. Driven by the tighter supply and demand condition, the average market price reached PhP7,819/MWh in June, the highest price recorded since May 2015. It should be noted though that the imposition of secondary price cap throughout the quarter somehow mitigated the significant impact to WESM customers.

Observations on the price spike events as above discussed have been provided to the PEM Board, the Department of Energy (DOE), and the Energy Regulatory Commission (ERC).

**Figure 8. Market Price Trend vs. Supply Margin, 2<sup>nd</sup> Quarter 2019**



**Table 12. Market Price Summary, 2<sup>nd</sup> Quarter 2019, 1<sup>st</sup> Quarter 2019, and 2<sup>nd</sup> Quarter 2018**

	2nd Quarter 2019 (26 Mar to 25 Jun 2019) in PhP/MWh			1st Quarter 2019 (26 Dec 2018 to 25 Mar 2019) in PhP/MWh			2nd Quarter 2018 (26 Mar to 25 Jun 2018) in PhP/MWh			% Q-on-Q Change (1Q 2019 - 2Q 2019)			% Y-on-Y Change (2Q 2018 - 2Q 2019)		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
System	35,803	1,054	7,288	34,142	-10,469	4,622	32,454	0	4,122	4.9	(110.1)	57.7	10.3		76.8

<sup>7</sup>The 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.

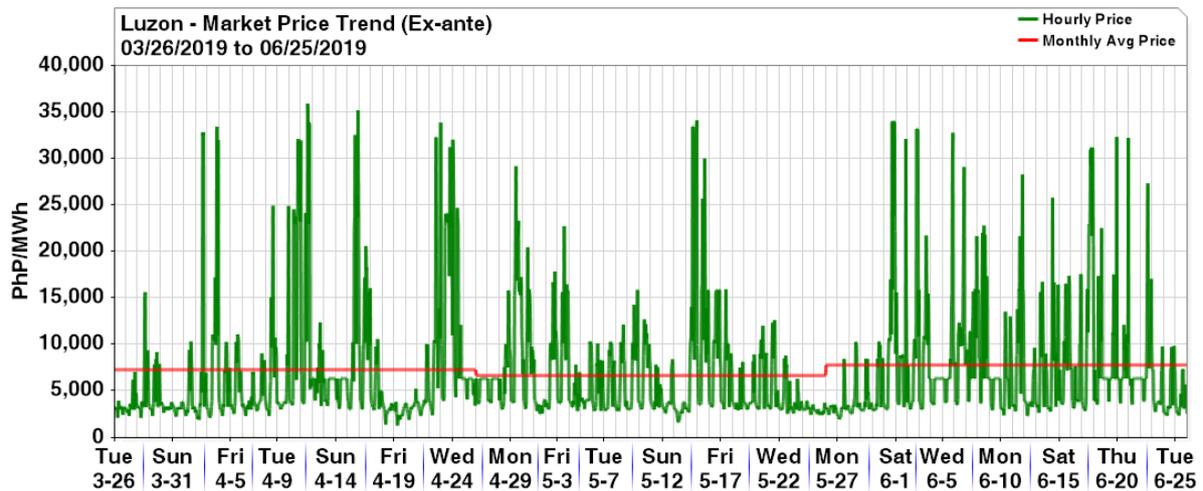
**Table 13. Monthly Market Price Summary, 2<sup>nd</sup> Quarter 2019**

System	April 2019 (26 Mar to 25 Apr 2019) in PhP/MWh			May 2019 (26 Apr to 25 May 2019) in PhP/MWh			June 2019 (26 May to 25 Jun 2019) in PhP/MWh		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
System	35,803	1,054	7,315	34,112	1,674	6,707	34,039	1,999	7,819

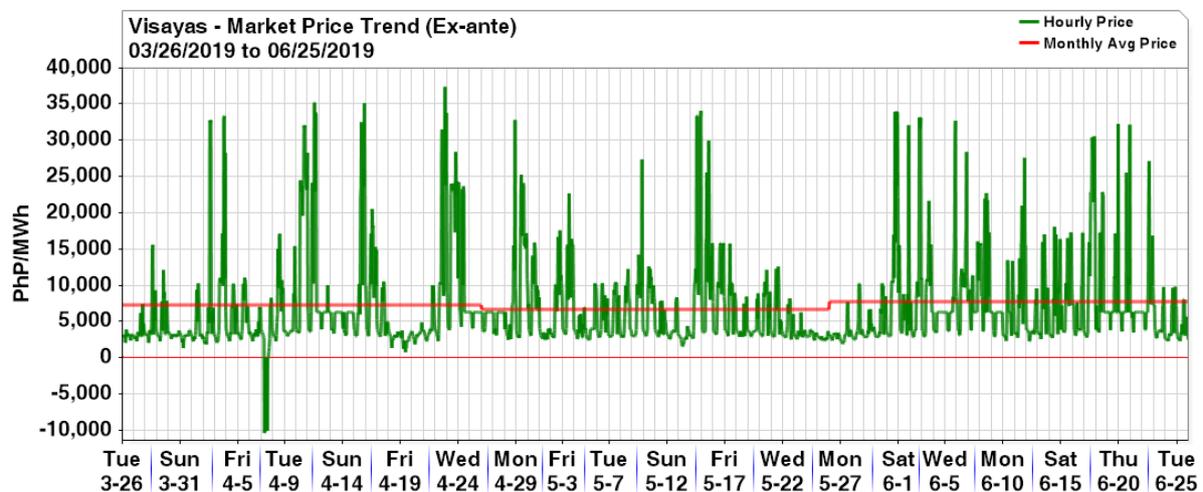
The market prices were higher in Visayas than Luzon by 0.6 percent, 0.7 percent, and 0.1 percent during April, May, and June, respectively.

Price separation between Luzon and Visayas occurs when the HVDC link between the region is unavailable or its maximum capacity is reached.

**Figure 9. Market Price Trend - Luzon, 2<sup>nd</sup> Quarter 2019**



**Figure 10. Market Price Trend - Visayas, 2<sup>nd</sup> Quarter 2019**



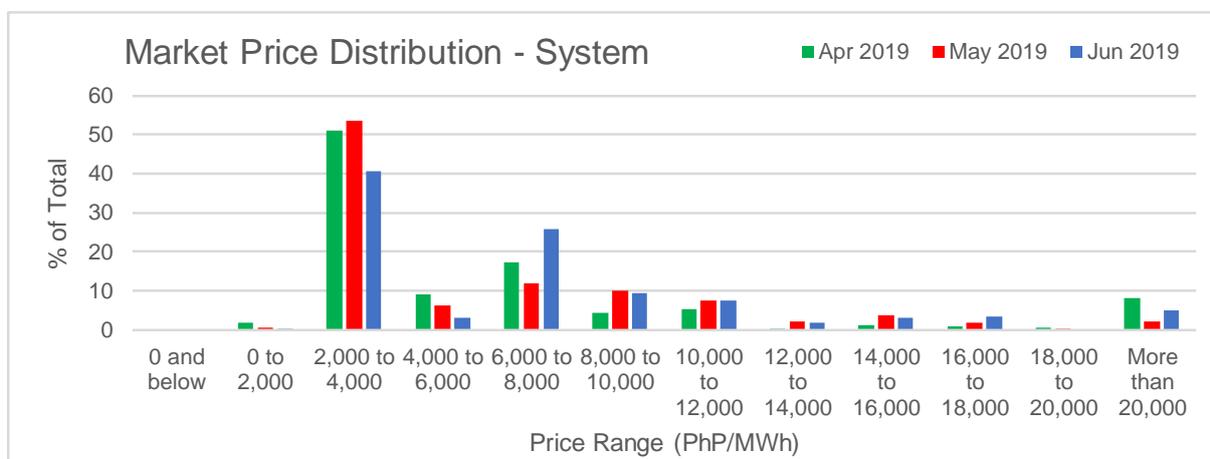
**Table 14. Monthly Regional Price Summary – 2<sup>nd</sup> Quarter 2019**

	Luzon in PhP/MWh			Visayas in PhP/MWh			% Difference		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
<b>April 2019</b>	35,910	1,328	7,308	37,442	-10,279	7,354	(4.1)	(112.9)	(0.6)
<b>May 2019</b>	34,112	1,674	6,700	34,112	1,674	6,745	0.0	0.0	(0.7)
<b>June 2019</b>	34,039	1,999	7,819	34,039	1,999	7,824	0.0	(0.0)	(0.1)

**b. Price Distribution**

Consistent with the average price trend discussed above, the frequency of prices above PhP20,000/MWh decreased from 8.1 percent in April to 2.1 percent in May then went up to 5.1 percent in June. Additionally, prices above PhP6,000/MWh were observed 56 percent of the time during June while the same condition was also noted at 38 percent and 40 percent of the time during April and May billing periods, respectively.

**Figure 11. Price Distribution, 2<sup>nd</sup> Quarter 2019**



**Table 15. Monthly Price Distribution – 2<sup>nd</sup> Quarter 2019**

Price Range (PhP/MWh)	% Distribution		
	Apr 2019	May 2019	Jun 2019
0 and below	0.0	0.0	0.0
0 to 2,000	1.7	0.6	0.1
2,000 to 4,000	51.1	53.5	40.7
4,000 to 6,000	9.0	6.4	3.1
6,000 to 8,000	17.3	11.9	25.9
8,000 to 10,000	4.3	10.0	9.4
10,000 to 12,000	5.4	7.6	7.4
12,000 to 14,000	0.3	2.1	1.7
14,000 to 16,000	1.3	3.8	3.1
16,000 to 18,000	0.9	1.8	3.4
18,000 to 20,000	0.5	0.3	0.0
More than 20,000	8.1	2.1	5.1
	100.0	100.0	100.0

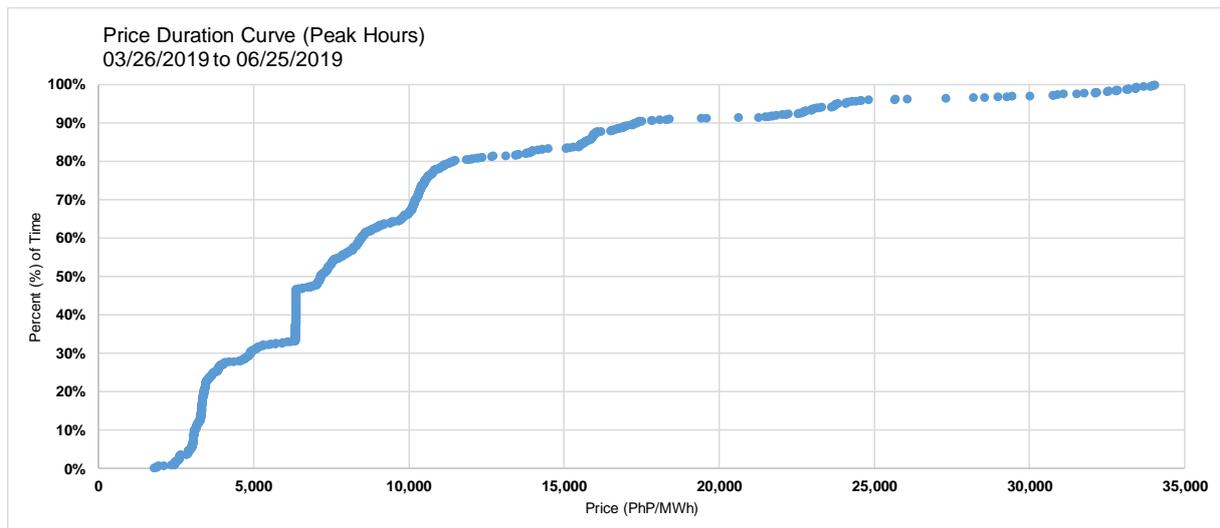
**c. Price Duration Curve**

The price duration curves demonstrate the higher market prices during peak<sup>8</sup> hours compared to off-peak<sup>9</sup> hours.

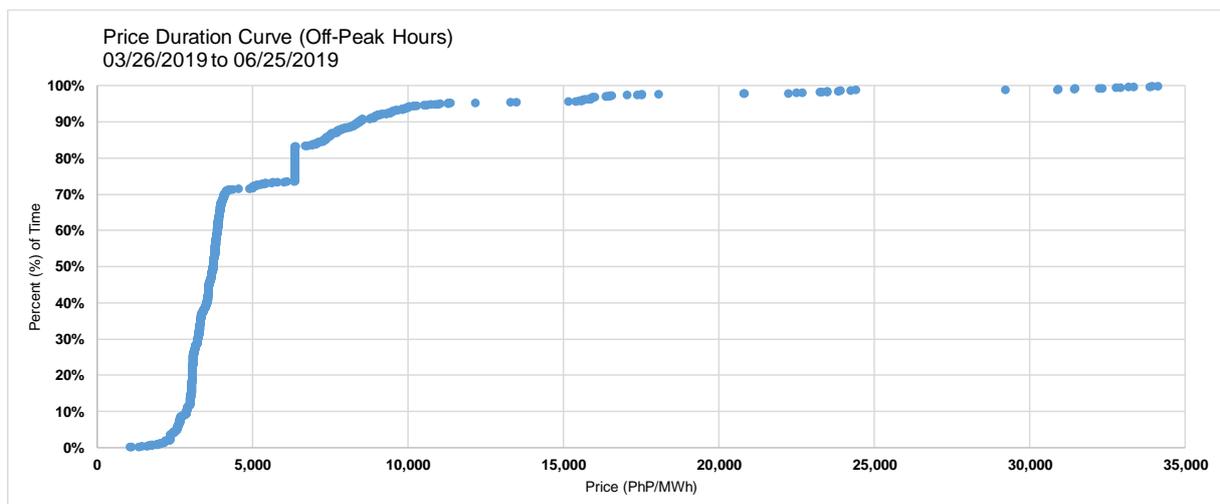
Seen in Figure 13 below, bulk of the market prices during the off-peak hours of the billing month, at 72 percent was at PhP5,000/MWh and below. About 22 percent, were within the price range PhP5,000/MWh to PhP10,000/MWh while the remaining 6 percent were above PhP10,000/MWh up to PhP32,000/MWh.

On the other hand, about 30 percent of the prices during the peak hours were below PhP5,000/MWh as shown in Figure 12. It was observed that market prices within PhP5,000/MWh up to PhP10,000/MWh was recorded at 36 percent and 33 percent was above PhP10,000/MWh up to PhP32,000/MWh. Less than one percent was recorded below PhP5,000/MWh.

**Figure 12. Price Duration Curve (Peak Period), 2<sup>nd</sup> Quarter 2019**



**Figure 13. Price Duration Curve (Off-Peak Period), 2<sup>nd</sup> Quarter 2019**



<sup>8</sup>Peak hours include 1000H-2100H from Mondays to Saturdays and 1900H-2000H on Sundays and Holidays

<sup>9</sup>Off-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

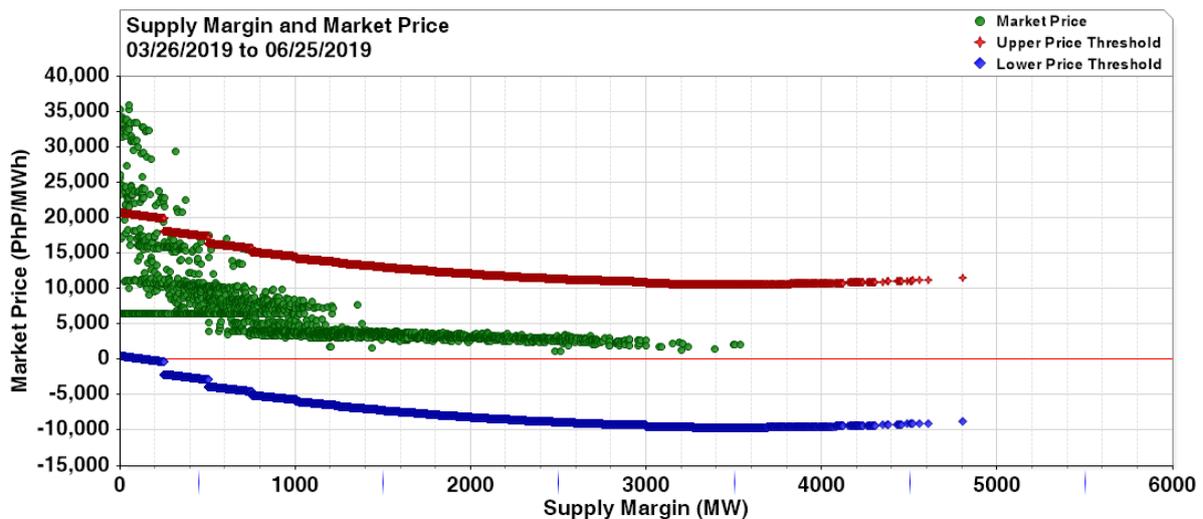
#### d. Interesting Pricing Event

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”. Annex A provides details on the MSC-approved methodology in determining interesting pricing events.

