MAG-AMAR-2017

ANNUAL MARKET ASSESSMENT REPORT

For the 2017 Billing Period

PHILIPPINE ELECTRICITY MARKET CORPORATION

MARKET ASSESSMENT GROUP (MAG)

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EXECUTIVE SUMMARY

This Annual Market Assessment Report (AMAR) provides an assessment of the results of the integrated Luzon and Visayas operations of the Wholesale Electricity Spot Market (WESM) for the period 26 December 2016 to 25 December 2017. The AMAR, which follows the WESM Catalogue of Market Monitoring Data and Indices (CMMDI), sets-out an overview of the results of market performance, trends and drivers which in turn provide the means by which to assess competition and conditions in the WESM, as well as the bidding behavior of trading participants. This is in support of the attainment of the WESM objectives to establish a competitive, efficient, transparent and reliable market for electricity.

Growth in the WESM registered capacity was observed throughout 2017 with the entry of new power plants, totaling 1,244 MW, and the expansion of existing capacities. From 17,479 MW in January, the WESM registered capacity increased by about 7.4 percent to 17,889 MW by the end of 2017. Of the total registered capacity, only about 64.7 percent was offered in the market, averaging at 11,581 MW. Preferential and non-scheduled capacities averaged 1,389 MW, comprising about 7.8 percent of the total registered capacity. Further, an average of 600 MW or about 3.1 percent of the registered capacity was attributed to the capacity designation of Malaya TPP as Must Run Unit (MRU), in cases of supply shortfall and to address system security. An average of 83 MW was scheduled by the System Operator as ancillary services to provide contingency and dispatchable reserves in the Visayas region. It should be noted that following the implementation of central scheduling and dispatch of energy and contracted reserves in Luzon beginning 22 December 2015, and in the Visayas beginning 07 October 2017, ancillary services schedules in both regions have been included as part of the offered capacity in the market.

Meanwhile, a high outage capacity was registered this year at an average of 2,321 MW, an 18.7 percent increase from last year. Coal plants comprised the bulk of the outage capacity at 1,252 MW or about 53.9 percent. Outage capacity was particularly higher during the first, third and fourth quarters of the billing year, with noticeable increases during the February, September, October and November billing months. Furthermore, generator-trading participants continued to submit capacity offers less than their respective maximum available capacity, as indicated by the persistently high level of capacity gap throughout the billing year. Following relevant provisions in the WESM Rules, these shall be subject to further investigation for possible non-compliance with the must-offer rule. Capacity gap averaged 1,990 MW during the year, with hydro plants accounting for majority at an average of 766 MW.

Effective supply levels increased by 7.1 percent from 10,880 MW to 11,652 MW in 2017. On the other hand, demand averaged 8,959 MW, posting a modest increase of 5.1 percent from last year's 8,522 MW, while demand plus reserve schedule rose by 5.8 percent to an average of 9,803 MW from the 9,262 MW in 2016. Sufficient margin between supply and demand generally prevailed during the twelve-month period, demonstrated by the average supply margin of 1,849 MW. Notwithstanding, narrow supply margin was still observed during periods of tight demand and supply conditions, with 17 trading intervals recording supply margin levels at below 100 MW.

System-wide market prices averaged at PhP3,350/MWh, an increase of 13.7 percent from last year's PhP2,948/MWh, which is the lowest annual average market price since the Visayas integration in the WESM on 26 December 2010. Meanwhile, in accordance with the WESM Manual on Administered Price Determination Methodology (APDM), administered prices were applied in 72 trading intervals during market intervention events, as well as during the period of the ERC's market suspension in the Visayas from 06 July at 1700H to 01 August at 1600H due to intensity scale 5 earthquake in the region. Spikes in market prices were observed this year, reaching above PhP30,000/MWh in three (3) trading intervals in October (02, 22 and 23 October at 1800H), driven by tight supply margins due to

low supply availability. Recorded during the period was the simultaneous forced outages of major coal plants Mariveles 2, Masinloc 1, Sual 1, Calaca 2, and QPPL on top of the deactivated shutdown of Pagbilao 1, 2 and 3, and the planned outage of natural gas plant San Lorenzo 1. The maximum price on record for the billing year was posted at PhP33,347/MWh on 23 October at 2300H.

Regional price separation between the Luzon and Visayas was likewise observed, brought about by the congestions in the HVDC. These occurred when the transfer capability of the HVDC, as imposed by the NGCP-SO, was maximized during the scheduling process. High incidence of regional price separation from July to September, on account of the unavailability of the HVDC from 06 July (1700H) to 07 September (2200H), affected 1,520 intervals. This is due to the tripping of the HVDC Interconnection following the earthquake which hit the Visayas on 06 July. During the period, the maximum price on record in Luzon was posted at PhP33,898/MWh, while it was only PhP8,278/MWh in the Visayas. During the same month, Luzon average market prices was recorded at PhP3,836/MWh, notably higher by 37.5 percent from the Visayas average price of PhP2,789/MWh.

The system-wide generation mix this year based on actual generation (metered quantity) showed that coal plants accounted for majority or 47.7 percent, followed in distant second by natural gas plants which accounted for 26.9 percent. Geothermal plants figured-in at third, with 11.8 percent. Hydro plants came next, contributing 7.6 percent, while oil-based plants comprised the next 2.3 percent. The 10-MW Masinloc battery energy storage also contributed to the generation mix. Meanwhile, preferential dispatch plants – biomass, solar and wind plants, accounted for the remaining 0.9 percent, 1.5 percent and 1.4 percent, respectively, of the total generation mix for 2017.

In terms of market concentration, the share of the four largest groups namely Aboitiz Power (AP), San Miguel Corporation (SMC), First Gen Corporation (FGC) and Power Sector Assets and Liabilities Management (PSALM) continued to dominate the market with a combined market share of 67 percent during the year. AP and SMC held the largest share with 19.9 percent each based on registered capacity by yearend. FGC came third at 15.5 percent, followed by PSALM with a market share of 11.7 percent. The Semirara Mining and Power Corporation (SMPC) group was at distant fifth with a share of 5.1 percent and Global Business Power Corporation (GBPC) at 4.6 percent.

SMC, which historically held the largest share of the market, dropped to second place beginning August this year, but regained the top spot tied with the AP group as of December attributable to the entry of the 150-MW coal facility of SMC Consolidated Power Corporation. Increase in SMC's market share was first observed in March from 19.2 percent to 19.9 percent, with the registration of the additional 150-MW unit of coal-fired plant SMC Limay. Meanwhile, the substantial increase in the market share of the AP group from 18 percent in July to 20 percent in August was on account of the entry in the market effective 27 July of the additional 436-MW unit of major coal plant Pagbilao. AP's market share further grew towards the end of the December billing month with the registration of the 2x176.2-MW coal-fired facility of Therma Visayas Inc (TVI) effective 23 December.

The resulting Herfindahl-Hirschman Index (HHI) across the billing year generally denoted a moderately concentrated market in terms of major participant group. However, higher HHI values almost bordering on the concentrated mark were observed from January to March based on offered capacity and actual generation. The varying conditions of supply availability as well as the offer behaviour of plants could have influenced the same.

Table of Contents

APPENDICES

List of Figures

List of Tables

I. INTRODUCTION

This Annual Market Assessment Report (AMAR) provides an assessment of the results of the integrated Luzon and Visayas operations of the Wholesale Electricity Spot Market (WESM) for the period 26 December 2016 to 25 December 2017. The AMAR, which follows the WESM Catalogue of Market Monitoring Data and Indices (CMMDI), sets-out an overview of the results of market performance, trends and drivers which in turn provide the means by which to assess competition and conditions in the WESM, as well as the bidding behavior of trading participants. This is in support of the attainment of the WESM objectives to establish a competitive, efficient, transparent and reliable market for electricity.

II. ELECTRICITY DEMAND

A. Demand[1] Characteristics

1. Demand Summary

Demand grew by 5.2 percent this year in the Luzon region, posting an average demand level of 7,569 MW from last year's 7,195 MW. Maximum and minimum demand levels likewise demonstrated increases this year by 3.9 percent and 10 percent, respectively. Maximum demand in the region grew from 9,725 MW in 2016 to 10,105 MW in the current year while an increase in minimum demand was also recorded from 3,817 MW to 4,198 MW.

From an average demand of 1,328 MW in 2016, the Visayas regional average demand grew by 6.4 percent to 1,413 MW in 2017. Likewise, maximum demand grew by 3.3 percent from 1,862 MW in the previous year to 1,924 MW. Lastly, minimum demand recorded an increase of 2.7 percent from 833 MW to 856 MW in the current year.

The annual demand growth in the two regions mirrors the growth in the country's annual gross domestic product (GDP)[2] by 6.7 percent in the current year 2017, and is a reflection of the continued growth of the national economy, as demonstrated by the annual GDP growth in the previous year 2016 at 6.8 percent. Correspondingly, the average demand in Luzon grew by 8.6 percent while the Visayas demand also grew by 13.3 percent in the previous billing year 2016.

Weather conditions may have likewise contributed to the annual demand increase trend. *Weather Underground*[3] reports that similar to the previous year 2016, the Luzon region maintained an average temperature of 29^{o}C during the year, and a maximum temperature of 37^{o}C. Similarly, Visayas temperatures were maintained at an average of 28^{o}C, though its maximum temperature declined from 39^{o}C to 36 ^{o}C.

Historical demand growth upon commencement of the WESM commercial operations in Luzon on 26 June 2006 showed that the annual increase in average demand this year at 5.2 percent was relatively higher when compared with previous years, but is below the average demand growth rate in the previous year at 8.6 percent. On the other hand, the historical trend in the rate of demand growth in the Visayas showed that the increase in average demand in the current year at 6.4 percent was one of the highest yearly increases in the region since the Visayas integration in the WESM on 26 December 2010.

[1] The demand is equal to the total scheduled MW of all load resources for each respective region plus losses.
[2] The GDP is the basic measure of a country's economic performance. It is defined as the total value of goods produced and services rendered in a given period.
[3] https://www.wunderground.com

Figure 1. Annual Demand Summary – Luzon

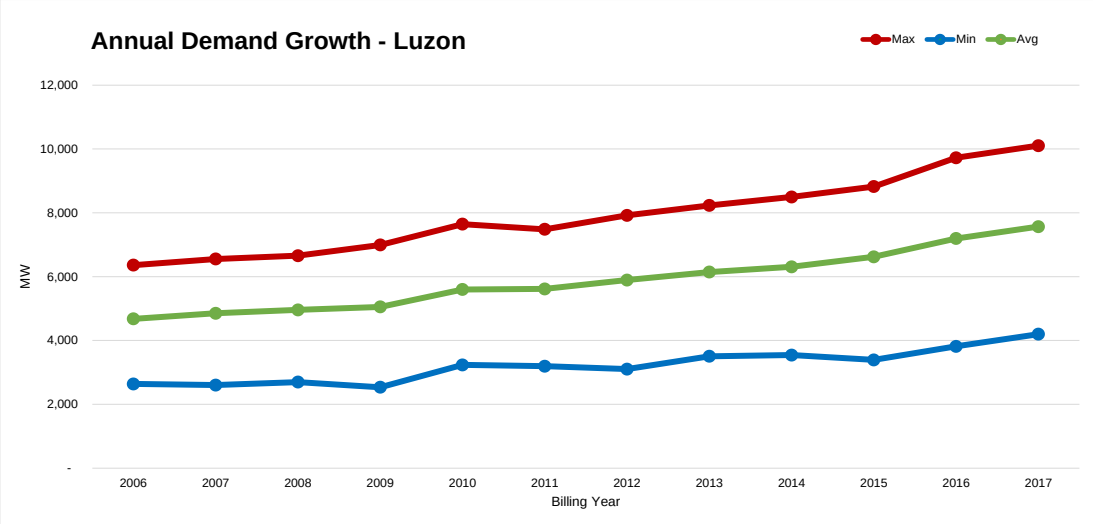


Figure 2. Annual Demand Summary – Visayas[4]

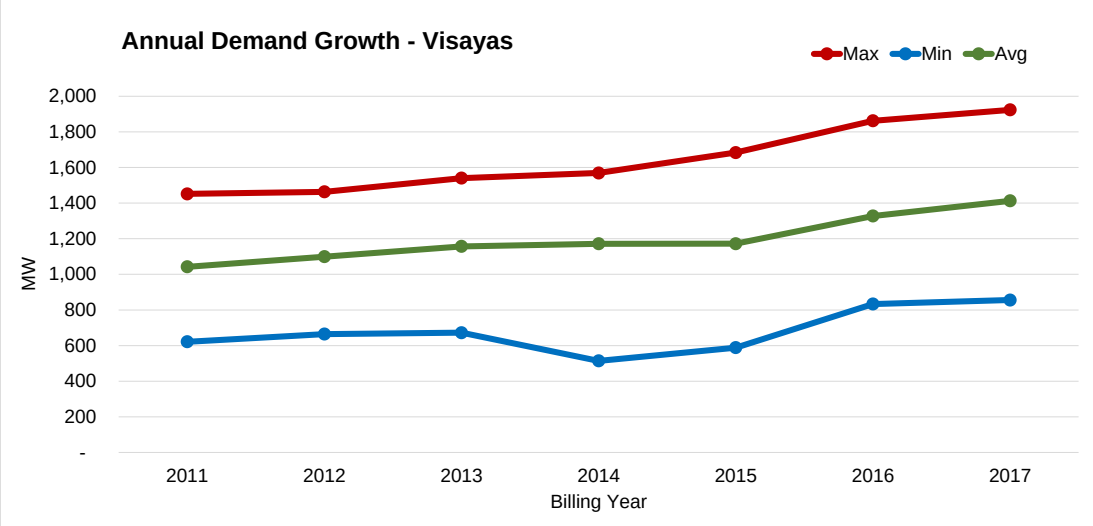


Table 1. Annual Demand Summary – Luzon

	Annual Demand Summary (MW) - Luzon											
	2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Max	6,361	6,553	6,658	6,993	7,644	7,485	7,921	8,232	8,497	8,824	9,725	10,105
Min	2,638	2,603	2,697	2,534	3,236	3,194	3,104	3,506	3,544	3,392	3,817	4,198
Avg	4,678	4,854	4,960	5,053	5,600	5,615	5,895	6,143	6,307	6,623	7,195	7,569

Table 2. Demand Summary – Visayas

	Annual Demand Summary (MW) - Visayas						
	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Max	1,452	1,463	1,540	1,569	1,684	1,862	1,924
Min	621	665	673	514	589	833	856
Avg	1,042	1,099	1,157	1,172	1,172	1,328	1,413

[4] For this Annual Report, hourly demand on 08 November 2013 beginning 0100H was excluded from the calculation of the 2013 annual demand, following the extremely low demand levels that day due to the devastation brought about by super typhoon Yolanda in the region. It can be recalled that the Energy Regulatory Commission (ERC) declared partial market intervention which affected the Visayas from 08 November 2013 at 1500H to 25 March 2014 at 2400H, due to the destruction of the Visayas power system brought about by typhoon Yolanda.

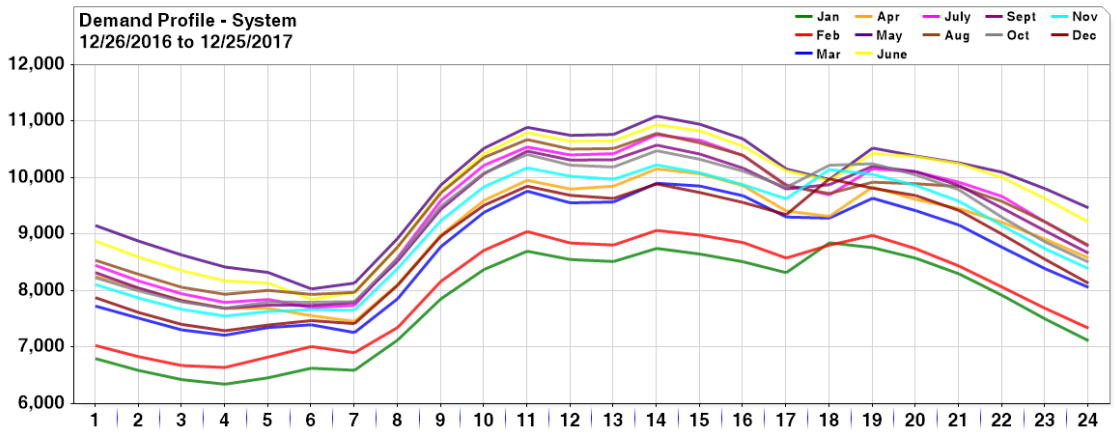
2. Demand Profile[5]

The demand profile for the current year showed that the demand pattern over the course of 24-hours is generally the same across the billing year on any given month.

Figure 3 illustrates the hourly average demand levels system-wide. Higher demand levels were observed during peak hours 1000H to 2100H, while demand levels were lower during off-peak hours 0100H to 0900H and 2200H to 2400H. Demand peaked at 1400H, averaging at 10,172 MW during the year. Meanwhile, morning and evening peak demand were generally observed at 1100H and 1900H, averaging at 10,069 MW and 9,853 MW, respectively. Conversely, low demand levels were posted at 0400H at an average of 7,514MW.

Monthly average demand levels showed that demand was higher during the second quarter, particularly during the summer months of May and June at an average of 9,781 MW and 9,640 MW, respectively. On the other hand, demand was lowest during the cooler months of January and February, averaging at 7,760 MW and 8,018 MW. As above-mentioned, the hourly average demand during the year peaked at 1400H, with the May billing month recording the highest average demand during this hour at 11,092 MW. Meanwhile, May likewise posted the highest average demand during the morning and evening peak at an average of 10,895 MW (1100H) and 10,562 MW (1900H), respectively. This is consistent with the seasonal increase in demand levels during the second quarter, essentially driven by the hot temperatures during the summer months.

Figure 3. Hourly System Demand Profile



The regional demand profile in Luzon as shown in Figure 4 below mirrors the trend system-wide. Demand levels reached its peak at 1400H, averaging at 8,560 MW during the year, while demand levels dipped at 0600H at an average of 6,389 MW. Luzon demand recorded its morning peak at 1100H, averaging at 8,471 MW across the year, while the evening peak demand was posted at 1900H, at an average of 8,227 MW.

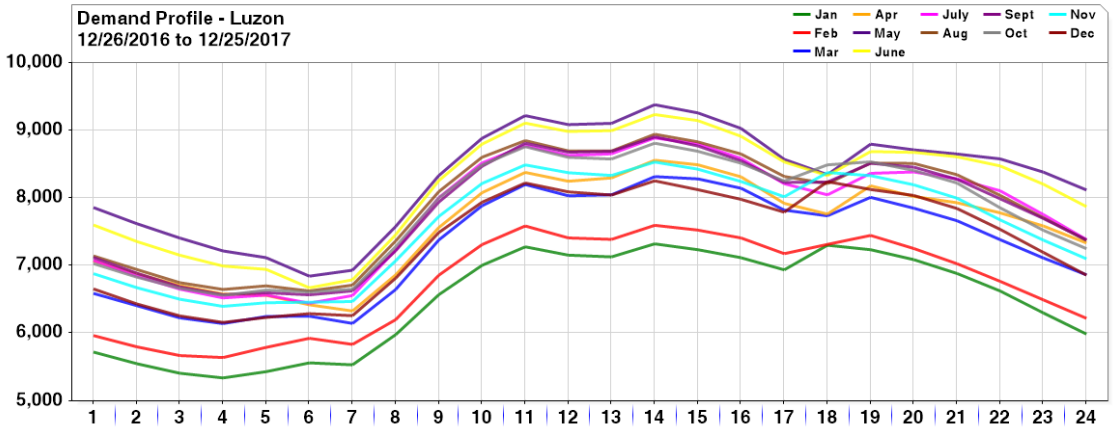
Consistent with the seasonality of demand, the first quarter of the year showed the lowest demand levels with the January and February billing month recording the lowest monthly average demand levels at 6,488 MW and 6,738 MW. Demand started to pick-up during the hot summer months in the second quarter, as the highest average monthly demand levels were posted during the period, particularly in May and June, at an average of 8,292 MW and 8,157 MW, respectively. Accordingly, the highest morning, afternoon and evening average

[5] Demand Profile illustrates monthly variation of average hourly demand over the course of a 24-hour period

demand levels were posted during the May billing month at 9,218 MW (1100H), 9,379 MW (1400H), and 8,796 MW (1900H), respectively.

Meanwhile, it was observed that the Luzon evening peak demand was posted at 1800H during the January, November and December billing months. The same differed from the demand pattern demonstrated from February to October which showed the evening demand peak at 1900H.

Figure 4. Hourly Demand Profile – Luzon



The Visayas demand profile is shown in Figure 5 below. As illustrated, peak hours in the region were from 1800H to 2100H, with demand reaching its highest during the evening peak 1900H at an average of 1,668 MW. This is a marked difference from the peak demand hour in Luzon which was posted at 1400H, indicating that majority of the end-consumers in the Visayas are residential consumers, with higher demand requirement during the evening. The lowest demand level in the region was posted at 0400H, averaging at 1,118 MW across the year.

The monthly demand pattern in the Visayas demonstrates higher demand levels during the summer months of May and June, averaging at 1,488 MW and 1,483 MW, respectively, and lower demand levels in January and February at 1,273 MW and 1,284 MW. Meanwhile, hourly demand levels showed that the highest hourly average peak demand level at 1900H was likewise posted in May and June at 1,731 MW at 1,745 MW, respectively, while the lowest average demand levels were posted in January and February at 1,007 MW and 1,002 MW.

Similar to the observation in Luzon, increase in the Visayas electricity demand was observed as early as 1800H during the last quarter of the year (from October to December), as illustrated in the hourly demand profile on Figure 5. The same pattern was also observed during the January billing month, with demand peaking at 1800H.

Figure 5. Hourly Demand Profile - Visayas

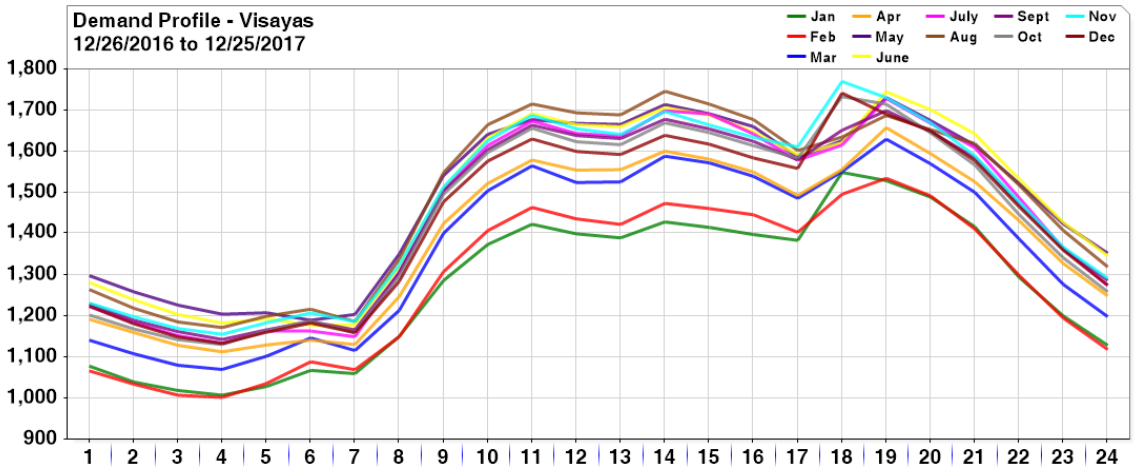


Table 3. Hourly Demand Profile – 2017

	Hourly Average Demand (MW) by Trading Interval (MW) - 2017																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Avg
Sys	8,088	7,845	7,638	7,514	7,579	7,551	7,541	8,231	9,123	9,723	10,069	9,905	9,895	10,172	10,049	9,843	9,482	9,645	9,853	9,693	9,484	9,145	8,767	8,395	8,959
Luz	6,893	6,686	6,507	6,398	6,440	6,389	6,404	6,976	7,685	8,182	8,471	8,331	8,328	8,560	8,463	8,285	7,980	8,032	8,227	8,132	7,977	7,734	7,444	7,145	7,569
Vis	1,200	1,163	1,133	1,118	1,142	1,161	1,146	1,270	1,455	1,559	1,613	1,586	1,580	1,630	1,609	1,578	1,533	1,629	1,668	1,615	1,548	1,439	1,335	1,256	1,413

Table 4. Hourly Demand Profile – 2016

	Hourly Average Demand (MW) by Trading Interval (MW) - 2016																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Avg
Sys	7,684	7,457	7,260	7,129	7,174	7,127	7,111	7,790	8,643	9,220	9,547	9,393	9,402	9,687	9,545	9,352	9,016	9,147	9,454	9,294	9,070	8,740	8,335	7,992	8,522
Luz	6,537	6,346	6,175	6,062	6,090	6,039	6,040	6,609	7,298	7,786	8,064	7,934	7,944	8,174	8,048	7,882	7,590	7,633	7,871	7,757	7,596	7,374	7,062	6,792	7,195
Vis	1,147	1,111	1,084	1,067	1,084	1,088	1,070	1,181	1,345	1,435	1,482	1,458	1,457	1,513	1,497	1,470	1,428	1,513	1,583	1,537	1,474	1,367	1,274	1,199	1,328

3. Load Factor[6]

The system-wide monthly load factor for the current year steadily averaged between a high of 78.8 percent (May) and a low of 73.3 percent (April), providing an indication on the efficiency of energy usage over the course of the billing year.

The load factor in Luzon effectively mirrors the system-wide load factor trend. The monthly load factor in the region was maintained relatively high and closely ranged between 80 percent in May and October, and 74.9 percent during the April billing month. Meanwhile, lower monthly load factors were noted for the Visayas across the year, though these closely ranged between 69 percent (May) and 62 percent (July).

When compared with the previous billing year, improvement in the system-wide and Luzon load factors were observed. The average system-wide load factor in 2016 was slightly lower at 71.4 percent from this year's 72.1 percent. Similarly, the load factor in Luzon averaged at 73 percent this year, higher than last year's 72.4 percent. Conversely, the load factor in the Visayas region recorded a decline at 61.9 percent from the 63.5 percent posted in the previous year.

[6] Load factor is a measure of the degree of uniformity of demand over a period of time, and is determined by dividing the total energy withdrawn by the product of the peak load and total numbers of hours in a particular billing period. For this Annual Report, load factor is computed from the metered quantity.

Figure 6. System Load Factor

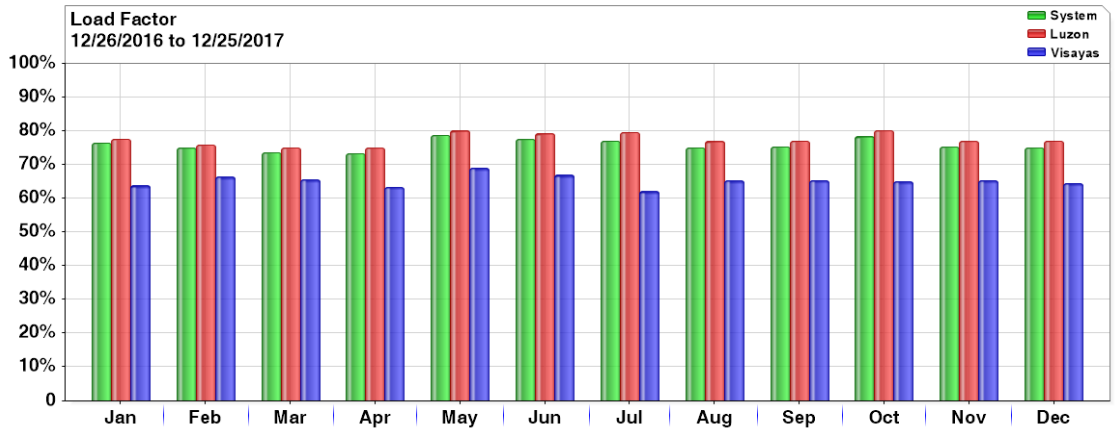


Table 5. Monthly Load Factor – 2017

	Load Factor (%) by Billing Month - 2017												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
System	76.4	74.9	73.6	73.3	78.8	77.5	77.0	75.1	75.3	78.2	75.2	74.9	72.1
Luzon	77.6	75.9	75.0	74.9	79.9	79.1	79.5	76.8	77.0	80.0	76.9	77.0	73.0
Visayas	63.7	66.3	65.5	63.4	69.0	66.8	62.0	65.2	65.3	64.9	65.3	64.4	61.9

Table 6. Monthly Load Factor – 2016

	Load Factor (%) by Billing Month - 2016												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
System	74.5	77.2	76.1	75.6	78.2	78.5	76.1	75.7	77.5	77.6	76.9	76.5	71.4
Luzon	75.2	78.1	77.0	76.3	79.3	79.7	77.3	76.8	79.1	79.4	78.5	78.0	72.4
Visayas	67.9	68.5	68.7	68.8	71.5	71.0	67.3	64.8	66.8	66.7	64.6	64.2	63.5

B. Load Forecast Variation[7]

As shown in Figures 7 and 8 below, majority of the variation between the load forecasts in the ex-ante and the ex-post runs were within +/-1 percent across the billing year.

In Luzon, about 66.4 percent of the load forecast variations ranged between +/-1 percent, 39.1 percent of which were variations within -1 and 0 percent. Variations ranging from -1 and -3 percent were also noted at 23.4 percent. Similarly, the variations ranging within +/-1 percent in the Visayas region were also high at 44.2 percent, while another 27.9 percent was attributed to load forecast variations between -1 and -3 percent.

The null results were noted to be high in the Visayas in July and August at 64.4 percent and 31.2 percent, respectively, due to the ERC's declaration of market suspension in the region during these months. Overall, the null results accounted for 8.4 percent of the total load forecast variations between the ex-ante and the ex-post runs in the Visayas region.

[7] The load forecast variation compares the ex-ante load schedule and the ex-post load, and intends to measure the level of accuracy of the load forecast in the ex-ante from the actual load in the ex-post.

Figure 7. Load Forecast Variation Distribution (Ex-Ante vs. Ex-Post) – Luzon

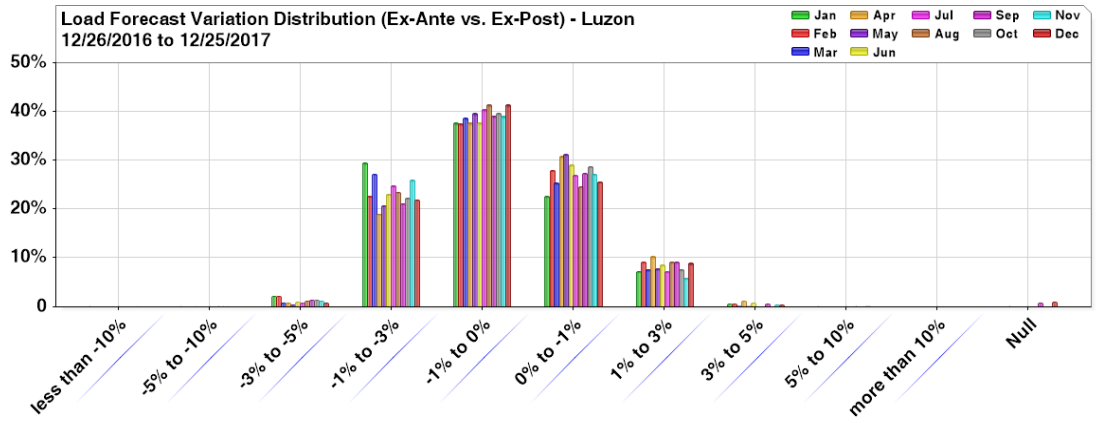


Table 7. Load Forecast Variation Distribution (Ex-Ante vs. Ex-Post) – Luzon

	Load Forecast Variation (%) Distribution (RTD vs. RTX), 2017 - Luzon												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Avg**
less than -10%	0.1										0.1		0.0
-5% to -10%	0.1			0.1					0.1	0.1	0.1		0.1
-3% to -5%	2.2	2.2	0.7	0.8	0.4	0.9	0.7	1.2	1.3	1.4	1.2	0.8	1.2
-1% to -3%	29.4	22.6	27.2	19.0	20.7	23.0	24.7	23.5	21.1	22.2	25.9	21.9	23.4
-1% to 0%	37.6	37.5	38.7	37.6	39.6	37.6	40.4	41.4	39.1	39.7	39.0	41.4	39.1
0% to -1%	22.6	28.0	25.3	30.8	31.3	29.0	26.9	24.6	27.4	28.8	27.2	25.6	27.3
1% to 3%	7.3	9.3	7.6	10.3	7.8	8.6	7.2	9.3	9.3	7.6	5.8	8.9	8.3
3% to 5%	0.5	0.5	0.3	1.2	0.3	0.8			0.7	0.1	0.4	0.4	0.4
5% to 10%	0.1								0.1		0.3		0.0
more than 10%													-
Null			0.1						0.8			1.0	0.2

Note: Results are null if either the ex-ante or the ex-post load forecast is null due to market intervention/suspension or if there was no ex-post run.

Figure 8. Load Forecast Variation Distribution (Ex-Ante vs. Ex-Post) - Visayas

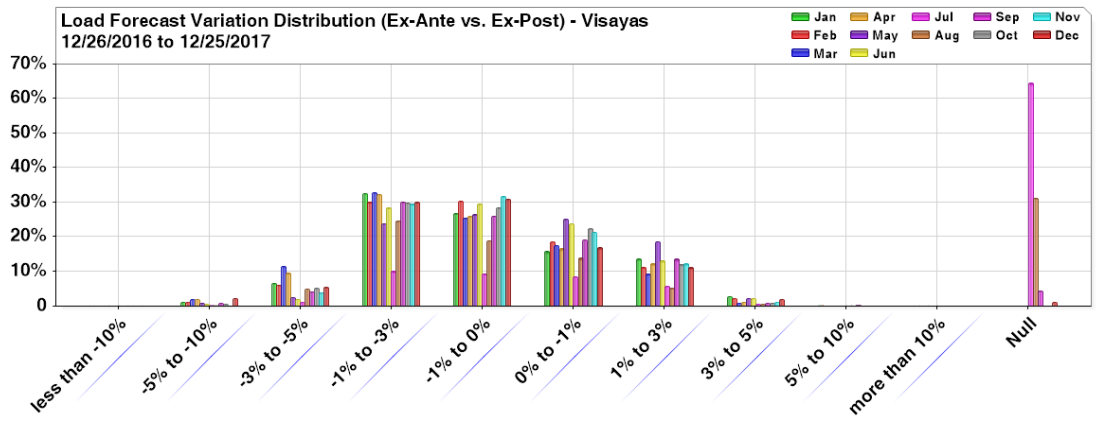


Table 8. Load Forecast Variation Distribution (Ex-Ante vs. Ex-Post) – Visayas

	Load Forecast Variation (%) Distribution (RTD vs. RTX), 2017 - Visayas												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
less than -10%	0.1	0.1	0.3		0.1				0.1	0.1	0.1	0.1	0.1
-5% to -10%	1.1	1.1	1.8	2.0	0.8	0.7	0.4	0.4	0.8	0.6	0.3	2.2	1.0
-3% to -5%	6.6	6.0	11.6	9.5	2.5	2.0	1.0	5.0	4.2	5.1	3.8	5.4	5.2
-1% to -3%	32.7	30.0	32.9	32.4	23.9	28.4	10.0	24.6	30.1	29.9	29.4	30.0	27.9
-1% to 0%	26.7	30.4	25.4	25.9	26.4	29.6	9.3	19.0	26.1	28.5	31.7	31.0	25.9
0% to -1%	15.9	18.5	17.6	16.7	25.1	23.9	8.6	13.8	19.2	22.4	21.4	17.1	18.4
1% to 3%	13.7	11.3	9.2	12.2	18.6	13.2	5.7	5.1	13.6	12.1	12.2	11.1	11.5
3% to 5%	2.8	2.2	0.9	1.1	2.1	2.2	0.6	0.7	0.9	0.8	1.1	1.8	1.4
5% to 10%	0.4	0.3			0.3	0.1		0.3	0.5	0.3		0.3	0.2
more than 10%		0.1	0.1		0.1								0.0
Null							64.4	31.2	4.3	0.3		1.0	8.4

Note: Results are null if either the ex-ante or the ex-post load forecast is null due to market intervention/suspension or if there was no ex-post run.

III. CAPACITY PROFILE

Figure 9 illustrates the growth in the WESM registered capacity throughout the billing year. From 17,479 MW in January, the WESM registered capacity increased by about 7.4 percent to 17,889 MW by the end of 2017. Influencing this growth was the registration of new plants in the market which for the year totaled 1,244 MW. Information on these new plants is detailed through Table 11 below. Changes in the existing capacities were likewise observed, which influenced the corresponding changes in the monthly registered capacity level. Expansion of capacities were noted, further augmenting the continued growth of the WESM registered capacity across the year.

Of the total registered capacity, about 64.7 percent was offered in the market[8], averaging at 11,581 MW. Noticeable dip in the monthly average offered capacity level was noted in February at an average of only 10,466 MW, the lowest recorded during the year. Meanwhile, offered capacity was noticeably higher in June at 12,051 MW.

On the other hand, preferential[9] and non-scheduled capacities averaged 1,389 MW, comprising about 7.8 percent of the total registered capacity. Further, an average of 600 MW or about 3.1 percent of the registered capacity was attributed to the capacity designation of Malaya TPP as Must Run Unit (MRU), in cases of supply shortfall and to address system security. Finally, an average of 83 MW was scheduled by the System Operator as ancillary services to provide contingency and dispatchable reserves in the Visayas region. It should be noted that following the implementation of central scheduling and dispatch of energy and contracted reserves in Luzon beginning 22 December 2015, and in the Visayas beginning 07 October 2017, ancillary services schedules in both regions have been included as part of the offered capacity in the market.

Unavailable capacities were observed consistently across the year, on account of outage capacity and capacity not offered. Outage capacity accounted for about 13.1 percent of the total WESM registered capacity, averaging at 2,321 MW, while another 11 percent was attributed to capacity not offered, which averaged at 1,967 MW this year. High outage capacity was noted in February and October, at an average of 3,145 MW and 2,868 MW, respectively. Meanwhile, capacity not offered was relatively higher in December at 2,440 MW. Capacity not offered in the market includes the registered capacities of scheduled generators which underwent commissioning tests during the year.