A total of 59 trading intervals in April, 12 trading intervals in May, and 40 trading intervals in June 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, 2<sup>nd</sup> Quarter 2019**



**Table 16. Interesting Pricing Events (Exceeding the Upper Threshold) – 2<sup>nd</sup> Quarter 2019**

Month	Day	Trading Interval	Supply Margin	Market Price	Lower Price Threshold	Upper Price Threshold
April	2	14	49	32,802	515	20,733
		15	54	32,495	515	20,733
		16	51	32,848	515	20,733
		19	3	33,121	515	20,733
	3	20	3	33,440	515	20,733
		22	33	31,446	515	20,733
		8	15	226	23,764	515
	9	23	379	22,492	-2,072	18,146
		9	32	24,250	515	20,733
	10	10	35	24,558	515	20,733
		11	33	24,298	515	20,733
		12	54	22,971	515	20,733
		13	57	23,772	515	20,733
		18	3	31,768	515	20,733
		19	2	32,118	515	20,733
		20	0	25,651	515	20,733
		21	1	24,826	515	20,733
		22	2	23,911	515	20,733
		23	3	23,253	515	20,733
	24	18	31,421	515	20,733	

Month	Day	Trading Interval	Supply Margin	Market Price	Lower Price Threshold	Upper Price Threshold
April	11	10	127	24,179	515	20,733
		14	57	35,803	515	20,733
		15	53	35,256	515	20,733
		16	46	23,023	515	20,733
		17	41	33,900	515	20,733
		18	34	33,682	515	20,733
		14	222	22,233	515	20,733
	15	15	86	23,720	515	20,733
		16	2	32,551	515	20,733
		17	172	23,301	515	20,733
		19	127	23,617	515	20,733
		20	3	26,064	515	20,733
		21	2	23,661	515	20,733
		22	3	35,194	515	20,733
		23	68	24,412	515	20,733
	22	14	64	31,533	515	20,733
		15	43	32,166	515	20,733
24	22	33,864	515	20,733		

Month	Day	Trading Interval	Supply Margin	Market Price	Lower Price Threshold	Upper Price Threshold
April	23	9	50	22,678	515	20,733
		10	17	24,688	515	20,733
		11	26	23,697	515	20,733
		12	73	23,219	515	20,733
		13	71	23,128	515	20,733
		14	132	24,073	515	20,733
		15	145	24,092	515	20,733
		16	109	23,236	515	20,733
		17	115	22,154	515	20,733
		19	87	30,776	515	20,733
		20	131	22,580	515	20,733
		21	68	24,414	515	20,733
22		1	23,832	515	20,733	
23		105	23,495	515	20,733	
24	1	79	30,887	515	20,733	
	2	136	29,219	515	20,733	
	3	127	23,473	515	20,733	
	9	124	23,314	515	20,733	
	10	242	22,711	515	20,733	
11	222	23,719	515	20,733		
12	254	22,738	-2,072	18,146		

Month	Day	Trading Interval	Supply Margin	Market Price	Lower Price Threshold	Upper Price Threshold	
May	29	10	127	22,662	515	20,733	
		11	157	28,552	515	20,733	
		14	236	22,758	515	20,733	
	14	14	85	33,420	515	20,733	
		15	61	33,439	515	20,733	
		16	99	33,430	515	20,733	
		21	137	32,799	515	20,733	
		22	13	33,351	515	20,733	
		23	14	34,112	515	20,733	
		11	130	25,688	515	20,733	
		15	15	107	30,025	515	20,733
			16	133	22,787	515	20,733
			17	8	33,963	515	20,733
			19	3	34,039	515	20,733
		June	31	20	72	23,845	515
21	3			33,958	515	20,733	
22	3			33,940	515	20,733	
23	248			22,225	515	20,733	
23	248			22,225	515	20,733	

Month	Day	Trading Interval	Supply Margin	Market Price	Lower Price Threshold	Upper Price Threshold	
June	1	21	146	32,132	515	20,733	
		19	3	33,198	515	20,733	
		20	3	33,169	515	20,733	
	2	21	3	32,910	515	20,733	
		22	3	33,166	515	20,733	
		15	35	21,729	515	20,733	
	3	21	80	29,443	515	20,733	
		22	131	32,772	515	20,733	
	5	20	223	21,278	-2,072	18,146	
		21	123	28,984	515	20,733	
	6	7	23	333	20,798	-2,072	18,146
		11	88	22,032	515	20,733	
	8	14	56	22,793	515	20,733	
		16	36	21,837	515	20,733	
	11	16	258	21,588	-2,072	18,146	
		21	179	28,185	515	20,733	
14	11	65	24,572	515	20,733		
	21	508	17,529	-3,794	16,424		

Month	Day	Trading Interval	Supply Margin	Market Price	Lower Price Threshold	Upper Price Threshold	
June	17	14	39	22,970	515	20,733	
		15	46	22,974	515	20,733	
		16	67	23,031	515	20,733	
		17	66	30,895	515	20,733	
		18	318	29,278	-2,072	18,146	
		19	65	30,762	515	20,733	
		20	205	21,676	515	20,733	
		21	81	31,081	515	20,733	
		22	97	30,903	515	20,733	
		23	357	20,818	-2,072	18,146	
		18	16	47	22,536	515	20,733
		19	23	155	32,330	515	20,733
	20	23	165	32,226	515	20,733	
	22	14	54	21,479	515	20,733	
		15	43	27,313	515	20,733	
	22	612	17,052	-3,794	16,424		

## V. Pricing Errors, Market Intervention, and Secondary Cap

System-wide non-congestion pricing errors in the ex-ante affected 72 trading intervals (10 percent of the time) in May and 3 trading intervals (0.4 percent of the time) in June which were mostly 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 24 trading intervals in the ex-ante related to the localized contingency constraint violation on Paco SS transformers. Meanwhile, in Visayas, non-congestion pricing errors affected 15 trading intervals during the ex-ante related to the localized contingency violation on Cadiz, Bacman, Daraga and Lumban transformers.

Meanwhile, the system-wide application of Price Substitution Methodology (PSM) affected a total of 403 trading intervals in the ex-ante. PSM application this month was mainly due to constraint on Samboan-Amlan Line 1 (Cebu-Negros submarine cable) with 77 affected trading intervals.

On the other hand, SO- and MO-initiated market interventions were declared for a total of 52 intervals for the billing period considered. Majority or 49 intervals (94 intervals) of which are SO-initiated due to the magnitude 6.1 earthquake on 22 April and numerous manual load dropping events caused by the thinning of the supply margin, especially in the April billing month. Market intervention was also declared by MO for 3 intervals (6 percent) in the Luzon and Visayas region on 4 and 15 April at 1300H and 0400H, respectively due to unimplementable schedules caused by inappropriate Load Predictor (LDP)<sup>10</sup> and on 27 March due to database error.

Due to sustained high prices throughout the second billing quarter, a total of 274 trading intervals were pegged at the secondary price cap level<sup>11</sup>. Of these, 53 percent of the total or 145 intervals occurred during June billing period while 34 percent or 93 intervals occurred in April. May billing period had the lowest frequency of secondary price caps imposed with 36 intervals or 13 percent of the total. It was noted that the last imposition of secondary cap was recorded in September 2014.

<sup>10</sup> The Load Predictor (LDP) is the forecasting application of Market Management System (MMS) Sable for the Real-time Dispatch (RTD). It is used to forecast demand for the next two hours at five-minute intervals. The forecasted system demand is used by the Real-Time Dispatch (RTD) process that computes ex-ante prices and schedules.

<sup>11</sup> The secondary cap, as of latest revision in ERC Resolution No. 4 Series of 2017 – A Resolution Adopting Amendments to the Pre-emptive Mitigating Measure in the Wholesale Electricity Spot Market, amounting to PhP6,245/MWh is imposed upon breach of the Generator Weighted Average Price (GWAP) over a rolling 120-hour period on the threshold amounting to PhP9,000/MWh.

**Table 17. PEN, PSM, MI, and Sec Cap Summary, 2<sup>nd</sup> Quarter 2019**

	Luz-Vis						Luzon						Visayas						Total					
	Apr 2019		May 2019		Jun 2019		Apr 2019		May 2019		Jun 2019		Apr 2019		May 2019		Jun 2019		Apr 2019		May 2019		Jun 2019	
	Freq.	% of Time																						
<b>PEN (RTD)</b>	-	-	72	10.0	3	0.4	10	1.3	21	2.9	16	2.2	8	1.1	2	0.3	2	0.3	18	2.4	95	13.2	21	2.8
<b>PEN (RTX)</b>	-	-	52	7.2	7	0.9	10	1.3	13	1.8	10	1.3	7	0.9	1	0.1	-	-	17	2.3	66	9.2	17	2.3
<b>PSM (RTD)</b>	113	15.2	143	19.9	146	19.6	1	0.1	3	0.4	-	-	9	1.2	4	0.6	4	0.5	122	16.4	150	20.8	150	20.2
<b>PSM (RTX)</b>	80	10.8	113	15.7	127	17.1	-	-	-	-	-	-	4	0.5	2	0.3	2	0.3	84	11.3	115	16.0	129	17.3
<b>MI</b>	3	0.4	-	-	-	-	36	4.8	3	0.4	10	1.3	-	-	-	-	-	-	39	5.2	3	0.4	10	1.3
<b>Secondary Cap</b>	68	9.1	36	5.0	139	18.7	-	-	-	-	-	-	25	3.4	-	-	6	0.8	93	12.5	36	5.0	145	19.5

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 affecting a total of 83 trading intervals in the ex-ante and 66 trading intervals in the ex-post.

Meanwhile, pricing errors due to load shedding affected 34 trading intervals in Luzon and 18 trading intervals in Visayas during the ex-ante.

**Table 18. PEN Type Summary, 2<sup>nd</sup> Quarter 2019**

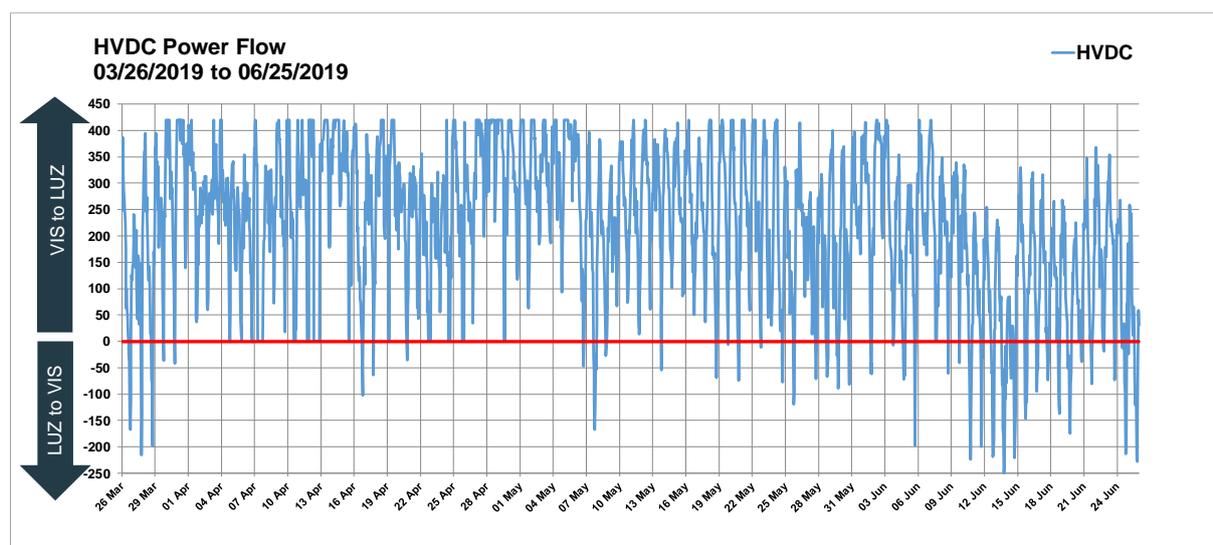
	Luz-Vis						Luzon						Visayas						Total					
	Apr 2019		May 2019		Jun 2019		Apr 2019		May 2019		Jun 2019		Apr 2019		May 2019		Jun 2019		Apr 2019		May 2019		Jun 2019	
	Freq.	% of Time																						
<b>PEN (RTD)</b>	-	-	72	10.0	3	0.4	10	1.3	39	5.4	20	2.7	8	1.1	4	0.6	2	0.3	18	2.4	115	16.0	25	3.4
Contingency	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Base Case	-	-	-	-	-	-	5	0.7	13	1.8	8	1.1	4	0.5	4	0.6	1	0.1	9	1.2	17	2.4	9	1.2
Over-generation	-	-	-	-	-	-	-	-	-	-	-	-	2	0.3	-	-	-	-	2	0.3	-	-	-	-
VoLL	-	-	-	-	-	-	5	0.7	26	3.6	4	0.5	2	0.3	-	-	1	0.1	7	0.9	26	3.6	5	0.7
Inappropriate Input Data	-	-	72	10.0	3	0.4	-	-	-	-	8	1.1	-	-	-	-	-	-	-	-	72	10.0	11	1.5
<b>PEN (RTX)</b>	-	-	52	7.2	7	0.9	11	1.5	22	3.1	14	1.9	7	0.9	2	0.3	-	-	18	2.4	76	10.6	21	2.8
Contingency	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Base Case	-	-	-	-	-	-	2	0.3	-	-	2	0.3	5	0.7	2	0.3	-	-	7	0.9	2	0.3	2	0.3
Over-generation	-	-	-	-	-	-	-	-	-	-	-	-	2	0.3	-	-	-	-	2	0.3	-	-	-	-
VoLL	-	-	-	-	-	-	9	1.2	22	3.1	5	0.7	-	-	-	-	-	-	9	1.2	22	3.1	5	0.7
Inappropriate Input Data	-	-	52	7.2	7	0.9	-	-	-	-	7	0.9	-	-	-	-	-	-	-	-	52	7.2	14	1.9

## VI. HVDC Scheduling

Power flow through the HVDC Interconnection was generally directed towards the Luzon region in the ex-ante, for 1,978 trading intervals, during the billing quarter, with schedules ranging from 0.35 MW to 420 MW. It may be noted that the 420-MW limit was maximized more frequently during the April and May billing months.

On the other hand, the HVDC power flow was directed towards the Visayas for 166 trading intervals in the ex-ante during the quarter, with schedules ranging from 0.7 MW to 250 MW.

**Figure 15. Summary of HVDC Limits Imposed by NGCP-SO, 2<sup>nd</sup> Quarter 2019**



**Table 19. Summary of HVDC Limits Imposed by NGCP-SO and Results of HVDC Schedules (Ex-ante and Ex-post), 2<sup>nd</sup> Quarter 2019**

Results of HVDC Scheduling	HVDC Limit during Ex-ante (Visayas/Luzon)						
	(No. of Trading Intervals)						
	April 2019		May 2019		June 2019		
	250/420	Total	250/420	Total	250/420	250/400	Total
<b>Visayas to Luzon</b>	<b>670</b>	<b>670</b>	<b>693</b>	<b>693</b>	<b>523</b>	<b>92</b>	<b>615</b>
Limit Not Maximized	606	606	607	607	517	91	608
Limit Maximized <sup>11</sup>	64	64	86	86	6	1	7
<b>Luzon to Visayas</b>	<b>23</b>	<b>23</b>	<b>24</b>	<b>24</b>	<b>91</b>	<b>28</b>	<b>119</b>
Limit Not Maximized	23	23	24	24	91	27	118
Limit Maximized <sup>11</sup>		-		-		1	1
<b>No Flow <sup>11</sup></b>	<b>12</b>	<b>12</b>		-			-
<b>TOTAL</b>	<b>705</b>	<b>705</b>	<b>717</b>	<b>717</b>	<b>614</b>	<b>120</b>	<b>734</b>

## VII. Price Setting Plants<sup>12</sup>

Most of the market prices, at 79 percent, during the billing quarter were below PhP10,000/MWh with coal and natural gas plants as frequent price setters, namely PEDC CFTPP, Sual CFTPP, Ilijan NGPP, PCPC CFTPP, and Sta Rita NGPP.

<sup>12</sup> 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, 2<sup>nd</sup> 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		
	Apr	May	Jun	Apr	May	Jun	Apr	May	Jun
PEDC CFTPP	5		2	217	240	133	13		
SUAL CFTPP				147	137	72			
ILIJAN NGPP				81	117	84			
PCPC CFTPP				94	81	61			
STA RITA NGPP				67	93	72			
TPC (SANGI) CFTPP	5			73	101	49			
CEDC CFTPP	3			90	82	47			
QPPL CFTPP				87	70	55			
SAN LORENZO NGPP				70	93	39		4	1
BAUANG DPP							36	67	70
SAN GABRIEL NGPP				85	35	49			
EAUC DPP							44	37	56
ANDA CFTPP				24	15	22	18	30	22
NAVOTAS DPP								40	90
CPPC DPP							42	40	41
AVION NGPP				36	39	27	4	11	3
TPC (CARMEN) DPP							25	51	43
PAGBILAO CFTPP				35	35	36			
CIP DPP							26	30	46
SUBIC DPP							26	37	37
TAPGC DPP							28	34	20
MASINLOC CFTPP				28	27	23			
BINGA HEP							21	31	22
AMBUKLAO HEP							29	33	7
KSPC CFTPP				25	24	16			
MAGAT HEP						2	3	8	49
BACMAN GPP	3			12	5	10	2	8	14
SAN ROQUE HEP							11	27	13
SLTEC CFTPP				37	13				
ANGAT HEP				12			17	2	
PALINPINON GPP I	7	9	14						
NABAS DPP							7	13	10
BATANGAS DPP							8	9	11
APEC CFTPP				12	6	4			
MASINLOC BATTERY				11	2	7			
PB 101							8	8	
MARIVELES CFTPP				11		5			
PB 102							7	5	
PALINPINON GPP II	8	1		2					
PANTABANGAN HEP				3			1	3	4
NASULO GPP	8	1							
TVI CFTPP						7			
PAGBILAO 3 CFTPP				5					
TONGONAN GPP	4								
LEYTE A GPP	3			1					
PETRON SFFPP							2		
SMC LIMAY CFTPP				2					
TIWI GPP		1							

Meanwhile, market prices above PhP10,000/MWh, at 21 percent, were set by oil-based plants led by PB 104, Limay CCGT, Bauang DPP, SLPGC GTPP, and Calumangan DPP.