[8] Following the implementation of central scheduling and dispatch of energy and contracted reserves in Luzon beginning 22 December 2015, and in the Visayas beginning 07 October 2017, ancillary services schedules in both regions have been included as part of the offered capacity in the market.
[9] Preferential capacity refers to the combined registered capacities of priority dispatch and must dispatch generating units.

The noticeable gap in Figure 9 below shows the market intervention and market suspension events which were recorded during the year. It is to be recalled that the Energy Regulatory Commission (ERC) declared market suspension in the Visayas from 06 July (1700H) to 01 August (1600H) due to the intensity scale 5 earthquake in the region. Meanwhile, market intervention events were likewise observed during the year, most notable of which were the market intervention events due to generation deficiency in the Visayas. This affected a total of 72 trading intervals in August, and another 22 intervals in September.

Figure 9. Capacity Profile

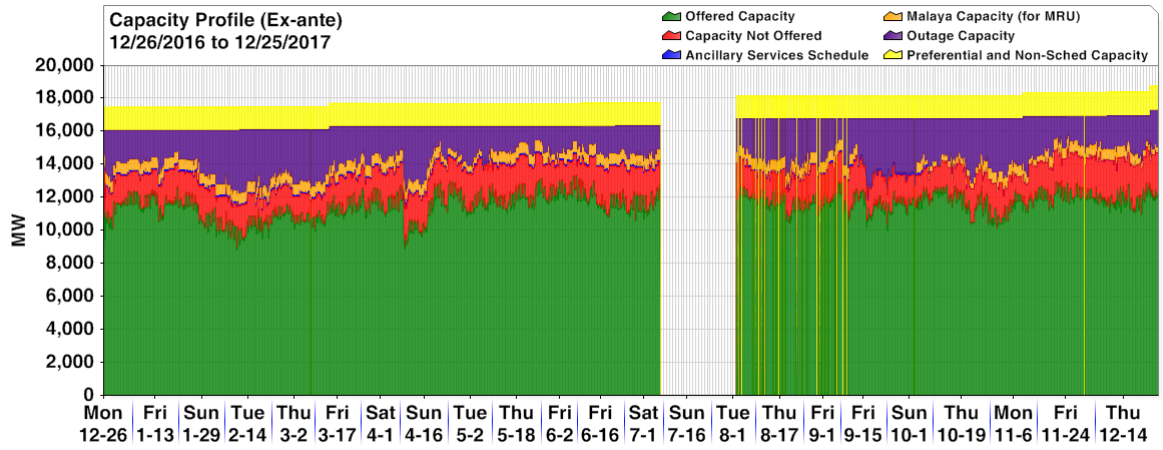


Table 9. Capacity Profile – System

	Capacity Profile (Average MW), 2017 - System													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg	% of Reg Cap
Registered Capacity (End of Month)	17,479	17,513	17,709	17,703	17,704	17,748	17,748	18,163	18,175	18,183	18,377	18,764	17,889	
Offered Capacity	11,591	10,466	11,121	11,329	11,890	12,051	11,699	11,772	11,640	11,861	11,694	11,986	11,581	64.7
Preferential and Non-Sched Capacity	1,381	1,381	1,382	1,380	1,377	1,377	1,377	1,380	1,387	1,395	1,407	1,431	1,389	7.8
Ancillary Services Schedule	91	89	88	87	86	89	82	45	65	115			83	0.4
Malaya Capacity (for MRU)	650	650	650	610	535	602	650	650	636	389	590	579	600	3.1
Outage Capacity	1,961	3,145	2,745	2,268	1,665	1,561	2,019	2,385	2,670	2,868	2,589	1,996	2,321	13.1
Capacity Not Offered	1,798	1,763	1,612	2,025	2,187	2,034	2,089	1,878	2,030	1,743	1,993	2,440	1,967	11.0

Capacity Mix

With the end in view of reducing the country's dependence on fossil fuels, efforts have been made to encourage and increase the use of renewable energy, as evident in the number of laws enacted in recent years. However, 2017's capacity mix showed that coal plants continued to dominate, accounting for 37.2 percent of the total registered capacity in the WESM. Following distantly were natural gas plants at 18.4 percent, hydro plants at 14 percent and oil-based plants at 13 percent. Meanwhile, geothermal plants contributed 9.9 percent of the capacity mix. Preferential dispatch plants – biomass, solar and wind plants – accounted for only 7.5 percent of the capacity mix.

Among all resource types, only coal plants had shown considerable growth over the course of the year. With the entry of the third unit of Pagbilao plant (436 MW), coals plants' share in the capacity mix increased to 38 percent in August from 36 percent in July. By the end of 2017, coal plants' share stood at 38.5 percent with the entry of 2 x 176 MW Therma Visayas plant.

Unlike the previous year when the market has seen an influx of solar plants, no new solar plant registered this year. Solar plants' share in the capacity mix remained at 4 percent.

Figure 10. Capacity Mix – System

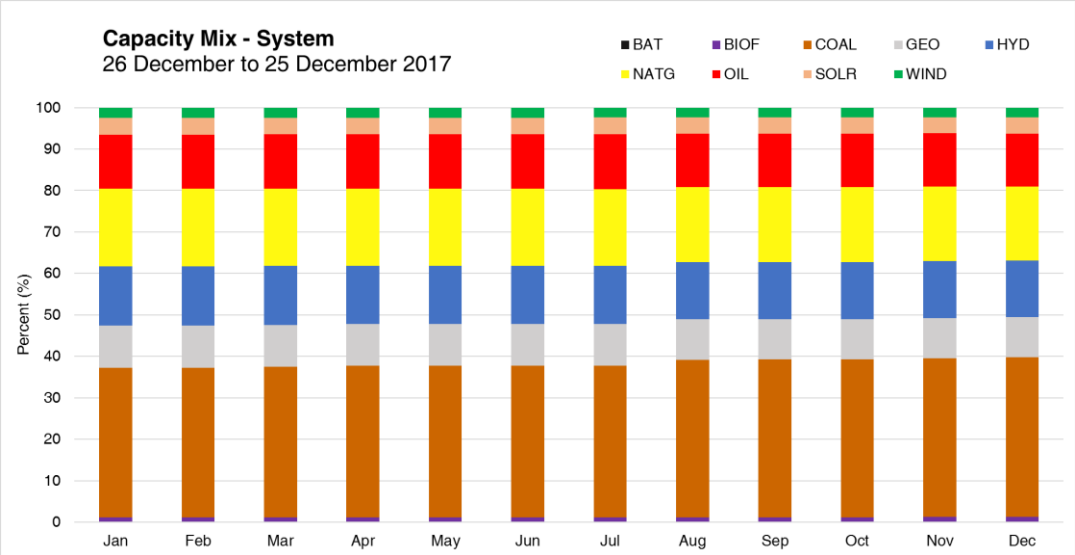


Table 10. Capacity Mix – System

	Capacity Mix (%) based on Registered Capacity - System, 2017												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
BAT	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
BIOF	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.2	1.1
COAL	36.1	36.1	36.3	36.6	36.6	36.6	36.6	38.0	38.1	38.1	38.3	38.5	37.2
GEO	10.2	10.1	10.1	10.0	10.0	10.0	10.0	9.8	9.8	9.8	9.7	9.7	9.9
HYD	14.3	14.3	14.2	14.1	14.1	14.1	14.1	13.8	13.7	13.7	13.7	13.6	14.0
NATG	18.8	18.8	18.7	18.6	18.6	18.6	18.5	18.1	18.1	18.1	18.0	17.8	18.4
OIL	13.0	13.0	13.1	13.1	13.1	13.2	13.2	12.9	12.9	12.9	12.8	12.9	13.0
SOLR	4.1	4.1	4.0	4.0	4.0	4.0	4.0	3.9	3.9	3.9	3.9	3.9	4.0
WIND	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.3	2.3	2.3	2.3	2.4

Table 11. New Power Plants

New Power Plants - 2017					
Region	Plant Type	Market Participant Name	Node ID	Registration Effectivity Date	Registered Capacity (MW)
Luzon	Coal	SMC Consolidated Power Corporation	1SMC_G02	14-Mar-17	150.0
Luzon	Oil-Based	Southwest Luzon Power Generation Corporation**	3SLPGC_G03	14-Mar-17	23.0
			3SLPGC_G04		23.0
Luzon	Coal	Pagbilao Energy Corporation	3PAGBIL_G03	27-Jul-17	436.0
Luzon	Biomass	Asian Carbon Neutral Power Corp.	1ACNPC_G01	27-Jul-17	3.2
Luzon	Biomass	San Jose City I Power Corporation	1IPOWER_G02	8-Sep-17	12.0
Luzon	Hydro	SN Aboitiz Power - Magat, Inc.	1MARIS_U01	14-Oct-17	3.8
			1MARIS_U02		3.8
Luzon	Coal	SMC Consolidated Power Corporation	1SMC_G03	9-Nov-17	150.0
Sub-total - Luzon					**804.8**
Visayas	Oil-Based	Central Negros Power Reliability, Inc.	6CENPRI_U04	1-Feb-17	6.4
Visayas	Oil-Based	PHINMA Energy Corporation	5PHNPB3_G01*	9-Jun-17	24.0
Visayas	Biomass	Hawaiian-Philippine Company**	6HPCO_G02	14-Nov-17	18.6
Visayas	Oil-Based	SPC Power Corporation	7TAPAL_PB4*	24-Nov-17	26.0
Luzon	Geothermal	Maibarara Geothermal, Inc.	3MGI_G02	8-Dec-17	12.0
Visayas	Coal	Therma Visayas, Inc.	5THVI_U01	23-Dec-17	176.2
			5THVI_U02		176.2
Sub-total - Visayas					**439.4**
Grand Total					**1,244.2**

* Acquired from the National Power Corporation as PB 102 (8STBAR_PB2) and PB 103 (8PANIT_PB), respectively. NPC ceased WESM membership effective 25 September 2016

**Capacities are used for modelling purposes only. These are subject to change upon submission of the ERC Certification of plant specifications based on ERC's ocular technical inspection.

IV. DEMAND AND SUPPLY

A. Demand[10] and Supply[11] Situation

Annual Trend

The system-wide annual demand and supply followed an increasing trend over the years, from the year 2011 with the integration of the Visayas in the WESM.

Demand grew by 5 percent from 6,658 MW in 2011 to 6,994 MW in 2012 and grew consistently further in the next succeeding years. The highest demand growth was recorded in 2016, when the annual average demand grew by 9.3 percent from 7,795 MW in 2015 to 8,522 MW. Robust economic growth during the year 2016 was a major influence in the higher rate of demand increase that year. Demand continued to grow in 2017 by 5.1 percent, averaging at 8,959 MW. The hourly system-wide demand reached its peak at 11,886 MW on 30 May 2017 at 1400H.

It is noted that beginning 22 December 2015, the central scheduling and dispatch of energy and contracted reserves in Luzon was implemented in the WESM. Henceforth, the level that the supply has to fill up is higher as it also has to sufficiently meet the hourly reserve schedule in the Luzon region. Consequently, the demand plus reserve schedule averaged at 9,262 MW in 2016. On the other hand, the central scheduling and dispatch of energy and reserves in the Visayas started on 07 October 2017. The demand plus reserve schedule in 2017 likewise increased, averaging at 9,803 MW.

Similar to the system-wide demand trend, effective supply levels also recorded yearly increases from year 2011. The annual effective supply averaged at 8,281 MW in 2011, recording a minimal increase of 0.7 percent in 2012, and a further 5.6 percent in 2013 to an average of 8,806 MW, which continued to increase in the years that followed. The highest year-on-year increase in terms of effective supply was posted in 2016 at 18.4 percent, from an average of 9,189 MW in 2015 to 10,880 MW. Lower outage capacity influenced the significant increase in the annual effective supply level for 2016. In addition, significant entry of additional/new capacity which totaled 1,506.9 MW was posted in 2016. Of this, about 40 percent were solar facilities which were then vying for accreditation under the Feed-in-Tariff (FIT) program. Effective supply increased by another 7.1 percent in 2017 at 11,652 MW. The hourly effective supply peaked at 13,927 MW on 21 April at 1000H.

As shown in Figure 11 below, the margin between demand and supply was noticeably wider during the holiday season in the December and January billing months. The supply margin[12] was most wide on 23 December 2017 at 0100H, reaching as wide as 4,800 MW. On the other hand, negative supply margin was observed in over 450 trading intervals, most of which were noted during the summer months of April to June, when the demand is seasonally high.

Note the ERC's suspension of the Visayas market from 08 November 2013 at 1500H to 25 March 2014 at 2400H due to the destruction of the Visayas power system brought about by the passage of typhoon Yolanda. Hence, the supply and demand data as presented in this section excluded these dates.

[10] 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).

[11] System demand is equal to the total scheduled MW of all load resources in Luzon and Visayas plus losses.

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

Figure 11. Demand and Supply – System, 2011-2017

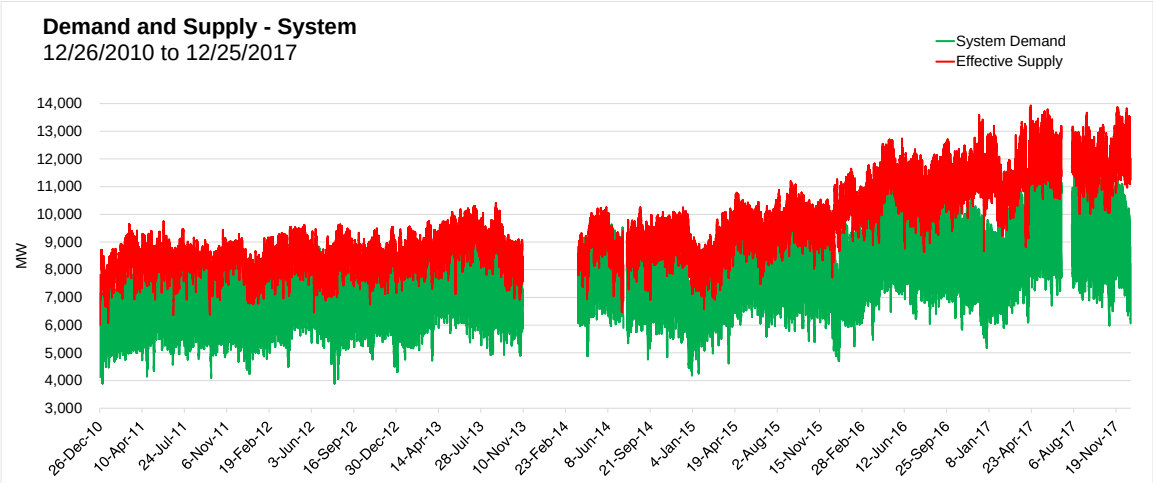


Table 12. Demand and Supply, Annual Trend – System

	Annual Trend in Demand and Supply (Avg MW), System						
	2011	2012	2013	2014	2015	2016	2017
Demand	6,658	6,994	7,311	7,679	7,795	8,522	8,959
Demand + R/S					7,804	9,262	9,803
Effective Supply	8,281	8,335	8,806	8,934	9,189	10,880	11,652
Margin	1,623	1,342	1,495	1,255	1,385	1,619	1,849

Monthly Trend

Increasing demand trend was observed during the year, coming from a low of 7,760 MW in January and 8,018 MW in February, the months marked by cooler temperatures, to a high of 9,781 MW during the summer month of May. Starting from the June billing month however, demand declined to 9,640 MW. Demand further dropped to 9,353 MW come July, that then steadily decreased until year-end. The December billing month posted its average monthly demand level at 8,802 MW, one of the lowest monthly average demand level in 2017.

Meanwhile, reserve schedule averaged 844 MW this year, an increase from the 740 MW posted in the previous year. Consequently, demand plus reserve schedule[13] rose by 5.8 percent to an average of 9,803 MW in the current year from the 9,262 MW recorded in 2016. Demand peaked on 30 May at 1400H at 11,886 MW, while the highest demand plus reserve schedule during the year was posted at 12,752 MW on 19 May at 1400H.

Shown in Figure 12 were the noticeable dips in the demand throughout the year. Demand was particularly lower during the first week of the billing year, brought about by the onslaught of Typhoon Nina beginning 25 December 2016 in the Southern Luzon region and the observance of non-working holidays from 26 December 2016 to 2 January 2017. Increasing demand requirement was evident henceforth, particularly from the onset of the summer season on April 5 as declared by PAG-ASA. Notwithstanding, the period 13 to 16 April posted low demand levels related to the observance of the Holy Week. This was noticeably illustrated in Figure 12 below. Drop in the level of demand was likewise noted during the observance of All Saints Day and All Souls Day on 01 and 02 November, respectively, as well as during the last week of the billing year attributable to the Christmas holidays.

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

On the other hand, effective supply recorded a dip in its monthly average level during the February billing month, from 11,534 MW in January to 10,599 MW, the lowest effective supply level during the year. This followed the high outage capacity which was recorded in February, driven by the high outage capacity of major coal plants. On top of this, outages relative to the maintenance shutdown of the Malampaya onshore natural gas complex on 28 January until 16 February 2017 were also noted. Supply levels increased to 11,077 MW in March and rose progressively until May, reaching a high of 12,075 MW as outage capacity decreased. It is significant to mention the noticeable drop in effective supply from 8 to 16 April due to the simultaneous outages of major plants following the series of earthquakes in Batangas. Notwithstanding, sustained decreases in the level of outage capacity was noted from April to May, and May to June, attributable to the return to normal operation of major natural gas and coal plants, which were affected by the series of earthquakes in Batangas that occurred from 8 to 16 April. This decline in outage capacity did not translate to higher supply in June as supply slightly declined to an average of 12,021 MW, influenced by the increase in the outage capacity of large generating coal plants during the last two weeks of June. Effective supply further dropped to an average of 11,715 MW in July before increasing slightly to 11,817 MW in August and declining to an average of 11,692 MW in September.

In the next succeeding months, effective supply retained its average monthly level, closely ranging between 11,786 MW in October and 11,743 MW in November. Come December, monthly effective supply levels surged to 12,298 MW, the highest recorded during the year. Hourly effective supply was at its highest on 21 April at 1000H, at 13,927 MW while the lowest was posted at 8,682 MW on 26 December 2016 at 1100H.

Sufficient margin between supply and demand generally prevailed during the twelve-month period, demonstrated by the average supply margin at 1,849 MW. Notwithstanding, narrow supply margin was still observed during periods of tight demand and supply conditions, with 17 trading intervals recording supply margin levels at below 100 MW. The lowest average monthly supply margins were posted in May at 1,506 MW and in March at 1,508 MW, both driven by the higher demand growth rate than the recorded supply increases during these months. Supply margin was also relatively low in June, averaging at 1,553 MW attributable to the decline in the level of effective supply during the month. Meanwhile, demand though slightly decreasing, was still considered relatively high, having recorded the second highest monthly average demand requirement for the year.

Year-on-year comparison showed that demand averaged 8,959 MW, posting a modest increase of 5.1 percent from last year's 8,522 MW, while demand plus reserve schedule rose by 5.8 percent to an average of 9,803 MW from the 9,262 MW in 2016. On the other hand, supply increased by 7.1 percent from 10,880MW to 11,652 MW. Consequently, supply margin increased by 14.2 percent from 1,619 MW in the previous year to 1,849 MW this year.

As above mentioned, the market intervention and market suspension events during the year marked the gaps in the demand and supply chart in Figure 12 below.

Figure 12. Demand and Effective Supply – System

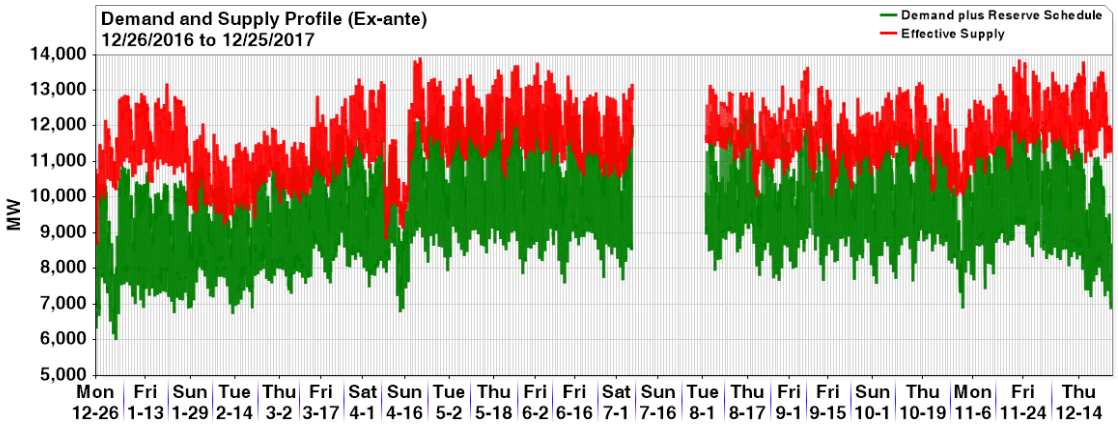


Table 13. Demand and Supply Summary – System, 2017

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
Demand	7,760	8,018	8,673	8,970	9,781	9,640	9,353	9,343	9,251	9,242	9,066	8,802	8,959
Reserve Schedule	932	906	896	768	788	828	757	724	732	840	926	937	844
Demand + R/S	8,692	8,924	9,569	9,739	10,569	10,468	10,109	10,067	9,983	10,082	9,993	9,739	9,803
Effective Supply	11,534	10,599	11,077	11,548	12,075	12,021	11,715	11,817	11,692	11,786	11,743	12,298	11,652
Margin	2,842	1,675	1,508	1,809	1,506	1,553	1,606	1,750	1,709	1,704	1,750	2,558	1,849

Table 14. Demand and Supply Summary – System, 2016

	Demand and Supply (MW), 2016 - System												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Avg**
Demand	7,406	7,729	8,185	8,863	9,361	9,148	8,803	8,709	8,729	8,645	8,421	8,278	8,522
Reserve Schedule	801	889	802	700	736	784	622	514	697	674	791	868	740
Demand + R/S	8,207	8,618	8,987	9,563	10,098	9,932	9,425	9,223	9,426	9,318	9,212	9,146	9,262
Effective Supply	10,179	10,465	10,414	10,844	11,476	10,898	10,785	10,424	11,004	11,117	11,296	11,667	10,880
Margin	1,972	1,847	1,427	1,294	1,378	966	1,360	1,202	1,578	1,799	2,084	2,521	1,619

Reflective of the trend system-wide, the demand and supply in Luzon also demonstrated year-on-year increases. Demand grew by 5.2 percent from last year's 7,195 MW to 7,569 MW while higher reserve schedule was also observed at an average of 817 MW this year from 740 MW in the previous year. As a result, the demand plus reserve schedule averaged at 8,386 MW in the current year, higher by 5.7 percent from 7,935 MW in 2016. Meanwhile, the effective supply in Luzon also increased by 5.6 percent to an average of 9,736 MW from last year's 9,220 MW. Accordingly, the average supply margin for the year was posted at 1,351 MW, wider by 5 percent from the 1,287 MW in the previous year. Figure 13 below shows that while the average supply margin in Luzon was generally wide, tight supply margins were still observed across the year.

Monthly demand levels in Luzon showed that demand was low at the beginning of the year, averaging at 6,488 MW and 6,734 MW in January and February, respectively. Demand then went on an increasing trend, reaching its peak in May at an average of 8,292 MW before declining to 8,157 MW in June and 7,803 MW in July. For the next succeeding months until year-end, monthly demand levels remained low, steadily ranging between 7,886 MW in August to 7,365MW in December.

Demand plus reserve schedule followed the demand trend and posted its highest monthly averages during the summer months of May and June at 9,080 MW and 8,986 MW, respectively. Conversely, January and February recorded the lowest monthly averages at 7,419 MW and 7,640 MW, respectively.

Effective supply in Luzon was also low during the first few months of the year. The lowest monthly average supply levels were posted in February at 8,757 MW and March at 9,038 MW, attributable to the high outage capacity in the region during these months. As above-noted, sudden drop in the Luzon supply curve was also observed from 8 to 16 April due to the simultaneous outages of major plants related to the series of earthquakes in Batangas. Nevertheless, effective supply levels increased towards the summer months and were at their highest in May and June at 10,164 MW and 10,065 MW, respectively. The December billing month likewise posted a relatively high effective supply level at 10,296 MW. These months recorded the lowest monthly average outage capacities during the year.

Consequently, supply margin levels reached its lowest in March at 835 MW, attributable to the increasing demand that corresponded with declining supply levels during the month. Despite the increase in available supply, supply margin levels were also narrow in May and June at an average of 1,083 MW and 1,080 MW, driven by the seasonal high demand during the summer months. On the other hand, supply margin levels were widest in January and December at 2,278 MW and 2,088 MW, respectively, essentially due to the low demand and high effective supply levels during these months.

The supply level in Luzon was augmented by the exchange of power between the Luzon and Visayas through the HVDC Link. Similar to previous years, the power flow was directed towards Luzon majority of the time, mostly during off-peak hours. However, as shown in Figure 13 below, the HVDC was unavailable for several trading intervals during the year, the most notable of which was due to the earthquake in the Visayas, which affected 1,520 trading intervals from 06 July (1700H) to 07 September (2200H). Summary of the import-export of power through the HVDC will be discussed in the next section of this Report.

Figure 13. Demand and Effective Supply – Luzon

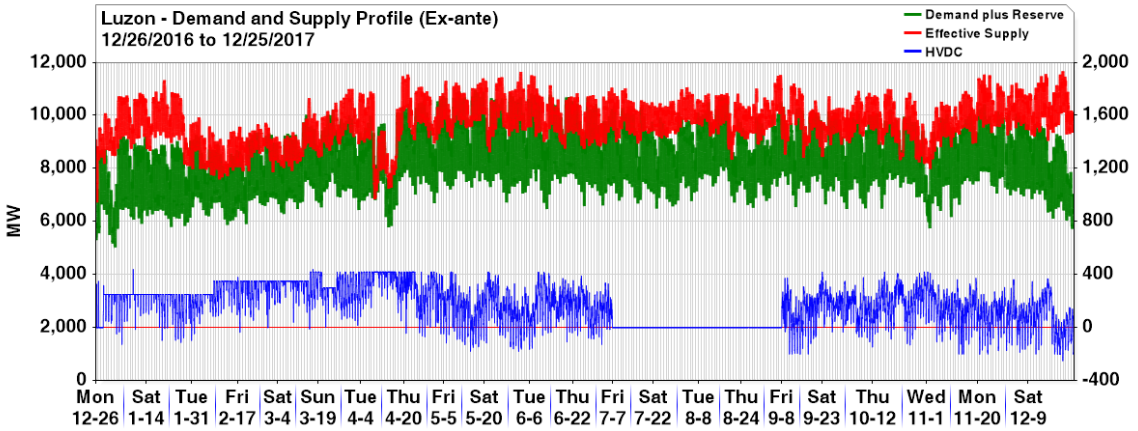


Table 15. Demand and Supply Summary – Luzon, 2017

	Demand and Supply (MW), 2017 - Luzon												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
Demand	6,488	6,734	7,307	7,577	8,292	8,157	7,803	7,886	7,821	7,801	7,597	7,365	7,569
Reserve Schedule	932	906	896	768	788	828	792	716	730	780	829	843	817
Demand + R/S	7,419	7,640	8,203	8,346	9,080	8,986	8,596	8,602	8,551	8,582	8,425	8,208	8,386
Effective Supply	9,697	8,757	9,038	9,488	10,164	10,065	9,895	10,011	9,869	9,801	9,731	10,296	9,736
Margin	2,278	1,117	835	1,143	1,083	1,080	1,299	1,409	1,317	1,219	1,306	2,088	1,351

Table 16. Demand and Supply Summary – Luzon, 2016

	Demand and Supply (MW), 2016 - Luzon												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
Demand	6,224	6,540	6,938	7,505	7,911	7,763	7,443	7,372	7,349	7,288	7,089	6,924	7,195
Reserve Schedule	801	889	802	700	736	784	622	514	697	674	791	868	740
Demand + R/S	7,025	7,430	7,740	8,206	8,647	8,547	8,065	7,886	8,046	7,962	7,880	7,792	7,935
Effective Supply	8,727	9,012	8,884	9,222	9,766	9,281	9,039	8,716	9,246	9,376	9,576	9,801	9,220
Margin	1,702	1,583	1,144	1,028	1,119	735	974	830	1,200	1,414	1,696	2,009	1,287

The Visayas region likewise exhibited increases in its demand and supply. For the current year, demand grew by 6.4 percent from 1,328 MW in 2016 to 1,413 MW. Effective supply also recorded an increase by 16.8 percent, from last year's 1,660 MW to 1,939 MW. Consequently, the margin between supply and demand significantly widened by 51.4 percent from an average of 333 MW to 504 MW this year. Shown in Figure 14 below is the interaction between demand and supply in the Visayas, which demonstrates the wide supply margin that generally prevailed in the region all throughout the 2017 billing year.

Monthly trend in the demand showed lower demand levels at the onset of the billing year, recording the lowest monthly average demand requirement in January and February at 1,273 MW and 1,284 MW, respectively. Demand levels grew until the summer months, reaching its monthly peak in May at 1,488 MW before slightly decreasing to 1,483 MW in June. Demand continued to decrease until the October billing month at 1,443 MW, before posting notable increases in November and December at 1,470 MW and 1,437 MW, respectively. It is noted that the central scheduling and dispatch of energy and contracted reserves in the Visayas was implemented beginning 07 October 2017, which raised the level that the supply has to fill up since it also has to sufficiently meet the hourly reserve schedule. Consequently, the demand plus reserve schedule from October, November and December averaged at 1,503 MW, 1,568 MW and 1,531 MW, respectively.

Effective supply levels followed the demand curve and started the year with low monthly averages posted at 1,838 MW (January) and 1,842 MW (February). Effective supply levels increased notably in March and April at 2,040 MW and 2,060 MW, respectively, the highest monthly average supply levels across the year. Decline in the supply was then recorded beginning May at 1,911 MW, which slightly increased to 1,956 MW in June.

Supply levels dipped from July to September, and recorded the lowest monthly average supply levels at 1,834 MW during the September billing month. Nevertheless, higher supply levels were recorded from October to December, influenced by the higher level of available capacity during these months. Note that the ERC declared market suspension in the Visayas on 06 July at 1700H following the power system disturbance due to the intensity 5 earthquake in the region on the same day. The Visayas market remained suspended until 01 August at 1600H, while Luzon continued with its market operations during this period.

Resultantly, wide supply margin was demonstrated in the Visayas from January to April, considering the low demand levels in January and February, and the higher effective supply levels in March and April. The margin between supply and demand was narrowest in May at 423 MW, driven by the significant growth in demand during the period, and in August and September, both at 388 MW. The drop in the effective supply levels during these months was attributable to the high outage capacity of the geothermal plants that were affected by the intensity 5 earthquake in the region.

As shown in Figure 14 below, the unavailability of the HVDC Interconnection from 06 July (1700H) to 07 September (2200H), also due to the intensity 5 earthquake in the region,

prevented the exchange of power between the Luzon and Visayas and likewise influenced the tight supply margins that prevailed in the Visayas during the period.

Also, it is significant to note that the ERC suspended the operations of the WESM in the Visayas starting 1700H of 06 July 2017 until 1600H of 01 August 2017, due to the disturbance to the network brought about by the intensity scale 5 earthquake in the region. This affected a total of 464 trading intervals in July and 160 trading intervals in August. A significant number of market intervention events were likewise noted right after the ERC declared market resumption in the region starting 1700H of 01 August. The NGCP-System Operator (SO) initiated market intervention in the Visayas due to generation deficiency from 01 August which continued on until the 07 September, affecting a total 72 trading intervals in August and 28 intervals in September. These were shown in the gaps on the supply and demand curve in Figure 14 below.

Figure 14. Demand and Effective Supply – Visayas

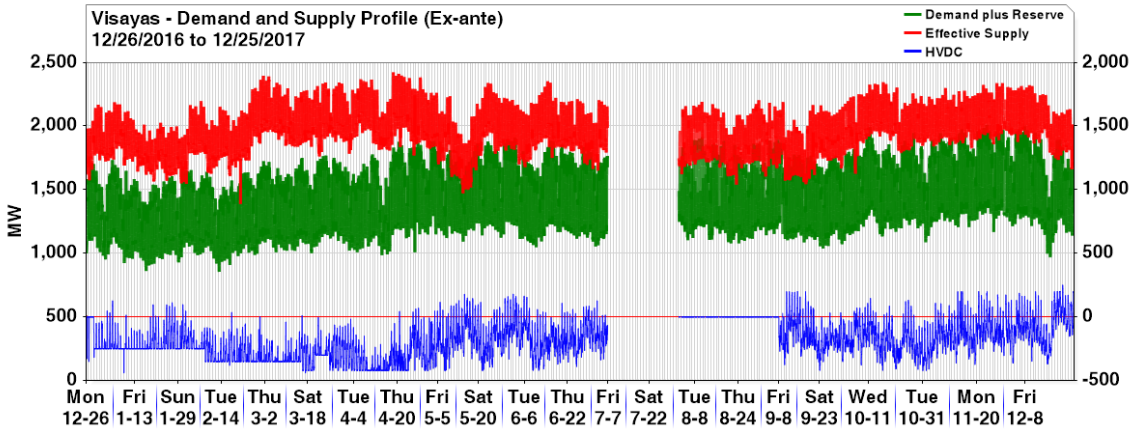


Table 17. Demand and Supply Summary – Visayas, 2017

	Demand and Supply (MW), 2017 - Visayas												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
Demand	1,273	1,284	1,366	1,393	1,488	1,483	1,451	1,464	1,446	1,443	1,470	1,437	1,413
Reserve Schedule	-	-	-	-	-	-	-	-	-	60	98	94	23
Demand + R/S	1,273	1,284	1,366	1,393	1,488	1,483	1,451	1,464	1,446	1,503	1,568	1,531	1,436
Effective Supply	1,838	1,842	2,040	2,060	1,911	1,956	1,898	1,852	1,834	1,985	2,011	2,002	1,939
Margin	565	558	674	666	423	473	447	388	388	482	444	471	504

Table 18. Demand and Supply Summary – Visayas, 2016

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
Demand	1,182	1,189	1,247	1,357	1,451	1,385	1,360	1,339	1,381	1,356	1,333	1,354	1,328
Effective Supply	1,452	1,453	1,530	1,622	1,710	1,616	1,746	1,711	1,758	1,742	1,720	1,866	1,660
Margin	270	264	283	267	259	231	386	372	377	385	387	511	333

B. HVDC Scheduling

As above mentioned, the Luzon and Visayas regions were able to import and export power through the Leyte-Luzon High Voltage Direct Current (HVDC) Link. The Visayas plants exported cheaper energy to Luzon by as much as 440 MW, particularly during off-peak hours, while the Luzon plants exported energy to Visayas by as much as 250 MW, mostly during the evening peak hours.

The HVDC power flow was predominantly directed towards Luzon, accounting for 6,517 trading intervals during the ex-ante, or 74.4 percent of the time during the year, while 7.3

percent or 638 trading intervals was attributed to the power flow from Luzon to Visayas. The remaining 7.3 percent (1,605 trading intervals) corresponded to the HVDC unavailability throughout the period, which in turn resulted in the regional price separation between the Luzon and Visayas. HVDC unavailability from 26-28 December 2016 was on account of the preventive outage related to the passage of Typhoon Nina in the Bicol region, which affected 64 trading intervals, while HVDC unavailability from 06 July (1700H) to 07 September (2200H) was due to the earthquake in the Visayas and affected another 1,520 intervals.

The HVDC power flow going to Luzon was maximized for a total of 1,494 trading intervals in the ex-ante (23 percent of the time with flow directed towards Luzon), while the power flow going to Visayas was maximized in 30 trading intervals (5 percent of the total intervals with flow directed towards Visayas). This resulted in the regional separation of prices during the affected intervals. Higher incidence of maximization of the HVDC power flow directed towards Luzon was observed from January to April, attributable to the wide supply margin which prevailed in the Visayas during these months, which effectively pushed the power flow from the Visayas to Luzon. Meanwhile, the HVDC unavailability from 06 July (1700H) to 07 September (2200H) likewise affected a significant number of trading intervals during the period. As already mentioned, both events triggered regional price separation between the Luzon and Visayas. *(see: section on regional market prices)*.

Figure 15. Result of HVDC Scheduling – 2017

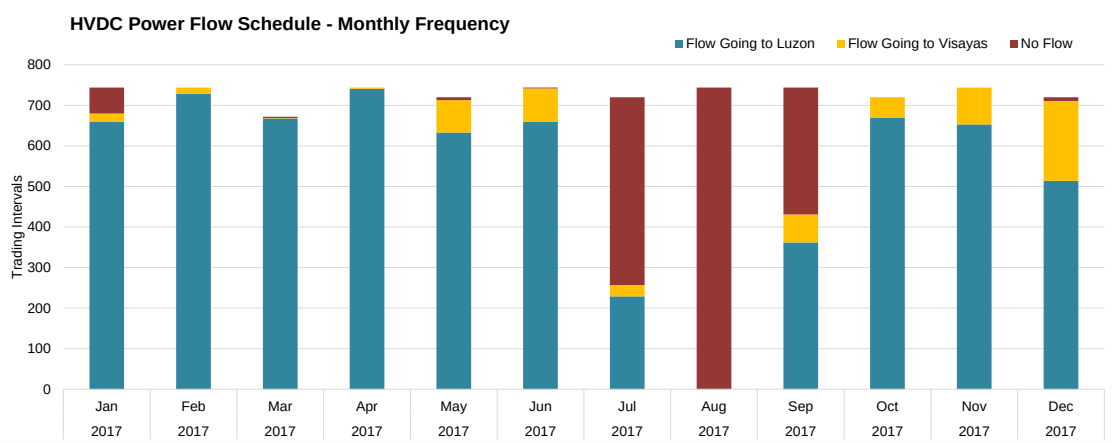


Table 19. Result of HVDC Scheduling – 2017

	Monthly Frequency of HVDC Power Flow - 2017													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	%
Flow Going to Luzon	659	729	668	741	633	660	229		362	669	653	514	6,517	74.4
Limit Not Maximized	203	366	276	486	613	658	229		361	668	649	514	5,023	
Limit Maximized	456	363	392	255	20	2		0	1	1	4	0	1,494	
Flow Going to Visayas	21	15	1	3	80	82	28		69	51	91	197	638	7.3
Limit Not Maximized	21	15	1	3	80	82	28		61	51	85	181	608	
Limit Maximized									8		6	16	30	
No Flow	64		3		7	2	463	744	313			9	1,605	18.3
Total Trading Intervals	744	744	672	744	720	744	720	744	744	720	744	720	8,760	100.0

Table 20. Monthly Summary of HVDC Schedules (MW) – 2017

	Monthly Summary of HVDC Schedule (MW) - 2017												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
	Flow Going to Luzon												
Max	440	381	440	420	420	420	338		420	420	420	369	440
Min	1	19	4	0	1	1	1		0	3	0	0	0
Avg	221	257	314	332	210	181	147		174	179	179	140	222
	Flow Going to Visayas												
Max	(3)	(2)	(11)	(1)	(0)	(1)	(1)		(0)	(6)	(1)	(0)	(0)
Min	(128)	(113)	(11)	(44)	(179)	(180)	(128)		(200)	(147)	(200)	(250)	(250)
Avg	(54)	(56)	(11)	(28)	(67)	(70)	(40)		(80)	(50)	(73)	(91)	(73)

C. Impact of Preferential and Non-Scheduled Generation to Demand and Supply

For the year in review, the preferential and non-scheduled generation contributed an average of 390 MW to the system-wide effective supply. Majority of this was on account of solar facilities, which comprised about 39 percent or about 150 MW of the total average contribution of preferential and non-scheduled generation to the supply level across the year. Wind plants contributed the next biggest, accounting for an average of 137 MW this year or 35 percent. At distant third and fourth are the biomass and hydro plants which comprised the remaining 21 percent (82 MW) and 5 percent (21 MW), respectively, of the total contribution of preferential and non-scheduled generation on the effective supply level.

It is also worthy to note the seasonal highs in the contribution of the various resource types. As shown in Figure 16 below, wind plants had noticeably larger impact to supply during the first and last quarters of the year, averaging at a high of 259 MW (in January) and 269 MW (in December), respectively. Meanwhile, solar plants contributed the highest during the summer months of April to June (161 MW and 172 MW, respectively). Note however that solar plants are not available for the duration of an entire day, and bulk of their contribution to supply peaked between 0800H to 1500H during the year. For 2017, its hourly maximum contribution to supply reached as much as 607 MW on 16 October at 1000H, 595 MW on 29 April at 1200H and 594 MW and 593 MW, respectively, on 26 and 28 April at 1200H. On the other hand, biomass plants demonstrated slightly higher impact during the last quarter of the billing year, recording its highest monthly average at 103 MW in December.

Year-on-year comparison showed notably higher impact to supply of preferential and non-scheduled generation in the current year by 33 percent, following the increase in the contribution of all resource types from an average of 293 MW in the previous year.

Figure 16. Impact of Preferential and Non-Scheduled Generation on Supply – System

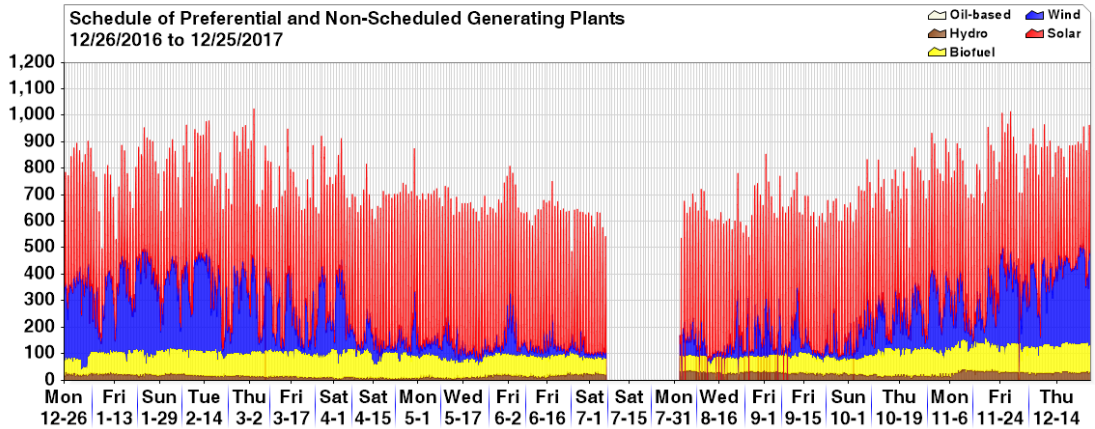


Table 21. Impact of Preferential and Non-Scheduled Generation on Supply – System, 2017

	Contribution to Supply of Preferential and Non-Scheduled Generation (Average MW), System - 2017												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
Biofuel	73	89	92	91	74	77	62	57	64	80	99	103	82
Hydro	22	19	14	9	10	18	24	31	29	20	28	30	21
Solar	128	140	155	161	172	157	154	154	155	146	149	135	150
Wind	259	246	161	106	51	44	25	50	62	105	167	269	137
Total	**483**	**495**	**421**	**367**	**307**	**296**	**265**	**292**	**310**	**351**	**443**	**537**	**390**

Table 22. Impact of Preferential and Non-Scheduled Generation on Supply – System, 2016

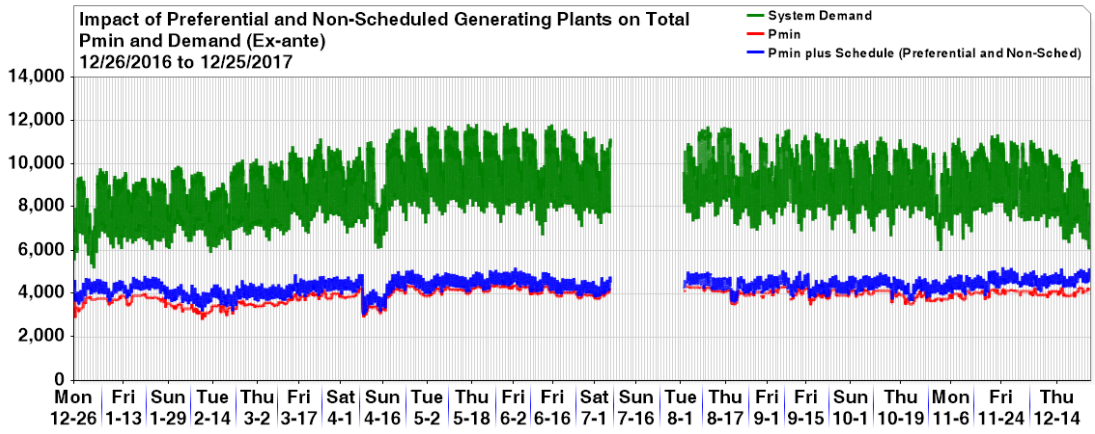
	Contribution to Supply of Preferential and Non-Scheduled Generation (Average MW), System - 2016												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
Biofuel	40	38	43	47	47	47	50	54	51	49	68	73	51
Hydro	9	9	6	3	4	13	13	19	17	19	18	17	12
Solar	13	28	83	141	157	138	137	135	146	141	140	135	116
Wind	154	188	148	75	48	45	47	102	100	89	167	219	115
Total	**215**	**262**	**279**	**262**	**256**	**243**	**249**	**305**	**314**	**300**	**391**	**444**	**293**

Preferential and non-scheduled generation also reduced the level of contestable demand in the market or the level of demand that is left for the generators to compete for. As shown in the chart below, the monthly ratio of Pmin to demand ranged from a minimum of 42.2 percent to a maximum of 48.3 percent. With the preferential and non-scheduled generating units, the ratio increased by an average of about 3 percent, further reducing the level of contestable demand during the year.

Table 23. Impact of Preferential and Non-Scheduled Generation on Total Pmin and Demand – System

	Percent of Demand, System - 2017												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
Pmin	48.3	42.2	42.6	42.7	42.6	43.3	42.2	43.9	43.7	43.1	43.5	46.3	43.7
Pmin + RTD of Preferential and Non-Sched Generation	54.5	48.3	47.4	46.8	45.7	46.4	45.0	32.4	45.0	46.7	48.3	51.9	46.5

Figure 17. Impact of Preferential and Non-Scheduled Generation on Total Pmin and Demand – System



D. Reserve Margin Index (RMI)[14]

The reserve margin index (RMI) for the billing year denotes that wide supply margin generally prevailed majority of the time during the period. This is demonstrated by the resulting RMI which exceeded 10 percent of the hourly demand in 78.6 percent of all the trading intervals for the year. Notwithstanding, the remaining 21.4 percent of the trading intervals during the year showed RMI levels of less than or equal to 10 percent, signaling tight demand and supply balance. The occurrence of RMIs of less than 10 percent was

[14] The reserve margin index (RMI) measures the supply-demand balance in the market. Its purpose is to measure and identify how tight the energy balance in the market is, because a tight energy balance in the market is usually accompanied by higher spot prices and tighter supply conditions suggest greater opportunities to exercise market power. For this Annual Report, the screening threshold is set at 10 percent.

predominantly observed during peak hours (42.2 percent of the time during peak, and 5.8 percent of the time during off-peak), as shown in Table 23 below.

The tight balance between demand and supply mostly manifested during the March, May and June billing months, as shown by the RMI results of less than or equal 10 percent (29.5 percent of the time 34.3 percent of the time and 35.3 percent of the time, respectively). The resulting RMI levels during these months were relatively tighter when compared with the other months of the year on account of increasing demand requirement as the summer season progressed. Demand growth was notably faster than the increase in supply during the March and May billing months. On the other hand, June recorded the second highest monthly average demand requirement for the year though this was a slight decrease from the May demand level, while supply also recorded a decline during the month. Supply was particularly tight towards the end of the June billing month, following the declining supply trend during the period.

Dips in the hourly RMI levels were particularly observed from 08-13 April, during which time outage capacity surged significantly in Luzon due to the earthquake in Batangas; from 08, 15-16 September due to high outage capacity; and on 02 and 22-23 October, also due to tight demand and supply conditions driven by multiple plant outages that marked the October billing month. RMI levels were also noticeably lower from 14-19 June which was due to the increase in outage capacity involving coal and natural gas plants on top of the forced outage of 647-MW Sual 2 that started on 14 June.

On the other hand, January exhibited better demand and supply balance when compared with the rest of the billing months. This is shown by the resulting RMIs of more than 10 percent in almost all of the trading intervals in the said month (99.2 percent of the time).

When compared with the previous billing year, it is observed that the occurrence of RMI levels of less than or equal 10 percent improved this year at 21.4 percent, coming from 27.9 percent in 2016.

Figure 18. Reserve Margin Index (RMI) based on Effective Supply – System

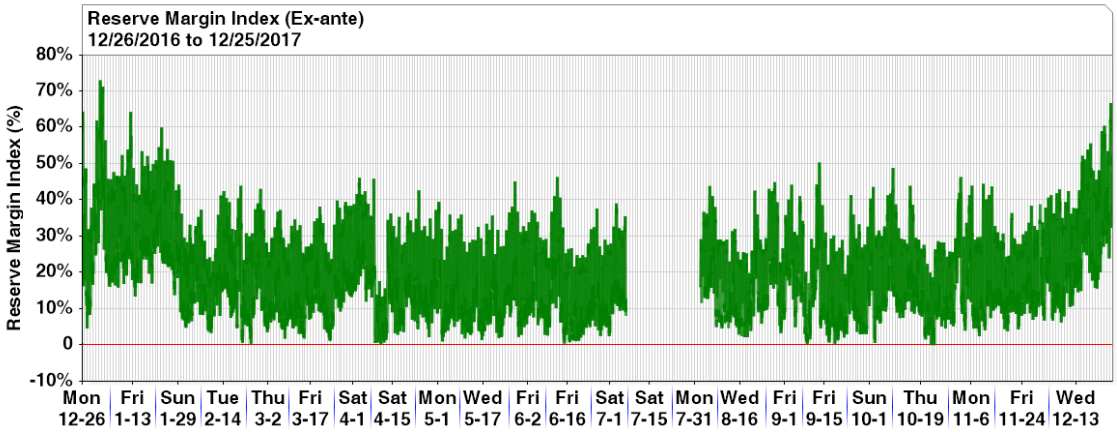


Table 24. RMI Distribution based on Effective Supply – System, 2017

	RMI Distribution by Billing Month (%), 2017 - System												
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Avg
Less or equal 10%	0.8	18.8	29.5	18.1	34.3	35.3	26.2	24.1	27.1	23.6	20.4	3.5	21.4
More than 10%	99.2	81.2	70.5	81.9	65.7	64.7	73.8	75.9	72.9	76.4	79.6	96.5	78.6

Table 25. RMI Distribution based on Effective Supply by Hour Type – System, 2017

RMI Distribution	No. of Trading Intervals		Percent of Time	
	Peak	Off-Peak	Peak	Off-Peak
Less or equal to 10%	1,455	265	42.2	5.8
More than 10%	1,996	4,309	57.8	94.2

Table 26. RMI Distribution based on Effective Supply – System, 2016

	RMI Distribution by Billing Month (%), 2016 - System												
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Avg
Less or equal 10%	15.7	18.3	31.7	41.2	41.0	60.3	34.6	37.9	20.6	15.8	12.9	4.9	27.9
More than 10%	84.3	81.7	68.3	58.8	59.0	39.7	65.4	62.1	79.4	84.2	87.1	95.1	72.1

As above mentioned, the unavailability of the HVDC Interconnection from 06 July (1700H) to 07 September (2200H) physically separated the Luzon and Visayas grids, preventing the import and export of power between the two regions. The unavailability of the HVDC was attributable to the intensity 5 earthquake in the Visayas on 06 July, which triggered the tripping of the HVDC Interconnection and disturbance to the Visayas network. The ERC declared market suspension in the Visayas from 06 July (1700H) to 01 August (1600H), which affected a total of 624 trading intervals. Meanwhile, market intervention due to generation deficiency was initiated by the NGCP-SO in the Visayas from 01 August which continued on until 07 September, affecting 94 trading intervals during the period.

During this period, both regions exhibited supply margins that were generally wide majority of the time. In Luzon, RMI results of more than 10 percent were observed in 74.9 percent of the trading intervals during the period. Nevertheless, demand and supply was tight in the remaining 25.1 percent of the time during the period. As shown in Figure 19 below, lower RMI levels were noticeable on 17-18, 31 July, 09-19 and 30 August, and 07 September, signaling tight demand and supply balance during the affected intervals.

Meanwhile, as discussed, the region was placed under market suspension from 06 July at 1700H to 01 August (1600H) and several times under market intervention in August and September due to generation deficiency. During the remaining intervals when the Visayas market was operating normally, RMI levels exceeded 10 percent of the hourly demand 92 percent of the time in the region. Conversely, tight demand and supply balance was demonstrated by the resulting RMI levels of less or equal to 10 percent that was observed in 8.7 percent of the time, when the Visayas market was operating normally.

Figure 19. RMI Distribution based on Effective Supply – Luzon, 06 July to 07 September 2017

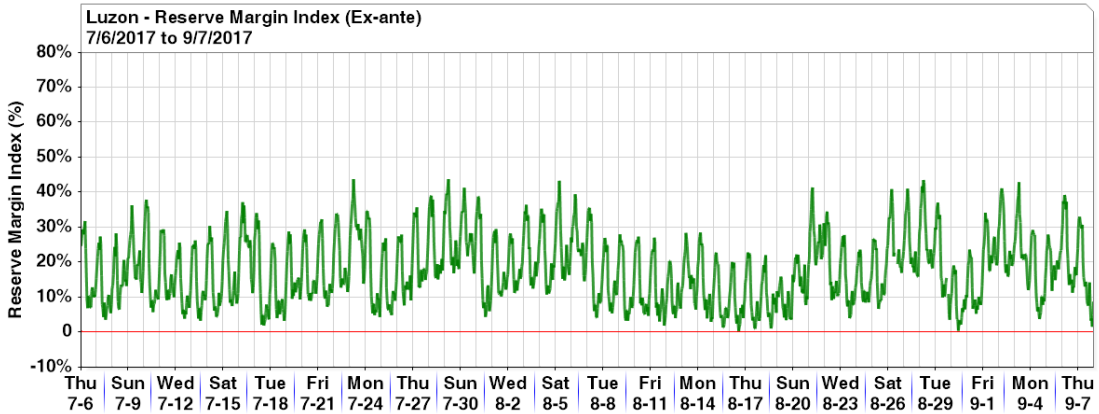


Figure 20. RMI Distribution based on Effective Supply – Visayas, 06 July to 07 September 2017

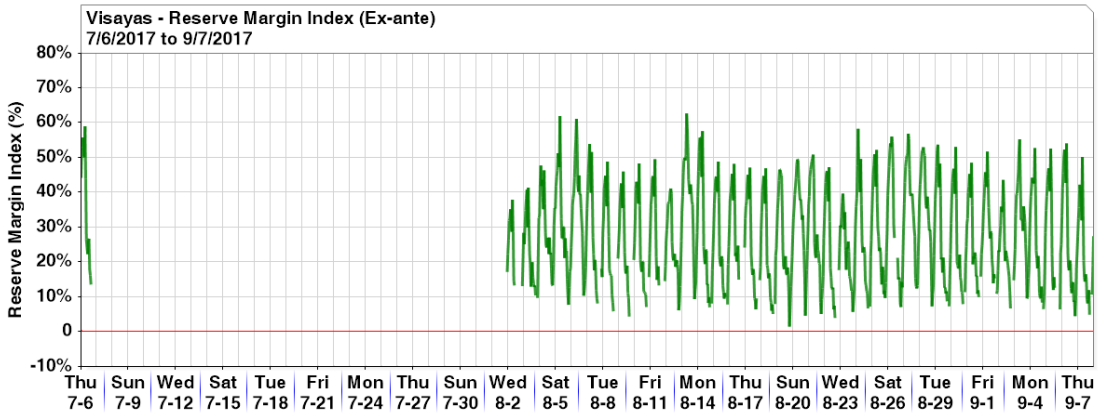


Table 27. RMI Distribution based on Effective Supply – Regional, 06 July to 07 September 2017

	RMI Distribution (%) - Luzon				RMI Distribution (%) - Visayas			
	06 to 25 July	August	26 Aug to 07 Sep	Avg	06 to 25 July	August	26 Aug to 07 Sep	Avg
Less or equal 10%	27.1	27.2	16.9	25.1	0	8.9	8.7	8.7
More than 10%	72.9	72.8	83.1	74.9	100	91.8	92.0	92.0

V. OUTAGES

A. Outage Capacity by Plant Type

Outage capacity averaged at 2,321 MW during the billing year, an increase of 18.7 percent from the average outage capacity posted in the previous year at 1,956 MW. Coal plants accounted for majority of the outage capacity this year, averaging at 1,252 MW and comprising about 53.9 percent of the total outage capacity. In second and third are the geothermal and natural gas plants, which accounted for an average of 356 MW (15.3 percent) and 337 MW (14.5 percent), respectively. Meanwhile, hydro and oil-based plants comprised the remaining 8.9 percent (208 MW) and 7.3 percent (169 MW) of the total outage capacity across the year.

Figure 21 below illustrates the higher level of outage capacity during the first, third and fourth quarters of the year, with noticeable spikes during the February, September, October and November billing months. Spike in outage capacity was likewise observed in April, though the second quarter recorded the lowest average outage capacity during the year. The highest monthly average capacity on outage was posted in February at 3,145 MW. March, September, October and November likewise recorded high monthly averages this year at 2,745 MW, 2,670 MW, 2,868 MW and 2,589 MW, respectively. Meanwhile, the summer months of May and June held the lowest average monthly outage capacity at 1,665 MW and 1,561 MW, respectively, giving rise to a relatively higher level of available capacity during the high demand season of May and June.

The capacity on outage averaged at 1,961 MW at the start of the billing year but increased remarkably to 3,145 MW in February. The hourly outage capacity spiked to 4,157 MW on 18 February from 1900H to 2400H when the 647-MW Sual 2 underwent forced outage due to the tripping of its boiler feed pump on top of the existing outages from other coal, natural gas, and hydro plants during the period. Increase in the outage capacity of natural gas plants attributed to the unavailability of Ilijan Block A and San Gabriel was likewise noted, related to

the 20-day scheduled shutdown of the Malampaya Gas Facility from 27 January to 17 February. Meanwhile, Ilijan Block B, Sta. Rita, San Lorenzo, and Avion ran using alternate fuel during the 20-day shutdown, and were placed on forced outages after for their fuel changeover activities. During the March billing month, the high level of outage capacity was sustained, but slightly declined to 2,745 MW.

While the capacity on outage was observed to be lower during the second quarter of the year, recording consistent decreases from April to June at an average of 2,268 MW, 1,665 MW and 1,561 MW, respectively, significant increase in outage capacity was posted from 08-16 April following the earthquake that hit the province of Batangas on 08 April resulting in the outages of multiple plants during the period. Outage capacity reached as high as 4,269 MW on 09 April from 0400H-0700H and 2000H driven by the significant rise in the outage capacity of the natural gas plants in Batangas that were affected by the earthquake. Moreover, it was noted that coal plants Calaca 2 and SLPGC 2 went on outage on 09 April, being likewise affected by the Batangas earthquake. These were on top of the existing planned outages of coal plants Calaca 1 and Pagbilao 1. In addition, Mariveles 1 and 2 and Pagbilao 2 went on forced outages on 09 April due to generator problems, causes of which were unrelated to the earthquake.

In the months following, outage capacity declined with the resumption to normal operations of the plants that went on outage due to the earthquake. However, increase in the capacity of outage was noted beginning the second half of June, influenced by the maintenance outage of 150-MW SMC 2 on 10-23 June, forced outage of 647-MW Sual 2 on 14 June and planned outage of Visayas coal plant KSPC 1 on 16 June. The level further increased during the last couple of days in June with the forced outage of GNPower 1 and 2 beginning 24 June resulting in an additional loss of 632 MW. Outage capacity then followed an increasing trend from June to July, averaging at 2,019 MW and further upward at 2,385 MW in August, with the outages of major coal plants Pagbilao 1 and 3, Masinloc 1, SMC 1 and 2, Calaca 1 and 2, SLTEC 2, QPPL, SLPGC 1 and GN Power 1, on top of the forced outage of Sual 2, which went on outage in June and remained unavailable in August.

Outage capacity further increased to an average of 2,670 MW in September, and was also particularly high from15-18 September influenced by the high forced outage capacity among the major coal plants in Luzon. Also, Visayas major coal plant TPC units 1 and 2 were likewise on forced outage on 17 September. Likewise noted were the forced outages of Malaya 1 and 2 beginning 13 September to 02 October due to the impact of typhoon Maring. Also, in the Visayas, geothermal plants recorded a high level of outage capacity as several units of Leyte A were still not able to resume operations after being hit by the earthquake last 06 July. The maximum outage on record for the year was recorded at a high of 4,854 MW on 16 September during peak hours 1100H to 1200H, driven by the simultaneous forced outages of major coal plants GNPower 1 and 2, Masinloc 2, SMC 2 and Sual 1 on top of the long duration outage of Sual 2, which was on forced outage since 14 June. Furthermore in the Visayas, on top of the high outage capacity among geothermal plants on 16 September, the 150-MW coal plant of PEDC unit 3 in the Visayas went on forced outage from 10 to 19 September. Outage capacity also rose to a high of 4,545 MW on 23 September attributable to the outages related to the natural gas fuel restriction of the SPEX Malampaya Onshore Gas from 22-25 September.

In the October billing month, the monthly average outage capacity increased even further to 2,868 MW. Hourly outage capacity during the month reached a maximum of 4,022 MW on 02 October at 1800H to 1900H mainly driven by the forced outages of major coal plants GNPower 1, QPPL and the maintenance outage of SMC 1 (29 August to 04 October) on top of the forced outages of natural gas, hydro and oil-based plants. The long-duration forced

outage of coal plant Sual 2 since 14 June and the planned outage of hydro plant Kalayaan 4 beginning 03 July were likewise noted.

The system-wide capacity on outage decreased in November and December, averaging at 2,589 MW and 1,996 MW, respectively. Despite the month-on-month decreases, spikes in outage capacity was still observed in November. Outage capacity spiked to 4,004 MW on 02 November from 0800H to 1300H driven by the increase in outage capacity among major coal plants. This was on account of the forced outage of major coal plant Pagbilao 2 during the affected trading intervals on top of the already high outage incidence during the period involving major coal plants Mariveles 2, Sual 1 and 2, Pagbilao 2 and 3 and SLPGC 1.

Figure 21. Capacity on Outage by Plant Type – System

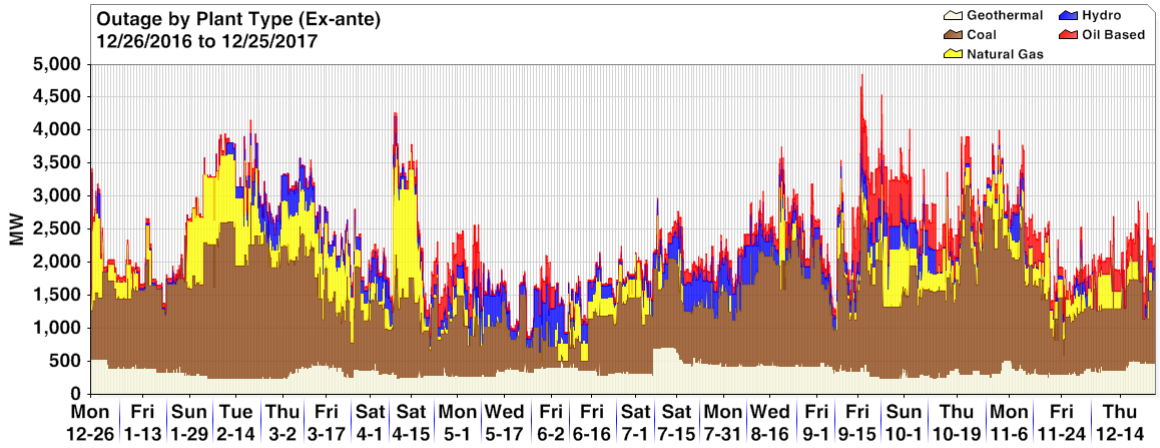


Table 28. Capacity on Outage by Plant Type – System

Plant Type	Outage Capacity by Plant Type (Avg MW), 2017 - System												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
Coal	1,199	1,921	1,461	1,041	773	573	1,027	1,354	1,483	1,491	1,644	1,051	1,252
Natural Gas	266	807	633	615	84	227	145	89	189	441	334	233	337
Geothermal	404	255	350	305	310	363	483	429	357	287	338	388	356
Hydro	26	138	295	203	289	314	267	360	245	218	92	53	208
Oil-Based	65	23	7	104	209	84	97	153	395	430	182	272	169
Total	**1,961**	**3,145**	**2,745**	**2,268**	**1,665**	**1,561**	**2,019**	**2,385**	**2,670**	**2,868**	**2,589**	**1,996**	**2,321**

Table 29. Year-on-Year Average Outage Capacity Comparison – System

	Year-on-Year Average Outage Capacity Comparison by Billing Month												
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Avg.
2017 (MW)	1,961	3,145	2,745	2,268	1,665	1,561	2,019	2,385	2,670	2,868	2,589	1,996	2,321
2016 (MW)	2,265	2,230	2,214	1,749	1,143	1,898	1,715	2,573	2,106	1,712	2,041	1,799	1,956
Y-Y (%) Change	(13.4)	41.0	24.0	29.6	45.7	(17.7)	17.7	(7.3)	26.8	67.5	26.8	10.9	18.7

Table 30. Capacity on Outage by Plant Type – Luzon

Plant Type	Outage Capacity by Plant Type (Avg MW), 2017 - Luzon												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
Coal	1,086	1,693	1,407	976	611	524	905	1,323	1,436	1,416	1,515	1,039	1,161
Natural Gas	266	807	633	615	84	227	145	89	189	441	334	233	337
Geothermal	347	222	328	273	236	282	262	283	241	236	273	237	268
Hydro	26	138	295	203	289	314	267	360	245	218	92	53	208
Oil-Based	60	22	7	103	205	82	89	132	370	412	169	247	159
Total	**1,786**	**2,882**	**2,669**	**2,171**	**1,425**	**1,429**	**1,669**	**2,187**	**2,482**	**2,724**	**2,382**	**1,809**	**2,133**

Table 31. Capacity on Outage by Plant Type – Visayas

Plant Type	Outage Capacity by Plant Type (Avg MW), 2017 - Visayas												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
Coal	113	229	54	65	162	49	122	32	47	75	129	12	91
Geothermal	58	33	22	31	73	81	221	145	116	51	65	151	87
Oil-Based	5	1	-	1	4	2	8	21	25	18	13	24	10
Total	**175**	**262**	**76**	**97**	**239**	**133**	**351**	**198**	**188**	**144**	**207**	**187**	**189**

B. Outage Capacity by Outage Category[15]

Based on outage category, the system-wide outage capacity was mainly attributable to forced outages at an average of 1,205 MW across the year. Forced outage capacity was noticeably high during the second half of the year, particularly during the September and October billing months which recorded the highest monthly averages at 1,834 MW and 1,874 MW, respectively. As discussed in the preceding section, these were driven by the high outage capacity of coal and natural gas plants.

Planned outage capacity figured in next averaging at 626 MW during the year, followed by maintenance outage at 393 MW. Lastly, system-wide outages related to deactivated shutdown averaged at 99 MW.

Figure 22. Capacity on Outage by Outage Type

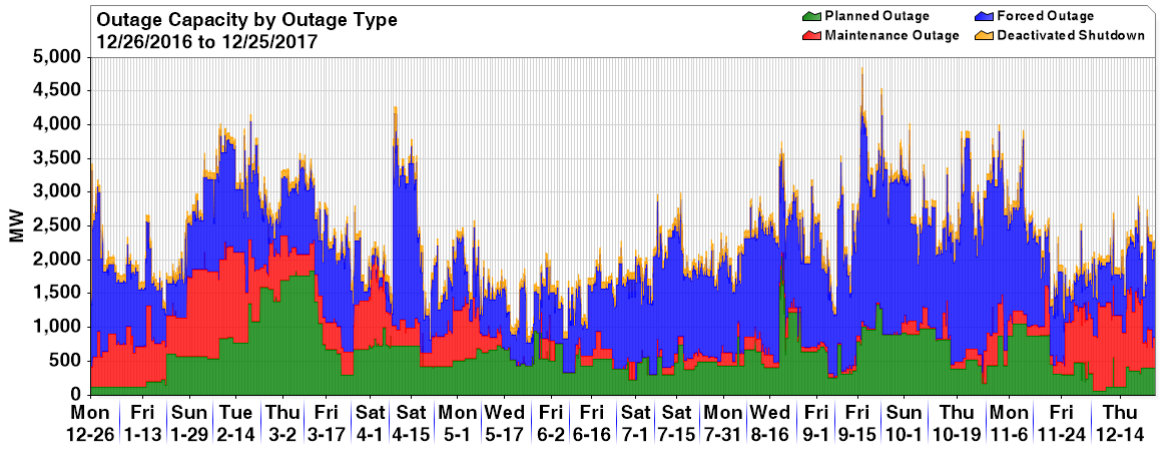


Table 32. Capacity on Outage by Outage Type – System

	Outage Capacity by Outage Type (Avg MW) - System, 2017												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
Deactivated Shutdown	99	99	99	99	99	99	99	99	99	99	99	99	99
Forced Outage	1,004	1,151	1,004	1,010	646	802	1,400	1,460	1,834	1,874	1,535	714	1,205
Maintenance Outage	644	1,048	437	511	337	127	95	147	49	122	292	911	393
Planned Outage	215	854	1,208	653	562	530	428	688	702	767	668	279	626

Table 33. Capacity on Outage by Outage Type – Luzon

	Outage Capacity by Outage Type (Avg MW) - Luzon, 2017												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
Deactivated Shutdown	99	99	99	99	99	99	99	99	99	99	99	99	99
Forced Outage	965	944	972	974	474	724	1,141	1,282	1,652	1,821	1,473	570	1,084
Maintenance Outage	643	1,047	393	451	337	127	93	127	38	102	260	890	376
Planned Outage	80	796	1,208	651	492	474	337	688	697	694	555	256	574

[15] Based on the Daily Operations Report by NGCP-SO, which adopted the revised outage classification of ERC through its Resolution No. 17, s.2013 "Adopting and Approving the Rules and Procedures to Govern the Monitoring of Reliability Performance of Generating Units and Transmission System".

Table 34. Capacity on Outage by Outage Type – Visayas

	Outage Capacity by Outage Type (Avg MW) - Visayas, 2017												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
Planned Outage	135	57	-	2	69	56	91	-	5	73	113	23	52
Maintenance Outage	1	0	44	60	-	-	1	19	11	20	33	21	17
Forced Outage	39	207	32	36	172	77	259	179	182	53	62	144	120
Deactivated Shutdown	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	**175**	**264**	**75**	**98**	**241**	**134**	**351**	**198**	**198**	**145**	**207**	**188**	**190**

C. Outage Frequency

Outages of 109 scheduled generating plants (80 in Luzon and 29 in Visayas) combined for a total of 1,363 outage incidents in 2017. Majority of the outages that occurred during the year were forced, at 1,034 events. On the other hand, maintenance outages and planned outages only recorded 206 and 123 events, respectively.

Outage frequency based on plant type showed that oil-based plants recorded the highest number of outage occurrences with a total of 464 incidents, followed by geothermal plants with 274 outage incidents and coal plants with 259. Hydro and natural gas plants posted a total of 187 and 179 outage incidents, respectively.

The August billing month posted the highest number of outage incidents in 2017, comprising of 133 forced outage incidents, 32 maintenance outage incidents and 20 planned outage incidents. Oil-based plants contributed the bulk in the count of outage incidents in June, registering the highest occurrences at 86. The frequency of outage incidents was likewise high in July and September, posting a total of 155 and 159 incidents, respectively, likewise attributed mainly to the outages of oil-based plants.

Note that the frequency of outages mentioned in this chapter is a count of the actual occurrence of the outage, regardless of length. A short-duration outage and an outage spanning an entire year are given one count each. Further, only those outages that occurred in 2017 were taken into account. Thus, outages that occurred prior to 2017 but remained on outage during the year or were able to resume operations sometime in 2017 were no longer counted.

Table 35. Monthly Frequency of Outage Incidents by Plant Type, 2017

Plant Type	Monthly Frequency of Outages by Plant Type, 2017 - System												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
COAL	13	23	22	26	19	17	14	29	35	20	24	17	259
GEO	22	10	31	19	19	21	31	29	18	30	19	25	274
HYD	14	13	10	14	32	22	18	25	6	8	18	7	187
NATG	17	25	6	23	9	7	18	16	17	14	10	17	179
OIL	9	14	7	19	47	26	74	86	83	36	29	34	464
Total	75	85	76	101	126	93	155	185	159	108	100	100	1,363

Table 36. Monthly Frequency of Outage Incidents by Outage Category, 2017

Outage Category	Monthly Frequency of Outages by Outage Category, 2017 - System												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Forced Outage	51	62	62	69	94	73	127	133	136	84	72	71	1,034
Maintenance Outage	21	16	6	16	22	3	18	32	13	20	19	20	206
Planned Outage	3	7	8	16	10	17	10	20	10	4	9	9	123
Total	75	85	76	101	126	93	155	185	159	108	100	100	1,363

D. Outage Factor[16]

The total outage factor system-wide was posted at 13.1 percent across the billing year, 6.8 percent of which was attributed to forced outage factor while planned outage factor contributed another 3.5 percent. On the other hand, maintenance outage factor was recorded at 2.2 percent during the year, and deactivated shutdown at 0.6 percent.

By plant type, geothermal and coal plants incurred the highest total outage factor at 20.1 percent and 18.9 percent, respectively. Natural gas plants posted the next highest outage factor at 10.3 percent, followed by hydro plants at 8.3 percent, biomass plants at 8.1 percent and oil-based plants at 7.1 percent.

Results of regional outage factors showed that the total outage factor was higher in Luzon than in the Visayas. For this year, outage factor in the Luzon region was posted at 14.4 percent, with forced outage factor accounting for 7.3 percent, while planned outage factor contributed another 3.9 percent. Maintenance outage factor in Luzon was posted at 2.5 percent and deactivated shutdown at 0.7 percent. Note that the Luzon geothermal plants contributed the bulk of the deactivated shutdown at 11.1 percent.

On the other hand, total outage factor in the Visayas region was recorded at 6.8 percent. Bulk of the same was due to forced outage factor at 4.4 percent, followed by planned outage factor at 1.7 percent, and maintenance outage factor at 0.6 percent.

Figure 23. Outage Factor – System

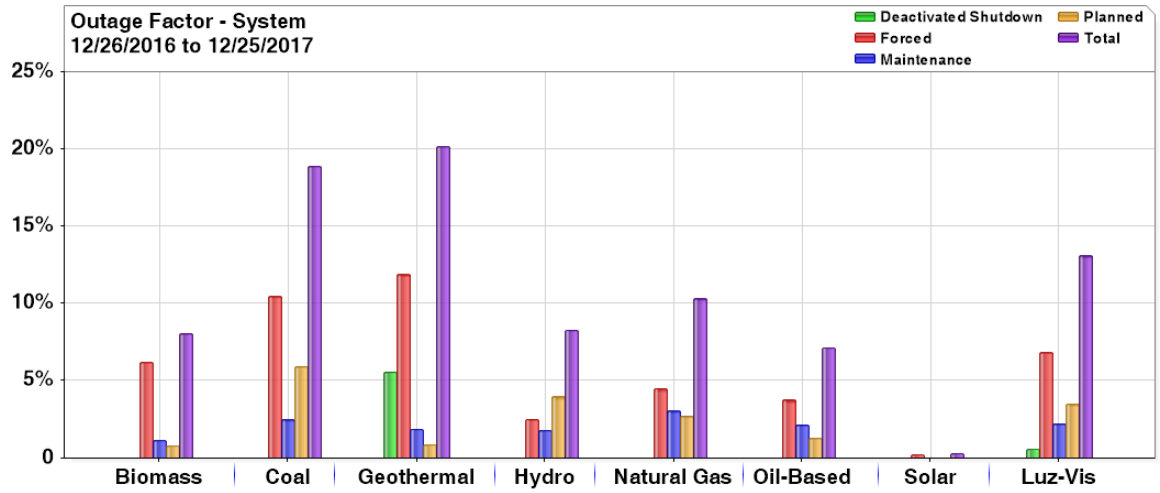


Table 37. Outage Factor Summary – 2017

	Outage Factor (%) Summary - 2017													
	System					Luzon					Visayas			
	Deactivated Shutdown	Forced	Maintenance	Planned	Total	Deactivated Shutdown	Forced	Maintenance	Planned	Total	Forced	Maintenance	Planned	Total
Biomass		6.2	1.1	0.8	8.1		0.0	0.6	1.4	2.0	11.8	1.6	0.2	13.5
Coal		10.5	2.5	5.9	18.9		11.8	2.8	6.3	20.8	3.5	1.0	4.1	8.6
Geothermal	5.6	11.9	1.9	0.8	20.1	11.1	15.4	3.1	0.6	30.2	8.3	0.7	1.0	10.0
Hydro		2.5	1.8	4.0	8.3		2.5	1.8	4.0	8.3				
Natural Gas		4.5	3.1	2.7	10.3		4.5	3.1	2.7	10.3				
Oil-Based		3.7	2.1	1.3	7.1		4.2	2.6	1.6	8.4	2.0	0.2		2.2
Solar		0.2	0.0	0.1	0.3						0.3	0.0	0.1	0.5
Total	**0.6**	**6.8**	**2.2**	**3.5**	**13.1**	**0.7**	**7.3**	**2.5**	**3.9**	**14.4**	**4.4**	**0.6**	**1.7**	**6.8**

[16] Outage factor is the ratio of the product of the capacity on outage and total number of outage days of plant type to the product of total capacity and period days covered, expressed in percent.