**Table 21. Price Setting Frequency Index Above PhP10,000/MWH, 2<sup>nd</sup> 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		
	Apr	May	Jun	Apr	May	Jun	Apr	May	Jun	Apr	May	Jun	Apr	May	Jun
PB 104				11	117	37	1		50						
LIMAY CCGT					30	50	34	5	24				3	3	10
BAUANG DPP	7	28	34	4		16	3	2	1				15	5	28
SLPGC GTPP	7	20	28										16	3	24
CALUMANGAN DPP				2	4	6							17	6	32
ANDA CFTPP	3	3	5		3	2	1	1	1		2	3	12	5	23
PB 101	5	5	7	1	4	4	3		2	7			6		8
CIP DPP	8	9	7	2		11	3	2			1		8		
SAN ROQUE HEP	13	25	9												3
MILLENNIUM GTPP					21	26									
PB 102	5	3	5	1	6	2	4		1	4			7		7
SUBIC DPP	1	1	8		11	4	6	2	1	1			6		
TAPGC DPP	2	7	4	3	5	6	3	2	1		1		6		
ANGAT HEP	8	4		5	5		2	2		1	1				
PANAY DPP III	6	2	6	2											8
KALAYAAN PSPP							8	3	4	1		1			
BOHOL DPP				4	2										9
PANAY DPP I				4		2									8
BACMAN GPP	1	1	3		1	3			2		1				2
CPPC DPP							1	2	7						
AVION NGPP	1	1									1		2		4
TPC (CARMEN) DPP	2		2										2	1	1
PANTABANGAN HEP	1					1							3		
ILIJAN NGPP															4
TPC (SANGI) CFTPP															4
PAGBILAO CFTPP	2		1												
KSPC CFTPP															1
MASINLOC BATTERY														1	
MASINLOC CFTPP															1

## VIII. Residual Supply

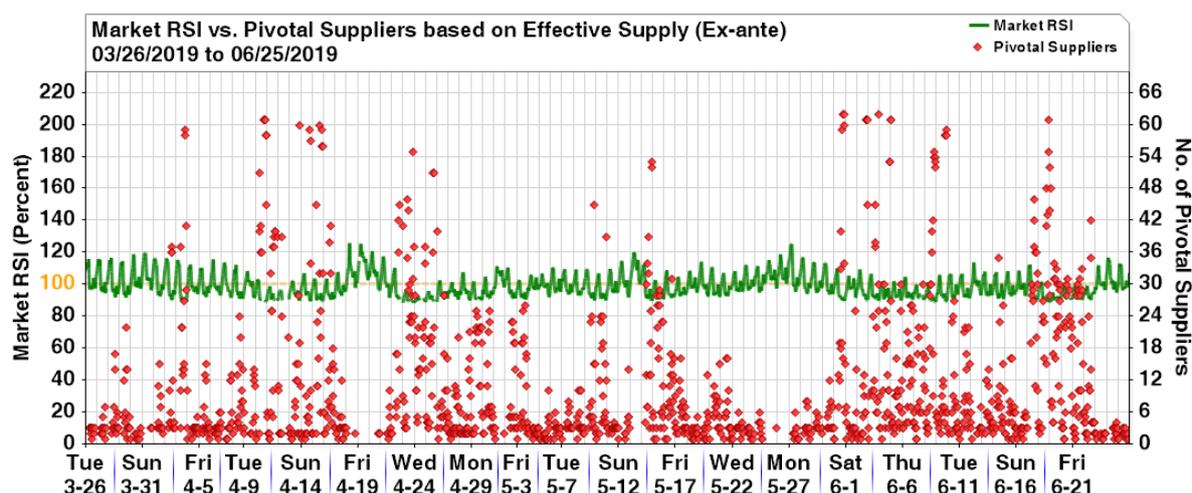
The succeeding figure below shows the hourly trend of the Market Residual Supply Index (Market RSI)<sup>13</sup> plotted against the number of pivotal supplier/s.

During the entire billing quarter, the market RSI was below the 100 percent mark for 64.9 percent of the time, indicating the presence of pivotal suppliers during said trading intervals.

It may be noted that majority of the market RSI was observed to be below 100 percent consistent with the narrow supply margin observed all throughout the billing quarter.

<sup>13</sup> 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.

**Figure 16. Market RSI vs. Pivotal Suppliers (Ex-Ante), 2<sup>nd</sup> Quarter 2019**



**IX. Pivotal Suppliers<sup>14</sup>**

Provided in Figure 21 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, pivotal suppliers were observed to be more prevalent with a total of 15,709 this billing quarter compared to last quarter’s 3,062.

**Table 22. Pivotal Supplier Frequency Index, 2<sup>nd</sup> Quarter 2019**

Top Pivotal Suppliers	Frequency (Number of trading intervals)		
	Apr	May	Jun
SUAL CFTPP	386	443	490
ILIJAN NGPP	406	403	488
STA RITA NGPP	359	336	433
MASINLOC CFTPP	219	210	294
PAGBILAO CFTPP	152	177	337
SAN LORENZO NGPP	191	157	233
QPPL CFTPP	173	131	215
LEYTE A GPP	185	107	179
MARIVELES CFTPP	166	91	208
SAN GABRIEL NGPP	163	108	180
LIMAY CCGT	147	99	204
PEDC CFTPP	145	77	173
KALAYAAN PSPP	116	103	166
SMC LIMAY CFTPP	113	90	156
PAGBILAO 3 CFTPP	50	80	207
SLPGC CFTPP	104	71	157
SAN ROQUE HEP	120	60	110
CEDC CFTPP	92	56	142
KSPC CFTPP	92	46	136
BAUANG DPP	97	45	120

<sup>14</sup> 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.

## X. Price-Setters and Pivotal Plants

Limay CCGT, and Baunang DPP were considered pivotal suppliers at the same time that they set prices at above PhP15,000/MWh. On the other hand, Sta Rita NGPP, Ilijan NGPP, and Sual CFTPP were pivotal and price setters at above PhP0/MWh up to PhP5,000/MWh.

**Table 23. PSI vs PSFI, 2<sup>nd</sup> Quarter 2019**

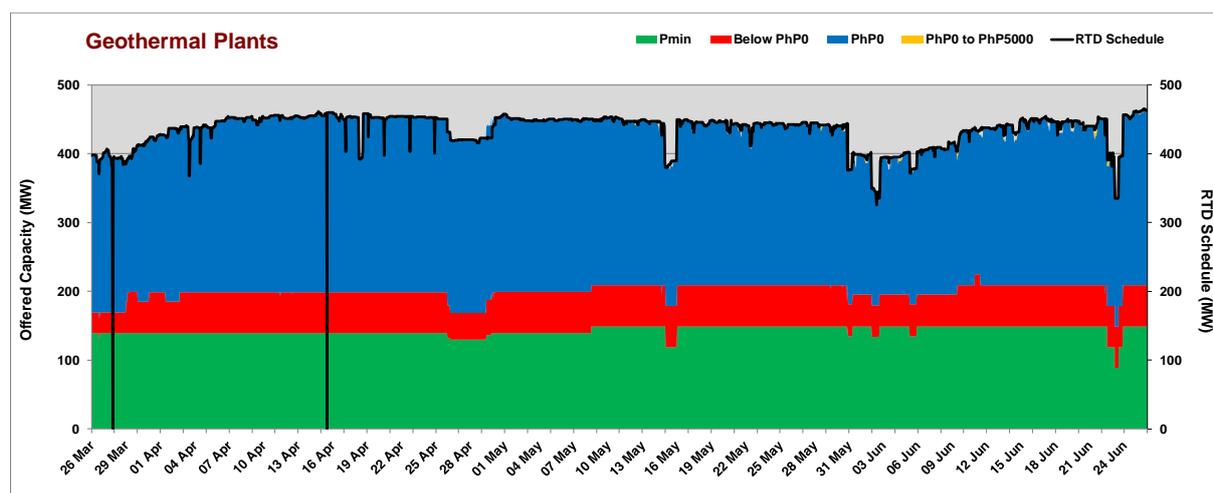
Pivotal Supplier and Price Setter	Frequency (Number of trading intervals)														
	Above PhP0/MWh to PhP5,000/MWh			Above PhP10,000/MWh to PhP15,000/MWh			Above PhP15,000/MWh to PhP20,000/MWh			Above PhP20,000/MWh to PhP25,000/MWh			Above PhP30,000/MWh to PhP32,000/MWh		
	Apr	May	Jun	Apr	May	Jun	Apr	May	Jun	Apr	May	Jun	Apr	May	Jun
LIMAY CCGT									35						
BAUANG DPP				2	6	11	3		8	2	2	1	15	5	28
STA RITA NGPP	41	32	23												
ILIJAN NGPP	14	27	13												4
SUAL CFTPP	26	9	4												
SAN ROQUE HEP				8	4	7									1
ANDA CFTPP										1			7	2	14
SLPGC GTPP													8	2	12
CALUMANGAN DPP									1				7	2	8
KALAYAAN PSPP										8	3	4			
PEDC CFTPP	7														
PB 102										1		1	1		5
PANAY DPP III						1	2								5
MAGAT HEP															
SUBIC DPP										2			5		
PB 101										1		1			3
AVION NGPP													2		3
TAPGC DPP										1			4		
PANAY DPP I							1								4
CIP DPP										1			4		

## 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 45.7 percent was priced below PhP0/MWh as seen in Figure 17. The remaining 0.2 percent was offered at PhP0/MWh to PhP10,000/MWh.

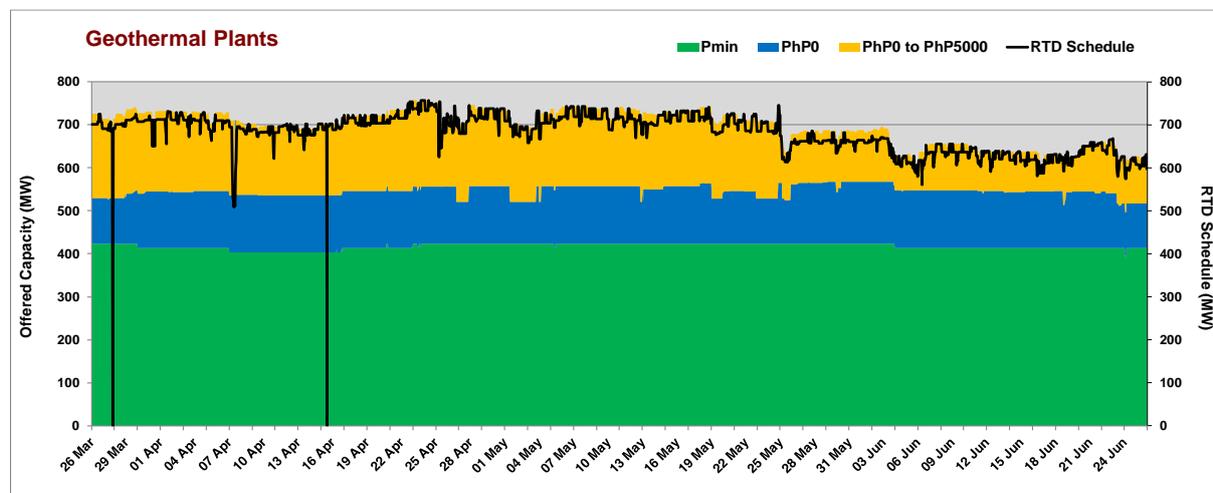
Accordingly, all of its submitted capacity offers, at 99.8 percent, were scheduled for dispatch in the market.

**Figure 17. Geothermal Plants Offer Pattern, Luzon – 2<sup>nd</sup> Quarter 2019**



On the other hand, Visayas geothermal plants had slightly higher-priced offers compared to Luzon geothermal plants. It was noted that about 21.6 percent of Visayas geothermal plants' offered capacity was priced at above PhP0/MWh up to PhP5,000/MWh while the remaining 78.4 percent was priced at PhP0/MWh and below as seen in Figure 18. It was noted that about 97.9 percent of these capacity offers were scheduled for dispatch.

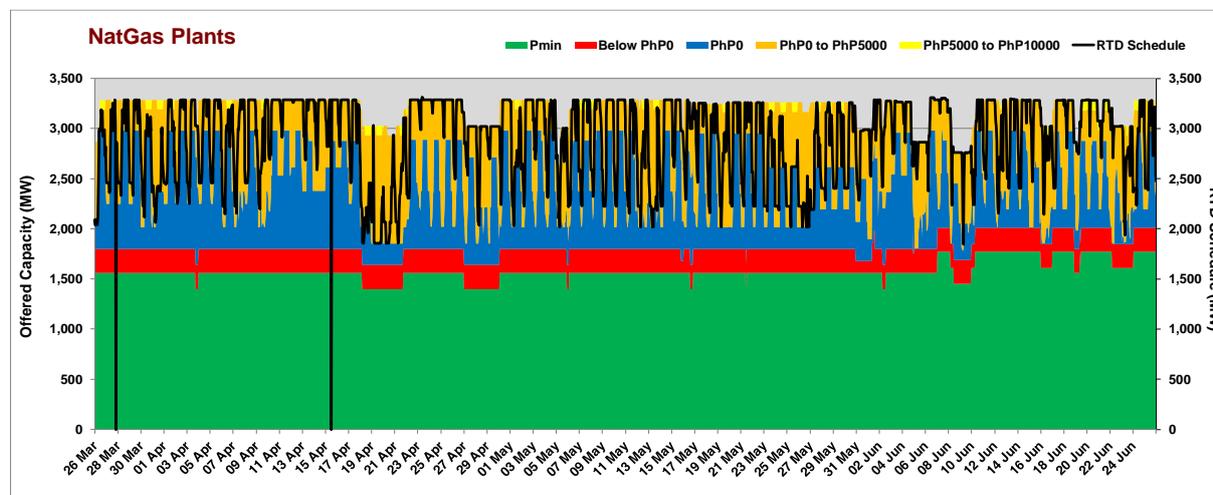
**Figure 18. Geothermal Plants Offer Pattern, Visayas – 2<sup>nd</sup> Quarter 2019**



About 76.4 percent of the natural gas plants' capacity offers were priced at PhP0/MWh and below, 23 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. A small portion, at 0.1 percent, was offered at prices above PhP25,000/MWh up to PhP32,000/MWh as seen in Figure 19.

Accordingly, about 90.3 percent of the offers of natural gas plants were scheduled for dispatch within the quarter.

**Figure 19. Natural Gas Plants Offer Pattern, Luzon – 2<sup>nd</sup> Quarter 2019**

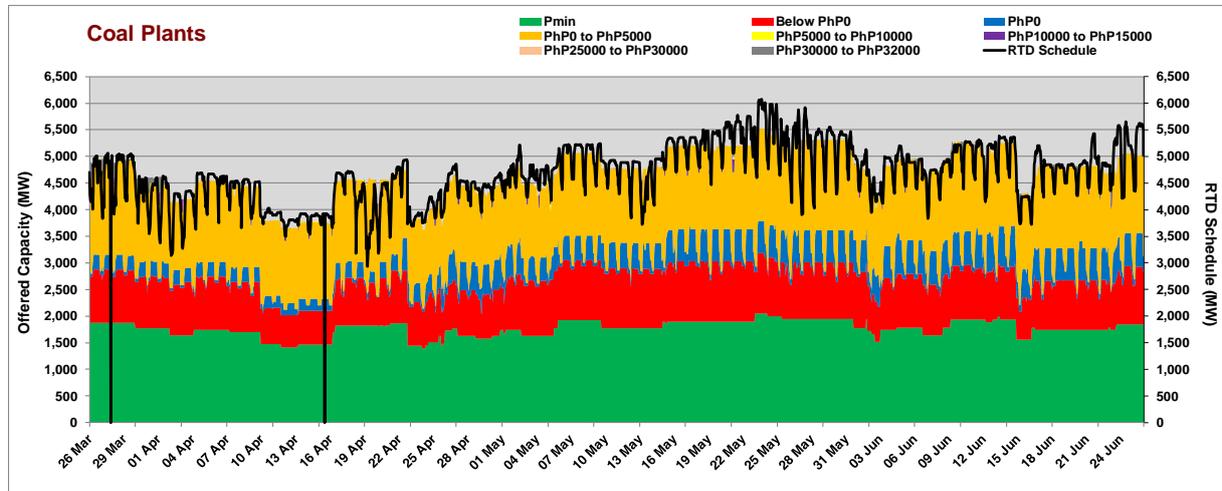


Luzon coal plants submitted 64.8 percent of its capacity offers at prices ranging from PhP0/MWh and below while 33.9 percent was submitted at prices above PhP0/MWh to

PhP5,000/MWh as seen in Figure 20. About 0.6 percent of their offered capacity were priced between PhP5,000/MWh to PhP15,000/MWh. The remaining 0.7 percent of the capacity offers were priced at PhP25,000/MWh to PhP32,000/MWh.