Table 38. Monthly Outage Factor Summary – 2017

Plant Type	Outage Type	Outage Factor (%) by Billing Month, System - 2017												
		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Avg
BIOMASS	Deactivated Shutdown													
	Forced Outage	1.0	1.5	5.3	3.1	4.6	2.7	13.9	17.5	17.5	5.6	2.1	0.3	6.2
	Maintenance Outage	1.9	2.2	1.8	3.3	1.0	0.2	0.0		1.0	0.9	0.8	0.4	1.1
	Planned Outage		0.1		0.9	0.8	0.7			1.4	2.1	2.5	0.1	0.8
BIOMASS Total Outage Factor		2.9	3.8	7.1	7.3	6.5	3.6	13.9	17.5	19.9	8.6	5.5	0.8	8.1
COAL	Deactivated Shutdown													
	Forced Outage	8.7	9.7	3.2	5.1	5.1	6.7	14.3	15.2	16.6	15.8	17.7	5.3	10.5
	Maintenance Outage	7.6	7.9	1.6	1.7		1.0		1.0		0.4	0.9	7.9	2.5
	Planned Outage	2.8	12.8	18.0	9.3	6.8	1.1	1.5	3.6	4.9	5.4	4.9	1.7	5.9
COAL Total Outage Factor		19.0	30.4	22.9	16.1	11.9	8.9	15.8	19.8	21.5	21.6	23.5	14.8	18.9
GEO	Deactivated Shutdown	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.5	5.6
	Forced Outage	13.5	4.7	9.1	8.8	11.6	13.7	20.4	15.0	12.9	9.0	9.7	14.1	11.9
	Maintenance Outage	1.9	3.6	3.1	2.6			1.3	3.6	2.0	1.1	2.6	0.8	1.9
	Planned Outage	2.0	0.6	2.0	0.2	0.5	1.3			0.3	0.6	1.1	1.5	0.8
GEO Total Outage Factor		22.9	14.4	19.7	17.2	17.6	20.6	27.3	24.2	20.7	16.3	19.0	21.9	20.1
HYD	Deactivated Shutdown													
	Forced Outage	0.1	1.6	10.3	0.2	2.4	4.3	2.1	1.8	2.6	3.8	0.9	0.9	2.5
	Maintenance Outage	0.8	2.9	0.6	7.9	6.0		0.2	0.2	0.1	1.2	1.6	0.1	1.8
	Planned Outage	0.2	1.0	0.8	0.0	3.1	8.1	8.4	12.3	7.2	3.8	1.3	1.2	4.0
HYDRO Total Outage Factor		1.1	5.6	11.7	8.1	11.5	12.3	10.7	14.3	9.8	8.8	3.7	2.1	8.3
NATG	Deactivated Shutdown													
	Forced Outage	4.6	12.4	11.5	15.6	0.8	0.1	1.2	0.5	2.7	4.3	0.1	0.8	4.5
	Maintenance Outage	3.5	12.0	7.8	3.0	1.6	0.4	0.6	0.0		1.2	2.5	4.3	3.1
	Planned Outage		0.3		0.2		6.3	2.7	2.2	3.1	8.0	7.6	2.0	2.7
NAT GAS Total Outage Factor		8.1	24.6	19.3	18.8	2.5	6.9	4.5	2.7	5.8	13.5	10.2	7.1	10.3
OIL-BASED	Deactivated Shutdown													
	Forced Outage	2.9	0.4	0.1	0.3	0.9	0.6	0.8	3.5	13.1	16.3	4.1	1.7	3.7
	Maintenance Outage		0.7	0.2	2.7	5.8	2.1	2.1	0.3	0.5	0.4	2.7	8.2	2.1
	Planned Outage				1.6	1.4	1.0	1.3	2.8	3.2	1.0	1.0	1.6	1.3
OIL Total Outage Factor		2.9	1.0	0.3	4.5	8.1	3.6	4.1	6.6	16.9	17.7	7.8	11.5	7.1
SOLAR	Deactivated Shutdown													
	Forced Outage	0.1	0.2	0.2	0.4	0.0	0.1	0.2	0.2	0.1	0.3	0.4	0.0	0.2
	Maintenance Outage				0.3									0.0
	Planned Outage				0.4		0.4			0.0				0.1
SOLAR Total Outage Factor		0.1	0.2	0.2	1.1	0.0	0.5	0.2	0.2	0.1	0.3	0.4	0.0	0.3
TOTAL	Deactivated Shutdown	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.6
	Forced Outage	5.8	6.6	5.8	5.8	3.7	4.6	8.0	8.2	10.3	10.4	8.4	3.9	6.8
	Maintenance Outage	3.7	6.0	2.5	2.9	1.9	0.7	0.5	0.8	0.3	0.7	1.6	4.9	2.2
	Planned Outage	1.2	4.9	6.9	3.7	3.2	3.0	2.4	3.8	3.9	4.2	3.7	1.5	3.5
Total Outage Factor		11.3	18.1	15.7	13.0	9.4	8.9	11.6	13.4	15.0	15.8	14.3	10.9	13.1

VI. CAPACITY GAP[17]

Generator-trading participants continued to submit capacity offers less than their respective maximum available capacity, as indicated by the persistently high level of capacity gap throughout the billing year. Following relevant provisions in the WESM Rules, these shall be subject to further investigation for possible non-compliance with the must-offer rule.

Hydro plants continued to account for majority of the capacity gap in 2017, comprising of about 39 percent of the capacity gap at an average of 766 MW. Higher level of capacity gap among hydro plants was observed during the second quarter. During this period, the monthly average capacity gap among hydro plants were posted at 907 MW in April, 1,022 MW in May and 957 MW in June. Capacity gap level among hydro plants was also relatively high in July at 906 MW. It is noted that most of the capacity gap observed from hydro plants were primarily due to water availability and elevation. Note, however, that the capacity gap involving hydro plants include the pumping capacity of hydro plant Kalayaan. Removal of the

[17] Capacity gap is calculated as registered capacity less offered capacity and outage capacity, calculated for each generator resource node per trading interval, including capacity of generating units on commissioning tests.

Kalaayan capacity during pumping hours reduced the total capacity gap by an average of about 164 MW.

Coal plants accounted for the next chunk of the capacity gap during the year, averaging at 522 MW or 26.5 percent of the total capacity gap in 2017. However, these were largely due to the testing and commissioning of major coal plants Pagbilao 3, SMC 1, 2 and 3 as well as SLPGC 1 and 2. The testing and commissioning of plants is discussed in the section on Over-riding Constraints of this Report. On the other hand, oil-based plants contributed 16.6 percent of the total capacity gap, accounting for an average of 327 MW. Geothermal plants constituted another 16 percent or an average of 315 MW, while natural gas plants accounted for the remaining 1.9 percent, at an average of 37 MW. As shown in Figure 24, the highest monthly average capacity gap of natural gas plants was posted in February at 160 MW. For the remainder of the year, however, their monthly average capacity gap ranged only from a low of only 6 MW to a high of 50MW.

Capacity gap across the year averaged 1,967 MW, lower by 23.5 percent from last year's 2,571 MW. The decline followed the lower capacity gap levels among all plant types on a year-on-year comparison, except for geothermal plants which recorded an increase from last year's 287 MW.

Figure 24. Capacity Gap – System

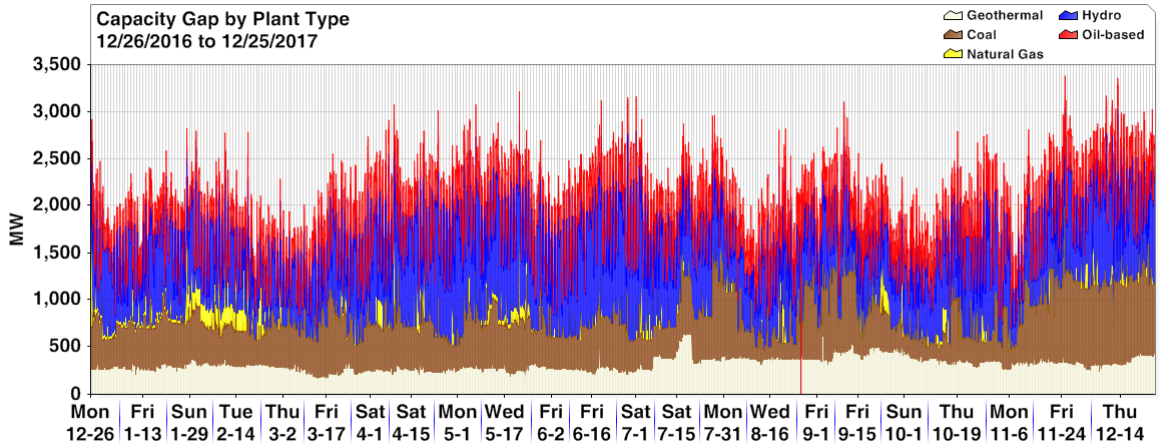


Table 39. Capacity Gap – System

Plant Type	Capacity Gap by Plant Type (Avg MW), 2017 - System												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
Coal	490	445	542	498	523	462	443	461	628	313	580	881	522
Natural Gas	45	160	14	33	50	6	25	21	23	23	12	26	37
Geothermal	274	307	240	245	258	266	365	371	418	368	326	338	315
Hydro	729	609	563	907	1,022	957	906	648	603	678	724	842	766
Oil-Based	259	242	252	342	334	345	350	377	358	360	351	353	327
Total	**1,798**	**1,763**	**1,612**	**2,025**	**2,187**	**2,034**	**2,089**	**1,878**	**2,030**	**1,743**	**1,993**	**2,440**	**1,967**

Table 40. Year-on-Year Average Capacity Gap Comparison

	Year-on-Year Average Capacity Gap Comparison by Billing Month												
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Avg.
2017 (MW)	1,798	1,763	1,612	2,025	2,187	2,034	2,089	1,878	2,030	1,743	1,993	2,440	1,967
2016 (MW)	2,087	1,971	2,651	3,073	3,236	3,030	3,330	2,959	2,351	2,284	2,002	1,904	2,571
Y-Y (%) Change	(13.9)	(10.5)	(39.2)	(34.1)	(32.4)	(32.9)	(37.3)	(36.5)	(13.6)	(23.7)	(0.5)	28.2	(23.5)

VII. MARKET PRICE OUTCOME[18]

A. Market Prices

Declining trend in market prices was observed beginning year 2014 as reflected in the maximum and average prices shown in Table 41.

Maximum prices were notably lower beginning year 2014, following WESM Tripartite Committee's Resolution No. 3, s.2015 which reduced the offer price ceiling of PhP62,000/MWh to PhP32,000/MWh[19] as well as the price mitigating measure on the secondary price cap[20] though this was imposed only in 2014, affecting the market price in 218 intervals during the billing year.

The maximum price posted during the course of the 2011 to 2017 billing years was recorded at PhP64,696/MWh on 14 December 2011 at 1900H. Declining trend in maximum prices was observed from PhP64,125/MWh in 2012 to PhP59,991/MWh in 2013 before plunging to PhP32,604/MWh in 2014.

In terms of average market prices, the annual average price during the current year was posted at PhP3,350/MWh, the second lowest in the market since the Visayas integration in the WESM on 26 December 2010. The same was higher by 13.7 percent from the average price in 2016 posted at PhP2,948/MWh. On the other hand, the highest average price was posted at PhP6,118/MWh in 2013, influenced by the unusual surge of extremely high market prices during the last quarter of that year, due to events of supply insufficiency. The frequency of prices above PhP32,000/MWh was mostly observed in the same year 2013, occurring in 314 trading intervals predominantly during the November to December 2013 billing months.

On the other hand, the lowest price on record was at negative PhP100,654/MWh on 26 December 2015 at 0400H. Extreme negative prices were mostly observed in 2014, when prices were as low as negative PhP10,027/MWh to PhP84,833/MWh in 31 trading intervals. These mostly occurred in the September 2014 billing month as demand levels dropped due to cooler weather conditions, which was aggravated by the shutdown of the HVDC Interconnection that made the Visayas unable to export its excess generation to Luzon. Subsequently, changes in the offer pattern of several Visayas plants were observed during the billing month, when generators began to offer all or a portion of their capacities at extreme negative prices during off-peak hours.

The data presented in this Report includes the administered prices imposed during events of market intervention/suspension which were consequently used in settlement during the affected trading intervals. Most notably, administered prices were used during the market suspension in the Visayas from 08 November 2013 at 1500H to 25 March 2014 at 2400H due to the destruction of the Visayas power system by the passage of typhoon Yolanda.

[18] 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, (iv) administered price for loads for trading intervals under market intervention, and (v) estimated load reference price (ELRP) for trading intervals where the ERC-approved Price Substitution Mechanism (PSM) was applied.

[19] As a price mitigating measure, the WESM Tripartite Committee composed of the DOE, ERC and PEMC issued Resolution No. 3 on 17 December 2015, which adopted the Offer Price Cap at PhP32,000/MWh, as initially set on 27 December 2013. The same Resolution also set the Offer Price Floor in the WESM at negative PhP10,000/MWh effective 01 January 2016.

[20] ERC Resolution No. 20, series of 2014 entitled "Adopting and Establishing a Pre-Emptive Mitigation Measure in the WESM" sets the cumulative price threshold (CPT) equivalent to an average spot price of PhP9,000/MWh over a rolling 7-day period or 168 trading intervals. A breach of the CPT triggers the imposition of a price cap amounting to PhP6,245/MWh.

Figure 25. Annual Market Price Trend – System

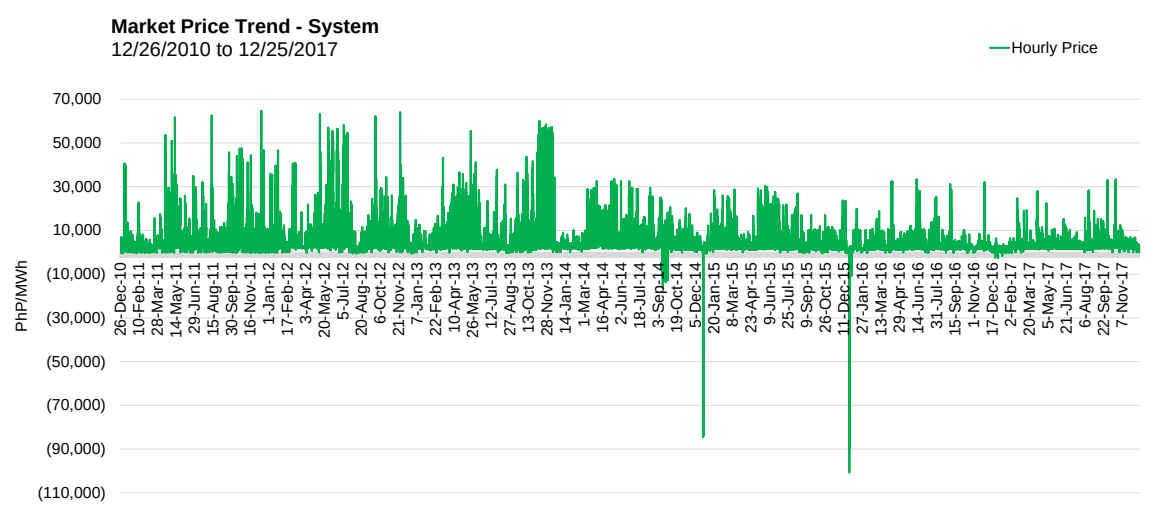


Table 41. Annual Market Price Trend – System

	Annual Market Price Trend - System						
	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Max	64,696	64,125	59,991	32,604	30,234	33,467	33,347
Min	(410)	(519)	(0)	(84,433)	(953)	(100,654)	(2,661)
Avg	4,271	5,486	6,118	4,904	3,829	2,948	3,350

Monthly Trend in Market Prices

The monthly trend in market prices for the current billing year 2017 showed that market prices were highest during the summer month of April, averaging at PhP3,988/MWh. High market prices were likewise observed from August to October as market prices averaged at PhP3,676/MWh, PhP3,894/MWh and PhP3,960/MWh, respectively. On the other hand, the lowest market prices were posted during the low demand season of January and December at an average of PhP1,768/MWh and PhP2,425/MWh, respectively.

Increasing trend in market prices was observed beginning February as average prices increased by 87 percent to PhP3,306/MWh from a low of PhP1,768/MWh in January. This followed the tighter supply and demand condition during the month on account of high outage capacity. Market prices further increased by 7 percent to an average of PhP3,537/MWh in March, as temperature levels rose and high outage capacity persisted.

Market prices reached their highest in April, with the onset of the summer season. In particular, higher market price levels from 8 to 16 April pulled up the average monthly market price while increase in market prices was also observed towards the latter half of April, largely driven by higher demand. It can be recalled that major natural gas and some of the major coal plants that were located in the province of Batangas went on outage due to the earthquake in the area on 08 April.

Market prices in the succeeding months dropped steadily. Market prices decreased by 12.9 percent in May, averaging at PhP3,471/MWh, even as demand continued to grow and supply remained tight. A further 1.6 percent decrease was posted in June, as market prices averaged at PhP3,414/MWh. This is due to the continued decreasing trend in outage capacity for the second consecutive month. Meanwhile, market prices went even lower in July by another 6.8 percent with the market price averaging at PhP3,182/MWh. This is

consistent with the wide supply margin which generally prevailed during the month, driven by the decreasing trend in the level of demand.

Note that in accordance with the WESM Manual on Administered Price Determination Methodology (APDM), administered prices were applied in the Visayas during the period of the ERC's market suspension in the region from 06 July at 1700H to 01 August at 1600H. Further, note that following its earthquake-related tripping on 06 July 2017 at 1700H, the Luzon-Leyte HVDC Interconnection remained unavailable until 07 September 2017 at 2200H. This physically separated the market into two pricing regions – Luzon and Visayas.

As already mentioned, the billing months August to October posted relatively higher market prices, demonstrating monthly increases of 15.5 percent, 5.9 percent and 1.7 percent, respectively. The Luzon and Visayas were separate pricing regions for the entirety of the August billing month and the same will be discussed in the next section on regional market prices. Meanwhile, the integrated Luzon and Visayas market resumed normal operations beginning 07 September at 2300H, following the resumption of operations of the HVDC Link. For the September billing month, market prices averaged PhP3,894/MWh, higher than the PhP3,676/MWh average price in August. Market prices further increased to PhP3,960/MWh in October, with price spikes above PhP30,000/MWh recorded during the month.

With lower demand levels and lower outage capacity, market prices decreased towards the end of the year. The November billing month demonstrated a decline in market prices by 16.7 percent, averaging at PhP3,298/MWh. A further decline of 26.5 percent was observed in December as market prices averaged at PhP2,425/MWh.

Spikes in market prices were observed throughout the year as shown in Figure 26. Prices went above PhP30,000/MWh in three (3) trading intervals in October (02, 22 and 23 October at 1800H), driven by tight supply margins due to low supply availability. Recorded during the period was the simultaneous forced outages of major coal plants Mariveles 2, Masinloc 1, Sual 1, Calaca 2, and QPPL on top of the deactivated shutdown of Pagbilao 1, 2 and 3, and the planned outage of natural gas plant San Lorenzo 1. The maximum price on record for the billing year was posted at PhP33,347/MWh on 23 October at 2300H.

Price spikes above PhP20,000/MWh were likewise observed in another ten (10) trading intervals across the year, most of which occurred during peak hours. Four (4) price spike incidents above PhP20,000/MWh were noted on 16 August (1000H, 1100H, 1400H) and 17 August (1100H). During this period, unavailable capacities remained high particularly in Luzon, influencing the effective supply levels in the region. High outage capacity was sustained mainly driven by the high outage capacity among coal plants. Meanwhile another three (3) trading intervals recorded price spikes above PhP20,000/MWh on 09 April (0500H, 1900H) and 10 April (2200H). High outage capacity was observed during this period when major coal and natural gas plants were on outage, most of which were associated with the earthquake that hit the Batangas province. The billing months of February, May and October posted one (1) price spike each at above PhP20,000/MWh. These were recorded on 18 February (1900H), 02 May (1600H) and 02 October (1900H). Tight supply was exhibited in each of these events, driven by high outage capacity.

On the other hand, the minimum price on record was posted at negative PhP2,661/MWh on 01 January at 1000H. Similar with the trend in the previous year, there was no extreme negative price that was recorded this year, following the issuance of Resolution No. 3,

s.2015[21] which set the offer price floor in the WESM at negative PhP10,000/MWh effective 01 January 2016.

Figure 26. Market Price Trend – System, 2017

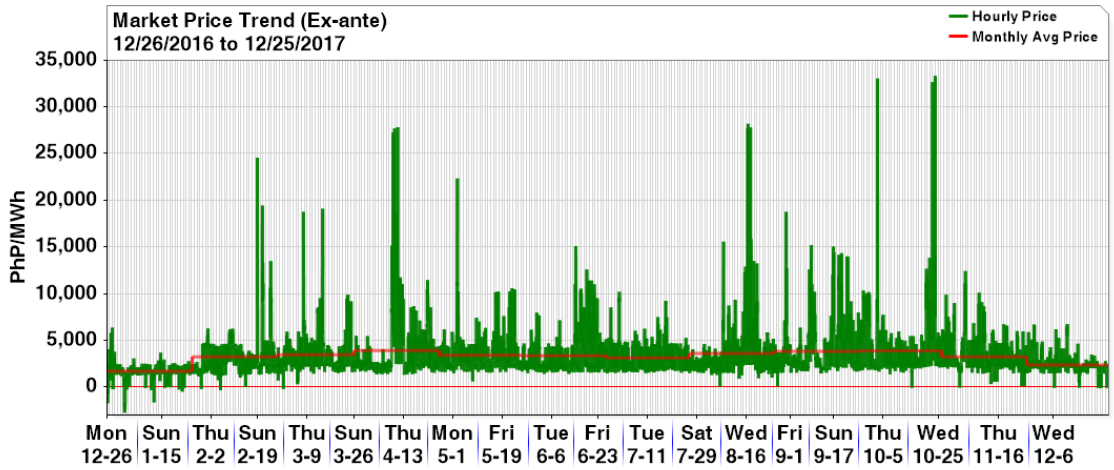


Table 42. Market Price Trend – System, 2017

	Market Price Trend (PhP/MWh) by Billing Month - 2017												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
Max	6,434	24,616	19,135	27,872	22,374	15,164	10,256	28,244	18,814	33,347	12,490	6,824	33,347
Min	(2,661)	(259)	(114)	1,404	700	1,488	1,534	130	180	-	-	-	(2,661)
Monthly Avg	1,768	3,306	3,537	3,988	3,471	3,414	3,182	3,676	3,894	3,960	3,298	2,425	3,350

Table 43. Year-on-Year Average Price Trend Comparison - System

	Year-on-Year Average Price Trend Comparison (PhP/MWh)												
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Avg
2017	1,768	3,306	3,537	3,988	3,471	3,414	3,182	3,676	3,894	3,960	3,298	2,425	3,350
2016	2,038	2,306	3,297	3,411	2,737	4,693	2,837	4,047	2,765	2,429	2,294	2,148	2,948
(%) Change	(13.2)	43.4	7.3	16.9	26.8	(27.2)	12.2	(9.1)	40.8	63.0	43.7	12.9	13.7

Regional price separation between the Luzon and Visayas was observed throughout the billing year brought about by the congestions in the HVDC. These occurred when the transfer capability of the HVDC, as imposed by the NGCP-SO, was maximized during the scheduling process. In addition, the HVDC Link was unavailable for a total of 1,605 intervals during the year, which likewise resulted in the price separation between the regions.

For the current year, the market prices in Luzon were higher by 18 percent than the market prices in the Visayas. Luzon prices averaged at PhP3,432/MWh while market prices in the Visayas averaged at PhP2,908/MWh.

Monthly comparison of regional prices demonstrates higher market prices in Luzon throughout the year except in July, with the Visayas region posting its average market price at PhP3,275/MWh. This is higher by 3.3 percent from the Luzon market price at PhP3,168/MWh in the same month. It should be noted that outage capacity in the Visayas region spiked to its highest in July, driven by the outages triggered by the intensity 5 earthquake that hit the Visayas on 06 July.

[21] As a price mitigating measure, the WESM Tripartite Committee composed of the DOE, ERC and PEMC issued Resolution No. 3 on 17 December 2015, which adopted the Offer Price Cap at PhP32,000/MWh, as initially set on 27 December 2013. The same Resolution also set the Offer Price Floor in the WESM at negative PhP10,000/MWh effective 01 January 2016.

In addition, negative prices were observed more frequently in the Visayas than in Luzon, mostly during the morning off-peak hours. This ranged from a low of negative PhP12,573/MWh on 22 January at 0900H to negative PhP1/MWh in various intervals. The negative prices in the Visayas were noted in a total of 169 trading intervals across the year, 131 of which occurred during the first quarter from January to March, while the remaining 38 intervals were with negative prices distributed over the May, August, September, October and November billing months. On the other hand, Luzon recorded three (3) negative market prices only, the lowest being negative PhP1,022/MWh on 01 January at 1000H.

It is also significant to note the high incidence of regional price separation from July to September, on account of the unavailability of the HVDC from 06 Jul (1700H) to 07 Sept (2200H), affecting 1,520 intervals. As discussed in previous sections, this is due to the tripping of the HVDC Interconnection following the earthquake which hit the Visayas on 06 July. As shown in Table 44, Luzon market prices during the August billing month were particularly higher than the market prices in the Visayas. It should be noted that the HVDC Interconnection was unavailable for the whole duration of August. During this time, the maximum price on record in Luzon was posted at PhP33,898/MWh, while it was only PhP8,278/MWh in the Visayas. During the same month, Luzon average market prices was recorded at PhP3,836/MWh, notably higher by 37.5 percent from the Visayas average price of PhP2,789/MWh. Further, it should also be noted that administered prices were applied in the Visayas during the period of the ERC's market suspension in the region from 06 July at 1700H to 01 August at 1600H, as well as during the market intervention events in the region due to generation deficiency which affected 232 trading intervals.

Year-on-year comparison of regional market prices are likewise shown in Table 45. For Luzon, average market prices increased by 16.5 percent from PhP2,945/MWh in 2016 to an average of PhP3,432/MWh this year. On the other hand, Visayas market prices declined by 1.8 percent from an average of PhP2,962/MWh in the previous year to PhP2,908/MWh.

Figure 27. Market Price Trend – Luzon

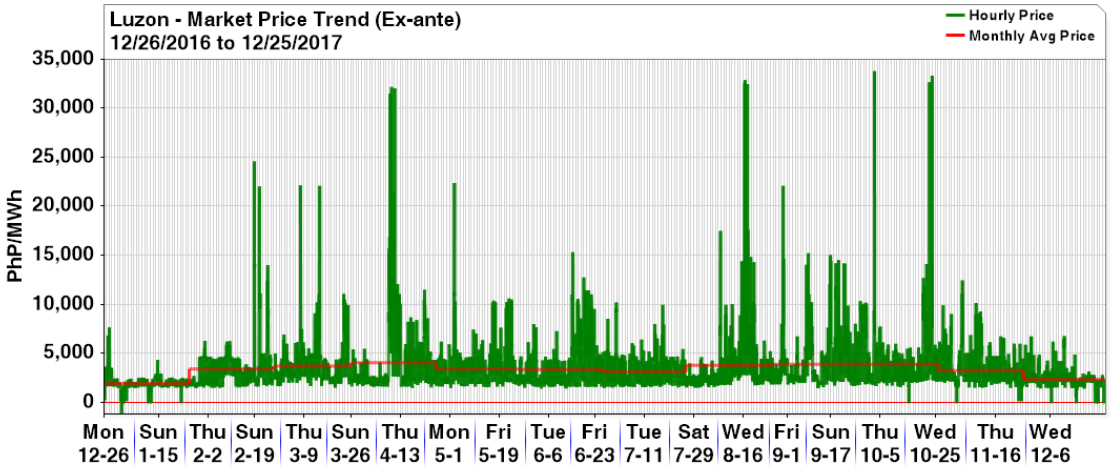


Figure 28. Market Price Trend – Visayas

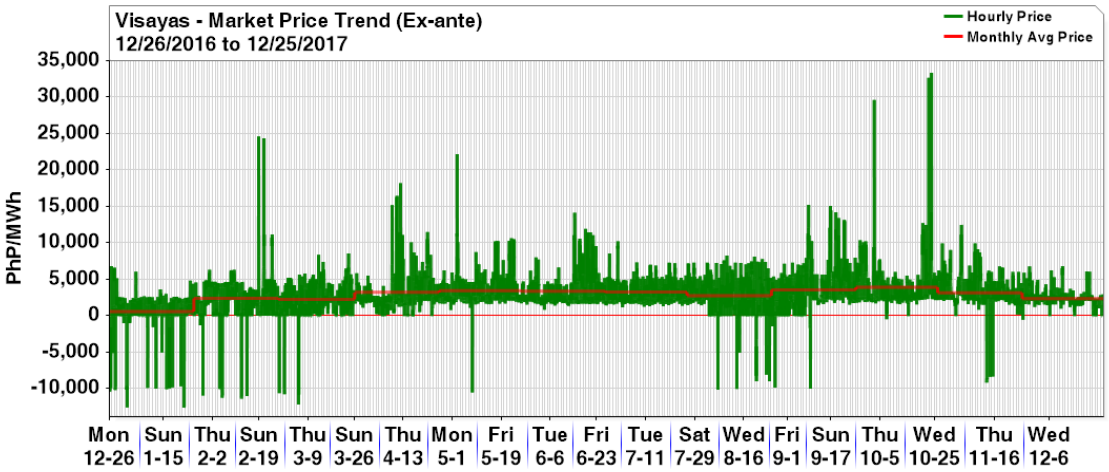


Table 44. Regional Price Summary

	Regional Market Price Trend (PhP/MWh) by Billing Month - 2017												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
	Luzon												
Max	7,693	24,616	22,171	32,189	22,407	15,366	10,256	32,898	22,117	33,798	12,490	6,824	33,798
Min	(1,022)	1,567	1,560	1,548	1,558	1,488	1,534	1,579	1,563	-	-	-	(1,022)
Monthly Avg	1,996	3,477	3,774	4,127	3,472	3,418	3,168	3,836	3,950	3,963	3,318	2,432	3,432
	Visayas												
Max	6,821	24,616	8,568	18,212	22,202	14,168	10,256	8,278	15,250	33,348	12,490	6,824	33,348
Min	(12,573)	(11,340)	(12,136)	-	(10,486)	852	1,174	(10,123)	(9,984)	(444)	(9,143)	(515)	(12,573)
Monthly Avg	606	2,408	2,269	3,233	3,466	3,393	3,275	2,789	3,590	3,945	3,192	2,392	2,908

Table 45. Year-on-Year Average Price Trend Comparison

	Year-on-Year Average Price Trend Comparison (PhP/MWh)												
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Avg
	Luzon												
2017	1,996	3,477	3,774	4,127	3,472	3,418	3,168	3,836	3,950	3,963	3,318	2,432	3,432
2016	1,991	2,288	3,274	3,373	2,725	4,685	2,841	4,043	2,771	2,507	2,272	2,185	2,945
(%) Change	0.3	52.0	15.3	22.3	27.4	(27.1)	11.5	(5.1)	42.5	58.1	46.1	11.3	16.5
	Visayas												
2017	606	2,408	2,269	3,233	3,466	3,393	3,275	2,789	3,590	3,945	3,192	2,392	2,908
2016	2,284	2,401	3,426	3,616	2,801	4,731	2,812	4,065	2,733	2,017	2,416	1,955	2,962
(%) Change	(73.5)	0.3	(33.8)	(10.6)	23.7	(28.3)	16.5	(31.4)	31.4	95.6	32.1	22.3	(1.8)

B. Frequency and Distribution

Figure 29 shows the monthly distribution of market prices throughout the billing year. The same demonstrates that majority of the market prices system-wide were distributed above PhP2,000/MWh to PhP4,000/MWh (58.5 percent). A considerable portion comprised of prices above PhP0/MWh to PhP2,000/MWh (17.5 percent) while another chunk were prices ranging above PhP4,000/MWh to PhP6,000/MWh (17.2 percent).

Another 2.7 percent of the prices were distributed above PhP6,000/MWh to PhP8,000/MWh, while 1.6 percent were prices above PhP8,000/MWh to PhP10,000/MWh. Higher market prices comprising of above PhP10,000/MWh to PhP20,000/MWh constitute a total of 1.7 percent of the market prices, while 0.1 percent were prices above PhP20,000/MWh.

Month-on-month comparison of the distribution of market prices showed that prices above PhP20,000/MWh were most frequently observed in April, August and October at 0.4 percent, 0.5 percent and 0.6 percent, respectively. This is consistent with the discussion in the

preceding section which indicated the occurrence of price spike events during the said billing months. Average market prices were also relatively higher during these months.

Conversely, the January billing month exhibited the highest distribution of market prices at PhP2,000/MWh and below (67.8 percent), 61.8 percent of which ranged above PhP0/MWh to PhP2,000/MWh. Meanwhile, another considerable portion (31.2 percent) were prices above PhP2,000/MWh to PhP4,000/MWh. This indicates that market prices were at their lowest during the January billing month. The December billing month, on the hand, had the highest distribution of prices above PhP2,000/MWh to PhP4,000/MWh (81.9 percent), demonstrating the low market prices which prevailed during this period. It is noted that the highest market prices in January and December were distributed above PhP6,000/MWh to PhP8,000/MWh, which are relatively lower when compared with the rest of the billing months.

Figure 29. Monthly Market Price Distribution – System

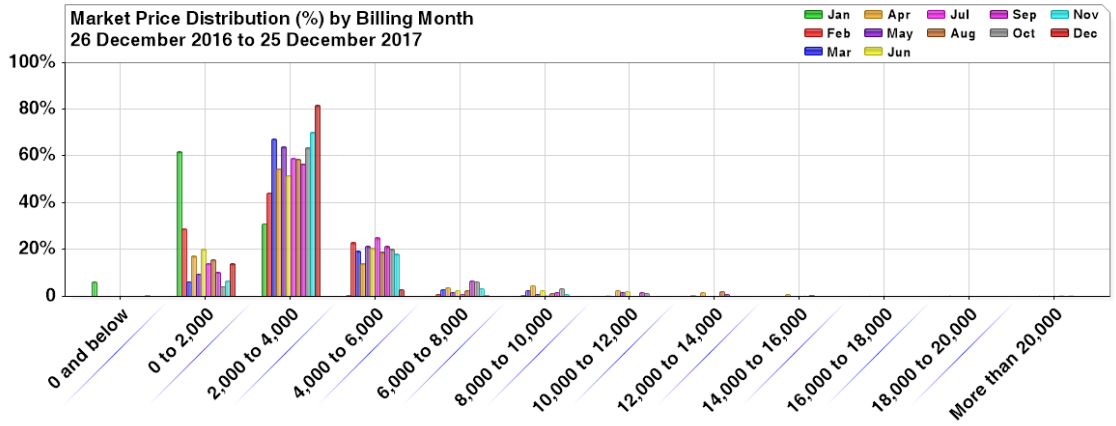


Table 46. Monthly Market Price Distribution – System

Price Range (PhP/MWh)	Market Price Distribution (%) by Billing Month, 2017												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
0 and below	6.0	0.4	0.1	-	-	-	-	-	-	0.1	0.1	0.7	0.6
0 to 2,000	61.8	28.8	6.3	17.2	9.6	20.4	14.0	15.7	10.2	4.0	6.5	13.9	17.5
2,000 to 4,000	31.2	44.4	67.6	54.6	64.0	51.7	59.2	58.9	56.7	63.6	70.3	81.9	58.5
4,000 to 6,000	0.8	23.1	19.5	14.0	21.7	20.7	25.1	19.1	21.5	20.4	18.1	2.8	17.2
6,000 to 8,000	0.1	0.9	2.8	3.6	1.8	2.3	1.0	2.4	6.6	6.3	3.5	0.7	2.7
8,000 to 10,000	-	0.8	2.7	4.6	1.0	2.6	0.6	1.1	1.6	3.2	0.9	-	1.6
10,000 to 12,000	-	0.5	0.1	2.6	1.8	1.9	0.1	0.1	1.5	1.4	0.3	-	0.9
12,000 to 14,000	-	0.7	0.4	1.6	-	0.1	-	1.9	0.9	0.3	0.3	-	0.5
14,000 to 16,000	-	0.1	0.1	0.9	-	0.3	-	0.3	0.8	0.1	-	-	0.2
16,000 to 18,000	-	-	-	0.4	-	-	-	-	-	-	-	-	0.0
18,000 to 20,000	-	0.1	0.3	0.1	-	-	-	-	0.1	-	-	-	0.1
More than 20,000	-	0.1	-	0.4	0.1	-	-	0.5	-	0.6	-	-	0.1

Distribution of regional market prices across the year demonstrates that majority of the prices ranged above PhP2,000/MWh to PhP4,000MWh, for both Luzon and Visayas. This accounted for 59.9 percent for Luzon, and 51.5 percent for Visayas. Meanwhile, consistent with the higher market prices which prevailed in Luzon, the distribution of market prices falling within the higher price range above PhP10,000/MWh were more frequent in the region, accounting for a total of 2.2 percent while the Visayas region showed price distribution within this range at only 1.1 percent. On the other hand, prices ranging from PhP2,000/MWh and below were more frequent in the Visayas, as shown in Table 48. This constituted 27 percent of the prices in the Visayas, while prices within the same range accounted for only 16 percent of the market prices in Luzon.

Figure 30. Regional Market Price Distribution

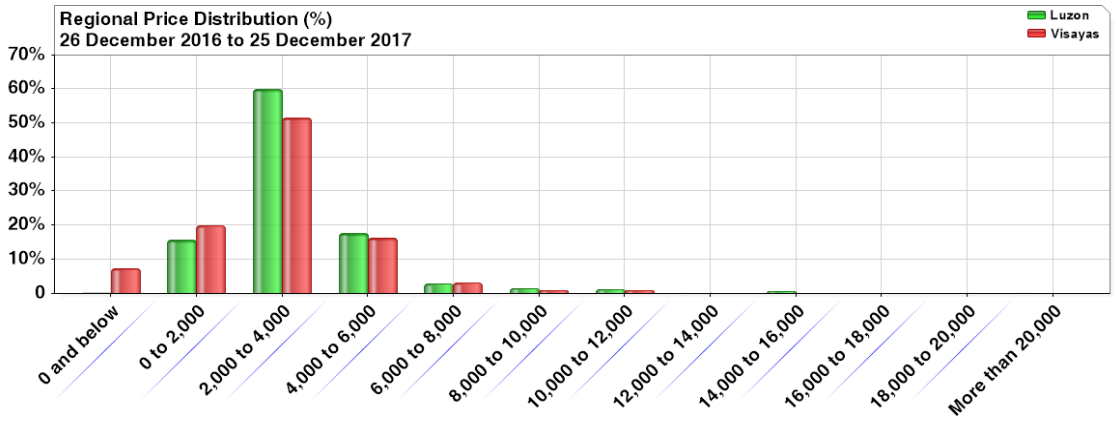


Table 47. Monthly Market Price Distribution – Luzon

Price Range (PhP/MWh)	Market Price Distribution (%) by Billing Month, 2017 - Luzon												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
0 and below	3.2	-	-	-	-	-	-	-	-	0.1	0.1	0.7	0.4
0 to 2,000	57.4	25.7	3.1	15.5	9.2	20.2	13.8	12.0	5.9	4.0	5.1	13.6	15.6
2,000 to 4,000	38.8	42.6	67.0	56.0	64.7	51.5	60.1	61.2	61.3	63.6	71.4	82.2	59.9
4,000 to 6,000	0.3	28.4	21.1	13.0	21.7	21.2	24.4	19.2	21.0	20.3	18.4	2.8	17.6
6,000 to 8,000	0.3	1.1	4.6	3.5	1.5	2.3	0.8	3.1	6.5	6.4	3.5	0.7	2.8
8,000 to 10,000	-	0.7	1.3	4.8	0.8	2.4	0.6	1.1	1.7	2.9	0.9	-	1.4
10,000 to 12,000	-	0.5	1.8	3.5	1.9	2.0	0.3	0.8	1.6	1.7	0.3	-	1.2
12,000 to 14,000	-	0.3	0.1	0.3	-	0.1	-	-	0.4	0.1	0.3	-	0.1
14,000 to 16,000	-	0.4	0.6	1.9	-	0.3	-	1.9	1.5	0.3	-	-	0.6
16,000 to 18,000	-	0.1	-	0.9	-	-	-	0.3	-	-	-	-	0.1
18,000 to 20,000													
More than 20,000	-	0.3	0.3	0.5	0.1	-	-	0.5	0.1	0.6	-	-	0.2

Table 48. Monthly Market Price Distribution – Visayas

Price Range (PhP/MWh)	Market Price Distribution by Billing Month, 2017 - Visayas												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
0 and below	31.9	17.2	15.0	2.0	0.6	-	-	10.8	6.3	0.3	1.2	0.8	7.2
0 to 2,000	48.0	26.3	29.3	24.1	9.7	21.5	16.8	21.8	13.7	4.7	6.7	15.4	19.9
2,000 to 4,000	18.3	34.7	38.5	53.2	62.6	51.5	58.3	43.3	44.6	63.1	69.6	80.6	51.5
4,000 to 6,000	1.2	18.7	15.0	13.0	22.4	20.0	21.9	18.4	24.7	20.4	17.5	2.2	16.3
6,000 to 8,000	0.7	1.7	1.8	3.5	1.8	2.7	2.4	5.5	6.7	6.4	3.6	1.0	3.2
8,000 to 10,000	-	0.5	0.3	1.5	1.0	2.2	0.4	0.3	1.2	2.8	0.9	-	0.9
10,000 to 12,000	-	0.4	-	1.7	1.8	1.9	0.1	-	1.3	1.4	0.1	-	0.7
12,000 to 14,000	-	0.1	-	0.3	-	0.1	-	-	0.8	0.3	0.3	-	0.2
14,000 to 16,000	-	-	-	0.1	-	0.1	-	-	0.5	0.1	-	-	0.1
16,000 to 18,000	-	-	-	0.4	-	-	-	-	-	-	-	-	0.0
18,000 to 20,000	-	-	-	0.1	-	-	-	-	-	0.1	-	-	0.0
More than 20,000	-	0.3	-	-	0.1	-	-	-	-	0.4	-	-	0.1

C. Summary of Pricing Errors

Throughout the billing year, the issuances of non-congestion pricing errors in the ex-ante affected a total of 1,081 trading intervals, accounting for 12.3 percent of the total trading intervals.

System-wide, it was noted that 192 trading intervals were subjected to non-congestion pricing errors (2.2 percent of the time during the year). Meanwhile, issuances of non-congestion pricing errors in Luzon during the ex-ante were noted 9.6 percent of the time during the year, affecting a total of 838 trading intervals. The highest monthly occurrence was observed in January (201 trading intervals), March (184 trading intervals) and April (127 trading intervals), mostly attributable to the localized contingency constraint violation on Zapote transformers. The frequency of non-congestion pricing errors from July to August was likewise relatively high affecting 73 trading intervals for each month. The reason for the

issuances was mostly on account of the localized contingency constraint violation on Manila transformers.

On the other hand, non-congestion pricing errors in the Visayas region during the ex-ante was noted in 0.7 percent of the time across 2017, affecting only 61 trading intervals. The highest frequency was observed in January, which recorded 25 non-congestion PEN in the ex-ante. These were mostly due to the over-generation in Visayas and inappropriate input data during the month.

Meanwhile, system-wide application of Price Substitution Methodology (PSM) were observed in a total of 1,586 trading intervals in the ex-ante, and 1,533 trading intervals in the ex-post. This affected 25.3 percent of trading intervals in the ex-ante and 22.2 percent of the time in the ex-post throughout the billing year.

As shown in Table 49 below, the April billing month recorded the highest number of system-wide PSM application this year, affecting 210 trading intervals corresponding to 28.2 percent of the time in the ex-ante run. PSM application this month was mainly due to the constraint on the Samboan-Amlan Line 1 (Cebu-Negros submarine cable) and Bauang-BPPC line 1. The system-wide PSM application in April was also high during ex-post, accounting for a total of 187 trading intervals or 25.1 percent of the time.

System-wide PSM applications were also more frequently observed during the October and December billing months, affecting a total of 201 (27.9 percent of the time) and 182 trading intervals (25.3 percent of the time), respectively. These were also mostly on account of the constraint on the Samboan-Amlan Line 1 (Cebu-Negros submarine cable).

Table 49. PEN-PSM Summary – 2017

	PEN - PSM Summary, 2017																							
	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
	Freq	% of Time	Freq	% of Time	Freq	% of Time	Freq	% of Time	Freq	% of Time	Freq	% of Time	Freq	% of Time	Freq	% of Time	Freq	% of Time	Freq	% of Time	Freq	% of Time	Freq	% of Time
PEN (RTD)																								
System	11	1.5	27	3.6	6	0.9	4	0.5	18	2.5	22	3.0	17	2.4	1	0.1	3	0.4	37	5.1	27	3.6	19	2.6
Luzon	201	27.0	70	9.4	184	27.4	127	17.1	32	4.4	8	1.1	73	10.1	73	9.8	44	5.9	10	1.4	5	0.7	11	1.5
Visayas	25	3.4	3	0.4	2	0.3	2	0.3	4	0.6	0	-	0	-	1	0.1	7	0.9	2	0.3	8	1.1	7	1.0
Total	234	31.5	100	13.4	192	28.6	132	17.7	53	7.4	30	4.0	90	12.5	75	10.1	49	6.6	49	6.8	40	5.4	37	5.1
PEN (RTX)																								
System	7	0.9	16	2.2	4	0.6	0	-	15	2.1	17	2.3	7	1.0		-	2	0.3	15	2.1	22	3.0	14	1.9
Luzon	15	2.0	6	0.8	10	1.5	12	1.6	0	-	0	-	2	0.3	4	0.5	5	0.7	0	-	2	0.3	1	0.1
Visayas	30	4.0	2	0.3	1	0.1	0	-	4	0.6	0	-	0	-		-	5	0.7	1	0.1	7	0.9	6	0.8
Total	52	7.0	24	3.2	15	2.2	12	1.6	19	2.6	17	2.3	9	1.3	4	0.5	12	1.6	16	2.2	31	4.2	21	2.9
PSM (RTD)																								
System	43	5.8	128	17.2	122	18.2	210	28.2	166	23.1	201	27.0	70	9.7		-	131	17.6	201	27.9	132	17.7	182	25.3
Luzon	0	-	1	0.1	16	2.4	45	6.0	2	0.3	0	-	0	-		-	2	0.3	0	-	1	0.1	0	-
Visayas	36	4.8	60	8.1	84	12.5	40	5.4	6	0.8	0	-	0	-	80	10.8	47	6.3	0	-		-	0	-
Total	79	10.6	189	25.4	212	31.5	281	37.8	172	23.9	201	27.0	70	9.7	80	10.8	179	24.1	201	27.9	133	17.9	182	25.3
PSM (RTX)																								
System	34	4.6	129	17.3	107	15.9	187	25.1	158	21.9	211	28.4	80	11.1		-	121	16.3	213	29.6	133	17.9	160	22.2
Luzon	0	-	0	-	0	-	0	-	0	-	0	-	0	-		-		-	2	0.3		-	0	-
Visayas	29	3.9	55	7.4	99	14.7	42	5.6	5	0.7	0	-	0	-	81	10.9	52	7.0	0	-	1	0.1	1	0.1
Total	63	8.5	184	24.7	206	30.7	229	30.8	163	22.6	211	28.4	80	11.1	81	10.9	173	23.3	215	29.9	134	18.0	161	22.4

Figure 31. PEN Monthly Frequency Summary – 2017

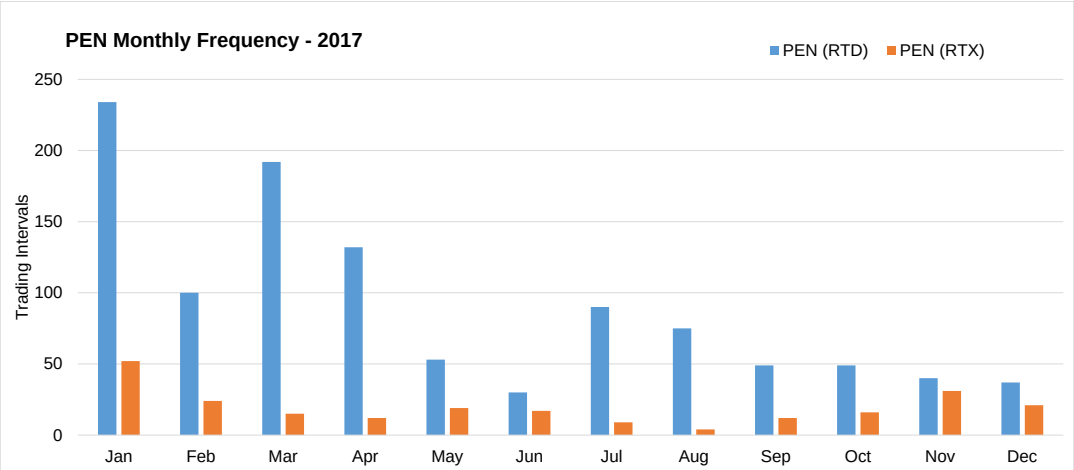
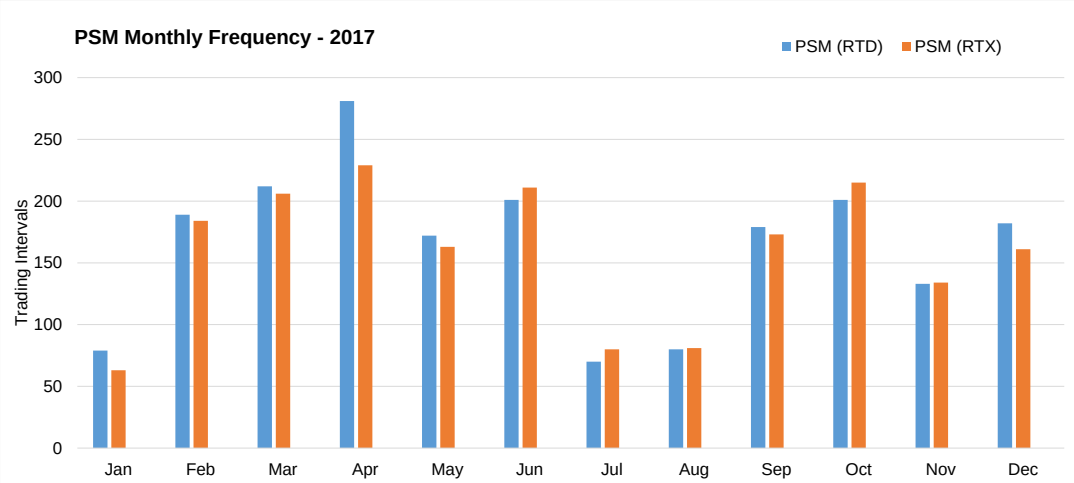


Figure 32. PSM Monthly Frequency Summary – 2017



Shown in Figure 33 and Table 50 are the non-congestion pricing errors by PEN type throughout the billing year, reflecting the occurrence of multiple types of PEN for some trading intervals.

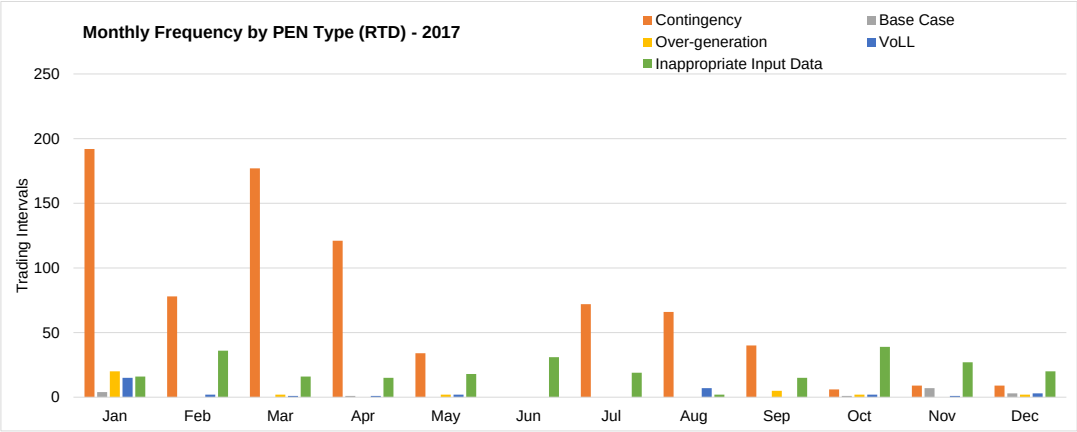
Issuances of contingency-related non-congestion pricing errors during the ex-ante posted the highest frequency across the year, affecting a total of 804 trading intervals (9.2 percent of the 2017 billing year). This was followed by pricing errors related to inappropriate input data which totalled 254 issuances during the year (2.9 percent of the time).

Note that contingency related pricing errors were mostly observed from January to April, affecting a total of 192, 78, 177 and 121 trading intervals, respectively, during these months. As already mentioned, the reason for majority of these issuances were the localized contingency constraint in the Zapote transformers. On the other hand, pricing errors due to inappropriate input data were distributed throughout the year, the highest frequency being noted during the October billing month, affecting 39 trading intervals, followed by the 36 issuances noted in February. For the month of October, these were due to the inappropriate input data in reserve requirements and in certain substations. Meanwhile, *inappropriate input data on Lumban loads* accounted for majority of the inappropriate input data-related pricing errors in February.

Table 50. PEN Type Summary – 2017

	PEN Type Summary - 2017																					
	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
	Freq	% of Time	Freq	% of Time	Freq	% of Time	Freq	% of Time	Freq	% of Time	Freq	% of Time	Freq	% of Time	Freq	% of Time	Freq	% of Time	Freq	% of Time	Freq	% of Time	Freq	% of Time
	System																							
PEN (RTD)	**11**	**1.5**	**27**	**3.6**	**6**	**0.9**	**4**	**0.5**	**18**	**2.5**	**22**	**3.0**	**17**	**2.4**	**1**	**0.1**	**3**	**0.4**	**37**	**5.1**	**27**	**3.6**	**19**	**2.6**
Contingency	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-
Base Case	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-
Over-generation	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-			0	-
VoLL	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-
Inappropriate Input Data	11	1.5	27	3.6	6	0.9	4	0.5	18	2.5	22	3.0	17	2.4	1	0.1	3	0.4	37	5.1	27	3.6	19	2.6
PEN (RTX)	**7**	**0.9**	**16**	**2.2**	**4**	**0.6**	**0**	**-**	**15**	**2.1**	**17**	**2.3**	**7**	**1.0**	**0**	**-**	**2**	**0.3**	**15**	**2.1**	**22**	**3.0**	**14**	**1.9**
Contingency	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-
Base Case	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-
Over-generation	1	0.1	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-			0	-
VoLL	6	0.8	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-
Inappropriate Input Data	0	-	16	2.2	4	0.6	0	-	15	2.1	17	2.3	7	1.0	0	-	2	0.3	15	2.1	22	3.0	14	1.9
	Luzon																							
PEN (RTD)	**207**	**27.8**	**86**	**11.6**	**188**	**28.0**	**132**	**17.7**	**34**	**4.7**	**9**	**1.2**	**74**	**10.3**	**73**	**9.8**	**50**	**6.7**	**10**	**1.4**	**9**	**1.2**	**11**	**1.5**
Contingency	192	25.8	78	10.5	177	26.3	121	16.3	34	4.7	0	-	72	10.0	66	8.9	40	5.4	6	0.8	9	1.2	9	1.3
Base Case	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	2	0.3
Over-generation	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	3	0.4	2	0.3			0	-
VoLL	11	1.5	2	0.3	1	0.1	1	0.1	0	-	0	-	0	-	6	0.8	0	-	0	-	0	-	0	-
Inappropriate Input Data	4	0.5	6	0.8	10	1.5	10	1.3	0	-	9	1.2	2	0.3	1	0.1	7	0.9	2	0.3	0	-	0	-
PEN (RTX)	**16**	**2.2**	**6**	**0.8**	**10**	**1.5**	**12**	**1.6**	**0**	**-**	**0**	**-**	**2**	**0.3**	**4**	**0.5**	**5**	**0.7**	**0**	**-**	**2**	**0.3**	**1**	**0.1**
Contingency	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-
Base Case	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	1	0.1
Over-generation	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-			0	-
VoLL	10	1.3	1	0.1	0	-	4	0.5	0	-	0	-	0	-	0	-	0	-	0	-	2	0.3	0	-
Inappropriate Input Data	6	0.8	5	0.7	10	1.5	8	1.1	0	-	0	-	2	0.3	4	0.5	5	0.7	0	-	0	-	0	-
	Visayas																							
PEN (RTD)	**29**	**3.9**	**3**	**0.4**	**2**	**0.3**	**2**	**0.3**	**4**	**0.6**	**0**	**-**	**0**	**-**	**1**	**0.1**	**7**	**0.9**	**3**	**0.4**	**8**	**1.1**	**7**	**1.0**
Contingency	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-
Base Case	4	0.5	0	-	0	-	1	0.1	0	-	0	-	0	-	0	-	0	-	1	0.1	7	0.9	1	0.1
Over-generation	20	2.7	0	-	2	0.3	0	-	2	0.3	0	-	0	-	0	-	2	0.3	0	-			2	0.3
VoLL	4	0.5	0	-	0	-	0	-	2	0.3	0	-	0	-	1	0.1	0	-	2	0.3	1	0.1	3	0.4
Inappropriate Input Data	1	0.1	3	0.4	0	-	1	0.1	0	-	0	-	0	-	0	-	5	0.7	0	-	0	-	1	0.1
PEN (RTX)	**30**	**4.0**	**2**	**0.3**	**1**	**0.1**	**0**	**-**	**4**	**0.6**	**0**	**-**	**0**	**-**	**0**	**-**	**8**	**1.1**	**1**	**0.1**	**7**	**0.9**	**6**	**0.8**
Contingency	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-
Base Case	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	7	0.9	0	-
Over-generation	21	2.8	1	0.1	1	0.1	0	-	2	0.3	0	-	0	-	0	-	1	0.1	0	-			2	0.3
VoLL	8	1.1	0	-	0	-	0	-	2	0.3	0	-	0	-	0	-	2	0.3	1	0.1	0	-	4	0.6
Inappropriate Input Data	1	0.1	1	0.1	0	-	0	-	0	-	0	-	0	-	0	-	5	0.7	0	-	0	-	0	-
	Total																							
PEN (RTD)	**247**	**33.2**	**116**	**15.6**	**196**	**29.2**	**138**	**18.5**	**56**	**7.8**	**31**	**4.2**	**91**	**12.6**	**75**	**10.1**	**60**	**8.1**	**50**	**6.9**	**44**	**5.9**	**37**	**5.1**
Contingency	192	25.8	78	10.5	177	26.3	121	16.3	34	4.7	0	-	72	10.0	66	8.9	40	5.4	6	0.8	9	1.2	9	1.3
Base Case	4	0.5	0	-	0	-	1	0.1	0	-	0	-	0	-	0	-	0	-	1	0.1	7	0.9	3	0.4
Over-generation	20	2.7	0	-	2	0.3	0	-	2	0.3	0	-	0	-	0	-	5	0.7	2	0.3			2	0.3
VoLL	15	2.0	2	0.3	1	0.1	1	0.1	2	0.3	0	-	0	-	7	0.9	0	-	2	0.3	1	0.1	3	0.4
Inappropriate Input Data	16	2.2	36	4.8	16	2.4	15	2.0	18	2.5	31	4.2	19	2.6	2	0.3	15	2.0	39	5.4	27	3.6	20	2.8
PEN (RTX)	**53**	**7.1**	**24**	**3.2**	**15**	**2.2**	**12**	**1.6**	**19**	**2.6**	**17**	**2.3**	**9**	**1.3**	**4**	**0.5**	**15**	**2.0**	**16**	**2.2**	**31**	**4.2**	**21**	**2.9**
Contingency	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-
Base Case	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	7	0.9	1	0.1
Over-generation	22	3.0	1	0.1	1	0.1	0	-	2	0.3	0	-	0	-	0	-	1	0.1	0	-			2	0.3
VoLL	24	3.2	1	0.1	0	-	4	0.5	2	0.3	0	-	0	-	0	-	2	0.3	1	0.1	2	0.3	4	0.6
Inappropriate Input Data	7	0.9	22	3.0	14	2.1	8	1.1	15	2.1	17	2.3	9	1.3	4	0.5	12	1.6	15	2.1	22	3.0	14	1.9

Figure 33. Monthly Frequency by PEN Type – Ex-Ante, 2017



D. Interesting Pricing Events

This section provides the assessment highlights of intervals determined to have price outliers based on the relationship of market price and supply margin or also known as “interesting pricing events”. The relationship of supply margin and price is another monitoring metric used to identify any unusual market outcome with a general intent of further assessing a rather unusual event. It should be noted that the supply margin analysis can

serve as a tool in detecting interesting pricing events but will not in itself determine definitively the existence of abuse of market power and possible conduct of anti-competitive behaviour.

The criteria used in the assessment were as follows: (a) reference threshold was set covering the period from 26 December 2013 to 25 December 2016; (b) upper and lower reference price thresholds were derived using a combination of statistical methods namely, bandwidth method, ordinary least squares (OLS) method and non-parametric method with a ±3 percent standard deviation; and (c) intervals with market intervention/suspension and negative supply margin (e.g. no under-generation) were excluded. Prices within the reference price thresholds are considered as "normal prices", while prices outside the thresholds are tagged as "interesting pricing events.

Table 51 provides the reference price thresholds and corresponding to a supply margin range.

Table 51. Price Thresholds and Supply Margin Range

Supply Margin Range (in MW)	Price Thresholds	
	Upper (PhP/MWh)	Lower (PhP/MWh)
0 to 250	22,025.70	(155.91)
250 to 500	19,273.79	(2,907.46)
500 to 750	17,448.17	(4,732.88)
750 to 1000	16,121.85	(6,059.12)
1,000 to 1,250	15,145.13	(7,035.81)
1,250 to 1,500	14,405.27	(7,775.67)
1,500 to 1,750	13,779.32	(8,401.63)
1,750 to 2,000	13,221.78	(8,959.19)
2,000 to 2,250	12,735.07	(9,445.90)
2,250 to 2,500	12,327.69	(9,853.29)
2,500 to 2,750	11,993.89	(10,187.14)
2,750 to 3,000	11,703.91	(10,477.24)
3,000 and above	11,733.76	(10,455.30)

As shown in Figure 34, 12 intervals were identified as interesting pricing events during the billing year. Consistent with the foregoing discussion on market prices, it is observed that these interesting pricing events mostly occurred during periods of tight supply and demand conditions. On the other hand, there was no interval with prices that went beyond the lower threshold.

Figure 34. List of Interesting Price Events, 2017

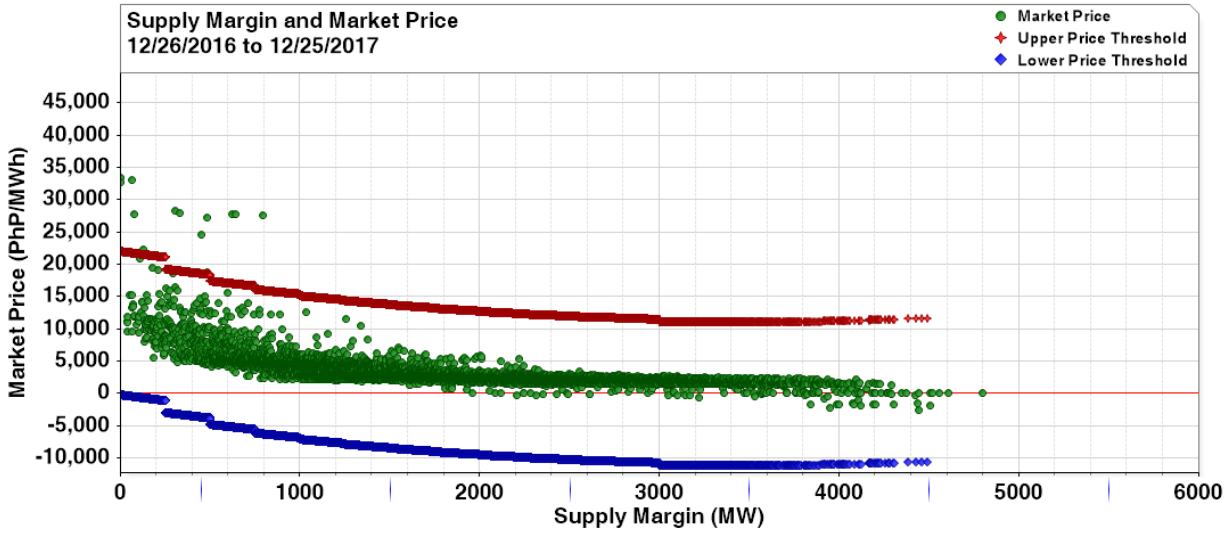


Table 52 lists the interesting pricing events and summary of reasons for the high market prices in 2017.

Table 52. Supply Margin Distribution and Price Thresholds

Date	Hour	Market Price (PhP/MWh)	Supply Margin (MW)	Reason/s for the High Market Price
2/18/2017	19	24,616	450	High outage capacity from major coal plants among other existing outages
4/9/2017	5	27,301	487	High outage capacity incurred in the Batangas region following the series of earthquakes in the area
4/9/2017	19	27,729	78	
4/10/2017	22	27,872	333	
5/2/2017	16	22,374	129	1. High capacity not offered; 2. Occurrence of pricing errors in both ex-ante and ex-post runs resulting to re-run of prices; and 3. Higher-priced capacity offers from a natural gas plant
8/16/2017	10	27,553	794	1. High system demand requirement; and 2. Lower effective supply due to the high outage incidents among coal plants
8/16/2017	11	27,727	623	
8/16/2017	14	28,244	306	
8/17/2017	11	27,844	643	
10/2/2017	18	33,084	68	1. High system demand requirement 2. Lower effective supply as a result of the following: > High outage capacity from major coal plants among other existing outages; and > Lower available cpacity from solar plants starting at 1800H
10/22/2017	18	32,673	2	
10/23/2017	18	33,347	1	

It is noteworthy to mention that the Market Surveillance Committee (MSC) periodically submits an Interesting Pricing Event Report, which provides an in-depth per incident analysis of the identified interesting pricing events, to the Department of Energy.

VIII. MARKET INTERVENTION/SUSPENSION[22]

System-wide market intervention events during the year affected a total of 11 trading intervals, all of which were initiated by the Market Operator due to force majeure arising from Market Management System (MMS)[23] concerns. Four (4) of these occurred in September due to workflow stoppage in the MMS, while the remaining seven (7) were observed in December owing to force majeure events resulting to un-implementable RTD schedules.

On the other hand, market intervention events in the Luzon region were kept to a minimum, affecting only three (3) trading intervals across the year. All three (3) events were System Operator-initiated due to force majeure arising from a system snapshot problem (1 event in March) and due to emergency/security event due to multiple tripping of transmission lines (2 events in September).

[22] The market intervention (MI) or suspension index is a general indicator used to assess the development of the WESM in relation to special conditions, which, under the WESM Rules, include emergency, system security threat, and force majeure events. Either the Market Operator (MO) or System Operator (SO) may declare/initiate market intervention depending on the emergency events. On the other hand, market suspension (MS) is an event wherein the ERC declares the operation of the spot market to be suspended in cases of natural calamities or national and international security emergencies. In the event of market intervention or suspension, the administered price shall be used for WESM settlement.

Under the WESM Rules, the administered price shall be used for settlement in cases where there is intervention in the market by the System Operator or where the market is suspended by the ERC (WESM Rule 6.2.3 and 6.8.3.1). The administered price applies when the Market Operator is not able to generate or determine the price for energy for a grid or island grid for any given trading interval that intervention or suspension is in effect.

[23] The MMS is the infrastructure that supports the WESM and the ancillary IS/IT facilities of the Market Operator.

Meanwhile, the Visayas region recorded the highest number of market intervention events during the billing year, affecting a total of 102 trading intervals. The System Operator declared market intervention on separate occasions during the August and September billing months on account of the generation deficiency that was prevalent during the period. These affected a total of 72 trading intervals in August and 22 intervals in September. On top of these, market intervention was initiated by the System Operator in another six (6) trading intervals in September due to multiple transmission line outages. The Market Operator also initiated market intervention in two (2) trading intervals in October due to unimplementable RTD schedule (force majeure event).

As already mentioned in previous sections, the ERC suspended the operations of the WESM in the Visayas starting 1700H of 06 July 2017, considering the disturbance to the network brought about by the intensity scale 5 earthquake in the region. Resumption of operations was effected upon issuance by the ERC of its Notice of Market Resumption effective 1700H of 01 August 2017.

The ERC's declaration of market suspension in the Visayas affected a total of 464 trading intervals in July and 160 trading intervals in August.

Table 53. Total Monthly Occurrences of Market Intervention

Initiated by	Remarks (Luz-Vis)	2017												
		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
MO	Force Majeure (MMS Concern)									4			7	
	Force Majeure (MO Other Concern)													
	Force Majeure (SCADA/EMS Concern)													
	Sub-Total (MO-Initiated)	0	0	0	0	0	0	0	0	4	0	0	7	11
NGCP-SO	Emergency/Security Event													
	Force Majeure (SCADA/EMS Concern)													
	Force Majeure (SO Other Concern)													
	Sub-Total (NGCP-SO-Initiated)	0	0	0	0	0	0	0	0	0	0	0	0	0
ERC	Declaration of Market Suspension													
	Sub-Total (ERC-Initiated)	0	0	0	0	0	0	0	0	0	0	0	0	0
Total		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**7**	**11**

Table 54. Monthly Occurrences of Market Intervention – Luzon

Initiated by	Remarks (Luzon)	2017												
		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
MO	Force Majeure (MMS Concern)													
	Force Majeure (MO Other Concern)													
	Sub-Total (MO-Initiated)	0	0	0	0	0	0	0	0	0	0	0	0	0
NGCP-SO	Emergency/Security Event									2				
	Force Majeure (SCADA/EMS Concern)			1										
	Force Majeure (SO Other Concern)													
	Sub-Total (NGCP-SO-Initiated)	0	0	1	0	0	0	0	0	2	0	0	0	3
ERC	Declaration of Market Suspension													
	Sub-Total (ERC-Initiated)	0	0	0	0	0	0	0	0	0	0	0	0	0
Total		**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**3**

Table 55. Monthly Occurrences of Market Intervention – Visayas

Initiated by	Remarks (Visayas)	2017												
		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
MO	Force Majeure (MMS Concern)										2			
	Force Majeure (MO Other Concern)													
	Sub-Total (MO-Initiated)	0	0	0	0	0	0	0	0	0	2	0	0	2
NGCP-SO	Emergency/Security Event								72	28				
	Force Majeure (SCADA/EMS Concern)													
	Force Majeure (SO Other Concern)													
	Sub-Total (NGCP-SO-Initiated)	0	0	0	0	0	0	0	72	28	0	0	0	100
ERC	Declaration of Market Suspension							464	160					
	Sub-Total (ERC-Initiated)	0	0	0	0	0	0	464	160	0	0	0	0	624
Total		**0**	**0**	**0**	**0**	**0**	**0**	**464**	**232**	**28**	**2**	**0**	**0**	**726**

IX. PRICE SETTING FREQUENCY INDEX (PSFI)[24]

The most frequent price-setting plants for prices PhP5,000/MWh and below were Luzon coal plants Masinloc, Pagbilao, Sual and QPPL, as well as natural gas plants Ilijan, Sta. Rita and San Lorenzo. On the other hand, major coal plants PEDC, CEDC, PCPC, KSPC and geothermal plants Palinpinon 1 and 2, Nasulo and Tongonan topped the list of price-setters in the Visayas.

On the other hand, for prices ranging above PhP5,000/MWh to PhP10,000/MWh, the top price-setters were mostly hydro and oil-based plants. Luzon oil-based plants Bauang, CIP, Subic, and hydro plants Angat, Magat and San Roque were on top of the list. Natural gas plant Avion also figured as a top price-setter.

Meanwhile, oil-based and hydro plants dominated the list of price-setters at the above PhP10,000/MWh to PhP15,000/MWh range. Oil-based plants Limay and Bauang held the top two places on the list of Luzon price-setting plants followed by hydro plants San Roque and Angat, and oil-based plants CIP, Subic and TAPGC. On the other hand, oil-based plants Nabas, Cebu II, and Bohol were the top price-setters in the Visayas region. Luzon major coal plant Masinloc likewise registered as a price-setter at this level in two (2) trading intervals during the November billing month.

It is noted that coal plant Masinloc was the marginal plant at PhP12,000/MWh on 03 November at 1800H and 1900H. Change in its offer pattern was observed from 30 October to 02 November and on 03 to 05 November when the plant offered a portion of its capacity at above PhP30,000/MWh to PhP32,000/MWh, and above PhP10,000/MWh to PhP15,000/MWh, respectively. Prior to this, Masinloc normally offered its capacity at above PhP0/MWh to PhP5,000/MWh, and a small portion at above PhP5,000/MWh to PhP10,000/MWh.

For prices within the higher price range of above PhP15,000/MWh to PhP20,000/MWh the price-setters were Luzon oil-based plants Limay, Bauang, CIP and TAGPC. These were all observed in August. Hydro plant Kalayaan also figured as a price-setter within this price range during the billing month of May. On the other hand, price-setting plants for prices above PhP20,000/MWh to PhP25,000/MWh were hydro plant Kalayaan, natural gas plants Avion and San Gabriel, and oil-based plant Subic. These were set in February, March and September. Meanwhile, Visayas oil-based plant CPPC likewise set the price at this level during the October billing month.

Finally, natural gas plants San Gabriel and Avion, Masinloc battery energy storage emerged as the top price-setters for prices above PhP30,000/MWh to PhP32,000/MWh. The price-setting at this level was incurred during the August and October billing months. Luzon coal plant Anda was also a price-setter within this price range in April, setting the price at PhP32,000/MWh in two (2) trading intervals.