About 99.6 percent of the capacity offers of Luzon coal plants were scheduled for dispatch within the quarter.

**Figure 20. Coal Plants Offer Pattern – Luzon, 2<sup>nd</sup> Quarter 2019**



Meanwhile, 63.2 percent of Visayas coal plants' capacity offers were priced at PhP0/MWh and below, 36.6 percent at PhP0/MWh to PhP10,000/MWh as seen in Figure 21. A minimal percentage, at 0.1 percent, was offered at prices ranging between PhP30,000/MWh and PhP32,000/MWh.

All or 100 percent of the offered capacities from Visayas coal plants were scheduled for dispatch.

**Figure 21. Coal Plants Offer Pattern, Visayas – 2<sup>nd</sup> Quarter 2019**

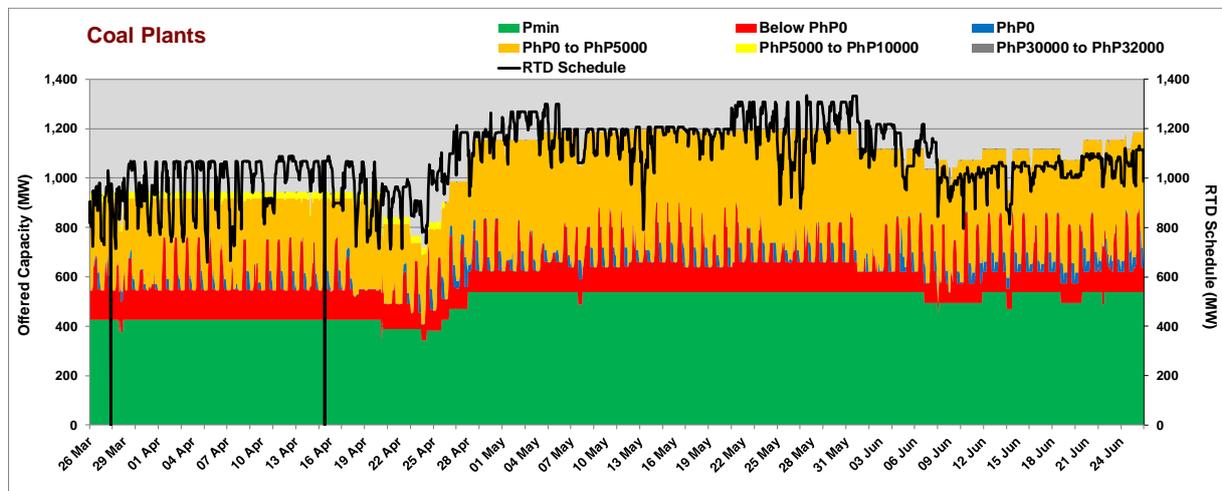
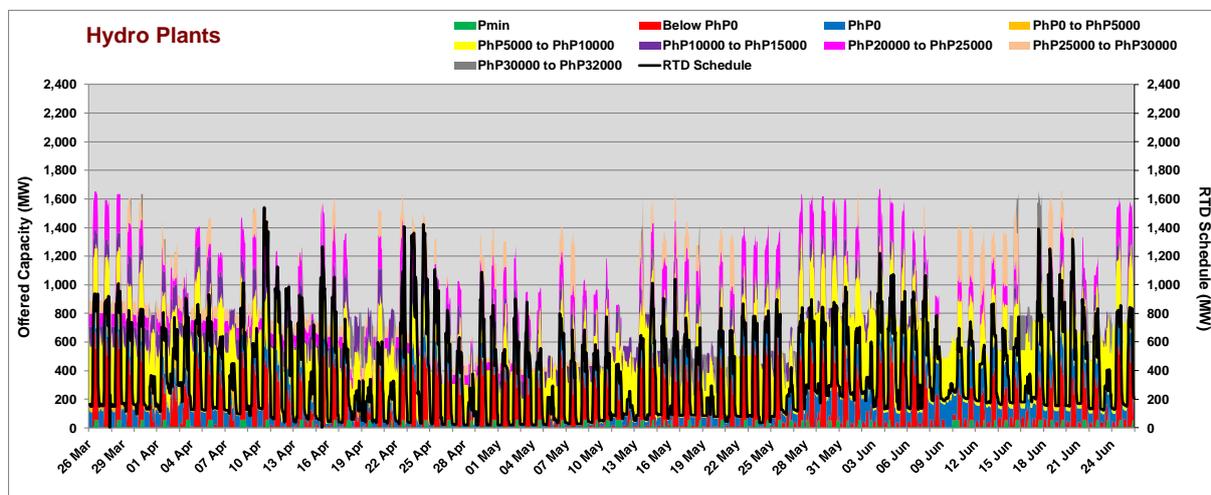


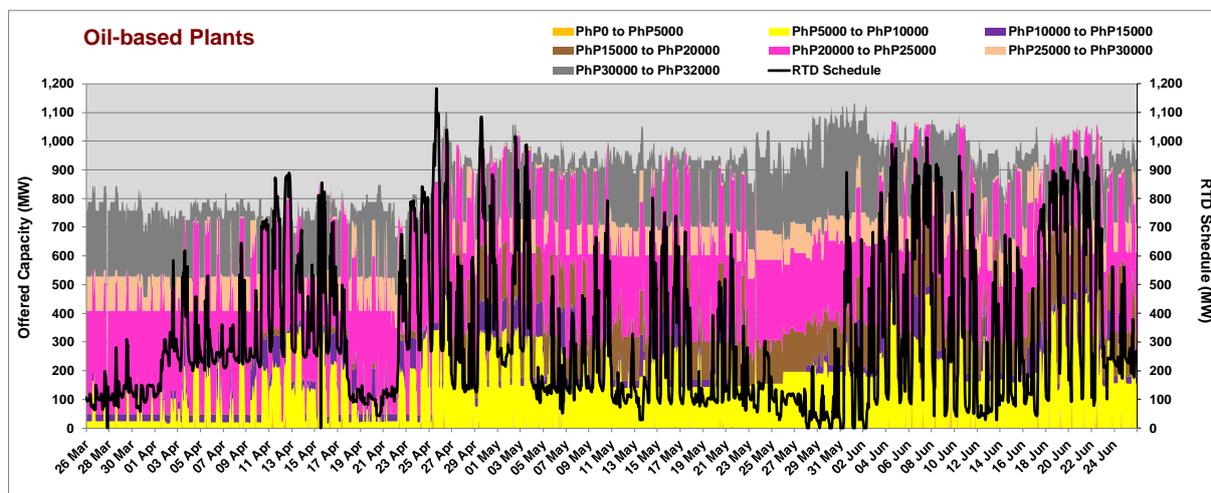
Figure 22 shows Luzon hydro plants priced 31.1 percent of their capacity at PhP0/MWh and below while 2.2 percent at PhP0/MWh up to PhP5,000/MWh. About 41.5 percent was priced at PhP5,000/MWh up to PhP10,000/MWh, 8.3 percent was priced at PhP10,000/MWh up to PhP20,000/MWh and 15.2 percent was priced at PhP20,000/MWh up to PhP30,000/MWh. The remaining 1.8 percent was priced at PhP30,000/MWh up to PhP32,000/MWh. Additionally, about 41.8 percent of the capacity offers of Luzon hydro plants were scheduled for dispatch within the quarter.

**Figure 22. Hydro Plants Offer Pattern, Luzon – 2<sup>nd</sup> Quarter 2019**



Luzon oil-based plants submitted the highest offer prices with 35.8 percent priced at above PhP20,000/MWh up to PhP25,000/MWh and 18.1 percent at above PhP30,000/MWh up to PhP32,000/MWh. Moreover, 6.8 percent was offered at PhP25,000/MWh to PhP30,000/MWh while 17.8 percent at PhP10,000/MWh to PhP20,000/MWh as seen in Figure 22. It was noted that only 21.5 percent of its capacity offers were priced at PhP10,000/MWh and below. It was noted that about 34.4 percent of these capacity offers were scheduled for dispatch.

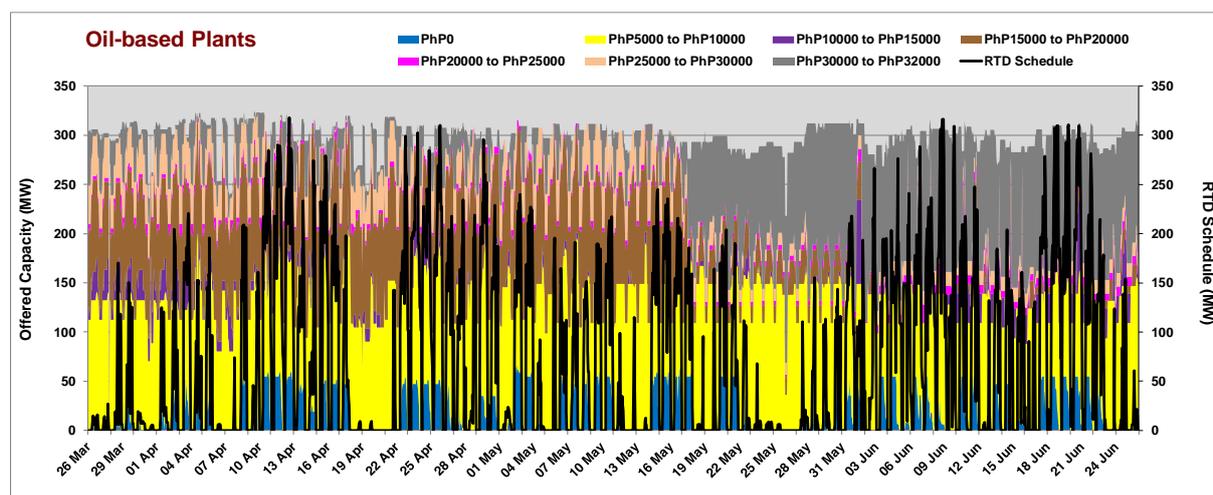
**Figure 23. Oil-based Plants Offer Pattern, Luzon – 2<sup>nd</sup> Quarter 2019**



Similarly, Visayas oil-based plants offered their capacities at relatively higher prices when compared with other plant types with 30.1 percent priced above PhP20,000/MWh as seen in Figure 24. About 40.8 percent was offered at PhP5,000/MWh to PhP10,000/MWh, 3.3 percent at PhP10,000/MWh to PhP15,000/MWh and 20.4 percent at PhP15,000/MWh to PhP20,000/MWh. Only 5.5 percent of their capacity offers were priced at PhP5,000/MWh and below.

About 22.9 percent of Visayas oil-based plants' capacity offered were scheduled for dispatch during the billing quarter.

**Figure 24. Oil-based Plants Offer Pattern, Visayas – 2<sup>nd</sup> 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 at 87 percent. Coal and geothermal plants followed with capacity factors of 64 percent and 45 percent, respectively. Oil-based and hydro plants came next at 18 percent and 17 percent, respectively. On the other hand, when measured in terms of registered capacity net of outage, natural gas and coal plants obtained the highest utilization at 89 percent and 77 percent, respectively. Geothermal plants followed with a capacity factor of 61 percent, oil-based plants with 25 percent, and hydro plants with 19 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 and coal plants posted the highest capacity factor at 93 percent. Natural gas plants followed with 90 percent while hydro and oil-based plants recorded capacity factors at 46 and 36 percent each.

Meanwhile, preferential dispatch plants – biomass plants' capacity factors were posted at 49 percent when measured based on registered capacity and 50 percent when based on registered less outage capacity while wind plants recorded the same capacity factors at 11 percent each. On the other hand, lower utilization level was noted for Luzon solar plants with their capacity factors based on registered capacity, and registered less outage capacity each at 19 percent.

On the other hand, sole battery energy storage facility in the WESM, Masinloc Battery, posted a capacity factor of 2 percent each when measured in terms of registered capacity, registered capacity net of outage, and offered capacity.

**Table 24. Capacity Factor – Luzon Plants, 2<sup>nd</sup> Quarter 2019**

Plant Type	RTD Sched. vs Registered Cap.			RTD Sched. vs Registered less Out. Cap.			RTD Sched. vs Offered Cap.		
	Apr 2019	May 2019	Jun 2019	Apr 2019	May 2019	Jun 2019	Apr 2019	May 2019	Jun 2019
Coal	59%	66%	66%	74%	75%	82%	92%	95%	93%
Natural Gas	87%	87%	88%	88%	88%	91%	89%	88%	92%
Geothermal	46%	46%	45%	61%	60%	62%	93%	93%	93%
Hydro	18%	13%	19%	20%	15%	22%	45%	43%	49%
Oil-based	20%	15%	18%	26%	22%	28%	44%	30%	36%
Wind	15%	9%	9%	15%	9%	9%	0%	0%	0%
Solar	22%	19%	17%	22%	19%	17%	0%	0%	0%
Biomass	50%	48%	49%	50%	49%	51%	0%	0%	0%
Battery	0%	0%	4%	0%	0%	4%	1%	0%	4%

In Visayas, geothermal plants obtained the highest utilization among resource types in terms of registered capacity with capacity factor at 76 percent. Coal and hydro plants then followed with capacity factors at 61 percent and 16 percent, respectively. Lastly, oil-based plants with the lowest capacity factor of 15 percent. In terms of registered capacity net of outage, geothermal recorded its capacity factors at 85 percent, coal plants at 64 percent and hydro plants had 16 percent. Oil-based plants recorded the lowest utilization at 15 percent, same with its measured registered capacity factor.

In terms of offered capacity, geothermal plants recorded a capacity factor of 98 percent while coal plants' capacity factor was at 81 percent. Meanwhile, oil-based plants posted a capacity factor of 24 percent.

Solar plants' capacity factors based on registered capacity and based on registered capacity net of outage in the region was recorded at 18 percent while wind plants recorded the same at 16 percent. Biomass plants recorded a capacity factor of 5 percent when measured in terms of registered capacity and 6 percent in terms of registered capacity net of outage.

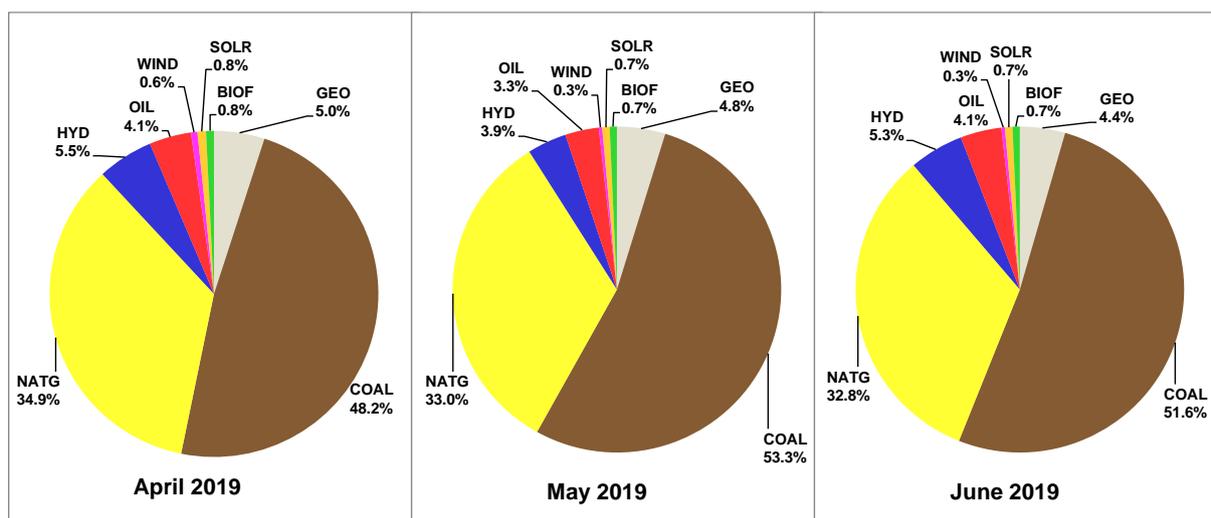
**Table 25. Capacity Factor, Visayas Plants – 2<sup>nd</sup> Quarter 2019**

Plant Type	RTD Sched. vs Registered Cap.			RTD Sched. vs Registered less Out. Cap.			RTD Sched. vs Offered Cap.		
	Apr 2019	May 2019	Jun 2019	Apr 2019	May 2019	Jun 2019	Apr 2019	May 2019	Jun 2019
Coal	54%	68%	63%	58%	69%	66%	83%	82%	79%
Geothermal	77%	82%	70%	84%	88%	84%	95%	101%	97%
Hydro	12%	16%	19%	12%	16%	19%	0%	0%	0%
Oil-based	14%	12%	17%	14%	13%	17%	22%	21%	28%
Wind	28%	10%	11%	28%	10%	11%	0%	0%	0%
Solar	17%	19%	19%	17%	19%	19%	0%	0%	0%
Biofuel	13%	3%	0%	13%	3%	0%	0%	0%	0%

### XIII. Generation Mix

In the Luzon region, coal plants consistently contributed the largest chunk of the metered quantity from April to June billing months, ranging from 48.2 to 53.3 percent. Natural gas plants followed with about 32.8 to 34.9 percent. Geothermal and hydro plants came next with about 4.4 to 5.0 percent and about 3.9 percent to 5.5 percent, respectively. Oil-based plants' contribution was the lowest at 3.3 to 4.1 percent. Meanwhile, the contribution of preferential and must-dispatch generating units ranged from 1.8 to 2.2 percent.