[24] The price setting indices identify generating plants that set the price or are near setting the spot prices. 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 not subject to PSM, a generator trading node is considered 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. 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 56. Price-Setting Plants – PhP5,000/MWh and Below

	Price-Setting Frequency Index - Percent of Time (PhP5,000/MWh and Below), 2017												
	Luzon Plants												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MASINLOC CFTPP	34.8	21.6	2.7	14.8	10.1	19.2	10.8	15.9	24.1	32.6	26.5	52.6	22.3
PAGBILAO CFTPP	35.2	15.7	4.2	7.1	6.3	14.7	16.0	18.7	20.4	23.2	33.1	35.3	19.3
SUAL CFTPP	32.8	27.6	29.8	22.7	15.1	23.0	18.5	15.2	11.0	12.6	6.9	10.1	18.7
ILIJAN NGPP	5.5	7.3	35.4	17.5	25.4	21.6	28.1	27.2	17.5	8.2	12.8	4.6	17.4
QPPL CFTPP	27.0	0.0	0.3	6.0	2.1	6.3	14.2	17.1	20.0	22.8	21.4	23.1	13.4
STA RITA NGPP	8.1	18.7	25.3	18.3	25.3	4.0	6.0	11.4	8.5	3.1	4.7	1.8	11.2
SAN LORENZO NGPP	16.9	23.5	37.8	16.9	25.4	0.5	0.1	0.7	3.6	0.1	0.3	1.4	10.4
NAVOTAS DPP	1.6	9.3	14.0	4.2	8.3	9.1	5.8	7.9	9.0	8.2	9.9	3.6	7.5
ANDA CFTPP	1.2	0.0	1.3	0.9	0.7	3.4	6.4	8.2	19.2	25.0	11.8	10.0	7.4
AVION NGPP	0.9	1.9	9.2	2.0	8.3	9.3	10.1	10.1	6.0	7.4	8.9	1.7	6.3
ANGAT HEP	10.9	12.1	3.6	4.2	0.0	0.0	6.3	11.0	5.4	1.3	5.0	7.6	5.6
SLTEC CFTPP	15.3	4.4	0.4	5.4	2.5	7.1	6.3	3.4	0.5	0.6	1.3	4.9	4.4
BAUANG DPP	0.0	1.2	8.6	3.8	8.3	8.3	11.7	0.0	0.0	0.0	0.0	0.0	3.4
SAN GABRIEL NGPP	0.5	0.5	0.7	1.6	1.9	5.9	5.6	6.0	3.0	3.9	4.4	3.6	3.2
APEC CFTPP	14.8	7.0	0.6	0.9	0.7	1.2	0.7	0.8	0.8	1.4	0.8	0.8	2.6
MAGAT HEP	3.0	5.6	0.0	0.4	6.9	2.8	4.0	4.4	0.3	1.1	0.7	0.7	2.5
MARIVELES CFTPP	3.1	0.0	0.0	0.0	5.1	6.6	1.7	1.5	0.3	0.6	0.4	7.5	2.2
SUBIC DPP	0.0	1.5	0.0	3.4	2.2	3.2	2.8	4.4	2.4	2.8	1.6	0.0	2.0
CIP DPP	0.0	9.0	8.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4
KALAYAAN PSPP	5.8	0.7	0.1	1.9	0.1	0.9	0.8	1.2	1.5	0.1	0.0	0.4	1.2
TAPGC DPP	0.0	3.0	1.9	1.1	0.0	0.3	0.3	1.6	1.2	1.9	2.0	0.0	1.1
BINGA HEP	1.9	0.0	0.0	0.0	0.3	0.0	0.4	0.4	0.7	0.3	0.9	0.4	0.4
MAKBAN GPP	2.8	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	1.3	0.1	0.7	0.4
BACMAN GPP	2.8	0.0	0.1	0.4	0.1	0.1	0.0	0.0	0.0	0.4	0.1	0.7	0.4
MASIWAY HEP	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.3
SMC LIMAY CFTPP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.8	0.1	1.9	0.0	0.3
CASECNAN HEP	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.3	0.6	0.2
BOTOCAN HEP	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.7	0.2
HEDCOR HEP	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.7	0.2
AMBUKLAO HEP	0.9	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.1	0.3	0.2
PETRON SFFPP	0.1	0.0	0.0	0.0	0.8	0.4	0.0	0.0	0.0	0.0	0.0	0.3	0.1
TIWI GPP	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.7	0.1
CALACA CFTPP	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
PANTABANGAN HEP	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.1
BAKUN HEP	0.1	0.0	0.0	0.0	0.0	0.3	0.1	0.1	0.0	0.0	0.1	0.0	0.1
MASINLOC BATTERY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.0
CALIRAYA HEP	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Visayas Plants												
PEDC CFTPP	11.3	19.6	9.7	25.0	7.5	19.6	8.2	15.6	10.9	13.2	18.3	10.3	14.2
CEDC CFTPP	23.0	7.3	19.0	17.2	10.0	14.2	1.9	22.8	18.3	13.2	3.8	6.5	13.1
PCPC CFTPP	10.3	13.8	12.6	18.0	8.9	12.6	6.4	9.1	12.8	11.9	2.7	16.5	11.3
KSPC CFTPP	19.5	12.8	11.0	3.5	1.9	2.4	0.0	13.3	8.5	2.1	3.9	23.1	8.5
PALINPINON GPP II	24.3	13.8	13.2	3.8	0.1	0.7	0.6	13.7	8.5	0.1	0.7	1.5	6.8
NASULO GPP	24.3	15.5	14.4	3.9	0.0	0.1	0.3	10.9	6.2	0.1	0.4	1.3	6.4
PALINPINON GPP I	23.0	13.8	14.9	5.0	0.3	0.9	0.0	9.7	6.2	0.4	0.7	1.1	6.3
TONGONAN GPP	20.7	14.2	13.4	2.4	0.1	0.0	0.0	0.0	1.5	0.1	0.1	0.4	4.4
TPC (SANGI) CFTPP	0.1	0.0	0.9	0.1	0.0	0.0	0.0	11.4	10.1	6.0	7.5	6.1	3.6
LEYTE A GPP	8.2	3.1	5.5	2.0	0.0	0.1	0.1	9.0	5.4	0.0	0.5	2.1	3.0
CPPC DPP	0.3	5.8	2.7	0.4	0.0	0.9	1.0	1.1	0.1	0.0	0.0	0.0	1.0
EAUC DPP	0.1	2.4	0.4	0.3	0.6	0.7	0.0	0.4	0.0	0.0	0.0	0.0	0.4
PB 102	0.5	0.4	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
CALUMANGAN DPP	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.5	0.0	0.0	0.0	0.0	0.1
PANAY DPP III	0.3	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0
TPC (CARMEN) DPP	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PB 101	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 57. Price-Setting Plants – Above PhP5,000/MWh to PhP10,000/MWh

	Price-Setting Frequency Index - Percent of Time (Above PhP5,000/MWh to PhP10,000/MWh), 2017												
	Luzon Plants												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
BAUANG DPP	0.1	1.1	2.5	3.0	0.8	1.3	0.4	6.5	5.9	5.8	5.8	0.4	2.8
ANGAT HEP	0.0	0.1	3.6	3.4	0.0	0.0	0.7	3.4	3.9	4.3	1.9	0.0	1.8
MAGAT HEP	0.1	0.4	3.1	2.2	1.4	3.0	0.6	0.5	4.2	1.9	0.4	0.0	1.5
CIP DPP	0.0	0.4	0.7	1.3	2.1	1.6	0.8	3.2	2.8	1.3	1.5	0.1	1.3
AVION NGPP	0.0	0.8	0.0	0.0	0.8	1.2	0.6	2.2	1.2	3.2	1.3	0.1	1.0
SAN ROQUE HEP	0.0	0.4	0.7	3.4	0.0	0.5	0.4	0.0	1.1	2.4	0.4	0.1	0.8
SUBIC DPP	0.0	0.1	1.6	0.1	0.7	0.3	0.3	0.4	0.5	0.6	2.2	0.1	0.6
TAPGC DPP	0.0	0.0	0.6	0.8	1.3	0.4	0.0	0.5	0.0	0.8	0.3	0.0	0.4
SAN GABRIEL NGPP	0.0	0.0	0.0	0.0	0.8	0.9	0.3	0.9	0.1	1.0	0.1	0.0	0.4
BATANGAS DPP	0.0	0.0	0.6	0.1	0.3	0.1	0.3	0.7	0.8	0.4	0.5	0.1	0.3
BINGA HEP	0.0	0.0	0.4	0.9	0.7	0.5	0.1	0.0	0.4	0.0	0.0	0.0	0.3
NAVOTAS DPP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	0.2
AMBUKLAO HEP	0.0	0.0	0.4	0.3	0.3	0.1	0.0	0.1	0.3	0.0	0.1	0.0	0.1
CASECNAN HEP	0.0	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PETRON SFFPP	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Visayas Plants												
EAUC DPP	0.8	1.1	4.2	8.7	3.9	1.7	0.6	6.3	7.7	4.9	4.3	1.3	3.8
TPC (CARMEN) DPP	0.7	1.3	3.3	2.4	1.7	1.9	0.1	3.1	5.1	4.3	1.9	0.4	2.2
CPPC DPP	0.0	0.8	0.7	1.7	3.3	0.8	0.4	3.4	6.2	2.2	2.2	0.4	1.9
PB 102	0.1	0.7	1.5	2.0	2.1	0.9	0.0	0.7	0.8	1.1	0.5	0.0	0.9
PB 101	0.4	0.5	1.3	1.5	1.3	0.7	0.0	0.8	1.2	1.5	0.8	0.0	0.8
PANAY DPP III	0.0	0.0	0.1	0.8	1.8	0.3	0.0	1.1	0.3	0.0	0.3	0.0	0.4
PEDC CFTPP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	2.0	0.4	0.0	0.0	0.3
CALUMANGAN DPP	0.1	0.0	0.1	0.3	0.7	0.8	0.0	0.1	0.3	0.4	0.1	0.0	0.3
BOHOL DPP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.8	0.0	0.0	0.0	0.2
PANAY DPP I	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0

Table 58. Price-Setting Plants – Above PhP10,000/MWh to PhP15,000/MWh

	Price-Setting Frequency Index - Percent of Time (Above PhP10,000/MWh to PhP15,000/MWh), 2017												
	Luzon Plants												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
LIMAY CCGT	0.0	0.5	0.9	1.9	0.0	0.1	0.0	1.9	1.3	0.3	0.1	0.0	0.6
BAUANG DPP	0.0	0.9	0.7	1.1	0.1	0.1	0.0	0.5	0.8	0.3	0.3	0.0	0.4
SAN ROQUE HEP	0.0	0.0	0.0	0.4	0.0	0.1	0.0	0.0	0.4	0.3	0.0	0.0	0.1
ANGAT HEP	0.0	0.0	0.9	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
CIP DPP	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.1
SUBIC DPP	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.1
TAPGC DPP	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.4	0.1	0.0	0.0	0.0	0.1
MASINLOC CFTPP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0
SAN GABRIEL NGPP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
	Visayas Plants												
NABAS DPP	0.0	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.3	0.1	0.0	0.1
CEBU DPP II	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.1	0.0	0.0
BOHOL DPP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.0	0.0
PB 101	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
PB 102	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0

Table 59. Price-Setting Plants – Above PhP15,000/MWh to PhP20,000/MWh

	Price-Setting Frequency Index - Percent of Time (Above PhP15,000/MWh to PhP20,000/MWh), 2017												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
LIMAY CCGT	0.0	0.0	0.1	1.5	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
BAUANG DPP	0.0	0.1	0.0	0.4	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.1
CIP DPP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
KALAYAAN PSPP	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TAPGC DPP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0

Table 60. Price-Setting Plants – Above PhP20,000/MWh to PhP25,000/MWh

	Price-Setting Frequency Index - Percent of Time (Above PhP20,000/MWh to PhP25,000/MWh), 2017												
	Luzon Plants												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
KALAYAAN PSPP	0.0	0.1	0.3	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1
AVION NGPP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
SAN GABRIEL NGPP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
SUBIC DPP	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Visayas Plant												
CPPC DPP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0

Table 61. Price-Setting Plants – Above PhP30,000/MWh to PhP32,000/MWh

	Price-Setting Frequency Index - Percent of Time (Above PhP30,000/MWh to PhP32,000/MWh), 2017												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
SAN GABRIEL NGPP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.3	0.0	0.0	0.1
AVION NGPP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.4	0.0	0.0	0.0
MASINLOC BATTERY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0
ANDA CFTPP	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

X. PIVOTAL SUPPLIER FREQUENCY INDEX[25]

Forty-one (41) plants from Luzon and 22 plants from the Visayas became system-wide pivotal suppliers during the billing year, indicating that the capacity of these plants became critical in meeting the total demand at a particular trading interval.

Natural gas plant Ilijan and Sta. Rita and major coal plants Sual, Pagbilao, Masinloc, and Mariveles as well as hydro plant Kalayaan topped the list of pivotal suppliers from Luzon. Large generating plants Ilijan, Sual and Sta. Rita became pivotal in 22.2 percent, 17.4 percent and 16.5 percent of the time during the year. Major coal plants Pagbilao, Masinloc and Mariveles distantly followed with 7.6 percent, 5.9 percent and 4 percent. Hydro plant Kalayaan likewise figured as a pivotal supplier also at 4 percent.

On the other hand, large geothermal plant Leyte A obtained the most frequency among the Visayas plants in becoming pivotal during the billing year at 4.1 percent, followed by major

[25] 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. A generator is considered pivotal if its capacity is needed to meet the demand requirements for a particular hour. The higher the demand requirement, or if a large plants is on outage, the higher the probability of generating plants qualifying as pivotal.

coal plants PEDC, CEDC, KSPC and PCPC at 2 percent, 1.4 percent 1.1 percent, and 0.5 percent, respectively.

It was observed that the frequency by which generating plants became pivotal was higher during the May and June billing months, the same months which demonstrated tight demand and supply.

Table 62. Pivotal Supplier Frequency Index by Billing Month – Luzon Plants

	Pivotal Supplier Index - Luzon Plants (Percent of Time), 2017												
	Jan	Feb	Mar	Apr	May	Jun	Jun 26- Jul 6	Aug	Sep 7 - 25	Oct	Nov	Dec	Annual
ILIJAN NGPP	-	6.3	37.6	16.1	38.6	40.2	30.3		38.6	22.6	23.3	4.0	22.2
SUAL CFTPP	2.4	21.1	42.1	22.6	39.0	30.9	6.8		8.3	6.0	4.2	-	17.4
STA RITA NGPP	0.4	20.7	16.4	16.7	26.0	22.3	10.6		31.6	20.3	17.2	1.7	16.5
PAGBILAO CFTPP	0.1	9.4	15.3	1.1	3.1	17.3	7.6		18.2	11.3	4.7	0.1	7.6
MASINLOC CFTPP	-	5.5	3.1	10.1	9.0	12.1	6.1		12.3	6.9	2.4	-	5.9
MARIVELES CFTPP	0.1	0.5	1.5	7.9	7.9	11.0	0.4		5.9	5.8	1.1	-	4.0
KALAYAAN PSPP	0.1	4.2	4.2	5.1	10.3	6.0	4.5		5.0	3.5	1.5	-	4.0
SAN LORENZO NGPP	0.1	4.3	6.7	0.1	6.3	6.9	3.0		9.2	1.9	-	-	3.3
CALACA CFTPP	-	1.6	1.8	2.2	5.8	5.8	2.3		11.4	4.4	0.9	-	3.1
QPPL CFTPP	-	-	1.3	7.5	4.4	6.3	2.3		8.6	4.0	0.5	-	3.1
SAN ROQUE HEP	-	2.7	3.4	7.1	2.1	2.3	-		7.9	4.7	0.4	-	2.8
MAGAT HEP	-	1.9	2.7	2.6	1.4	5.0	1.1		6.8	3.6	0.1	-	2.2
SAN GABRIEL NGPP	-	1.2	-	-	2.5	5.6	1.5		4.2	3.1	0.1	-	1.6
SLPGC CFTPP	-	0.1	1.6	3.5	1.1	3.1	0.4		3.7	1.3	-	-	1.3
LIMAY CCGT	-	0.7	1.0	4.7	1.1	3.0	-		2.4	1.0	-	-	1.3
SLTEC CFTPP	-	0.4	1.3	3.4	0.7	2.6	-		3.7	1.8	-	-	1.3
BAUANG DPP	-	0.9	0.4	2.8	0.6	1.7	-		2.9	1.3	-	-	1.0
MAKBAN GPP	-	0.9	0.3	2.3	0.6	1.6	-		2.9	1.4	-	-	0.9
NAVOTAS DPP	-	0.5	0.3	1.9	0.6	1.2	-		2.4	0.8	-	-	0.7
ANGAT HEP	-	0.5	1.0	2.2	-	-	-		2.9	0.8	-	-	0.6
BACMAN GPP	-	0.5	-	1.2	0.3	0.5	-		1.3	0.8	-	-	0.4
BINGA HEP	-	0.5	0.1	1.2	-	0.5	-		1.5	0.8	-	-	0.4
SMC LIMAY CFTPP	-	-	-	-	-	-	-		2.0	2.1	0.1	-	0.3
TIWI GPP	-	0.4	-	0.9	-	0.3	-		1.3	0.8	-	-	0.3
AMBUKLAO HEP	-	0.4	-	0.8	-	0.3	-		1.1	0.7	-	-	0.3
SUBIC DPP	-	0.4	-	0.8	-	0.3	-		0.7	0.7	-	-	0.3
AVION NGPP	-	0.4	-	-	-	0.3	-		0.4	0.7	-	-	0.2
ANDA CFTPP	-	-	-	0.4	-	0.1	-		0.4	0.7	-	-	0.2
CASECNAN HEP	-	0.3	-	0.3	-	0.1	-		0.4	0.6	-	-	0.2
PANTABANGAN HEP	-	0.4	-	0.4	-	-	-		0.2	-	-	-	0.1
TAPGC DPP	-	0.1	-	0.1	-	-	-		0.4	0.4	-	-	0.1
BAKUN HEP	-	-	-	-	-	-	-		0.2	0.4	-	-	0.1
APEC CFTPP	-	-	-	-	-	-	-		-	0.4	-	-	0.0
BATANGAS DPP	-	-	-	-	-	-	-		-	0.4	-	-	0.0
CIP DPP	-	-	-	-	-	-	-		-	0.4	-	-	0.0
HEDCOR HEP	-	-	-	-	-	-	-		-	0.4	-	-	0.0
MAIBARARA GPP	-	-	-	-	-	-	-		-	0.4	-	-	0.0
MASINLOC BATTERY	-	-	-	-	-	-	-		-	0.4	-	-	0.0
BOTOCAN HEP	-	-	-	-	-	-	-		-	0.3	-	-	0.0
CALIRAYA HEP	-	-	-	-	-	-	-		-	0.1	-	-	0.0
PETRON SFFPP	-	-	-	-	-	-	-		-	0.1	-	-	0.0

Table 63. Pivotal Supplier Frequency Index by Billing Month – Visayas Plants

	Pivotal Supplier Index - Visayas Plants (Percent of Time), 2017												
	Jan	Feb	Mar	Apr	May	Jun	Jun 26- Jul 6	Aug	Sep 7 - 25	Oct	Nov	Dec	Annual
LEYTE A GPP		3.4	4.5	7.8	4.6	6.5	2.3		3.9	2.9	0.1		4.1
PEDC CFTPP		0.5	1.6	3.6	1.0	3.8	0.4		4.6	1.9	0.1		2.0
CEDC CFTPP		0.5	0.3	3.4	0.8	2.7	-		3.7	0.8	-		1.4
KSPC CFTPP		0.9	0.7	3.0	0.6	0.7	-		3.1	1.1	-		1.1
PCPC CFTPP		0.4	-	1.2	0.3	0.5	-		1.5	0.3	-		0.5
PALINPINON GPP I		0.4	-	0.9	-	0.3	-		1.3	0.4	-		0.4
TPC (SANGI) CFTPP		0.1	-	0.9	-	0.3	-		1.3	0.6	-		0.3
TONGONAN GPP		0.4	-	0.8	-	0.1	-		0.7	0.4	-		0.3
CPPC DPP		0.1	-	0.1	-	0.1	-		0.4	0.3	-		0.1
EAUC DPP		0.1	-	0.1	-	-	-		0.4	0.3	-		0.1
NASULO GPP		0.1	-	0.1	-	-	-		0.4	0.3	-		0.1
PALINPINON GPP II		0.1	-	0.1	-	0.1	-		-	0.3	-		0.1
PANAY DPP III		-	-	-	-	-	-		0.4	0.3	-		0.1
TPC (CARMEN) DPP		-	-	0.1	-	-	-		-	0.3	-		0.1
BOHOL DPP		-	-	-	-	-	-		-	0.3	-		0.0
CALUMANGAN DPP		-	-	-	-	-	-		-	0.3	-		0.0
CEBU DPP I		-	-	-	-	-	-		-	0.3	-		0.0
CEBU DPP II		-	-	-	-	-	-		-	0.3	-		0.0
NABAS DPP		-	-	-	-	-	-		-	0.3	-		0.0
PANAY DPP I		-	-	-	-	-	-		-	0.3	-		0.0
PB 101		-	-	-	-	-	-		-	0.3	-		0.0
PB 102		-	-	-	-	-	-		-	0.3	-		0.0

The pivotal supplier frequency index was likewise calculated separately for Luzon and Visayas during the unavailability of the HVDC Link from 06 July (1700H) to 07 September

(2200H). During this period, large natural gas plants Ilijan and Sta. Rita and major coal plants Pagbilao, Sual, Mariveles and Masinloc topped the list of pivotal suppliers in the Luzon region. Meanwhile, during the same period in the Visayas, major coal plants PEDC, CEDC and KSPC and geothermal plant Leyte A emerged as the top pivotal suppliers. Note that the regional calculation also excluded the trading intervals that were placed under market suspension and market intervention.

Table 64. Pivotal Supplier Frequency Index by Billing Month – Regional

	Pivotal Supplier Index - Regional (Percent of Time), 2017			
	Luzon Plants			
	Jul 06 - 25	Aug	Aug 25 - Sep 7	Total
ILIJAN NGPP	33.8	46.4	21.9	36.2
STA RITA NGPP	24.4	41.7	19.7	30.0
PAGBILAO CFTPP	12.2	21.8	3.9	14.2
SUAL CFTPP	7.9	15.9	6.5	10.7
MARIVELES CFTPP	6.8	15.7	2.6	9.4
MASINLOC CFTPP	2.4	14.2	3.5	7.1
SAN LORENZO NGPP	4.8	10.2	5.2	6.9
CALACA CFTPP	5.2	4.8	5.8	5.2
QPPL CFTPP	2.4	7.8	4.5	4.9
SAN GABRIEL NGPP	2.1	6.7	3.2	4.1
KALAYAAN PSPP	1.4	5.5	3.5	3.4
MAGAT HEP	0.8	4.7	3.5	2.8
SAN ROQUE HEP	0.3	4.2	3.2	2.4
SLPGC CFTPP	0.3	1.9	0.6	1.0
BAUANG DPP	-	1.4	0.6	0.7
LIMAY CCGT	0.5	0.9	0.3	0.6
MAKBAN GPP	-	1.2	0.6	0.6
SLTEC CFTPP	0.3	0.5	1.3	0.6
NAVOTAS DPP	-	1.0	0.6	0.5
ANGAT HEP	-	0.7	0.6	0.4
BINGA HEP	-	0.7	0.3	0.3
SMC LIMAY CFTPP	-	0.7	0.3	0.3
BACMAN GPP	-	0.5	0.3	0.3
TIWI GPP	-	0.3	0.3	0.2
AMBUKLAO HEP	-	0.2	0.3	0.1
ANDA CFTPP	-	0.2	0.3	0.1
AVION NGPP	-	0.2	0.3	0.1
BAKUN HEP	-	0.2	0.3	0.1
SUBIC DPP	-	0.2	0.3	0.1
TAPGC DPP	-	0.2	0.3	0.1
CASECNAN HEP	-	0.2	-	0.1
PANTABANGAN HEP	-	0.2	-	0.1
	Visayas Plants			
PEDC CFTPP		24.6	29.4	26.2
LEYTE A GPP		18.5	21.6	19.6
CEDC CFTPP		16.6	18.7	17.3
KSPC CFTPP		11.1	12.3	11.5
PCPC CFTPP		3.6	2.3	3.2
TPC (SANGI) CFTPP		3.3	2.9	3.2
PALINPINON GPP I		1.6	1.3	1.5
CPPC DPP		0.2	-	0.1
EAUC DPP		0.2	-	0.1
NASULO GPP		0.2	-	0.1
PALINPINON GPP II		0.2	-	0.1
PANAY DPP III		0.2	-	0.1
TONGONAN GPP		0.2	-	0.1
TPC (CARMEN) DPP		0.2	-	0.1

PSI vs. PSFI

Some suppliers that were pivotal during the year were also able to set the market price in the same trading interval, making them pivotal and price-setting plants at the same time.

For prices above PhP0/MWh to PhP5,000/MWh, natural gas plants Sta. Rita and Ilijan were the most frequent price-setters and pivotal suppliers at the same time at 1.6 percent and 1.5 percent of the time, respectively, followed by coal plant Sual at 0.4 percent. Meanwhile, hydro plants San Roque and Magat topped the list for prices above PhP5,000/MWh to PhP10,000/MWh, becoming pivotal and price-setter at 0.6 percent of the time each. They were distantly followed by natural gas plant San Gabriel at 0.1 percent.

Oil-based, hydro and even natural gas plants dominated the list of price-setters and pivotal suppliers within the higher price range of above PhP15,000/MWh. Oil-based plant Limay, hydro plant San Roque and oil-based plant Bauang were the top price-setters and pivotal suppliers for prices above PhP15,000/MWh to PhP20,000/MWh. On the other hand, hydro plant Kalayaan was the only price-setter and pivotal at the same time for prices above

PhP20,000/MWh to PhP25,000/MWh. Finally, natural gas plants Avion and San Gabriel as well as Masinloc battery energy storage showed the most frequency of being pivotal and price-setter at the same time, for prices above PhP30,000/MWh to PhP32,000/MWh.

Table 65. Price-Setters and Pivotal Plants

		Price-Setters and Pivotal Plants - Percent of Time - 2017												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Region	Plant Name	Above PhP0/MWh to PhP5,000/MWh												
LUZON	STA RITA NGPP		9.1	0.0	0.7	4.0	0.0	0.0		0.0	0.0	0.0	0.0	1.6
LUZON	ILIJAN NGPP		0.0	0.0	0.0	3.2	6.3	2.7		1.3	0.4	1.9	0.1	1.5
LUZON	SUAL CFTPP		0.1	0.4	1.3	0.4	1.1	0.0		0.0	0.0	0.0	0.0	0.4
VISAYAS	PEDC CFTPP		0.0	0.0	0.7	0.0	0.1	0.0		0.0	0.1	0.0	0.0	0.1
LUZON	BAUANG DPP		0.0	0.0	0.0	0.0	0.1	0.0		0.0	0.0	0.0	0.0	0.0
LUZON	MAGAT HEP		0.0	0.0	0.0	0.0	0.1	0.0		0.0	0.0	0.0	0.0	0.0
VISAYAS	LEYTE A GPP		0.0	0.0	0.1	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
		Above PhP5,000/MWh to PhP10,000/MWh												
LUZON	SAN ROQUE HEP		0.4	0.3	1.7	0.0	0.1	0.0		1.3	1.8	0.0	0.0	0.6
LUZON	MAGAT HEP		0.3	0.4	0.8	0.4	1.3	0.4		1.5	0.6	0.0	0.0	0.6
LUZON	SAN GABRIEL NGPP		0.0	0.0	0.0	0.0	0.7	0.4		0.0	0.1	0.0	0.0	0.1
LUZON	BAUANG DPP		0.1	0.1	0.1	0.0	0.4	0.0		0.0	0.0	0.0	0.0	0.1
LUZON	MASINLOC CFTPP		0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.3	0.0	0.0
LUZON	AMBUKLAO HEP		0.0	0.0	0.0	0.0	0.0	0.0		0.2	0.0	0.0	0.0	0.0
LUZON	ANGAT HEP		0.0	0.1	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
		Above PhP15,000/MWh to PhP20,000/MWh												
LUZON	LIMAY CCGT		0.3	0.0	0.5	0.0	0.1	0.0		0.4	0.0	0.0	0.0	0.1
LUZON	SAN ROQUE HEP		0.0	0.0	0.4	0.0	0.1	0.0		0.2	0.3	0.0	0.0	0.1
LUZON	BAUANG DPP		0.3	0.0	0.0	0.1	0.1	0.0		0.2	0.0	0.0	0.0	0.1
LUZON	ANGAT HEP		0.0	0.3	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
LUZON	SAN GABRIEL NGPP		0.0	0.0	0.0	0.0	0.0	0.0		0.2	0.0	0.0	0.0	0.0
		Above PhP20,000/MWh to PhP25,000/MWh												
LUZON	KALAYAAN PSPP		0.1	0.1	0.1	0.1	0.0	0.0		0.0	0.0	0.0	0.0	0.1
		Above PhP30,000/MWh to PhP32,000/MWh												
LUZON	AVION NGPP		0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.4	0.0	0.0	0.0
LUZON	MASINLOC BATTERY		0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.3	0.0	0.0	0.0
LUZON	SAN GABRIEL NGPP		0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.3	0.0	0.0	0.0

XI. MARKET RESIDUAL SUPPLY[26]

The presence of pivotal suppliers was noted in 26.9 percent of the time during the billing year, as demonstrated by the resulting hourly market RSI below 100 percent during said intervals. Meanwhile, majority or 73.1 percent of the remaining trading intervals indicated that the system-wide effective supply level was sufficient in meeting demand requirements. This was manifested through the hourly market RSI of more than or equal to 100 percent.

Following the tight supply margins that manifested during the billing months of May and June, the market RSI fell below the 100 percent mark most frequently during these months, occurring in 42.9 percent and 43.4 percent of the time, respectively, and exhibiting the highest number of pivotal suppliers during the period. The market RSI of below 100 percent was also frequent in March at 42.2 percent of the time. Correspondingly, it is noted that low reserve margin index (RMI) levels were likewise incurred in March, May and June.

As shown in Figure 35, noticeable increase in the hourly number of pivotal suppliers was observed in certain intervals on 20 and 23 February, 8-11 April, 14-16 June, 8-9 and 16-19 September and 02, 22-23 October, indicating tight demand and supply balance during the said trading dates.

Market RSI levels improved this year when compared with billing year 2016, indicated by the occurrence of market RSI of less than 100 percent at 38.5 percent in the previous year.

[26] The Residual Supply Index (RSI) measures the ratio of effective supply without a generator to the total supply required to meet the demand. The RSI of a generator measures the percentage of the remaining effective supply in the market after subtracting the effective supply of that generator. The Market RSI is measured as the lowest RSI among all generators in the market. A market RSI less than 100 percent indicates the presence of pivotal generator/s or supplier/s.

Figure 35. Market RSI Based on Effective Supply – System

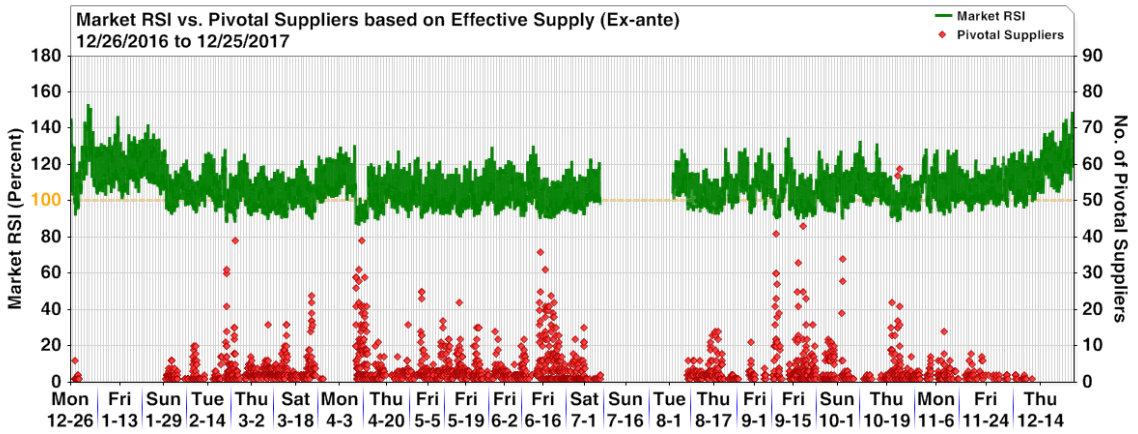


Table 66. Market RSI Summary – System, 2017

	Market RSI (%) Distribution by Billing Month, 2017 - System												
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Avg
Less than 100%	2.4	27.2	42.2	24.2	42.9	43.4	31.3	26.6	30.7	27.0	24.3	4.2	26.9
More than or equal to 100%	97.6	72.8	57.8	75.8	57.1	56.6	68.8	73.4	69.3	73.0	75.7	95.8	73.1

Table 67. Market RSI Summary – System, 2016

	Market RSI (%) Distribution by Billing Month, 2016 - System												
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Avg
Less than 100%	24.6	27.6	48.0	52.6	53.7	72.3	48.2	56.3	26.5	25.7	18.2	7.9	38.5
More than or equal to 100%	75.4	72.4	52.0	47.4	46.3	27.7	51.8	43.7	73.5	74.3	81.8	92.1	61.5

Looking at the regional RSI levels during the unavailability of the HVDC Link which physically separated the Luzon and Visayas grids from 06 July (1700H) to 07 September (2200H), it is noted that the Luzon and Visayas showed higher frequency in terms of regional market RSI levels of less than 100 percent when compared with the market RSI levels that were obtained system-wide during the year. This correspondingly indicates the higher incidence of pivotal suppliers in the regions during this period.

In Luzon, the regional calculation for market RSI showed that the effective supply was sufficient in meeting the demand in 61.5 percent of the time. This was indicated by the resulting RSI exceeding the 100 percent mark during the period. The remaining 38.5 percent showed tight demand and supply demonstrated by the RSI below 100 percent. Low RSI levels at the below 100 percent mark were most frequently observed from 06 to 25 July at 45.8 percent of the time, and during the August billing month at 40.1 percent of the time. Noticeable dip in the market RSI levels were observed from 17-18 July, 09-19, 30 August, and 07 September, with more generators becoming pivotal during this period.

On the other hand, supply was generally sufficient to meet the demand in the Visayas region during the same period, as shown by the market RSI of more than or equal to 100 percent that occurred in 69.4 percent of the trading intervals from 06 July to 07 September. However, the remaining 30.6 percent of the intervals manifested the presence of pivotal suppliers which are needed to meet the demand requirement in the Visayas across the same period.

Table 68. Market RSI Summary – Regional, 06 July to 07 September 2017

	Market RSI Distribution (%) - Luzon				Market RSI Distribution (%) - Visayas			
	06 to 25 July	August	26 Aug to 07 Sep	Avg	06 to 25 July	August	26 Aug to 07 Sep	Avg
Less than 100%	45.8	40.1	23.1	38.5	56.3	28.7	32.5	30.6
More than or equal to 100%	54.2	59.9	76.9	61.5	43.8	71.3	67.5	69.4

Figure 36. Market RSI Based on Effective Supply – Luzon, 06 July to 07 September 2017

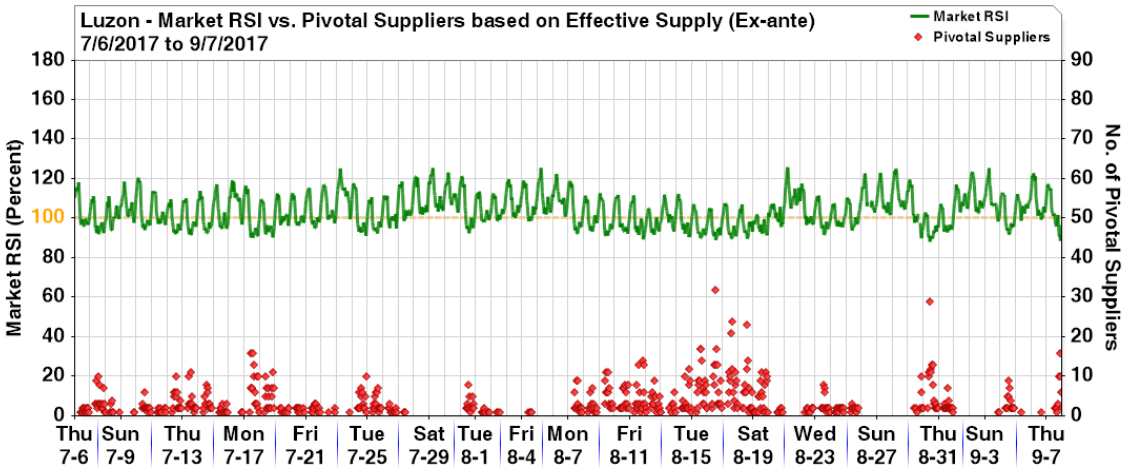
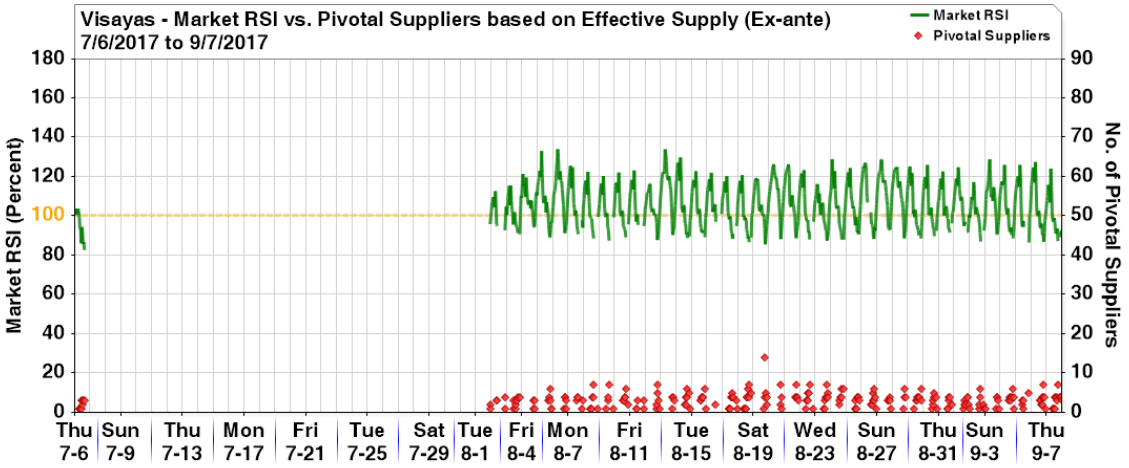


Figure 37. Market RSI Based on Effective Supply – Visayas, 06 July to 07 September 2017



XII. GENERATOR OFFER PATTERN[27]

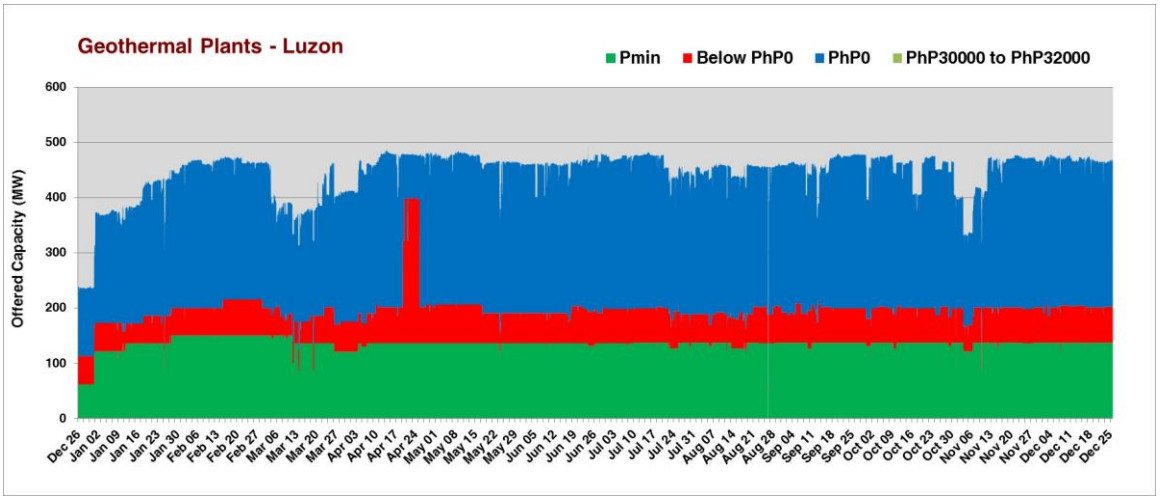
Among all plant types, the geothermal plants in Luzon submitted their capacity at the lowest offer prices, with 55.9 percent of the total offers priced at PhP0/MWh. The remaining 44.1 percent were priced even lower at below PhP0/MWh.