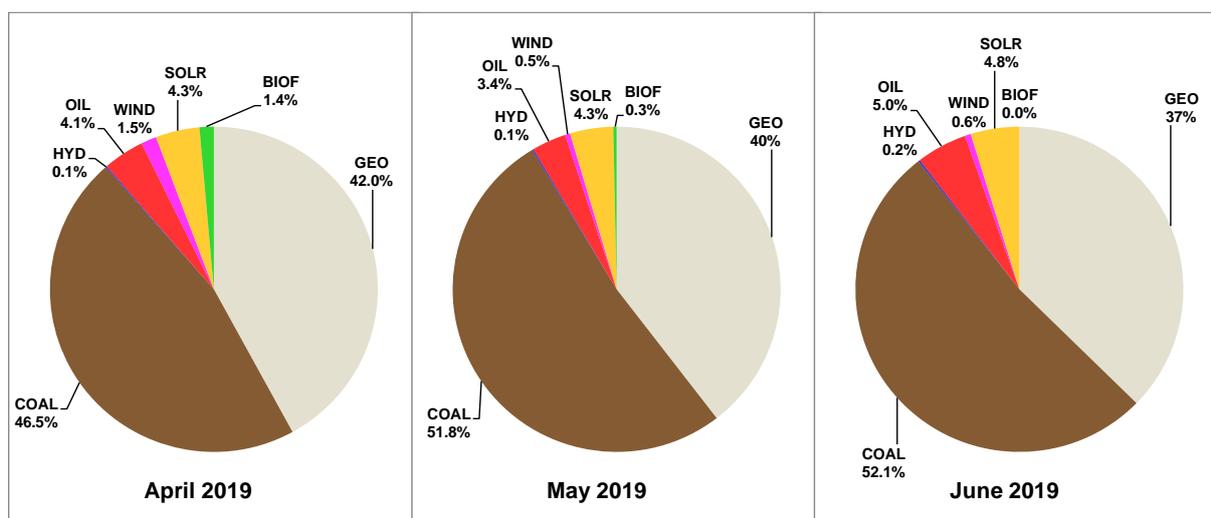
**Figure 25. Generation Mix (Based on Metered Quantity) – Luzon, 2<sup>nd</sup> Quarter 2019**



In the Visayas region, coal plants had the highest contribution in the generation mix during the billing quarter ranging from 46.5 to 52.1 percent. Geothermal plants followed with shares ranging from 37.3 to 42 percent. Meanwhile, oil-based plants' contribution ranged from 3.4 to 5 percent and hydro plants had the least contribution at 0.1 to 0.2 percent all throughout the quarter.

On the other hand, preferential and must-dispatch generating units had higher contribution at about 5.1 to 7.3 percent in Visayas compared to 1.8 to 2.2 percent in Luzon.

**Figure 26. Generation Mix (Based on Metered Quantity), Visayas – 2<sup>nd</sup> Quarter 2019**



#### XIV. Market Concentration

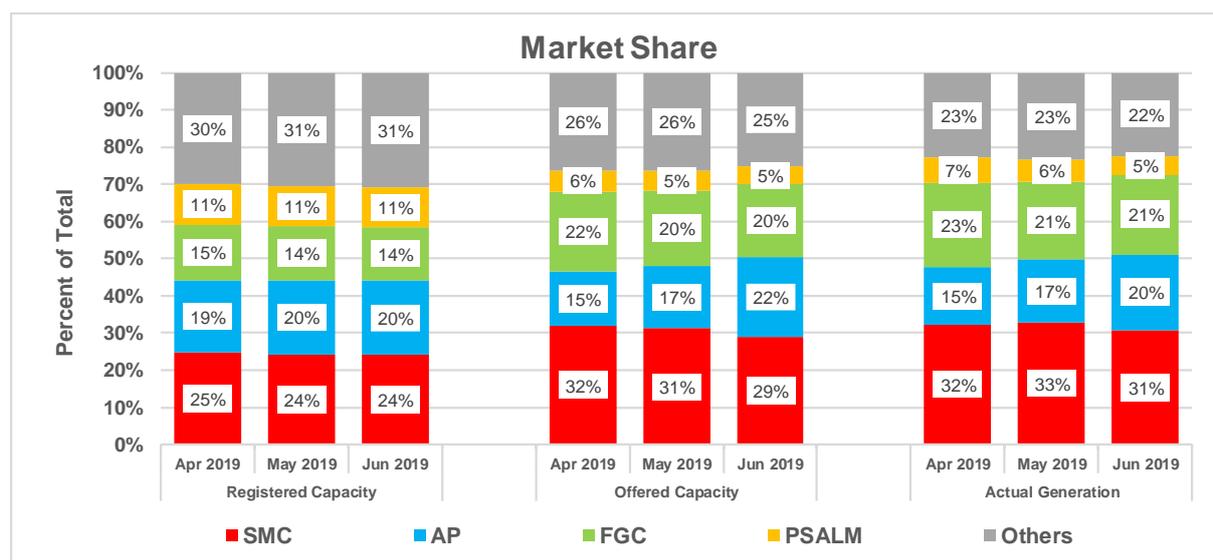
##### a. Market Share

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 SMC's market shares grew to 29 percent when based on offered capacity and 31 percent when based on actual generation compared to 24 percent based on registered capacity during the June billing month. The market shares of AP increased to 22 percent when based on offered capacity and 20 percent when based on actual generation. FGC's market share was likewise higher at 20 percent when based on offered capacity and 21 percent when based on actual generation. PSALM, on the other hand, recorded lower market shares at 5 percent both based on offered capacity and actual generation.

**Figure 27. Market Share by Major Participant Group based on Registered Capacity, Offered Capacity, and Actual Generation, 2<sup>nd</sup> Quarter 2019**

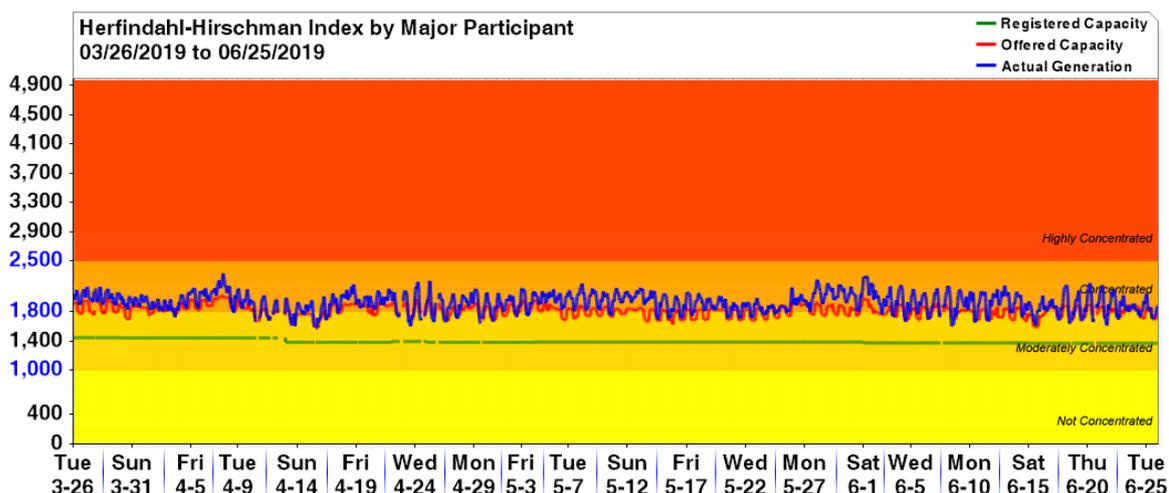


**b. Herfindahl-Hirschman Index (HHI)**

The Herfindahl-Hirschman Index (HHI)<sup>15</sup> calculated based on registered capacity by major participant grouping indicated a moderately concentrated market throughout second billing quarter of 2019. Meanwhile, when measured in terms of offered capacity, 36 percent of the time (778 trading intervals) showed a moderately concentrated market while the remaining 64 percent (1,378 trading intervals) showed a concentrated market. On the other hand, HHI calculation based on actual generation indicated a concentrated market more frequently at 1,839 trading intervals (85 percent) while 317 trading intervals (15 percent) showed a moderately concentrated market.

<sup>15</sup> 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 28. Hourly HHI based by Major Participant Grouping, 2<sup>nd</sup> Quarter 2019**



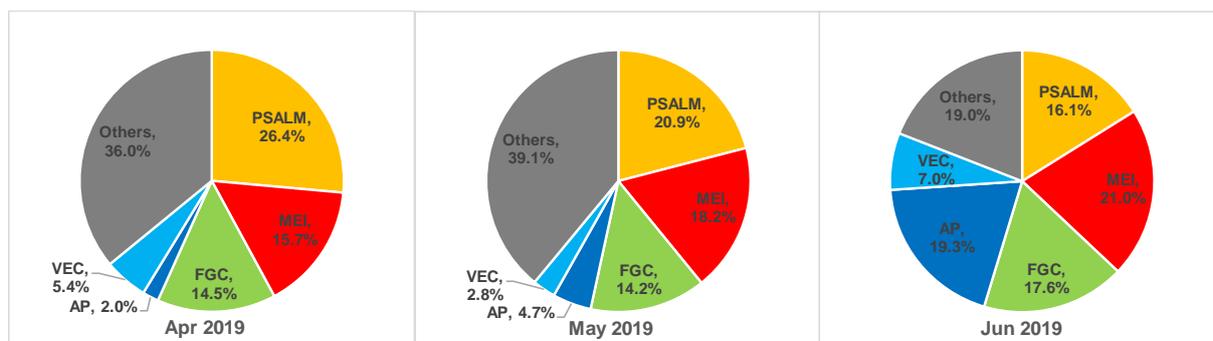
**c. Total Trading Amount (TTA) Share**

The 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.

Provided in Figure 29, PSALM held the highest TTA share with about 21 percent of the entire TTA during the billing quarter. Followed by Millennium Energy, Inc. (MEI) with about 18 percent and First Gen Corporation (FGC) with 15 percent. AP came next with 9 percent and Vivant Energy Corporation (VEC) came fifth with 5 percent.

On the other hand, SMC’s TTA share continued to decline throughout the second billing quarter. Even though SMC had the highest market share in terms of registered capacity, it incurred a negative TTA share by the end of the second quarter due to high level of outage capacity.

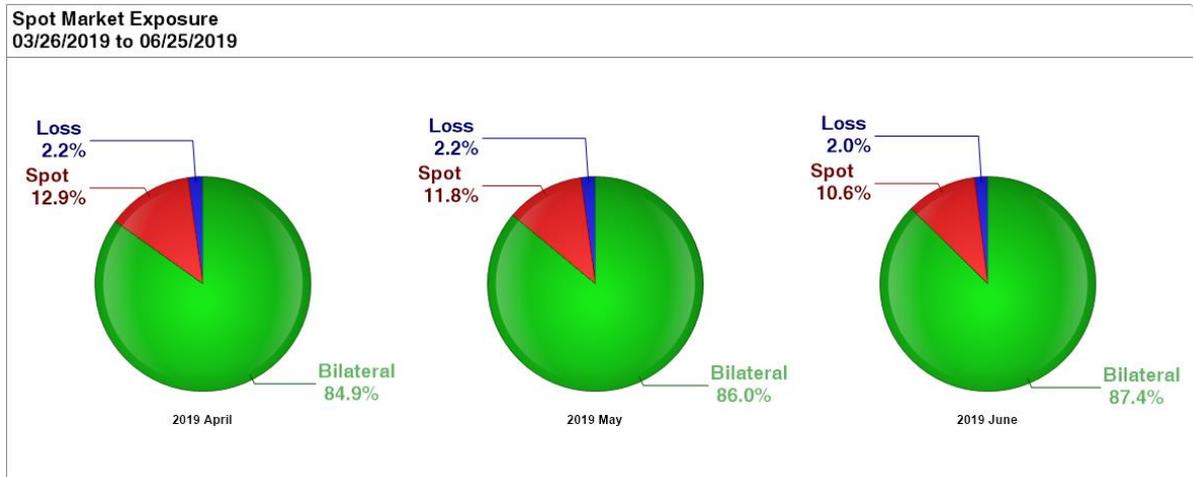
**Figure 29. Total Trading Amount Share by Major Participant Grouping, 2<sup>nd</sup> Quarter 2019**



## XV. Spot Exposure

Spot market transaction of generator-trading participants during the quarter ranged from 11 percent in June to 13 percent in April of the total energy transaction in the WESM. Still, majority of the total energy injected into the grid was covered by bilateral contracts.

**Figure 30. Spot Market Exposure, 2<sup>nd</sup> 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	Twi 3	43.7	10/23/2005 13:26			Deactivated Shutdown	Twi 3 decommissioned since May 26 2009	
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
LUZON	OIL	Malaya 2	350	05/19/2018 13:01	06/22/2019 13:59	399.04	Deactivated Shutdown	Burnt air heater 2A. RECLASSIFIED FROM FORCE. OMC OUTAGE	Apr-1979
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-2018
LUZON	GEO	Twi 1	59	11/29/2018 13:31			Maintenance Outage	Maintenance Outage	Jan-1979
LUZON	COAL	Calaca 1	300	12/30/2018 22:38			Planned Outage	APMT until 25 June 2019 (GOMP)	Sep-1984
LUZON	GEO	Makban 10	20	01/07/2019 23:40	03/29/2019 20:32	80.87	Forced Outage	On reserve shutdown pending availability of steam supply (steam optimization)	Apr-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	GEO	Twi 6	57	02/09/2019 7:01	03/28/2019 23:32	47.69	Planned Outage	Turbine generator overhauling until 29 March 2019	Jan-1979
LUZON	HYD	Magat 1	95	03/10/2019 6:01	05/03/2019 20:45	54.61	Planned Outage	Annual preventive maintenance and testing (GOMP)	Aug-1983
LUZON	HYD	San Roque 2	145	03/11/2019 15:01			Planned Outage	Planned outage until September 11 2019	May-2003
VISAYAS	BIOF	SCBE	8.3	03/20/2019 2:37	03/27/2019 9:43	7.30	Forced Outage	Auto-tripped due to internal problem	Feb-2009
LUZON	COAL	SLTEC 1	121	03/20/2019 20:30	04/13/2019 2:03	23.23	Forced Outage	Boiler Tube Leak	Apr-2015
LUZON	NATG	San Gabriel	420	03/22/2019 4:30	03/26/2019 7:24	4.12	Maintenance Outage	Maintenance outage until 27 March 2019	Jul-2016
VISAYAS	GEO	Leyte 1	35	03/24/2019 0:29	03/27/2019 8:19	3.33	Planned Outage	Annual PMS of TGPP Unit 1. up to 29 March 2019	Jun-1983
LUZON	COAL	CEDC 1	82	03/25/2019 0:33	04/22/2019 15:23	28.62	Planned Outage	APMS	Apr-2010
VISAYAS	BIOF	FFHC	13	03/25/2019 4:57	03/26/2019 10:38	1.24	Maintenance Outage	Offline due to weekly maintenance	Feb-2009
LUZON	COAL	Pagbilao 1	382	03/26/2019 2:36	03/30/2019 0:00	3.89	Forced Outage	Boiler Tube Leak.	Mar-1996
VISAYAS	OIL	Bohol 1	4	03/26/2019 10:43	03/26/2019 11:44	0.04	Forced Outage	Affected by the tripping of BDPP-SIFC Transformer 1.	Sep-1978
VISAYAS	OIL	Bohol 2	4	03/26/2019 10:43	03/26/2019 11:46	0.04	Forced Outage	Affected by the tripping of BDPP-SIFC Transformer 1.	Sep-1978
LUZON	GEO	Bacman 3	20	03/26/2019 15:17	03/26/2019 16:02	0.03	Forced Outage	Tripped due to condenser level low	Sep-1993
VISAYAS	OIL	Bohol 1	4	03/26/2019 19:31	03/28/2019 17:28	1.91	Forced Outage	Unusual sound of turbocharger	Sep-1978
VISAYAS	BIOF	HPCO	3	03/27/2019 7:52	03/27/2019 11:38	0.16	Maintenance Outage	Offline due to repair of their connection asset DS at line side in Hacienda San Di	Feb-2015
VISAYAS	GEO	Leyte 3	36	03/27/2019 12:10	03/29/2019 0:10	1.50	Forced Outage	Economic shutdown due to steam supply deficiency	Jun-1983
VISAYAS	SOLR	Isilasol 3	40.5	03/27/2019 16:15	03/27/2019 17:23	0.05	Forced Outage	Isolated. Affected by NONECO maintenance activities	Mar-2016
VISAYAS	COAL	PALM 1	135	03/28/2019 13:48	03/28/2019 15:45	0.08	Forced Outage	Tripped	Aug-2016
VISAYAS	BIOF	FFHC	13	03/28/2019 13:48	03/28/2019 14:42	0.04	Forced Outage	Affected by grid disturbance	Feb-2009
VISAYAS	BIOF	HPCO	3	03/28/2019 13:48	03/28/2019 14:42	0.04	Forced Outage	Affected by grid disturbance	Feb-2015
VISAYAS	COAL	PALM 1	135	03/28/2019 17:19	03/28/2019 19:56	1.11	Forced Outage	Offline	Aug-2016
VISAYAS	BIOF	SCBE	8.3	03/29/2019 15:50	06/14/2019 16:56	77.05	Forced Outage	Due to internal problem	Feb-2009
LUZON	COAL	Masinloc 2	344	03/29/2019 23:50	04/04/2019 1:15	5.06	Forced Outage	Boiler slagging trouble	Jun-1998
LUZON	COAL	Pagbilao 1	382	03/30/2019 0:01	04/24/2019 10:45	25.45	Planned Outage	Maintenance Outage until 28 April 2019 2400H	Mar-1996
VISAYAS	GEO	PGPP2 Unit 1	20	03/30/2019 0:04	04/21/2019 11:03	22.48	Maintenance Outage	Offline due to scheduled maintenance activities	Aug-1983
VISAYAS	GEO	Malibog 3	72	03/31/2019 5:34	03/31/2019 12:33	0.29	Forced Outage	Under assessment	Jul-1997
VISAYAS	BIOF	URC 2	40	04/01/2019 7:44	04/01/2019 8:01	0.01	Forced Outage	Emergency offline due to boiler problem	Jan-2015
LUZON	GEO	Twi 6	57	04/01/2019 8:32	04/02/2019 13:47	1.22	Forced Outage	High turbine vibration	Jan-1979
VISAYAS	BIOF	HPCO	3	04/01/2019 10:50	04/01/2019 22:28	0.48	Maintenance Outage	Offline due to weekly maintenance	Feb-2015
VISAYAS	BIOF	URC 1	40	04/01/2019 11:07	04/01/2019 19:02	0.33	Forced Outage	Emergency offline due to boiler problem	Jan-2015
LUZON	COAL	Pagbilao 3	420	04/02/2019 0:59	04/16/2019 7:48	14.28	Forced Outage	Boiler slagging	Mar-2018
LUZON	GEO	Makban 7	20	04/03/2019 7:35	04/05/2019 19:53	2.51	Forced Outage	Turbine Oil Leak	Apr-1979
VISAYAS	BIOF	HPCO	3	04/03/2019 8:40	04/03/2019 10:29	0.08	Forced Outage	Offline due to Line clearing	Feb-2015
LUZON	NATG	San Lorenzo 2	261.8	04/03/2019 16:25	04/03/2019 22:28	0.25	Forced Outage	On emergency shutdown due to exciter trouble	Sep-2002
LUZON	HYD	Ambuklao 3	35	04/03/2019 18:08	04/03/2019 20:52	0.11	Forced Outage	Tripped due to broken shear pin	Dec-1956
LUZON	GEO	Bacman 1	60	04/04/2019 10:05	04/04/2019 12:02	0.08	Forced Outage	Cooling system trouble	Sep-1993
VISAYAS	OIL	Bohol 4	4	04/04/2019 12:36	04/04/2019 17:05	0.19	Forced Outage	Emergency shutdown due to excessive fuel leak	Sep-1978
VISAYAS	GEO	PGPP2 Unit 2	20	04/06/2019 9:57	04/06/2019 11:06	0.05	Forced Outage	Auto-tripped. cause of tripping under investigation	Aug-1983
VISAYAS	GEO	PGPP2 Unit 2	20	04/07/2019 0:05	04/16/2019 16:40	9.69	Maintenance Outage	Offline due to PMS	Aug-1983
LUZON	COAL	SLPGC 2	150	04/07/2019 4:09	04/20/2019 23:14	13.80	Forced Outage	Primary Air Fan A high stator winding temp and Primary Air Fan B high motor be	Jul-2016
VISAYAS	BIOF	HPCO	3	04/07/2019 18:12	04/07/2019 19:15	0.04	Forced Outage	Offline due to Boiler problem	Feb-2015
LUZON	GEO	Makban 3	63	04/07/2019 19:30	04/07/2019 20:04	0.02	Forced Outage	Turbine Trouble	Apr-1979
VISAYAS	BIOF	FFHC	13	04/07/2019 20:45	04/09/2019 8:18	1.48	Maintenance Outage	Offline due to weekly maintenance	Feb-2009
VISAYAS	BIOF	HPCO	3	04/08/2019 5:33	04/08/2019 21:15	0.65	Maintenance Outage	Offline due to weekly maintenance	Feb-2015
LUZON	OIL	Limay 1	60	04/08/2019 8:06	04/08/2019 9:31	0.06	Forced Outage	High temperature on turbine lube oil	May-1993
VISAYAS	OIL	PB102 Unit 4	6	04/08/2019 14:02	04/10/2019 15:35	2.06	Forced Outage	LOW TEMPERATURE ON TURBINE OIL PRESSURE	Apr-1981
LUZON	COAL	Sual 1	647	04/09/2019 21:49	04/16/2019 4:42	6.29	Forced Outage	Boiler circulating pump piping leak	Oct-1999
VISAYAS	BIOF	HPCO	3	04/10/2019 8:22	04/10/2019 13:57	0.23	Forced Outage	Emergency offline due to mill problem	Feb-2015
VISAYAS	OIL	Bohol 2	4	04/10/2019 8:26	04/10/2019 9:11	0.03	Forced Outage	High exhaust gas temperature at A-bank	Sep-1978
VISAYAS	GEO	Upper Mahiao 4	32	04/10/2019 17:02	04/11/2019 2:35	0.40	Forced Outage	Tripped due to loss of 24 VDC supply	Jul-1997
VISAYAS	GEO	Upper Mahiao 3	32	04/10/2019 17:02	04/10/2019 22:45	0.24	Forced Outage	Under assessment	Jul-1997
LUZON	OIL	Limay 5	60	04/11/2019 6:43	04/11/2019 10:31	0.16	Forced Outage	Static Frequency Converter SFC trouble	Dec-1994
LUZON	COAL	SMC 2	150	04/11/2019 16:28	04/22/2019 1:50	10.39	Forced Outage	High furnace pressure	Sep-2017
LUZON	OIL	Limay 1	60	04/11/2019 18:09	04/11/2019 19:02	0.04	Forced Outage	Generator speed measuring disturbance alarm	May-1993
VISAYAS	OIL	PB101 Unit 3	6	04/11/2019 18:20	04/12/2019 13:15	0.79	Forced Outage	Low Lube Oil Pressure	1978 / 1986 / 1989
LUZON	HYD	Ambuklao 1	35	04/12/2019 2:41	04/12/2019 4:20	0.07	Forced Outage	Generator core high temperature	Dec-1956
VISAYAS	GEO	Upper Mahiao 1	32	04/12/2019 4:20	04/12/2019 6:01	0.07	Forced Outage	Tripped. Under assessment by Plant Personnel	Jul-1997
VISAYAS	OIL	CENPRI 3	4.2	04/12/2019 12:12	04/13/2019 7:03	0.79	Forced Outage	Auto tripped due to activation of Generator Differential Protection	Jun-2016
LUZON	OIL	Limay 4	90	04/12/2019 17:10	04/12/2019 20:34	0.14	Forced Outage	Tripping 125Vdc power supply	May-1993
VISAYAS	OIL	Bohol 1	4	04/12/2019 20:06	04/14/2019 18:11	1.92	Forced Outage	Fuel leak on cylinder no. 7	Sep-1978
LUZON	OIL	Limay 1	60	04/12/2019 22:12	04/12/2019 23:13	0.04	Forced Outage	Tripped due to actuation of turbine overspeed relay	May-1993
LUZON	OIL	Limay 1	60	04/13/2019 0:41	04/13/2019 10:54	0.43	Forced Outage	Tripped due to actuation of turbine overspeed relay	May-1993
VISAYAS	OIL	CENPRI 4	6.4	04/13/2019 7:03	04/13/2019 15:58	0.37	Forced Outage	Isolated due to PMS of 69kV Calumangan-San Enrique Line section	May-2017
VISAYAS	OIL	CENPRI 5	6.4	04/13/2019 7:03	04/13/2019 15:58	0.37	Forced Outage	Isolated due to PMS of 69kV Calumangan-San Enrique Line section	
VISAYAS	OIL	CENPRI 1	4.2	04/13/2019 7:03	04/13/2019 15:58	0.37	Forced Outage	Isolated due to PMS of 69kV Calumangan-San Enrique Line section	Jun-2016
VISAYAS	OIL	CENPRI 2	4.2	04/13/2019 7:03	04/13/2019 15:58	0.37	Forced Outage	Isolated due to PMS of 69kV Calumangan-San Enrique Line section	Apr-2016
VISAYAS	OIL	CENPRI 3	4.2	04/13/2019 7:03	04/13/2019 15:58	0.37	Forced Outage	Isolated due to PMS of 69kV Calumangan-San Enrique Line section	Jun-2016
VISAYAS	SOLR	Isilasol 2	27.2	04/13/2019 7:05	04/13/2019 16:00	0.37	Forced Outage	Isolated due to PMS of 69kV Calumangan-San Enrique Line section	Mar-2016
VISAYAS	OIL	CENPRI 1	4.2	04/13/2019 20:01	04/15/2019 10:03	1.58	Forced Outage	Unable to put unit in service due to excessive leaking of lube oil at lube oil pump	Jun-2016
VISAYAS	BIOF	FFHC	13	04/14/2019 11:06	04/16/2019 1:55	1.62	Maintenance Outage	Offline due to weekly maintenance	Feb-2009
VISAYAS	OIL	PB102 Unit 1	6	04/14/2019 20:08	04/15/2019 8:10	0.50	Forced Outage	Excessive exhaust gas leak at Cyl. 5R	Apr-1981
VISAYAS	BIOF	HPCO	3	04/15/2019 5:30	04/15/2019 17:55	0.52	Maintenance Outage	Offline due to weekly maintenance	Feb-2015
VISAYAS	GEO	PGPP2 Unit 2	20	04/16/2019 17:55	04/16/2019 20:51	0.12	Maintenance Outage	Offline under test & commissioning	Aug-1983
VISAYAS	BIOF	HPCO	3	04/16/2019 18:41	04/16/2019 19:24	0.03	Forced Outage	Auto-tripped on their 13.8kV PCB	Feb-2015
LUZON	OIL	Limay 1	60	04/17/2019 11:53	04/17/2019 14:26	0.11	Forced Outage	Governor trouble.	May-1993
VISAYAS	BIOF	URC 2	40	04/18/2019 0:55	04/18/2019 3:05	0.09	Forced Outage	Offline due to Boiler problem	Jan-2015
LUZON	NATG	Sta. Rita 2	255.7	04/18/2019 4:40	04/21/2019 16:14	3.48	Planned Outage	Maintenance Outage until 21 April 2019	Jun-2000
LUZON	COAL	SMC 4	150	04/18/2019 6:31	04/21/2019 4:28	2.91	Planned Outage	On Commissioning Test	
LUZON	GEO	Bacman 2	60	04/18/2019 7:14	04/18/2019 15:22	0.34	Maintenance Outage	Corrective works on plant.s Gas Removal System. RECLASSIFIED FROM FORCE. OMC OUTAGE	
VISAYAS	BIOF	HPCO	3	04/18/2019 13:13	04/22/2019 23:14	4.42	Maintenance Outage	Offline due to weekly shutdown	Feb-2015
VISAYAS	BIOF	URC 2	40	04/19/2019 1:14	04/23/2019 9:39	4.35	Maintenance Outage	Offline due to weekly maintenance	Jan-2015
LUZON	NATG	Avion 1	50.3	04/20/2019 8:00	04/21/2019 2:45	0.78	Maintenance Outage	PMPC to perform maintenance works	Aug-2016
LUZON	NATG	Avion 2	50.3	04/20/2019 8:00	04/21/2019 2:45	0.78	Maintenance Outage	PMPC to perform maintenance works	Aug-2016
LUZON	GEO	Bacman 1	60	04/20/2019 11:01	04/20/2019 12:33	0.06	Forced Outage	Power Supply trouble	
VISAYAS	COAL	Keppo Salcon 2	103	04/20/2019					