Dip in the offered capacity of the Luzon geothermal plants was noted at the start of the billing year, following the high outage incidence involving Tiwi A and B and Bacman (on forced outages). Moreover, it was noted that Makban B began its maintenance outage on 10 January. Low level of capacity offered was likewise noted among the Luzon geothermal plants in March following the outages of Makban 1, Bacman 1 and Tiwi 1. Further dips in the capacity offers of Luzon geothermal plants were observed with the forced outages of Bacman 1 on 30 October followed by Bacman 2, beginning 31 October and the maintenance outages of Makban units 3 and 4 from 03 to 06 November.

Considering the low offer prices of the Luzon geothermal plants, 100 percent of their offered capacity was scheduled for dispatch during the year.

[27] The generator offer index aims to determine trends or strategy in the offer behavior of generating plants according to resource type.

Figure 38. Geothermal Plants Offer Pattern – Luzon

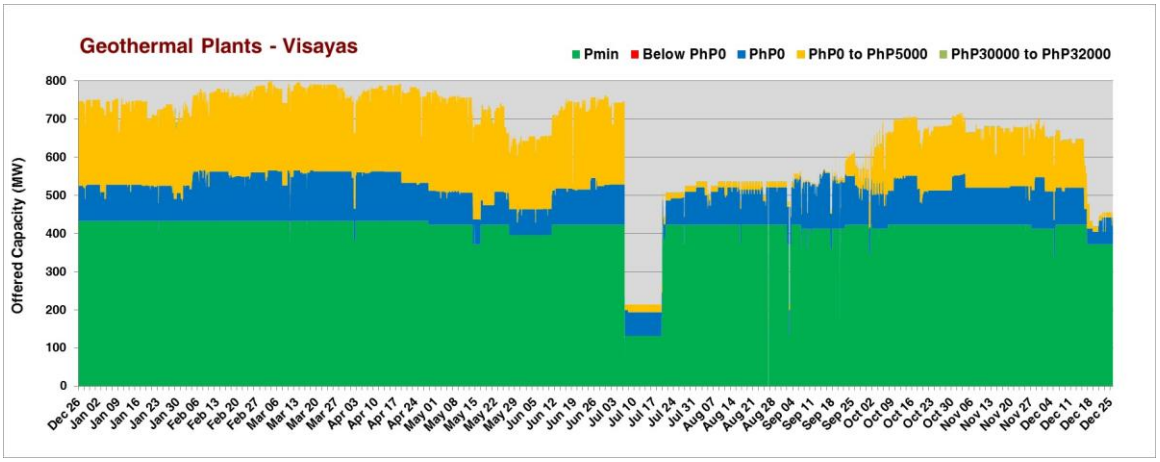


The offer prices of the geothermal plants in the Visayas were higher than those in Luzon, though majority of its capacity offers at 62.4 percent were submitted at below PhP0/MWh. 14.9 percent were capacity offers priced at PhP0/MWh while 22.7 percent were priced above PhP0/MWh to PhP5,000/MWh. A very small portion of the offers at 0.1 percent were priced above PhP30,000/MWh to PhP32,000/MWh.

Significant drop in the capacity offers of the Visayas geothermal plants was observed on 06 July, with the capacity offers dropping to as low as 103.8 MW during the day following the intensity 5 earthquake in the region which triggered the surge in outages among the geothermal plants. The offered capacity of the geothermal plants in the Visayas remained low until September, as several units of Leyte A were still not able to resume operations. Lower level of offered capacity from Visayas geothermal plants was likewise observed beginning 15 December following the series of forced outages of Tongonan GPP.

About 96.8 percent of the total offered capacity of the region's geothermal plants were scheduled for dispatch across the billing year.

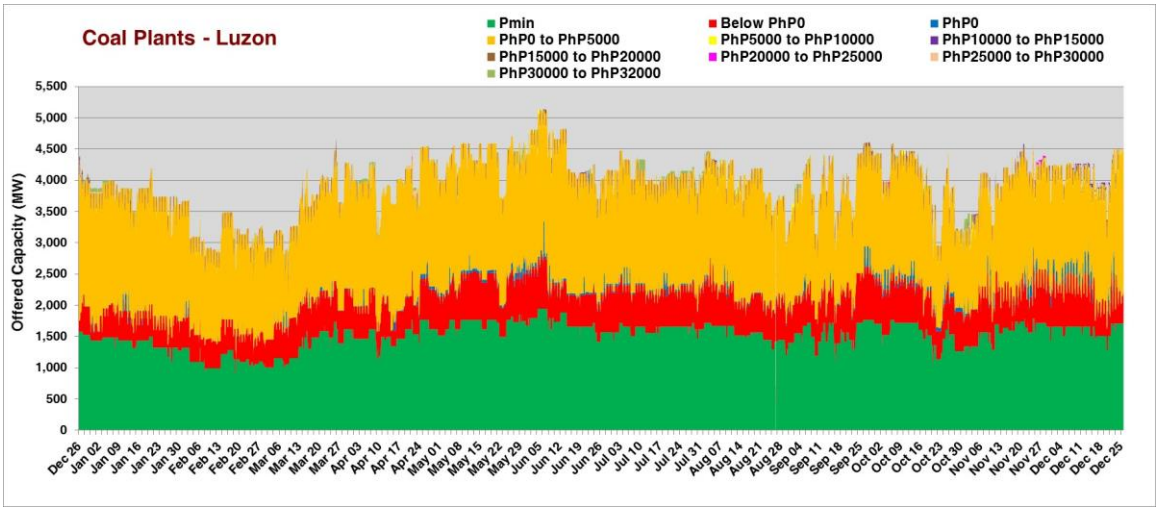
Figure 39. Geothermal Plants Offer Pattern – Visayas



The coal plants in Luzon submitted bulk of its capacity offers above PhP0/MWh to PhP5,000/MWh, accounting for 44.6 percent of its total capacity offers throughout the year. Offer prices above PhP5,000/MWh to PhP15,000/MWh comprised about 0.9 percent, while 0.3 percent were priced above PhP30,000/MWh to PhP32,000/MWh. The remaining majority of 53 percent were capacity offers submitted below PhP0/MWh while 1.1 percent of the offers were priced at PhP0/MWh. About 93.6 percent of the offers were scheduled for dispatch.

Lower capacity offers were observed among the Luzon coal plants in February and March, due to the high outage capacity recorded during this period. Hourly offered capacity levels were also low on 19 September and 20 October as shown in Figure 40 below.

Figure 40. Coal Plants Offer Pattern – Luzon

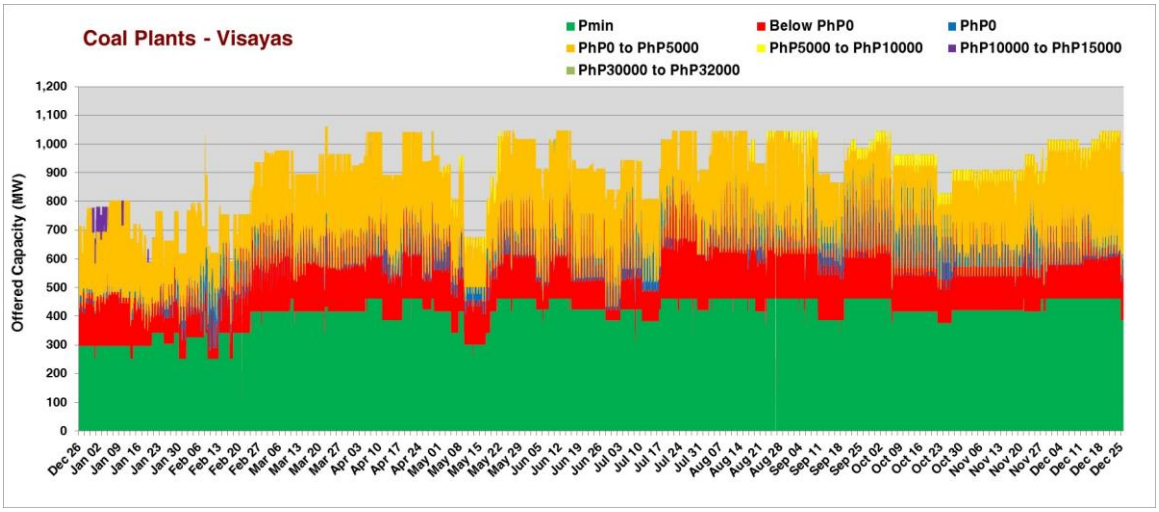


On the other hand, majority or 64.4 percent of the offers of the Visayas coal plants were priced at below PhP0/MWh while another 4.1 percent were priced at PhP0/MWh. Offers above PhP0/MWh to PhP5,000/MWh comprised a significant 30.4 percent of the total capacity offers of the Visayas coal plants. Meanwhile, the remaining 0.9 percent were apportioned in offer prices above PhP5,000/MWh to PhP15,000/MWh while the remaining 0.1 percent were priced even higher at above PhP30,000/MWh to PhP32,000/MWh.

Visayas coal plants' offered capacity were noticeably lower in January and February, attributed to their high outage capacity at the start of the billing year, but started to increase in March, as plants on outage resumed operations. Dip in the offered capacity of Visayas coal plants was noted from 09-17 May with the forced outages of major coal plants Palm 1 (09-17 May), PEDC 1 (12 May), PEDC 2 (29 April to 20 May) and PEDC 3 (9-18 May).

82.6 percent of the total offered capacity of the Visayas coal plants were scheduled for dispatch during the year.

Figure 41. Coal Plants Offer Pattern – Visayas

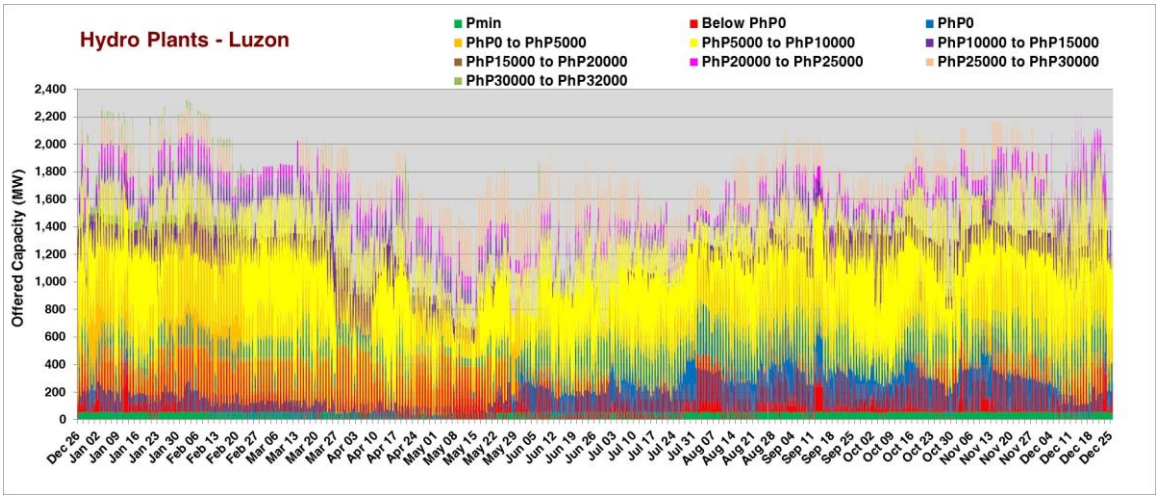


Hydro plants offered their capacity at higher prices. Bulk of their capacity offers were priced above PhP5,000/MWh to PhP10.000/MWh, comprising 44.2 percent of their total offers during the year. Meanwhile, 6.9 percent constituted of offer prices above PhP10,000/MWh to PhP20,000/MWh while 7.3 percent were priced above PhP20,000/MWh to PhP30,000/MWh. 0.7 percent were priced even higher at above PhP30,000/MWh to PhP32,000/MWh. Nevertheless, it should be noted that some of the large hydro plants are ancillary services providers and were thus submitting their capacity offers at higher prices.

Lower priced capacity offers were likewise observed from hydro plants, with 13.1 percent of the capacity offers priced above PhP0/MWh to PhP5,000/MWh while another 14 percent were priced at PhP0/MWh. The remaining 13.9 percent were capacity offers submitted at PhP0/MWh and below. It is noted that more capacities were offered by hydro plants at PhP0/MWh during the second half of the billing year, as shown in Figure 42. Meanwhile, dip in the level of capacity offers of hydro plants was likewise observed during the summer months of May and June.

39.3 percent of the offers of hydro plants had been scheduled for dispatch during the year. Their capacity offers were dispatched more frequently in August at 46.3 percent and September at 46.5 percent.

Figure 42. Hydro Plants Offer Pattern – Luzon



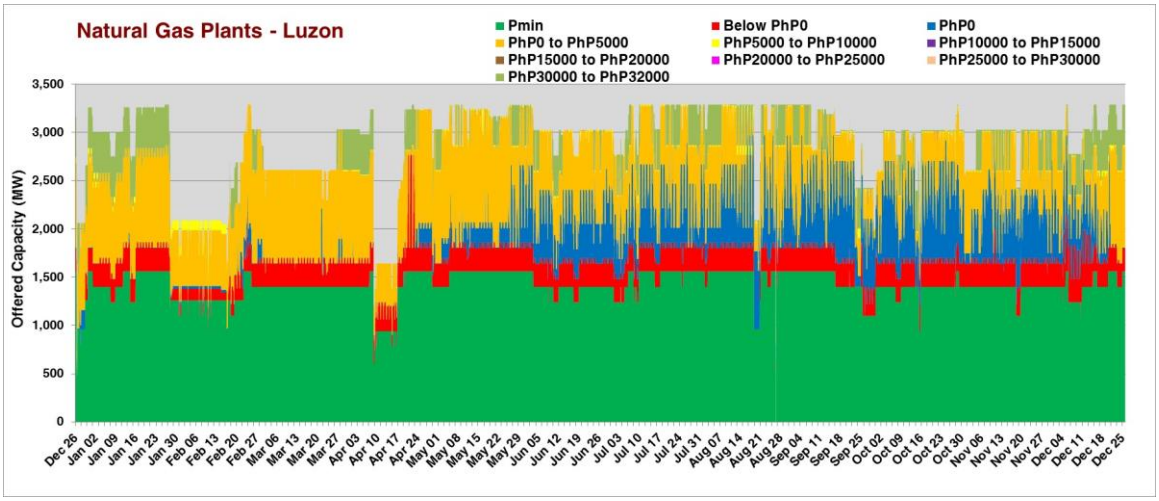
Natural gas plants submitted majority of their offered capacity or 57.3 percent of their total offers at below PhP0/MWh throughout the billing year. Meanwhile, 24.4 percent were capacity offers priced above PhP0/MWh to PhP5,000/MWh while 0.6 percent were offer prices ranging above PhP5,000/MWh to PhP10,000/MWh. The remaining 5.9 percent were priced further higher at above PhP30,000/MWh to PhP32,000/MWh, with natural gas plants San Gabriel and Avion offering a portion of their capacities within this price range.

Change in the offer pattern of natural gas plants was noted as they offer more of their capacity at PhP0/MWh during the second half of the year. On the other hand, higher priced capacity offers were submitted at above PhP30,000/MWh to PhP32,000/MWh in January, April, August and December, with this comprising 14.3 percent, 8.3 percent, 6.7 percent and 11 percent, respectively, of the total offered capacity of natural gas plants in these months.

Noticeable dips in the capacity offers of natural gas plants were observed on 26 December due to the outages of Avion, Ilijan, and San Lorenzo that were affected by the passage of Typhoon Nina and from 09 to 16 April related to the simultaneous outages of Ilijan, Sta. Rita, San Lorenzo San Gabriel, and Avion due to the earthquake in the area. Lower capacity offers were likewise observed from natural gas plants from 27 January to 17 February as Ilijan Block A and San Gabriel went on outages during the period related to the 20-day scheduled shutdown of the Malampaya Gas Facility while Ilijan NGPP Block B, Sta. Rita NGPP, San Lorenzo NGPP, and Avion NGPP underwent short-duration forced outages.

79.4 percent of the total capacity offers of natural gas plants were scheduled for dispatch.

Figure 43. Natural Gas Plants Offer Pattern – Luzon

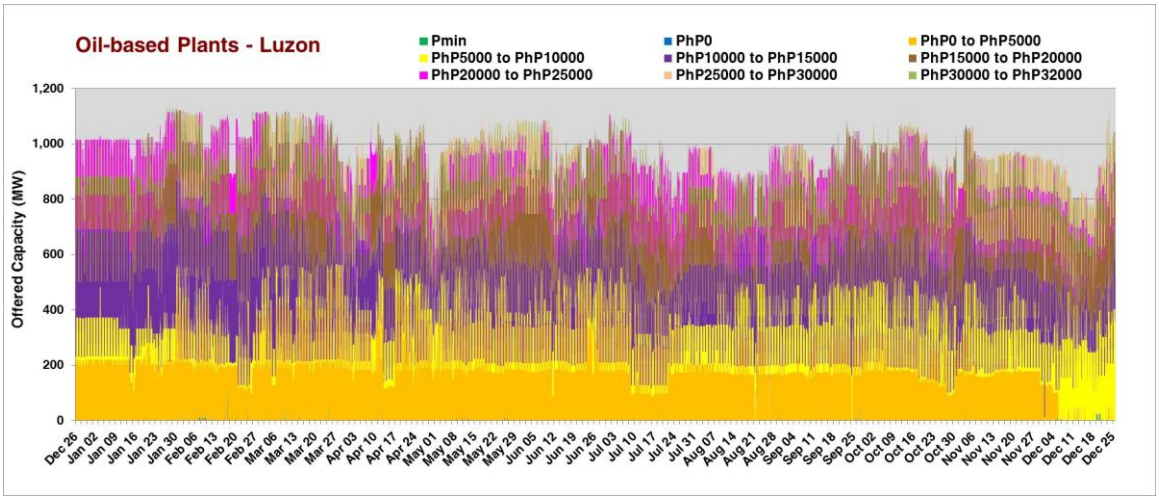


Luzon oil-based plants continued to submit the highest priced capacity offers during the year. Bulk of their capacity offers comprising of 49.1 percent were priced above PhP10,000/MWh to PhP20,000/MWh. About 7.5 percent were priced even higher at above PhP20,000/MWh to PhP25,000/MWh, while 3 percent were priced above PhP25,000/MWh to PhP30,000/MWh. Meanwhile, another 5.7 percent comprised of offers submitted above PhP30,000/MWh to PhP32,000/MWh.

The remaining 34.6 percent were offer prices at PhP10,000/MWh and below, 11.5 percent of which were capacity offers ranging above PhP5,000/MWh to PhP10,000/MWh. The last 23.1 percent comprised of offers submitted at hP5,000/MWh and below.

Considering the high priced capacity offers of Luzon oil-based plants, only 13.8 percent of its total offers was scheduled for dispatch during the year. Notwithstanding, the offered capacity of oil-based plants that were scheduled for dispatch were notably higher than the annual average during the April and May billing months at 29.6 percent and 24.1 percent, respectively, during events of tight demand and supply across these months.

Figure 44. Oil-based Plants Offer Pattern – Luzon



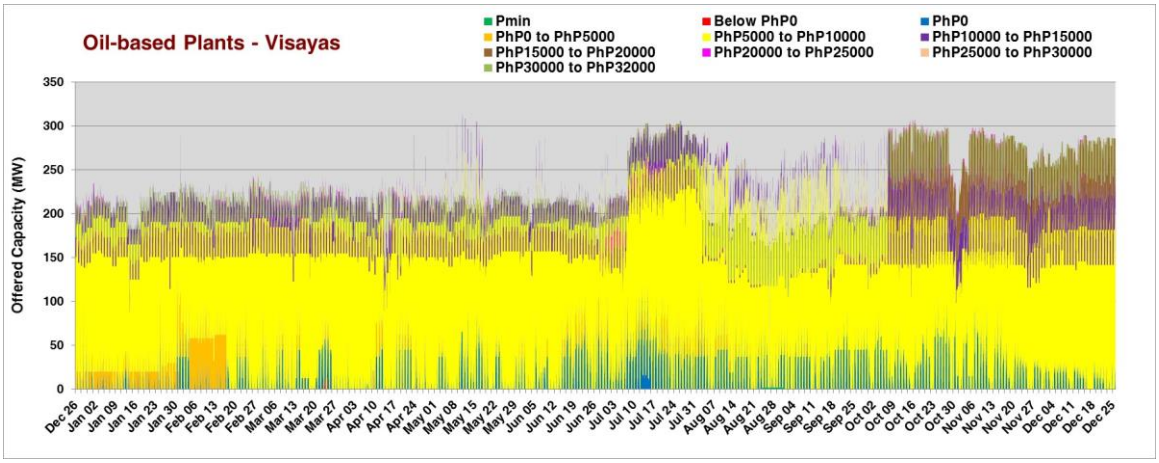
High offer prices were likewise observed among the Visayas oil-based plants during the year. Nevertheless, their offer prices were still lower when compared with the offer prices of the oil-based plants in Luzon.

A significant chunk of the capacity offers of the Visayas oil-based plants ranged above PhP5,000/MWh to PhP10,000/MWh. This comprised 69.1 percent of the total offers of the Visayas oil-based plants for the year. Meanwhile, 10 percent of the capacity offers were submitted above PhP10,000/MWh to PhP15,000/MWh while another 5 percent were priced higher at above PhP15,000/MWh to PhP20,000/MWh. A further 0.4 percent of the offers were priced above PhP20,000/MWh to PhP25,000/MWh while 6.7 percent were capacity offers ranging above PhP30,000/MWh to PhP32,000/MWh. The remaining 8.8 percent were lower priced offers. Of which, 2.9 percent comprised of offers priced above PhP0MWh to PhP5,000/MWh while 5.9 percent were priced at PhP0/MWh.

Change in the offer pattern of the Visayas oil-based plants was observed as they offer more capacity in the market from October to December. However, these were offered within the higher price range of above PhP15,000/MWh to PhP20,000/MWh. It should be noted that the central scheduling and dispatch of energy and contracted reserves in the Visayas market commenced on 07 October.

Consequently, only 12.7 percent of the capacity offers of the Visayas oil-based plants were scheduled for dispatch. However, their capacity offers were dispatched more frequently from July to October, accounting for 28.1 percent, 18.3 percent, 20.3 percent and 14.6 percent, respectively, of their total capacity offers during these months.

Figure 45. Oil-based Plants Offer Pattern – Visayas



XIII. GENERATOR CAPACITY FACTOR[28]

For billing year 2017, natural gas, coal and geothermal plants showed higher utilization among all resource types system-wide, with capacity factors of 69.8 percent, 61.4 percent and 56.7 percent, respectively, when measured based on registered capacity. For hydro plants, only about 26 percent of its registered capacity was actually utilized while the capacity factor of oil-based plants was even lower at only 8.3 percent.

Capacity factors determined based on available capacity (where outages are netted out) and offered capacity would show higher utilization among natural gas, coal and geothermal plants which submitted most of their capacity offers at relatively lower prices. On the other hand, hydro plants recorded their utilization based on available capacity at 28.5 percent and 44.2 percent based on offered capacity, while oil-based plants demonstrated lower utilization levels at 8.9 percent (based on available capacity), and 15.9 percent (based on offered capacity). The low utilization of hydro plants is consistent with their limited offer submission as reflected in their high level of capacity gap.

Meanwhile, capacity factors of preferential dispatch generating units – wind and solar were recorded at 28.7 percent and 18 percent, respectively. Note that solar plants are not available for the duration of an entire day, and bulk of their contribution to supply peaked only between 0800H to 1500H during the billing year. Meanwhile, biomass plants posted their utilization level at 36.5 percent in terms of registered capacity and 39.3 percent in terms of available capacity.

[28] The capacity factor is calculated as the ratio of the metered quantity (actual generation) in the market of each of the plant type relative to the registered capacity, registered less outage capacity, and maximum offered capacity.

Figure 46. Capacity Factor – System

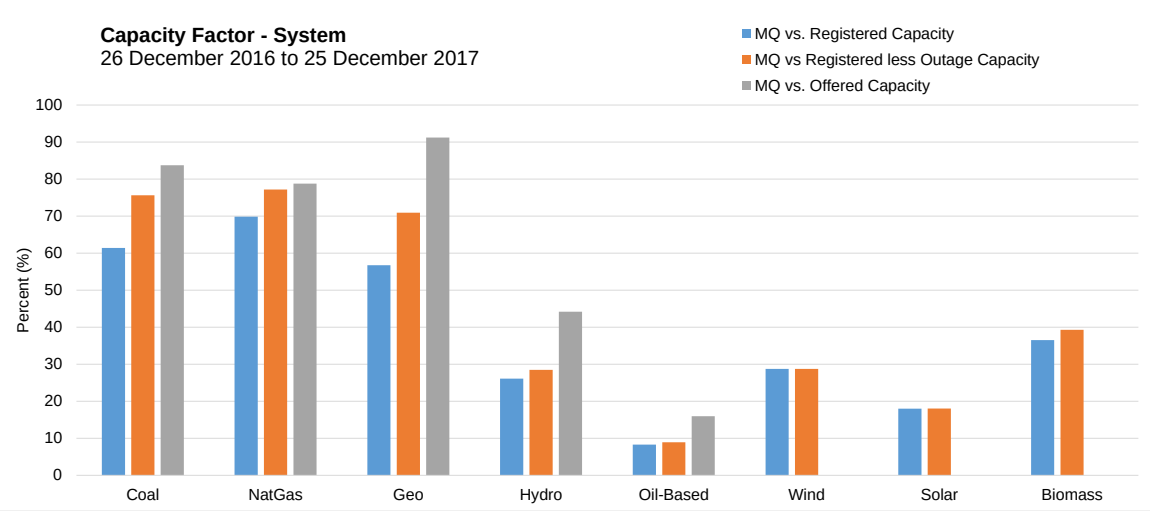


Table 69. Capacity Factor by Plant Type – System

Plant Type	Capacity Factor (%) by Billing Month, System - 2017												
	MQ vs. Registered Capacity												
	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept	Oct	Nov	Dec	Avg
Coal	55.2	53.7	57.8	65.5	71.4	71.3	67.6	63.0	59.6	60.7	55.3	56.3	61.4
Natural Gas	54.5	52.8	68.9	59.8	77.8	76.4	77.2	77.4	77.5	74.6	75.5	66.2	69.8
Geothermal	56.0	63.2	61.8	63.9	63.4	60.0	47.4	47.3	50.2	57.6	57.4	53.0	56.7
Hydro	29.2	32.2	24.7	20.9	18.3	21.3	20.6	28.2	32.8	25.7	30.5	28.0	26.1
Oil-Based	1.6	6.8	8.0	14.3	13.2	8.7	8.7	9.6	8.5	8.9	5.7	5.4	8.3
Wind	57.6	54.0	36.9	23.7	9.5	7.1	5.2	17.1	13.7	22.3	38.2	59.7	28.7
Solar	14.9	17.8	20.6	21.1	21.0	19.4	16.2	17.0	18.3	16.5	17.1	16.1	18.0
Biomass	35.1	42.6	42.3	39.6	34.0	35.4	31.9	29.8	29.9	35.8	39.4	41.9	36.5

Plant Type	MQ vs. Registered less Outage Capacity												
	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept	Oct	Nov	Dec	Avg
Coal	68.1	77.2	74.9	78.0	81.1	78.2	80.3	78.4	75.9	77.4	72.3	66.0	75.6
Natural Gas	59.3	63.2	85.3	73.6	79.8	82.1	80.8	79.6	81.7	86.1	84.0	71.2	77.2
Geothermal	72.5	73.8	76.9	77.1	76.8	75.5	65.1	62.3	62.8	68.8	70.9	67.7	70.9
Hydro	29.5	34.0	28.0	22.8	20.7	24.4	23.1	33.0	36.4	28.2	31.7	28.6	28.5
Oil-Based	1.6	6.8	8.0	15.0	14.5	9.1	9.0	10.2	10.2	10.9	6.2	6.1	8.9
Wind	57.6	54.0	36.9	23.7	9.5	7.1	5.2	17.1	13.7	22.3	38.2	59.7	28.7
Solar	14.9	17.8	20.6	21.3	21.0	19.5	16.2	17.0	18.3	16.6	17.2	16.1	18.0
Biomass	36.0	44.2	44.7	41.4	35.6	36.0	37.0	36.1	36.9	38.8	41.1	42.2	39.3

Plant Type	MQ vs. Offered Capacity												
	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept	Oct	Nov	Dec	Avg
Coal	75.3	85.7	84.2	85.8	89.3	84.8	87.4	85.5	86.2	82.1	81.1	77.3	83.7
Natural Gas	60.2	74.7	85.7	74.5	81.1	82.2	81.4	80.1	82.6	86.8	84.3	71.9	78.8
Geothermal	90.6	92.4	92.5	92.6	93.1	92.9	90.7	86.0	89.6	92.2	91.6	89.3	91.2
Hydro	43.0	47.2	38.8	39.0	40.1	45.2	40.3	48.9	51.5	41.4	46.8	45.1	44.2
Oil-Based	3.0	12.1	14.1	28.2	25.5	16.8	16.7	19.8	17.2	16.7	11.0	11.0	15.9

Regional calculation of capacity factors indicates better utilization among the coal and natural gas plants in Luzon than the other resource types in the region in terms of registered and available capacities. Coal plants posted their utilization at 62.8 percent and 79.2 percent, respectively, based on registered and available capacity, while natural gas plants' utilization was at 69.8 percent and 77.2 percent. Geothermal plants demonstrated lower capacity factors at 46.4 percent and 66.5 percent, suggesting the high level of outage capacity among the Luzon geothermal plants. On the other hand, lower levels of utilization were exhibited by hydro and oil-based plants during the year. When measured in terms of registered capacity, hydro plants recorded their capacity factor at 25.9 percent, while oil-based plants posted a mere 7.8 percent. Based on available capacity their utilization levels were still low though slightly higher at 28.2 percent and 8.5 percent, respectively. Note however, that a portion of the capacity of hydro plants were scheduled as ancillary services (contracted reserves).

Wind and solar plants posted their capacity factors at 30.1 percent and 19.6 percent, respectively, based on registered and available capacity. Biomass plants posted higher utilization at 58.9 percent based on registered and 60 percent based on available capacity.

Meanwhile, higher capacity factors were recorded by all plant types when measured based on offered capacity. The capacity factor of geothermal plants was the highest in Luzon at 92.9 percent, indicating that their capacity offers when submitted in the market are generally scheduled and dispatched. Coal and natural gas plants posted their respective utilization levels at 88.7 percent and 78.8 percent, while hydro and oil-based plants recorded 43.4 percent and 14.8 percent, respectively.

In the Visayas, geothermal plants demonstrated the highest capacity factor at 67.1 percent (based on registered capacity), 73.9 percent (based on available capacity), and 89.7 percent (based on offered capacity). The coal plants in the Visayas followed distantly with capacity factors of 54.4 percent, 59.5 percent and 62.6 percent, respectively.

On the other hand, wind plants recorded their utilization at 23.6 percent both in terms of registered and available capacity while solar plants recorded their utilization levels at 16.9 percent and 17 percent, respectively. Meanwhile, biomass plants held their capacity factor at 16.1 percent and 17.2 percent, respectively during the year.

Figure 47. Capacity Factor – Luzon

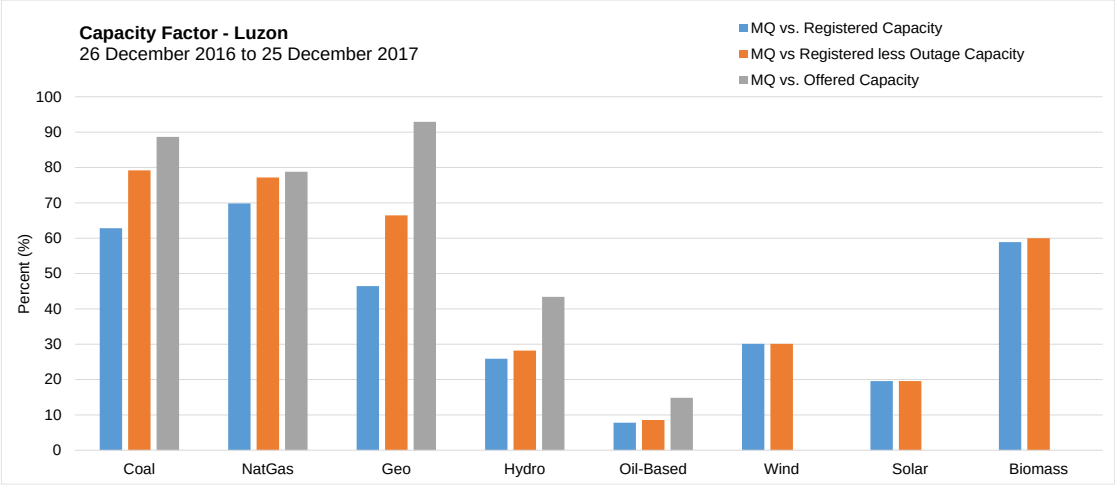


Figure 48. Capacity Factor – Visayas

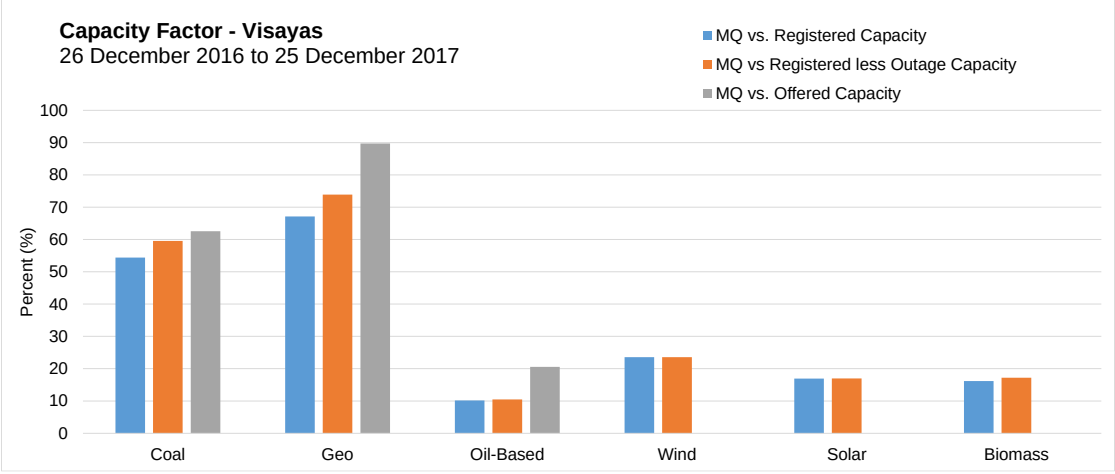


Table 70. Capacity Factor by Plant Type – Luzon

Plant Type	Capacity Factor (%) by Billing Month, Luzon - 2017 MQ vs. Registered Capacity												
	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept	Oct	Nov	Dec	Avg
Coal	57.7	55.9	58.8	67.3	74.4	73.9	69.9	63.2	59.3	61.2	55.4	56.9	62.7
Natural Gas	54.5	52.8	68.9	59.8	77.8	76.4	77.2	77.4	77.5	74.6	75.5	66.2	69.8
Geothermal	37.8	48.8	42.3	47.0	49.4	48.4	48.9	46.6	47.5	47.4	45.0	48.2	46.5
Hydro	29.0	32.1	24.7	20.8	18.2	21.2	20.4	28.0	32.6	25.5	30.4	27.9	25.9
Oil-Based	0.9	6.9	8.8	16.1	14.0	9.0	6.1	6.6	6.3	8.2	4.9	5.4	7.8
Wind	59.4	55.7	36.5	21.5	8.5	8.1	4.7	16.8	14.7	25.2	42.4	68.0	30.1
Solar	17.3	19.1	23.1	24.3	22.6	20.8	18.8	18.0	19.6	16.8	17.9	16.7	19.6
Biomass	43.6	58.0	60.2	61.2	54.9	64.7	67.2	62.9	57.8	59.6	55.9	60.7	58.8

Plant Type	MQ vs. Registered less Outage Capacity												
	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept	Oct	Nov	Dec	Avg
Coal	72.8	82.3	79.9	82.0	83.9	81.7	83.8	81.6	78.5	80.7	74.3	68.7	79.1
Natural Gas	59.3	63.2	85.3	73.6	79.8	82.1	80.8	79.6	81.7	86.1	84.0	71.2	77.2
Geothermal	61.9	65.0	67.0	67.8	67.3	70.8	69.3	68.4	65.2	64.5	64.9	65.5	66.5
Hydro	29.3	34.0	28.0	22.7	20.6	24.3	22.8	32.8	36.2	28.0	31.6	28.5	28.3
Oil-Based	0.9	6.9	8.9	17.1	15.7	9.4	6.4	7.1	7.9	10.6	5.4	6.2	8.5
Wind	59.4	55.7	36.5	21.5	8.5	8.1	4.7	16.8	14.7	25.2	42.4	68.0	30.1
Solar	17.3	19.1	23.1	24.3	22.6	20.8	18.8	18.0	19.6	16.8	17.9	16.7	19.6
Biomass	44.6	59.3	61.3	61.2	56.9	65.4	67.2	62.9	59.6	62.1	58.8	60.8	60.0

Plant Type	MQ vs. Offered Capacity												
	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept	Oct	Nov	Dec	Avg
Coal	78.2	91.2	90.8	92.0	93.6	89.6	92.5	90.5	91.3	86.6	85.3	82.1	88.6
Natural Gas	60.2	74.7	85.7	74.5	81.1	82.2	81.4	80.1	82.6	86.8	84.3	71.9	78.8
Geothermal	93.1	94.1	93.6	92.3	93.5	93.7	93.0	92.6	92.6	92.0	92.2	92.3	92.9
Hydro	42.4	46.7	38.4	38.6	39.6	44.6	39.6	48.2	50.8	40.8	46.3	44.6	43.6
Oil-Based	1.6	11.9	15.1	31.2	26.6	16.8	12.0	13.8	12.5	15.6	9.7	11.3	14.8

Table 71. Capacity Factor by Plant Type – Visayas

Plant Type	Capacity Factor (%) by Billing Month, Visayas - 2017 MQ vs. Registered Capacity												
	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept	Oct	Nov	Dec	Avg
Coal	42.2	42.7	52.6	56.1	55.9	57.9	55.9	62.0	61.7	57.8	55.2	53.0	54.4
Geothermal	74.2	77.7	81.3	80.9	77.4	71.7	45.9	47.9	52.9	67.9	69.8	57.8	67.1
Oil-Based	4.4	6.3	4.4	6.7	10.0	7.7	18.6	21.1	16.9	11.6	9.0	5.5	10.2
Wind	50.6	47.5	38.4	31.9	13.1	3.5	7.0	18.3	9.7	11.5	22.6	28.6	23.6
Solar	13.2	16.9	18.9	18.9	19.9	18.5	14.4	16.3	17.4	16.3	16.6	15.6	16.9
Biomass	27.4	28.6	26.1	20.3	15.9	10.1	1.3	0.0	2.9	11.7	23.9	25.7	16.1

Plant Type	MQ vs. Registered less Outage Capacity												
	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept	Oct	Nov	Dec	Avg
Coal	47.3	54.6	55.5	59.8	66.1	60.8	63.3	63.9	64.6	62.3	62.9	53.5	59.5
Geothermal	79.4	80.7	83.4	83.9	84.4	79.0	61.1	57.3	60.9	72.1	75.3	69.7	73.9
Oil-Based	4.5	6.3	4.4	6.7	10.0	7.7	18.9	22.0	17.8	12.1	9.2	5.8	10.5
Wind	50.6	47.5	38.4	31.9	13.1	3.5	7.0	18.3	9.7	11.5	22.6	28.6	23.6
Solar	13.3	16.9	19.0	19.2	19.9	18.6	14.4	16.3	17.4	16.4	16.7	15.6	17.0
Biomass	28.2	30.1	28.6	22.1	16.7	10.3	1.7	0.1	4.4	13.2	24.7	26.0	17.2

Plant Type	MQ vs. Offered Capacity												
	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept	Oct	Nov	Dec	Avg
Coal	60.2	61.4	59.3	60.6	67.7	62.5	64.2	64.9	66.4	63.1	63.4	57.2	62.6
Geothermal	89.3	91.4	91.9	92.7	92.9	92.4	88.3	80.4	87.1	92.4	91.1	86.9	89.7
Oil-Based	9.5	13.1	9.1	14.4	20.7	16.7	34.3	42.9	39.1	21.1	15.5	10.2	20.5

XIV. TRANSMISSION CONGESTION FREQUENCY INDICES

The Transmission Congestion Frequency Indices present the frequency of transmission congestions, which includes the constraints and congestion in generator and load-side substations, transmission lines, and those encountered by the submarine cable.