## 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	OIL	Limay 6	60	04/22/2019 17:11	04/22/2019 22:38	0.23	Forced Outage	Isolated due tripping of Hermosa-Limay 230kV L1. L2 and L3 caused by 6.1 mag	Dec-1994
LUZON	OIL	Limay 7	60	04/22/2019 17:11	04/22/2019 22:21	0.22	Forced Outage	Isolated due tripping of Hermosa-Limay 230kV L1. L2 and L3 caused by 6.1 mag	Dec-1994
LUZON	OIL	Limay 4	90	04/22/2019 17:11	04/22/2019 21:22	0.17	Forced Outage	Isolated due tripping of Hermosa-Limay 230kV L1. L2 and L3 caused by 6.1 mag	May-1993
LUZON	OIL	Limay 3	60	04/22/2019 17:11	04/22/2019 21:51	0.19	Forced Outage	Isolated due tripping of Hermosa-Limay 230kV L1. L2 and L3 caused by 6.1 mag	May-1993
LUZON	COAL	ANDA 1	72	04/22/2019 17:11	04/22/2019 18:45	0.07	Forced Outage	Affected by 6.1 magnitude earthquake	Sep-2016
LUZON	GEO	Bacman 1	60	04/22/2019 17:11	04/22/2019 18:27	0.05	Forced Outage	Affected by 6.1 magnitude earthquake	
VISAYAS	COAL	CEDC 1	82	04/22/2019 17:32	04/25/2019 13:55	2.85	Forced Outage	Offline. Gen problem	Apr-2010
VISAYAS	COAL	TPC Sangi 2	85	04/22/2019 22:56	04/26/2019 6:31	3.32	Forced Outage	MANUALLY CUT-OUT DUE TO FURNACE PRESSURE HIGH - HIGH	Oct-2015
LUZON	HYD	Magat 3	95	04/23/2019 7:01	05/07/2019 23:20	14.68	Planned Outage	Annual preventive maintenance and testing	Oct-1983
LUZON	HYD	Magat 4	95	04/23/2019 7:01	05/07/2019 23:20	14.68	Planned Outage	Annual preventive maintenance and testing	Oct-1983
VISAYAS	GEO	PGPP2 Unit 2	20	04/23/2019 9:03	04/23/2019 15:59	0.29	Maintenance Outage	Offline to conduct governor troubleshooting	Aug-1983
VISAYAS	BIOF	HPCO	3	04/23/2019 10:16	04/23/2019 16:28	0.26	Forced Outage	Offline due to internal problem	Feb-2015
VISAYAS	COAL	TPC Sangi 1	60	04/23/2019 21:41	05/04/2019 6:31	10.37	Forced Outage	Boiler tube leak	Oct-2015
LUZON	COAL	SLTEC 2	122.9	04/23/2019 23:10	04/24/2019 10:50	0.49	Forced Outage	Tripped due to turbine trouble	Feb-2016
LUZON	NATG	Avion 2	50.3	04/24/2019 6:27	04/24/2019 9:31	0.13	Forced Outage	Drain valve trouble	Aug-2016
LUZON	OIL	Limay 4	90	04/24/2019 6:57	04/24/2019 16:24	0.39	Forced Outage	Steam stub valve malfunction	May-1993
VISAYAS	OIL	Bohol 4	4	04/24/2019 11:32	04/24/2019 16:04	0.19	Forced Outage	Emergency cut out due to abnormal knocking sound	Sep-1978
LUZON	HYD	Caliraya 1	14	04/24/2019 12:37	04/24/2019 15:14	0.11	Forced Outage	Inverter failure	Oct-2002
LUZON	HYD	Caliraya 2	14	04/24/2019 13:37	04/24/2019 15:15	0.07	Forced Outage	Inverter failure	Oct-2002
LUZON	COAL	Pagbilao 1	382	04/24/2019 22:56	04/24/2019 23:59	0.04	Planned Outage	Conducted Load Rejection Test(LRT) at 30MW load	Mar-1996
LUZON	COAL	Pagbilao 1	382	04/25/2019 0:00	04/25/2019 10:24	0.43	Forced Outage	Fiber Optic controller problem	Mar-1996
VISAYAS	OIL	Bohol 4	4	04/25/2019 9:04	04/25/2019 14:08	0.21	Forced Outage	Unusual sound at charge air distributor	Sep-1978
VISAYAS	BIOF	HPCO	3	04/25/2019 10:10	04/25/2019 15:21	0.22	Forced Outage	Offline due to low voltage at 13.8kV side. Note. Receiving Voltage. 67.9kV	Feb-2015
LUZON	COAL	SLTEC 2	122.9	04/25/2019 15:32	04/25/2019 22:41	0.30	Forced Outage	Batangas SIPS activation	Feb-2016
LUZON	COAL	SLPGC 2	150	04/25/2019 15:32	04/25/2019 21:30	0.25	Forced Outage	Batangas SIPS activation	Jul-2016
LUZON	COAL	SLPGC 1	150	04/25/2019 15:32	04/25/2019 18:09	0.11	Forced Outage	Batangas SIPS activation	Jul-2016
LUZON	COAL	SLTEC 1	121	04/25/2019 15:33	04/26/2019 14:05	0.94	Forced Outage	Batangas SIPS activation	Apr-2015
LUZON	HYD	Binga 4	35	04/25/2019 20:00	04/29/2019 11:30	3.65	Planned Outage	Annual preventive maintenance	Jan-1960
LUZON	OIL	MGTPP	100	04/26/2019 15:36	04/26/2019 22:46	0.30	Forced Outage	Actuation of Fire System Trip	1993
VISAYAS	GEO	PGPP1 Unit 2	37.5	04/26/2019 16:53	04/27/2019 18:49	1.08	Forced Outage	Auto-tripped. Under investigation	
LUZON	NATG	Sta. Rita 3	265.5	04/27/2019 0:45	04/30/2019 1:55	3.05	Forced Outage	Replacement of burner for combustion chamber	Oct-2001
LUZON	COAL	Calaca 2	300	04/27/2019 2:49	05/05/2019 4:56	8.09	Forced Outage	Boiler Tube Leak	Sep-1984
VISAYAS	SOLR	Montesol 1	14.4	04/27/2019 7:18	04/27/2019 16:29	0.38	Forced Outage	Affected by PMS of 69kV Arlan-Guihulangan Sub TL per PAN NEGROS-2019-04	Mar-2016
VISAYAS	OIL	Bohol 1	4	04/27/2019 9:28	04/28/2019 18:05	1.36	Forced Outage	High EGT at A bank	Sep-1978
VISAYAS	OIL	CENPRI 1	4.2	04/27/2019 19:53	04/28/2019 0:01	0.17	Forced Outage	Auto-tripped due to high winding temperature	Jun-2016
VISAYAS	OIL	CENPRI 1	4.2	04/28/2019 0:01	05/31/2019 16:05	33.67	Forced Outage	Due to high winding temperature	Jun-2016
VISAYAS	BIOF	URC 1	40	04/28/2019 0:53			Forced Outage	Offline due to Boiler problem	Jan-2015
VISAYAS	BIOF	URC 2	40	04/28/2019 1:59	04/28/2019 4:09	0.09	Forced Outage	Offline due to Boiler problem	Jan-2015
VISAYAS	BIOF	URC 2	40	04/28/2019 5:04	04/28/2019 10:26	0.22	Forced Outage	Offline due to Boiler problem	Jan-2015
VISAYAS	BIOF	HPCO	3	04/28/2019 17:26	04/29/2019 17:00	0.98	Maintenance Outage	Offline due to weekly maintenance	Feb-2015
LUZON	COAL	SLTEC 1	121	04/28/2019 17:38	04/30/2019 1:00	1.31	Forced Outage	Boiler Tube Leak	Apr-2015
VISAYAS	OIL	PB102 Unit 1	6	04/28/2019 18:16			Forced Outage	Internal fault	Apr-1981
LUZON	HYD	Binga 3	35	04/28/2019 21:31	04/28/2019 23:00	0.06	Planned Outage	Removal of Unit 4 draft tube stoplogs	Jan-1960
LUZON	HYD	Binga 1	35	04/28/2019 21:34	04/28/2019 23:00	0.06	Planned Outage	Removal of Unit 4 draft tube stoplogs	Jan-1960
LUZON	HYD	Binga 2	35	04/28/2019 21:34	04/28/2019 23:00	0.06	Planned Outage	Removal of Unit 4 draft tube stoplogs	Jan-1960
LUZON	OIL	MGTPP	100	04/29/2019 8:15	04/29/2019 13:45	0.23	Forced Outage	Starting failure	1993
LUZON	HYD	Kalayaan 2	180	04/29/2019 9:23	04/29/2019 11:32	0.09	Forced Outage	Failed start-up.	Aug-1982
LUZON	HYD	Angat M 3	50	04/29/2019 11:27	05/02/2019 16:28	3.21	Forced Outage	Tripped due to High Bearing Temperature	Oct-1967
LUZON	GEO	Twi 5	57	04/29/2019 16:20	04/29/2019 17:27	0.05	Forced Outage	Tripped at 35MW load	Jan-1979
VISAYAS	BIOF	HPCO	3	04/30/2019 8:52	04/30/2019 9:06	0.01	Forced Outage	Offline to facilitate shift from unit 1 to unit 2	Feb-2015
VISAYAS	BIOF	HPCO	3	04/30/2019 9:52	05/03/2019 5:54	2.83	Forced Outage	Emergency offline due to boiler problem	Feb-2015
VISAYAS	SOLR	San Carlos Sun	46.8	05/01/2019 6:00	05/01/2019 9:21	0.14	Forced Outage	Affected by tripping of 69kV Cadiz - San Carlos Sub TL CO.	Mar-2016
VISAYAS	SOLR	San Carlos 1	19.8	05/01/2019 6:00	05/01/2019 9:15	0.14	Forced Outage	Affected by tripping of 69kV Cadiz - San Carlos Sub TL CO.	Aug-2014
VISAYAS	SOLR	San Carlos 2	19.8	05/01/2019 6:00	05/01/2019 9:18	0.14	Forced Outage	Affected by tripping of 69kV Cadiz - San Carlos Sub TL CO.	Sep-2015
LUZON	HYD	Binga 1	35	05/01/2019 8:01	05/01/2019 11:01	0.13	Planned Outage	Annual Preventive Maintenance	Jan-1960
LUZON	HYD	Binga 2	35	05/01/2019 8:01	05/01/2019 11:01	0.13	Planned Outage	Annual Preventive Maintenance	Jan-1960
LUZON	HYD	Binga 3	35	05/01/2019 8:01	05/04/2019 22:35	3.61	Planned Outage	APM unit 05 May 2019	Jan-1960
LUZON	HYD	Binga 4	35	05/01/2019 8:01	05/01/2019 11:01	0.13	Planned Outage	Annual Preventive Maintenance	Jan-1960
VISAYAS	GEO	PGPP1 Unit 3	37.5	05/01/2019 8:32	05/03/2019 16:36	2.34	Forced Outage	Auto-tripped. cause of tripping under investigation	
LUZON	COAL	Pagbilao 1	382	05/02/2019 15:27	05/14/2019 21:14	12.24	Forced Outage	Tripped due to excessive water leak at feed water flow sensing line	Mar-1996
VISAYAS	BIOF	URC 2	40	05/03/2019 11:55	05/04/2019 14:55	1.13	Forced Outage	Emergency offline due to boiler problem	Jan-2015
VISAYAS	OIL	Bohol 1	4	05/03/2019 16:47	05/04/2019 8:17	0.65	Forced Outage	Cut out due to High exhaust gas temperature at cyl. B bank	Sep-1978
LUZON	HYD	Kalayaan 1	180	05/03/2019 17:08	05/03/2019 21:21	0.18	Forced Outage	Main Transformer tripping with neutral overcurrent indication(RECLASSIFIED FR	Aug-1982
LUZON	OIL	Malaya 1	300	05/03/2019 18:21			Forced Outage	Declared unavailable due to motorization of unit generator caused by the non-ope	Aug-1975
LUZON	COAL	SBPL	455	05/03/2019 18:41	05/03/2019 21:58	0.14	Planned Outage	Unit tripped at 210MW load. (Commissioning Test)	
VISAYAS	GEO	PGPP1 Unit 3	37.5	05/04/2019 0:09	05/04/2019 2:22	0.09	Forced Outage	Offline to facilitate immediate repair for one inch drain pipe of gland steam sealing line	
LUZON	HYD	Binga 1	35	05/04/2019 8:01	05/04/2019 12:00	0.17	Planned Outage	On total plant shutdown in relation to APM activities of Unit 3	Jan-1960
LUZON	HYD	Binga 2	35	05/04/2019 8:01	05/04/2019 12:00	0.17	Planned Outage	On total plant shutdown in relation to APM activities of Unit 3	Jan-1960
LUZON	HYD	Binga 3	35	05/04/2019 8:01	05/04/2019 12:00	0.17	Planned Outage	On total plant shutdown in relation to APM activities of Unit 3	Jan-1960
VISAYAS	BIOF	URC 2	40	05/04/2019 17:02	05/04/2019 19:54	0.12	Forced Outage	Emergency offline due to boiler problem	Jan-2015
VISAYAS	BIOF	HPCO	3	05/04/2019 18:18	05/04/2019 19:19	0.04	Forced Outage	Offline due to internal problem	Feb-2015
VISAYAS	BIOF	URC 2	40	05/05/2019 7:01	05/05/2019 9:12	0.09	Forced Outage	Offline due to Boiler problem	Jan-2015
VISAYAS	GEO	PGPP2 Unit 1	20	05/05/2019 7:06	05/05/2019 10:17	0.13	Maintenance Outage	Offline due to Maintenance activities	Aug-1983
LUZON	GEO	Twi 6	57	05/05/2019 9:02	05/05/2019 11:42	0.11	Forced Outage	Tripped by excitation trouble	Jan-1979
VISAYAS	BIOF	HPCO	3	05/05/2019 10:14	05/07/2019 3:54	1.74	Maintenance Outage	Offline due to weekly maintenance	Feb-2015
VISAYAS	OIL	Bohol 3	4.2	05/05/2019 12:51	05/05/2019 17:05	0.18	Forced Outage	Severe fuel leak at cylinder 12	Sep-1978
LUZON	NATG	San Lorenzo 2	261.8	05/05/2019 21:11	05/06/2019 1:23	0.17	Forced Outage	Tripped while in the process of fuel change-over from gas to oil	Sep-2002
VISAYAS	BIOF	URC 2	40	05/06/2019 1:39	05/06/2019 3:07	0.06	Forced Outage	Offline due to boiler problem	Jan-2015
VISAYAS	OIL	PDPP3 C	12	05/06/2019 18:58	05/06/2019 19:29	0.02	Forced Outage	High exhaust gas temperature	Transferred Mar 2005
LUZON	HYD	Ambuklao 1	35	05/07/2019 8:01	05/08/2019 22:27	1.60	Maintenance Outage	Internal leak on unit 1 turbine governor servomotors	Dec-1956
VISAYAS	GEO	Mahangdong B1	5	05/07/2019 9:55	05/07/2019 20:06	0.42	Forced Outage	Tripped with load of 36 MW. Under assessment by Plant Personnel.	Jul-1997
VISAYAS	COAL	PALM 1	135	05/07/2019 14:23	05/07/2019 23:29	0.38	Forced Outage	Due to internal trouble	Aug-2016
VISAYAS	SOLR	San Carlos 1	19.8	05/07/2019 14:23	05/07/2019 15:07	0.03	Forced Outage	Affected by Grid Fluctuation due to tripping of PCPC (134.8MW)	Aug-2014
VISAYAS	SOLR	San Carlos 2	19.8	05/07/2019 14:23	05/07/2019 15:07	0.03	Forced Outage	Affected by Grid Fluctuation due to tripping of PCPC (134.8MW)	Sep-2015
VISAYAS	BIOF	HPCO	3	05/07/2019 15:43	05/08/2019 8:17	0.69	Forced Outage	Offline due to low voltage at 13.8kV side	Feb-2015
LUZON	HYD	Ambuklao 3	35	05/08/2019 18:01	05/08/2019 22:04	0.17	Forced Outage	Lube oil high pressure pump trouble	Dec-1956
LUZON	HYD	Kalayaan 2	180	05/09/2019 8:48	05/09/2019 11:41	0.12	Forced Outage	Failed to synchronize	Aug-1982
VISAYAS	SOLR	Islasol 3	40.5	05/09/2019 12:17	05/09/2019 13:33	0.05	Forced Outage	Isolated due to tripping of 69kV Cadiz-Manapla Solar Line	Mar-2016
LUZON	COAL	GN Power 1	316	05/09/2019 14:21	05/21/2019 12:59	11.94	Forced Outage	High Turbine Vibration	May-2013
VISAYAS	GEO	Upper Mahiao 1	32	05/09/2019 23:00	05/10/2019 15:23	0.68	Forced Outage	Loss of excitation	Jul-1997
VISAYAS	OIL	Bohol 2	4	05/10/2019 10:53	05/10/2019 21:01	0.42	Forced Outage	Lube oil leak on copper tubing for instrumentation	Sep-1978
VISAYAS	BIOF	HPCO	3	05/11/2019 14:58	05/11/2019 15:13	0.01	Forced Outage	Offline due to internal problem	Feb-2015
LUZON	GEO	Makban 3	63	05/11/2019 1					

## 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	OIL	Limay 4	90	05/17/2019 13:11	05/20/2019 21:29	3.35	Forced Outage	Sudden closure of diverter damper. Declared not available at 1449H.	May-1993
LUZON	BIOF	iPower 2	12	05/18/2019 12:00			Forced Outage	Emergency plant shutdown due to leak at cooling tower	Dec-2017
VISAYAS	BIOF	HPCO	3	05/18/2019 18:26	05/18/2019 20:46	0.10	Forced Outage	Offline due to low voltage at 13.8kV side	Feb-2015
VISAYAS	OIL	Bohol 3	4.2	05/18/2019 19:41	05/18/2019 23:14	0.15	Forced Outage	Fuel oil leak at A Bank header	Sep-1978
VISAYAS	GEO	PGPP1 Unit 2	37.5	05/18/2019 22:41	05/19/2019 22:31	0.99	Forced Outage	Auto tripped. On going investigation	
LUZON	HYD	Magat 2	95	05/20/2019 6:01			Maintenance Outage	Maintenance outage until 18 July 2019	Aug-1983
LUZON	HYD	Magat 2	97	05/20/2019 6:01			Maintenance Outage	Maintenance outage until 18 July 2019	Aug-1983
VISAYAS	SOLR	Isilasol 2	27.2	05/20/2019 8:03	05/20/2019 9:50	0.07	Forced Outage	Auto-tripped due to vegetation along their 13.8kV line	Mar-2016
LUZON	OIL	Limay 1	60	05/20/2019 12:29	05/20/2019 21:09	0.36	Forced Outage	Failed to synchronized due to cooler fan trouble	May-1993
VISAYAS	GEO	Mahanagdong A1	5	05/21/2019 7:08			Forced Outage	Emergency shutdown	Jul-1997
LUZON	NATG	Sta. Rita 1	257.3	05/21/2019 9:08	05/21/2019 10:37	0.06	Forced Outage	Tripped due to GT protection triggered by radio interference signal.	Jan-2000
LUZON	COAL	GN Power 1	316	05/21/2019 13:02	05/22/2019 23:38	1.44	Forced Outage	Emergency shutdown due to intercept valve 2 trouble	May-2013
LUZON	OIL	SLPGC 3	25	05/21/2019 14:00	05/27/2019 23:58	6.42	Forced Outage	Burnt Medium Voltage Circuit Breaker	Mar-2018
VISAYAS	OIL	Bohol 2	4	05/21/2019 14:47	05/21/2019 19:05	0.18	Forced Outage	Emergency cut out due to severe oil leak at cyl. copper tubing	Sep-1978
VISAYAS	GEO	Mahanagdong B1	5	05/22/2019 12:45			Forced Outage	AVR 24VDC power failure	Jul-1997
LUZON	COAL	SBPL	455	05/22/2019 20:33	05/22/2019 23:32	0.12	Forced Outage	Tripped at 400MW load. Feedwater flow problem. On Commissioning Test.	
LUZON	OIL	Limay 1	60	05/22/2019 20:55	05/23/2019 13:36	0.70	Forced Outage	Fuel Nozzle flow-off valve malfunction	May-1993
VISAYAS	GEO	PGPP1 Unit 2	37.5	05/23/2019 22:04	05/24/2019 17:15	1.80	Maintenance Outage	Offline due to maintenance activities	
LUZON	HYD	Binga 1	35	05/23/2019 8:01	05/23/2019 16:51	0.37	Planned Outage	Installation of unit 2 draft tube stoplogs	Jan-1960
LUZON	HYD	Binga 2	35	05/23/2019 8:01	05/27/2019 4:53	3.87	Planned Outage	Unit 2 APM	Jan-1960
LUZON	HYD	Binga 4	35	05/23/2019 8:01	05/23/2019 16:51	0.37	Planned Outage	Installation of unit 2 draft tube stoplogs	Jan-1960
LUZON	HYD	Binga 3	35	05/23/2019 8:07	05/23/2019 16:51	0.36	Planned Outage	Installation of unit 2 draft tube stoplogs	Jan-1960
LUZON	COAL	SLTEC 1	121	05/24/2019 5:19	06/04/2019 7:39	11.10	Forced Outage	Boiler Tube Leak	Apr-2015
LUZON	HYD	Binga 1	35	05/24/2019 8:01	05/24/2019 16:50	0.37	Planned Outage	Protection testing of overhead lines and power intake trash rack cleaning	Jan-1960
LUZON	HYD	Binga 3	35	05/24/2019 8:01	05/24/2019 16:50	0.37	Planned Outage	Protection testing of overhead lines and power intake trash rack cleaning	Jan-1960
LUZON	HYD	Binga 4	35	05/24/2019 8:01	05/24/2019 16:50	0.37	Planned Outage	Protection testing of overhead lines and power intake trash rack cleaning	Jan-1960
VISAYAS	GEO	Malitbog 3	72	05/25/2019 0:36			Planned Outage	Annual PMS	Jul-1997
VISAYAS	GEO	PGPP1 Unit 1	37.5	05/25/2019 4:12			Maintenance Outage	Offline to conduct repair of cooling tower leak at cooling tower hot distribution basin	
LUZON	HYD	Binga 1	35	05/25/2019 8:09	05/25/2019 16:01	0.33	Planned Outage	Protection testing of overhead lines and power intake trash rack cleaning	Jan-1960
LUZON	HYD	Binga 3	35	05/25/2019 8:09	05/25/2019 16:01	0.33	Planned Outage	Protection testing of overhead lines and power intake trash rack cleaning	Jan-1960
LUZON	HYD	Binga 4	35	05/25/2019 8:09	05/25/2019 16:10	0.33	Planned Outage	Protection testing of overhead lines and power intake trash rack cleaning	Jan-1960
LUZON	COAL	SLTEC 2	122.9	05/25/2019 8:22			Forced Outage	On emergency shutdown due to boiler tube leak	Feb-2016
LUZON	COAL	SBPL	455	05/25/2019 20:26	05/25/2019 23:52	0.14	Forced Outage	Tripped due to GSUT Oil Temperature High High (On commissioning Test)	
LUZON	OIL	Limay 5	60	05/25/2019 23:51	05/26/2019 13:45	0.58	Forced Outage	Blow off valve trouble	Dec-1994
LUZON	NATG	Avion 1	50.3	05/26/2019 8:00	05/26/2019 20:00	0.50	Maintenance Outage	Maintenance activities until 2000H	Aug-2016
LUZON	NATG	Avion 2	50.3	05/26/2019 8:00	05/26/2019 20:00	0.50	Maintenance Outage	Maintenance activities until 2000H	Aug-2016
LUZON	COAL	SBPL	455	05/27/2019 15:28	06/14/2019 15:55	18.02	Forced Outage	SBPL at 95MW load. On Commissioning Test	
LUZON	OIL	Limay 3	60	05/27/2019 23:32	05/28/2019 11:30	0.50	Forced Outage	Tripped by generator protection	May-1993
VISAYAS	OIL	Bohol 4	4	05/28/2019 15:21	05/29/2019 8:10	0.70	Forced Outage	Emergency cut out due to excessive fresh cooling water leak at cylinder A bank	Sep-1978
LUZON	OIL	Limay 3	60	05/29/2019 6:54	05/29/2019 13:40	0.28	Forced Outage	Starting failure	May-1993
LUZON	GEO	Makban 2	63	05/29/2019 19:22	06/02/2019 14:32	3.80	Maintenance Outage	Maintenance Outage	Apr-1979
LUZON	HYD	Binga 1	35	05/29/2019 20:01	06/02/2019 15:30	3.81	Planned Outage	Maintenance Outage Until 02 June 2019	Jan-1960
VISAYAS	OIL	Bohol 4	4	05/30/2019 10:48	05/30/2019 11:12	0.02	Forced Outage	Water leak at injection cooling system	Sep-1978
LUZON	GEO	Twi 5	57	05/30/2019 19:18	06/09/2019 8:24	9.55	Forced Outage	Tripped at 42MW load	Jan-1979
LUZON	GEO	Twi 6	57	05/30/2019 19:45	05/31/2019 6:08	0.43	Forced Outage	Tripped at 26MW load	Jan-1979
LUZON	NATG	Ilijan A1	190	05/30/2019 23:58	06/01/2019 10:25	1.44	Maintenance Outage	Maintenance outage until 02 June 2019.	Jun-2002
VISAYAS	OIL	Bohol 4	4	05/31/2019 14:10	06/01/2019 9:11	0.79	Forced Outage	Shutdown. Exhaust gas leak at B-bank and high EGT at A and B bank	Sep-1978
LUZON	COAL	QPLP	459	05/31/2019 14:45	06/01/2019 15:27	1.03	Forced Outage	Hydraulic leak at Control Valve 2	May-2000
VISAYAS	COAL	TPC Sangi 2	85	06/01/2019 0:50	06/20/2019 11:25	19.44	Planned Outage	APMS	Oct-2015
LUZON	COAL	Sual 2	647	06/01/2019 19:18	06/02/2019 23:00	1.15	Forced Outage	Tripped by generator transformer BUCCHOLZ relay actuation	Oct-1999
LUZON	GEO	Makban 1	63	06/01/2019 20:15	06/10/2019 21:15	9.04	Forced Outage	Tripped due to power supply problem	Apr-1979
LUZON	COAL	SMC 1	150	06/02/2019 4:50	06/12/2019 20:29	10.65	Forced Outage	Emergency shutdown due to boiler tube leak	May-2017
LUZON	NATG	San Lorenzo 2	261.8	06/02/2019 6:34	06/02/2019 11:39	0.21	Forced Outage	Loss redundancy of critical automation processor of the unit	Sep-2002
LUZON	COAL	GN Power 1	316	06/02/2019 11:07	06/09/2019 1:47	6.61	Forced Outage	Air Heater Trouble... System frequency is 59.024hz	May-2013
VISAYAS	OIL	Bohol 3	4.2	06/02/2019 18:25	06/02/2019 22:07	0.15	Forced Outage	Jacket cooling water pressure low	Sep-1978
VISAYAS	OIL	PB102 Unit 4	6	06/02/2019 18:44	06/04/2019 18:11	1.98	Forced Outage	Cooling Water Leak between Cylinder and cyl. head at Cyl. No. 1L	Apr-1981
VISAYAS	OIL	PB101 Unit 1	6	06/02/2019 19:14	06/03/2019 18:07	0.95	Forced Outage	Shutdown due to gas cutting at Cylinder head 3L	1978 / 1986 / 1989
LUZON	HYD	Binga 3	35	06/03/2019 16:46	06/03/2019 17:43	0.04	Forced Outage	Tripped due to line trouble	Jan-1960
LUZON	HYD	Magat 3	95	06/03/2019 16:54	06/04/2019 0:32	0.32	Forced Outage	Excitation trouble.	Oct-1983
LUZON	HYD	Magat 4	95	06/03/2019 16:54	06/03/2019 17:21	0.02	Forced Outage	Affected by tripping of unit 3	Oct-1983
LUZON	HYD	Binga 4	35	06/03/2019 16:54	06/03/2019 17:44	0.03	Forced Outage	Tripped due to line trouble	Jan-1960
VISAYAS	OIL	PB102 Unit 3	6	06/03/2019 18:57	06/04/2019 18:06	0.96	Forced Outage	Emergency shutdown due to presence of fire at right side Turbo-charger	Apr-1981
VISAYAS	GEO	PGPP2 Unit 3	20	06/04/2019 0:06			Maintenance Outage	Offline due to PMS	Aug-1983
VISAYAS	OIL	CENPRI 1	4.2	06/04/2019 9:01	06/04/2019 20:12	0.47	Forced Outage	Auto-tripped due to Loss of Field.	Jun-2016
VISAYAS	OIL	CENPRI 5	6.4	06/04/2019 9:04	06/04/2019 20:10	0.46	Forced Outage	Auto-tripped due to Jacket Water Low Pressure	
LUZON	NATG	San Gabriel	420	06/04/2019 18:04	06/06/2019 7:13	1.55	Forced Outage	On emergency shutdown due to differential pressure air filter trouble.	Jul-2016
LUZON	COAL	SMC 4	150	06/05/2019 11:46			Forced Outage	High furnace pressure	
LUZON	COAL	SMC 4	150	06/05/2019 11:46	06/20/2019 7:17	14.81	Forced Outage	High furnace pressure. On Commissioning Test	
VISAYAS	OIL	Bohol 1	4	06/06/2019 10:04	06/06/2019 16:05	0.25	Forced Outage	High EGT at cylinder no. 3	Sep-1978
VISAYAS	OIL	Bohol 2	4	06/06/2019 10:10	06/06/2019 16:06	0.25	Forced Outage	Fuel leak at cylinder no. 6.	Sep-1978
LUZON	COAL	Calaca 2	300	06/06/2019 15:06	06/08/2019 5:11	1.59	Forced Outage	Tripped with 203MW load	Sep-1984
LUZON	GEO	Bacman 1	60	06/06/2019 17:03	06/06/2019 18:19	0.05	Forced Outage	Aux. supply undervoltage	Sep-1993
LUZON	HYD	Magat 4	95	06/06/2019 19:56	06/06/2019 20:39	0.03	Forced Outage	Shaft seal high temperature	Oct-1983
VISAYAS	COAL	CEDC 2	82	06/06/2019 21:03	06/07/2019 23:33	1.10	Forced Outage	Boiler Drain Valve Replacement	Jun-2010
VISAYAS	OIL	PB102 Unit 2	6	06/07/2019 18:30	06/08/2019 13:11	0.78	Forced Outage	Internal Trouble	Apr-1981
LUZON	HYD	San Roque 1	145	06/08/2019 0:01	06/14/2019 17:00	6.71	Planned Outage	Maintenance Outage until 17 June 2019	May-2003
LUZON	HYD	San Roque 3	145	06/08/2019 0:01	06/14/2019 17:00	6.71	Planned Outage	Maintenance Outage until 17 June 2019	May-2003
LUZON	NATG	San Lorenzo 1	264.8	06/08/2019 4:41	06/09/2019 21:27	1.70	Planned Outage	Maintenance Outage	Sep-2002
VISAYAS	SOLR	San Carlos Sun	46.8	06/08/2019 6:28	06/08/2019 16:13	0.41	Forced Outage	Isolated due to Line maintenance of 69KV Escalante-San Carlos Line section	Mar-2016
VISAYAS	SOLR	San Carlos 1	19.8	06/08/2019 6:28	06/08/2019 16:28	0.42	Forced Outage	Isolated due to Line maintenance of 69KV Escalante-San Carlos Line section	Aug-2014
VISAYAS	SOLR	San Carlos 2	19.8	06/08/2019 6:28	06/08/2019 16:30	0.42	Forced Outage	Isolated due to Line maintenance of 69KV Escalante-San Carlos Line section	Sep-2015
LUZON	NATG	San Lorenzo 2	261.8	06/08/2019 9:20	06/10/2019 5:32	1.84	Forced Outage	Tripped while on the process of change over of fuel from natural gas to fuel oil.	Sep-2002
VISAYAS	SOLR	Isilasol 2	27.2	06/09/2019 7:18	06/09/2019 19:51	0.52	Forced Outage	Isolated due to maintenance along 69KV Bacolod-San Enrique Sub TL	Mar-2016
VISAYAS	OIL	Bohol 1	4	06/09/2019 19:17	06/09/2019 23:06	0.16	Forced Outage	Fuel leak at cylinder 5.	Sep-1978
VISAYAS	OIL	Bohol 1	4	06/10/2019 18:10	06/10/2019 20:23	0.09	Forced Outage	Affected tripping of BDPP 10 MVA Transformer	Sep-1978
VISAYAS	OIL	Bohol 2	4	06/10/2019 18:10	06/10/2019 20:24	0.09	Forced Outage	Affected tripping of BDPP 10 MVA Transformer	Sep-1978
LUZON	OIL	Limay 1	60	06/11/2019 8:00	06/12/2019 21:41	1.57	Forced Outage	Flame-off problem (start-up).	May-1993
VISAYAS	OIL	CENPRI 1	4.2	06/11/2019 10:52	06/11/2019 11:28	0.03	Forced Outage	Offline due to governor malfunction	Jun-2016
VISAYAS	GEO	Malitbog 2	72	06/11/2019 15:52	06/11/2019 16:41	0.03	Forced Outage	Scrubber High Level indication	Jul-1997
VISAYAS	OIL	Bohol 3	4.2	06/11/2019 17:26	06/12/2019 8:20	0.62	Forced Outage	Turbo Charger problem	Sep-1978
LUZON	COAL	SLTEC 1	121	06/12/2019 3:42	06/12/2019 17:30	0.57	Forced Outage	Primary Air fan A and B high vibration	Apr-2015
LUZON	OIL	MGTPP	100	06/12/2019 9:59	06/15/2019 7:05	2.88	Forced Outage	Jack-in pump trouble	1993
LUZON	GEO	Twi 5	57	06/12/2019 14:29	06/12/2019 15:30	0.04	Forced Outage	Tripped due to low vacuum	Jan-1979
LUZON	COAL	SMC 1	150	06/13/2019 9:46	06/23/2019 3:55	9.76	Forced Outage	Suspected Boiler tube leak	May-2017

## 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	San Gabriel	420	06/18/2019 21:39	06/19/2019 7:42	0.42	Forced Outage	Malampaya Natural Gas Supply Restriction	Jul-2016
VISAYAS	OIL	Bohol 4	4	06/19/2019 9:14	06/23/2019 9:23	4.01	Forced Outage	Abnormal sound of turbocharger at B-bank	Sep-1978
VISAYAS	OIL	PDPP3 G	13	06/19/2019 9:34	06/19/2019 12:08	0.11	Forced Outage	Tripping of lube oil pump	Transferred Mar 2005
LUZON	NATG	San Lorenzo 2	261.8	06/19/2019 9:57	06/19/2019 10:45	0.03	Forced Outage	Fuel supply change-over from gas to oil	Sep-2002
VISAYAS	OIL	Bohol 2	4	06/19/2019 12:39	06/19/2019 18:05	0.23	Forced Outage	Excessive fuel oil leak on cylinder 1.	Sep-1978
VISAYAS	OIL	Bohol 2	4	06/19/2019 19:18	06/19/2019 23:18	0.17	Forced Outage	Emergency out due to fuel leak at A bank supply line	Sep-1978
LUZON	OIL	Limay 3	60	06/20/2019 6:37	06/20/2019 7:47	0.05	Forced Outage	Flame-off trip	May-1993
VISAYAS	OIL	PDPP3 G	13	06/20/2019 9:59	06/20/2019 10:47	0.03	Forced Outage	low lube oil pressure	Transferred Mar 2005
VISAYAS	SOLR	San Carlos 1	19.8	06/21/2019 7:05	06/21/2019 8:15	0.05	Forced Outage	Auto-tripping of 13.2kV Main PCB due to internal plant problem	Aug-2014
LUZON	COAL	SBPL	455	06/21/2019 16:51	06/21/2019 23:10	0.26	Forced Outage	Loss of flame and DCS trouble	
LUZON	COAL	SBPL	455	06/22/2019 0:47	06/22/2019 23:30	0.95	Forced Outage	Tripped at 176MW load. System frequency is 59.47hz. Induced Draft fan vibration	
LUZON	NATG	Sta. Rita 1	257.3	06/22/2019 4:27	06/23/2019 21:25	1.71	Maintenance Outage	Off Line Compressor Washing until 23 June 2019	Jun-2000
VISAYAS	COAL	PALM 1	135	06/22/2019 8:31	06/22/2019 11:25	0.12	Forced Outage	Cause under investigation	Aug-2016
VISAYAS	OIL	PDPP3 E	12	06/22/2019 10:45	06/22/2019 13:10	0.10	Forced Outage	Emergency Stop due to Engine Governor Malfunction	Transferred Mar 2005
LUZON	GEO	Bacman 1	60	06/22/2019 11:06	06/23/2019 19:34	1.35	Forced Outage	Tripped by generator tranf. buchholz relay indication	Sep-1993
LUZON	OIL	Limay 3	60	06/23/2019 0:33	06/23/2019 11:06	0.44	Forced Outage	Unit start-up trouble	May-1993
LUZON	GEO	Bacman 2	60	06/23/2019 1:22	06/23/2019 10:50	0.39	Forced Outage	Station Service tie breaker trouble	Sep-1993
LUZON	COAL	SLPGC 2	150	06/23/2019 3:17	06/23/2019 14:09	0.45	Forced Outage	Hotspot correction at Main Transformer bushing. phase B	Jul-2016
VISAYAS	SOLR	Silay	20	06/23/2019 7:04	06/23/2019 12:45	0.24	Forced Outage	Isolated due to maintenance activities and load shifting of 69kV Talisay-Silay Line	Apr-2016
VISAYAS	GEO	PGPP2 Unit 1	20	06/24/2019 1:22	06/24/2019 3:45	0.10	Forced Outage	To conduct load rejection by opening CB52SN to test the logic for Household opt	Aug-1983
VISAYAS	GEO	PGPP2 Unit 2	20	06/24/2019 1:22	06/24/2019 3:30	0.09	Forced Outage	To conduct load rejection by opening CB52SN to test the logic for Household opt	Aug-1983
VISAYAS	COAL	TPC Sangi 2	85	06/24/2019 9:06			Forced Outage	HIGH VIBRATION AT FA BLOWER	Oct-2015
LUZON	COAL	SBPL	455	06/24/2019 15:45	06/25/2019 0:49	0.38	Forced Outage	Unit Transformer bushing hot spot correction. On Commissioning Test.	

## Methodology in Determining Interesting Pricing Events

Supply margin is defined as the MW difference between the system effective supply<sup>1</sup> and demand requirement plus reserve schedules<sup>2</sup>.

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 thresholds<sup>3</sup>. 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  $\pm 3$  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”.

<sup>1</sup> 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).

<sup>2</sup> 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.

<sup>3</sup> 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](http://www.albertamsa.ca).