A. Frequency of active constraints (Ex-ante)

About 91 percent of the constraints on load-end transformers in the ex-ante were attributed to the Luzon region. This is equivalent to a total of 1,595 constraints in Luzon out of the total 1,752. Meanwhile, the Visayas region recorded a total of 157 constraints on load-end transformers in the ex-ante, accounting for 9 percent of the total system-wide.

Majority of the constraints on load-end transformers in Luzon were related to the constraints on the Zapote transformer, which recorded a total of 969 constraints (55.3 percent of the total 1,752 system-wide) during the year. It is noted that the constraints on the Zapote transformer were observed from January to April only, following the upgrade of the Zapote substation to integrate its additional 300MVA transformer. The frequency of the constraints on the Manila (Paco) transformers were also relatively high at 400 (22.8 percent), distributed throughout the year from April to December, the highest of which was recorded in July with 91 constraints.

On the other hand, constraints on the Lapu-Lapu transformer were the most frequent in the Visayas. This accounted for a total of 82 constraints, which is 4.7 percent of the total 1,752 constraints on load-end transformers system-wide.

Table 72. Frequency of Constraints, Load-Side Transformers (Ex-Ante)

Frequency of Constraints on Load-End Transformers (Ex-Ante) - 2017														
Region	**Equipment Name**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
Luzon	Mexico Transformer									1	3			4
Luzon	Dona Imelda (Araneta) Transformer					1				16				17
Luzon	Dolores Transformer			7										7
Luzon	Manila (Paco) Transformer				10	77	63	91	65	38	25	17	14	400
Luzon	Quezon (Balintawak) Transformer		1	31	75								4	111
Luzon	Zapote Transformer	232	144	296	297									969
Luzon	Dasmariñas Transformer	7	7	5										19
Luzon	Lumban Transformer	6	28				8						1	43
Luzon	Malaya Transformer	5	2	1	5				6	3			3	25
Sub-Total (Luzon)		**250**	**182**	**340**	**387**	**78**	**71**	**91**	**71**	**58**	**28**	**17**	**22**	**1595**
Visayas	Calbayog Transformer											2		2
Visayas	Lapu-Lapu Transformer			6	67					4			5	82
Visayas	Mandaue Transformer											1		1
Visayas	Naga Transformer					5			3			1		9
Visayas	Quiot Transformer						1	16					1	18
Visayas	Sigpit Transformer		2	3	2							17		24
Visayas	Talavera Transformer			3				1						4
Visayas	Cadiz Transformer									1				1
Visayas	Mabinay Transformer				1							7	2	10
Visayas	PEDC Transformer	1					1				1			3
Visayas	Sta. Barbara Transformer	3												3
Sub-Total (Visayas)		**4**	**2**	**12**	**70**	**5**	**2**	**17**	**3**	**5**	**1**	**28**	**8**	**157**
Total (Luzon and Visayas)		**254**	**184**	**352**	**457**	**83**	**73**	**108**	**74**	**63**	**29**	**45**	**30**	**1752**

A total of 132 generator transformer constraints were recorded in the ex-ante across the year, majority of which were in Luzon which accounted for a total of 89 constraints (67.4 percent). Out of the said 89 constraints, 28 (21.2 percent) were constraints on the Angat transformers, while 18 (13.6 percent) were constraints on Binga transformer.

Meanwhile, the remaining 43 constraints (32.6 percent) were in the Visayas. The highest occurrence was noted at 16.7 percent (22 constraints) attributable to the constraints on the Tongonan transformer followed by the 19 constraints on the Palinpinon 1 transformer.

Table 73. Frequency of Constraints, Generator Transformers (Ex-Ante)

Frequency of Constraints on Generator Transformers (Ex-Ante) - 2017														
Region	**Equipment Name**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
Luzon	Angat Transformer	2	1	5	5				5	4	2	2	2	28
Luzon	Bakun Transformer						4	1	1					6
Luzon	BCCPP Transformer										8			8
Luzon	Binga Transformer			5	3	1	9							18
Luzon	Casecnan Transformer									1		1		2
Luzon	Bacman Transformer	1		3	2	2	3				3			14
Luzon	Caliraya Transformer	2												2
Luzon	Makban Transformer			1	1					1	8			11
Sub-Total (Luzon)		**5**	**1**	**14**	**11**	**3**	**16**	**1**	**6**	**6**	**21**	**3**	**2**	**89**
Visayas	Tongonan Transformer	2				13	1			6				22
Visayas	CEDC Transformer		2											2
Visayas	Palinpinon GPP 1 Transformer	1	2	2		1	3	2					8	19
Sub-Total (Visayas)		**3**	**4**	**2**	**0**	**14**	**4**	**2**	**0**	**6**	**0**	**0**	**8**	**43**
Total (Luzon and Visayas)		**8**	**5**	**16**	**11**	**17**	**20**	**3**	**6**	**12**	**21**	**3**	**10**	**132**

Constraints on transmission lines during the ex-ante totaled 1,174 across the year, majority of which were attributable to the constraints on Luzon transmission lines. This accounted for a total of 881 constraints or 75 percent of the total constraints recorded for Luzon and Visayas. Constraints on transmission lines in the Luzon region were most frequently observed on the Bauang-BPPC 230kV Line, accounting for 30.7 percent or a total of 360 constraints in 2017. Constraints on the Quezon (Balintawak)-San Jose 230kV Line were likewise frequent, with 23.6 percent or a total of 277 constraints during year.

It was noted that most of the constraints on the Bauang - BPPC line 1 was recorded as a result of N-1 contingency on Nagsaag-San Manuel tie line. Meanwhile, most of the constraints on Balintawak-San Jose line 3 was recorded as a result of N-1 contingency on Balintawak-San Jose line 2.

On the other hand, constraints on the transmission lines in the Visayas region accounted for the remaining 25 percent or 293 constraints. Bulk of these was attributable to the high frequency of constraints noted on the Bacolod-Cadiz 138kV Line, recording a total of 264 constraints throughout the billing year, which is 22.5 percent of the total constraints on the transmission lines in both Luzon and Visayas.

Table 74. Frequency of Constraints, Transmission Lines (Ex-Ante)

Frequency of Constraints on Transmission Lines (Ex-Ante) - 2017														
Region	**Equipment Name**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
Luzon	Bauang-Balingueo 230kV Line		6		10	17	4							37
Luzon	Bauang-BPPC 230kV Line		11	60	136	94	52	5			1	1		360
Luzon	BPPC-Balingueo 230kV Line		1											1
Luzon	Hermosa-Bataan 230kV Line											2	12	14
Luzon	Hermosa-Duhat 230kV Line												21	21
Luzon	Mexico-Cruz na Daan 230kV Line									1				1
Luzon	Mexico-Hermosa 230kV Line				2		3			12	12	3	6	38
Luzon	Mexico-Quezon (Balintawak) 230kV Line				8					5			1	14
Luzon	San Manuel (New)-Pantabangan 230kV Line									1				1
Luzon	Quezon (Balintawak)-San Jose 230kV Line			3	24	31	55		11	7		57	89	277
Luzon	Dolores-Malaya 230kV Line			2								11		13
Luzon	Muntinlupa (Sucat)-Biñan 230kV Line				66	14								80
Luzon	Amadeo-Calaca 230kV Line						1			6				7
Luzon	Dasmariñas-Amadeo 230kV Line										1			1
Luzon	Dasmariñas EHV-Dasmariñas dummy Line	1		5	3									9
Luzon	Sta. Rosa-Calaca 230kV Line										7			7
Sub-Total (Luzon)		**1**	**18**	**70**	**249**	**156**	**115**	**5**	**11**	**32**	**21**	**74**	**129**	**881**
Visayas	Cebu-Mandaue 138kV Line											3		3
Visayas	Mandaue-Lapu-lapu 138kV Line												9	9
Visayas	New Naga-Quiot 138kV Line	2				1	2				1	7	4	17
Visayas	Bacolod-Cadiz 138kV Line			22	42	51	10	6	9	59	43	17	5	264
Sub-Total (Visayas)		**2**	**0**	**22**	**42**	**52**	**12**	**6**	**9**	**59**	**44**	**27**	**18**	**293**
Total (Luzon and Visayas)		**3**	**18**	**92**	**291**	**208**	**127**	**11**	**20**	**91**	**65**	**101**	**147**	**1174**

Constraints at the Visayas submarine cables in the ex-ante totaled 2,622 this year, with the Cebu-Negros submarine cable dominantly accounting for 92.4 percent (2,424 constraints) of the total constraints, distantly followed by the Negros-Panay submarine cable with 5.8 percent or 153 constraints.

Table 75. Frequency of Constraints, Submarine Cable (Ex-Ante)

Frequency of Constraints on Submarine Cables (Ex-Ante) - 2017														
Region	**Equipment Name**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
Visayas	Leyte-Bohol Submarine Cable									2		4		6
Visayas	Leyte-Cebu Submarine Cable	6	2			19	4	4	1	1			2	39
Visayas	Cebu-Negros Submarine Cable	146	274	277	287	156	273	106	138	217	245	138	167	2424
Visayas	Negros-Panay Submarine Cable		8	12	20	6	36	2	8	27	30	1	3	153
Total		**152**	**284**	**289**	**307**	**181**	**313**	**112**	**147**	**247**	**275**	**143**	**172**	**2622**

B. Frequency of active constraints (Ex-post)

Occurrence of constraints on load-end transformers were significantly lower in the ex-post than in the ex-ante. Considering that the N-1 contingency is no longer imposed in the ex-post run, all occurrences were on account of base case constraints. A total of 195 constraints on load-end transformers were noted during the ex-post, 72.8 percent (142 constraints) of which were attributable to constraints on Visayas load-end transformers. Constraints on the Lapu-Lapu transformer were the most frequent, accounting for 34.9 percent (68 constraints) of the total load-end transformer constraints in the ex-post during the year.

The remaining 53 constraints of the total 142 was attributable to the constraints on Luzon load-end transformers (27.2 percent), with the Lumban transformer accounting for majority of the same at 23.1 percent (45 constraints).

Table 76. Frequency of Constraints, Load-Side Transformers (Ex-Post)

Frequency of Constraints on Load-End Transformers (Ex-Post) - 2017														
Region	**Equipment Name**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
Luzon	Labrador Transformer											2		2
Luzon	Quezon (Balintawak) Transformer						1						4	5
Luzon	Lumban Transformer	10	25				9						1	45
Luzon	Malaya Transformer		1											1
Sub-Total (Luzon)		**10**	**26**	**0**	**0**	**0**	**10**	**0**	**0**	**0**	**0**	**2**	**5**	**53**
Visayas	Calbayog Transformer											3		3
Visayas	Tongonan Transformer											1		1
Visayas	Lapu-Lapu Transformer			1	60					4			3	68
Visayas	Naga Transformer					6								6
Visayas	Quiot Transformer						3	16						19
Visayas	Sigpit Transformer		2							1		16		19
Visayas	Amlan Transformer										1			1
Visayas	Bacolod Transformer										1			1
Visayas	Cadiz Transformer					2				2				4
Visayas	Mabinay Transformer											7	2	9
Visayas	PEDC Transformer						1				2			3
Visayas	Sta. Barbara Transformer	8												8
Sub-Total (Visayas)		**8**	**2**	**1**	**60**	**8**	**4**	**16**	**0**	**7**	**4**	**27**	**5**	**142**
Total (Luzon and Visayas)		**18**	**28**	**1**	**60**	**8**	**14**	**16**	**0**	**7**	**4**	**29**	**10**	**195**

Constraints on generator transformers were likewise observed during ex-post, which totalled at 121. 57.9 percent (70 constraints) were attributed to Luzon and the remaining 42.1 percent (51 constraints) were attributed to Visayas.

In Luzon, constraints were most frequently observed at the Angat and Bacman transformers with 24 (19.8 percent) and 19 constraints (15.7 percent), respectively. In the Visayas, constraints on the Tongonan transformer was the most frequent at 21.5 percent (26 constraints) followed by Palinpinon 1 transformer at 16.5 percent (20 constraints).

Table 77. Frequency of Constraints, Generator Transformers (Ex-Post)

Frequency of Constraints on Generator Transformers (Ex-Post) - 2017														
Region	**Equipment Name**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
Luzon	Angat Transformer											10	14	24
Luzon	Bakun Transformer						4		2					6
Luzon	BCCPP Transformer										4			4
Luzon	Binga Transformer						2							2
Luzon	Bacman Transformer	1		3	4	2	4				3	2		19
Luzon	Ilijan Transformer								1					1
Luzon	Makban Transformer				2					2	10			14
Sub-Total (Luzon)		**1**	**0**	**3**	**6**	**2**	**10**	**0**	**3**	**2**	**17**	**12**	**14**	**70**
Visayas	Tongonan Transformer	2				15	2			6			1	26
Visayas	CEDC Transformer		2	1										3
Visayas	Palinpinon GPP 1 Transformer	1	3	2		2	5						7	20
Visayas	Palinpinon GPP 2 Transformer	1				1								2
Sub-Total (Visayas)		**4**	**5**	**3**	**0**	**18**	**7**	**0**	**0**	**6**	**0**	**0**	**8**	**51**
Total (Luzon and Visayas)		**5**	**5**	**6**	**6**	**20**	**17**	**0**	**3**	**8**	**17**	**12**	**22**	**121**

The frequency of constraints on transmission lines remarkably decreased during the ex-post runs when compared with the ex-ante, essentially on account of the decrease in the number of constraints in the Luzon region.

A total of 372 constraints were recorded in the ex-post, 8.9 percent (33 constraints) were observed in Luzon while the majority, which accounted for 91.1 percent (339 constraints), were attributable to constraints on the Visayas transmission lines. Bulk of the constraints were on the Bacolod-Cadiz 138kV Line with 304 constraints across the year (81.7 percent).

Table 78. Frequency of Constraints, Transmission Lines (Ex-Post)

Frequency of Constraints on Transmission Lines (Ex-Post) - 2017														
Region	**Equipment Name**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
Luzon	Bauang-BPPC 230kV Line				8	11								19
Luzon	Amadeo-Calaca 230kV Line						1			1				2
Luzon	Dasmariñas-Amadeo 230kV Line										2			2
Luzon	Dasmariñas EHV-Dasmariñas dummy Line			4										4
Luzon	Sta. Rosa-Calaca 230kV Line										6			6
Sub-Total (Luzon)		**0**	**0**	**4**	**8**	**11**	**1**	**0**	**0**	**1**	**8**	**0**	**0**	**33**
Visayas	Cebu-Mandaue 138kV Line											2		2
Visayas	Mandaue-Lapu-lapu 138kV Line												9	9
Visayas	New Naga-Quiot 138kV Line	2				1	3				3	9	6	24
Visayas	Bacolod-Cadiz 138kV Line	1		15	52	72	27	3	12	45	36	25	16	304
Sub-Total (Visayas)		**3**	**0**	**15**	**52**	**73**	**30**	**3**	**12**	**45**	**39**	**36**	**31**	**339**
Total (Luzon and Visayas)		**3**	**0**	**19**	**60**	**84**	**31**	**3**	**12**	**46**	**47**	**36**	**31**	**372**

Occurrences of constraints at the Visayas submarine cables during the ex-post totaled at 2,637. Majority of these constraints were on the Cebu-Negros submarine cable, accounting for 2,491 (94.5 percent) of the total constraints in the ex-post.

Table 79. Frequency of Constraints, Submarine Cable (Ex-Post)

Frequency of Constraints on Submarine Cables (Ex-Post) - 2017														
Region	**Equipment Name**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
Visayas	Leyte-Bohol Submarine Cable									1		4	1	6
Visayas	Leyte-Cebu Submarine Cable	1				12	2	1		1	1			18
Visayas	Cebu-Negros Submarine Cable	139	263	284	318	179	282	115	135	215	244	139	178	2491
Visayas	Negros-Panay Submarine Cable		5	9	12	3	26	4	4	24	23		12	122
Total		**140**	**268**	**293**	**330**	**194**	**310**	**120**	**139**	**241**	**268**	**143**	**191**	**2637**

XV. OVER-RIDING CONSTRAINTS[29]

A. Over-riding Events by Category

A total of 139,354 over-riding events[30] were recorded involving 65 Luzon generators and 34 Visayas generators across the billing year 2017. Impositions on Luzon generators accounted for 75.4 percent (105,022 events) of the total over-riding events while the remaining 24.6 percent (34,322 events) were attributed to the impositions made on Visayas generators. Majority of these events at 94.4 percent or 131,540 events, were categorized under non-security limit events. Meanwhile, events categorized under security limit accounted for 5.6 percent or 7,814 of the total over-riding events during the year.

As shown in Figure 49, the monthly comparison of over-riding events showed higher frequency during the first half of the year. January and February recorded the highest

[29] Over-riding constraints, as defined in the WESM Rules, are constraints imposed in the market dispatch optimization model (MDOM) by the MO, at the recommendation of the SO, with the intention of over-riding the effect of a Trading Participant's offers or demand bids. The categories of the over-riding events throughout the year are based on the data and information provided by the SO.

[30] The monitoring of the over-riding constraints on generators is done on a per generator trading node per trading interval. A constraint imposed on a generator trading node on a particular trading interval is considered as one over-riding event. The monitoring of the over-riding constraints is based on the data and information provided by MO (i.e. real time market results and MMS-input files on security limits) and SO (i.e. SO Data for Market Monitoring).

monthly number of over-riding events at 15,514 and 15,814, respectively. These were driven by the high number of non-security limit events which accounted for 14,739 events (January) and 14,530 events (February), the highest monthly impositions for non-security limit across the year. Meanwhile, looking at the hourly frequency of over-riding events, it is noted that the highest number of over-riding events recorded in a single trading interval was noted on 17 January at 0900H when a total of 40 generators were imposed with over-riding constraints.

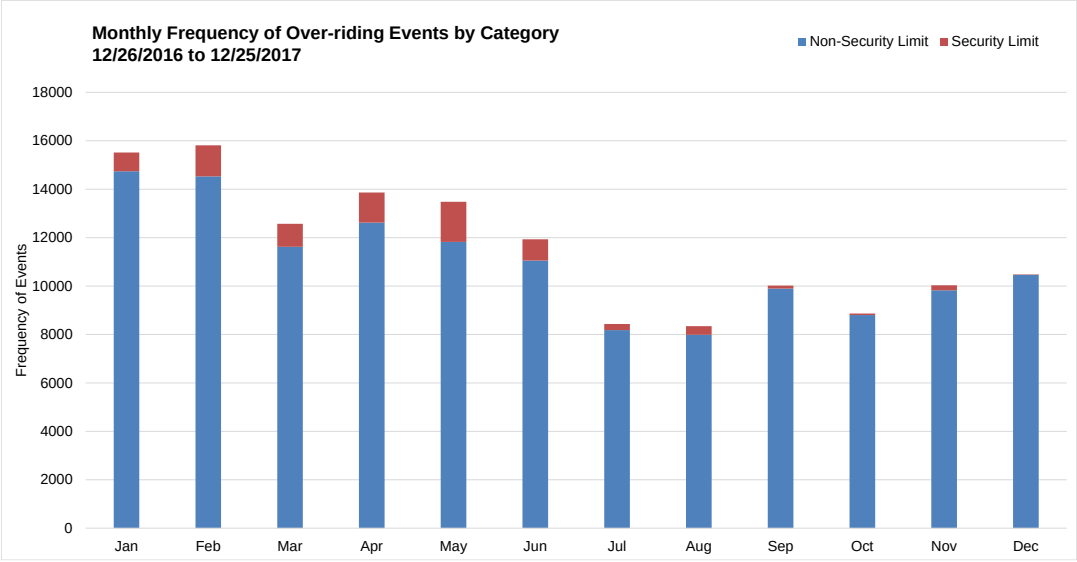
During the second half of the year, lower occurrence of over-riding events was noted, in part due to the ERC's declaration of market suspension in the Visayas starting 06 July at 1700H until 01 August at 1600H. Also, the NGCP-SO intermittently placed the Visayas under market intervention due to generation deficiency which affected another 72 trading intervals during the August billing month and a further 22 intervals in September. Another 6 intervals were placed under market intervention in September due to multiple line outage. Accordingly, no over-riding events were recorded in the Visayas region during trading intervals which were placed under market suspension and market intervention.

In addition, occurrences of over-riding events were likewise lower in October attributable to the lower impositions of over-riding constraints (related to non-security limit events) on coal and solar plants, which normally make-up the bulk of the over-riding events by plant type.

Table 80. Summary of Over-riding Events by Category

	Summary of Over-riding Events by Category - 2017												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
	Luzon												
Non-Security Limit	10,938	11,560	9,022	9,703	9,019	8,438	7,255	6,130	7,361	6,678	7,845	8,683	102,632
Security Limit		98	201	497	887	100		353	37	42	175		2,390
Sub-total - Luzon	**10,938**	**11,658**	**9,223**	**10,200**	**9,906**	**8,538**	**7,255**	**6,483**	**7,398**	**6,720**	**8,020**	**8,683**	**105,022**
	Visayas												
Non-Security Limit	3,801	2,970	2,599	2,916	2,804	2,614	925	1,859	2,534	2,124	1,981	1,781	28,908
Security Limit	775	1,186	747	749	771	781	255	1	86	24	29	20	5,424
Sub-total - Visayas	**4,576**	**4,156**	**3,346**	**3,665**	**3,575**	**3,395**	**1,180**	**1,860**	**2,620**	**2,148**	**2,010**	**1,801**	**34,332**
Total	**15,514**	**15,814**	**12,569**	**13,865**	**13,481**	**11,933**	**8,435**	**8,343**	**10,018**	**8,868**	**10,030**	**10,484**	**139,354**

Figure 49. Monthly Frequency of Over-riding Events by Category - System



As above-mentioned, non-security limit events accounted for the majority of the over-riding events during the year. Commercial tests comprised the bulk of the non-security limit events, accounting for 90.8 percent (126,491 events) of the total over-riding constraints in 2017. It should be noted further that the commercial tests were largely on account of the conduct of

commissioning tests involving 42 generating plants as shown in Table 81. The January and February billing months recorded the highest number of over-riding events due to commercial tests. In January, events related to commissioning tests accounted for 12,021 events involving 31 registered plants that have yet to start commercial operations. Likewise in the February billing month, conduct of commercial tests contributed majority of the commercial tests, accounting for 12,121 events involving 30 registered plants that have yet to start commercial operations. Generating plants that were on commissioning tests during this period included Masinloc Battery, coal plant SMC Limay, as well as biomass plants Aseagas, Bicol and Gift and some 24 solar plants, which registered in the WESM as early as February 2016. Aside from commissioning tests, other commercial tests were likewise conducted by various plants resulting in 1,265 over-riding events this month. These commercial tests included load tests, ancillary tests, net dependable capacity tests, net contracted capacity tests, reliability tests, emission tests, gas turbine optimization tests, performance tests, heat run tests, capacity tests, and equipment tests.

Generating unit limitation comprised the next chunk of over-riding events related to non-security limit, comprising 3.6 percent (5,003 events) of the total over-riding events during the year. The January to March billing months posted the highest number of events related to generating unit limitation at 1,453, 1,630 and 1,156 events, respectively. During these months, the pending configuration of Market Participant Interface (MPI) of NWPDC Wind 1 and 2 consistently figured as the main driver for the high occurrence of over-riding events due to generating unit limitation. This accounted for 1,383 events, 1,487 events and 1,102 events, respectively. Moreover, in February, natural gas plants Sta. Rita NGPP, San Lorenzo NGPP, and Ilijan NGPP Block B incurred a total of 21 events for their fuel changeover activities related to the scheduled shutdown of the Malampaya Gas Facility.

Security-related events on the other hand, were partly driven by the designation of Malaya TPP as a Must Run Unit (MRU) for the provision of Real-Power Balancing and Frequency Control, which accounted for 1.5 percent (2,214 events) of the total over-riding constraints imposed during the year. The April and May billing months posted the highest occurrence at 497 and 623 events, respectively. Emergency de-rating accounted for a nominal 0.1 percent (93 events) of the total over-riding events during the year while ‘’Other Types”, as may be recommended by the SO, accounted for the remaining 4 percent (5,597 events). This type figured more prominently during the first half of the billing year. The highest frequency was observed in February and May at 1,186 events and 1,035 events, respectively. In February, most of these events involved the following generators: coal plants TPC (Sangi) for 743 events, CEDC 1 for 347 events, geothermal plant Palinpinon for 49 events, coal plant PEDC 3 for 16 events and oil-based plant Calumangan 4 for 15 events. Meanwhile, during the May billing month, security limit events under “Other Types” involved major coal plants Calaca 1 and 2, SLPGC 2, SLTEC 1 and 2, natural gas plants Sta. Rita 1, 2, 3, and 4, and San Lorenzo 1 and 2 were recorded related to the shutdown of Biñan-Muntinlupa (Sucat) 230kV L1 & L2 on 21 May to facilitate restoration works.

It was also observed that throughout the billing year, occurrences of over-riding events followed a certain pattern that showed higher impositions during trading intervals 0700H to 1800H. This trend was similar to what was observed in the previous billing year and was on account of the conduct of commissioning tests of solar plants. The trend reached a maximum of 24 events in a single interval during the January billing month.

Table 81. Summary of Reasons for Over-riding Events

	Summary of Reasons for Over-riding Events by Category - 2017												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
	Luzon												
NON-SECURITY LIMIT	10,938	11,560	9,022	9,703	9,019	8,438	7,255	6,130	7,361	6,678	7,845	8,683	102,632
Commercial Test	9,485	9,930	7,867	9,605	8,971	8,383	7,187	6,025	7,160	6,620	7,787	8,571	97,591
Generating Unit Limitation	1,453	1,630	1,155	98	48	55	68	81	201	58	58	98	5,003
Regulatory Requirements								24				14	38
SECURITY LIMIT		98	201	497	887	100		353	37	42	175		2,390
MRU		98	201	497	623	100		351	37	42	175		2,124
Other Types					264			2					266
Subtotal - Luzon	10,938	11,658	9,223	10,200	9,906	8,538	7,255	6,483	7,398	6,720	8,020	8,683	105,022
	Visayas												
NON-SECURITY LIMIT	3,801	2,970	2,599	2,916	2,804	2,614	925	1,859	2,534	2,124	1,981	1,781	28,908
Commercial Test	3,801	2,970	2,599	2,916	2,804	2,614	925	1,859	2,534	2,124	1,981	1,773	28,900
Regulatory Requirements												8	8
SECURITY LIMIT	775	1,186	747	749	771	781	255	1	86	24	29	20	5,424
Emergency De-Rating/ Outage of Specific Transmission	84		1						3	1	4		93
Other Types	691	1,186	746	749	771	781	255	1	83	23	25	20	5,331
Subtotal - Visayas	4,576	4,156	3,346	3,665	3,575	3,395	1,180	1,860	2,620	2,148	2,010	1,801	34,332
Total	15,514	15,814	12,569	13,865	13,481	11,933	8,435	8,343	10,018	8,868	10,030	10,484	139,354

B. Over-riding Events by Plant Type

Solar plants comprised majority of the over-riding events this year, accounting for 51.5 percent (71,825 events). Biomass plants came second at 14.1 percent (19,664 events), followed by hydro plants which accounted for 13.5 percent (18,788 events) of the total over-riding events. Coal plants figured next at 10.5 percent (14,643 events), followed distantly by geothermal plants at 3.6 percent (4,991 events), wind plants at 2.9 percent (3,872 events), oil-based plants at 2.1 percent (2,996 events), natural gas plants at 1 percent (1,372 events) and battery energy storage at 0.8 percent (1,103 events).

All impositions on solar plants were on account of commercial tests. These occurred more frequently during the first half of the year, the highest of which were observed in January and February at 8,331 events and 7,531 events, respectively, involving 24 solar plants. As above-mentioned, the solar plants on commissioning tests were registered in the WESM as early as February 2016. Biomass plants similarly recorded higher number of over-riding events during the first half of the year, driven by the high number of commercial tests conducted during the period. The highest frequency was posted in February, May and June at 2,158 events, 2,083 events and 2,151 events, respectively due to the commissioning tests involving biomass plants Aseagas, Bicol, and GIFT on these months.

The conduct of commercial tests similarly drove the high frequency of over-riding events involving hydro plants. Increase in the number of over-riding events were particularly noted in November and December at 2,582 events and 3,054 events, respectively. The higher number of over-riding events involving hydro plants in November was related to the start of commissioning tests of Maris 2. Further increase in over-riding events was noted in December due to the over-riding constraints imposed on Maris Canal 1 and 2 for their commissioning tests.

The conduct of commercial test (non-security limit) and “Other Types” (security limit) accounted for majority of the over-riding events for coal plants. The January and April billing months recorded the highest occurrence of commercial tests for coal plants at 1,246 events and 1,702 events, respectively. These involved the commissioning tests of major coal plants SMC Limay and PEDC in January. Meanwhile, the commissioning tests of SMC Limay continued in April and contributed to the increase in the over-riding events in the same month. On top of this, major coal plants SLPGC also underwent commissioning, capacity and reliability tests in April.

Wind plants recorded over-riding events, all due to generating unit limitation from January to March only. As already mentioned, these were on account of the pending MPI configuration

of NWPDC 1 and 2. Meanwhile, accounting for a total of 2,124 events during the year, the designation of Malaya as MRU was the main driver for the over-riding events involving oil-based plants.

On the other hand, the commercial tests (dependable capacity tests) involving natural gas plants San Lorenzo and Sta. Rita drove the increase in the over-riding events of natural gas plants in January and April. San Gabriel was also noted to have conducted the same test in January. Lastly, Masinloc battery energy storage was likewise observed with over-riding events from January to March due to the conduct of commissioning tests.

Table 82. Summary of Over-riding Events by Plant Type

	Summary of Over-riding Events by Plant Type - 2017												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
BAT	128	622	338			12	3						1,103
BIOF	1,658	2,158	1,926	1,861	2,083	2,151	1,039	590	1,296	1,862	1,727	1,313	19,664
COAL	2,009	1,819	1,147	2,486	1,857	1,179	1,005	500	1,012	174	314	1,141	14,643
GEO	744	793	665	744	744	730	542		29				4,991
HYD	966	1,156	1,236	1,523	1,421	1,543	924	1,375	1,639	1,369	2,582	3,054	18,788
NATG	249	119		102	194	24	267	38	132	41	33	173	1,372
OIL	46	129	256	544	808	125		418	121	113	240	196	2,996
SOLR	8,331	7,531	5,899	6,605	6,374	6,169	4,655	5,422	5,789	5,309	5,134	4,607	71,825
WIND	1,383	1,487	1,102										3,972
Total	**15,514**	**15,814**	**12,569**	**13,865**	**13,481**	**11,933**	**8,435**	**8,343**	**10,018**	**8,868**	**10,030**	**10,484**	**139,354**

C. Impact of Over-riding Events

As shown in Figure 50, the imposition of over-riding constraints on generators[31] affected 8,021 trading intervals or 91.6 percent of the total trading intervals in 2017. This augmented the effective supply[32] level at an average of 206 MW, lower than last year's 356 MW. Nevertheless, the impact of over-riding events to the effective supply reached a maximum of 965 MW during the December billing month.

Figure 51 shows the hourly trend of Pmin and demand in 2017 and demonstrates that the imposition of over-riding constraints resulted in higher Pmin or price taker levels in almost all the trading intervals across the year. This corresponds to an average increase in Pmin of 298 MW, though this was a decline from the 461 MW posted in the previous year. The highest Pmin level increase was posted in April and May, averaging at 489 MW and 437 MW, respectively.

The ratio of Pmin to demand during year was 43.7 percent. Taking into account the effect of the imposed over-riding constraints on the Pmin level, the ratio grew to 46.3 percent, reducing further the level of demand that the generators are left to compete with by about 2.6 percent.

[31] Excluding the other constraints considered in the MMS (e.g. ramp rate offers).

[32] The supply is equal to the total offered capacity of all generator resources and nomination level from non-scheduled generators, adjusted for any security limit provided by the NGCP-System Operator.

Figure 50. Impact on Supply – 2017

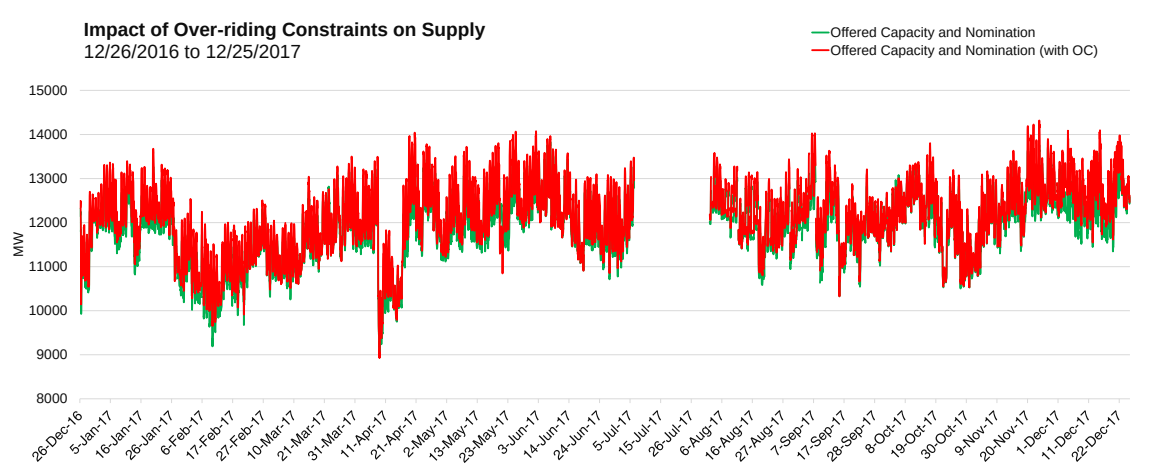


Figure 51. Impact on Pmin and Demand – 2017

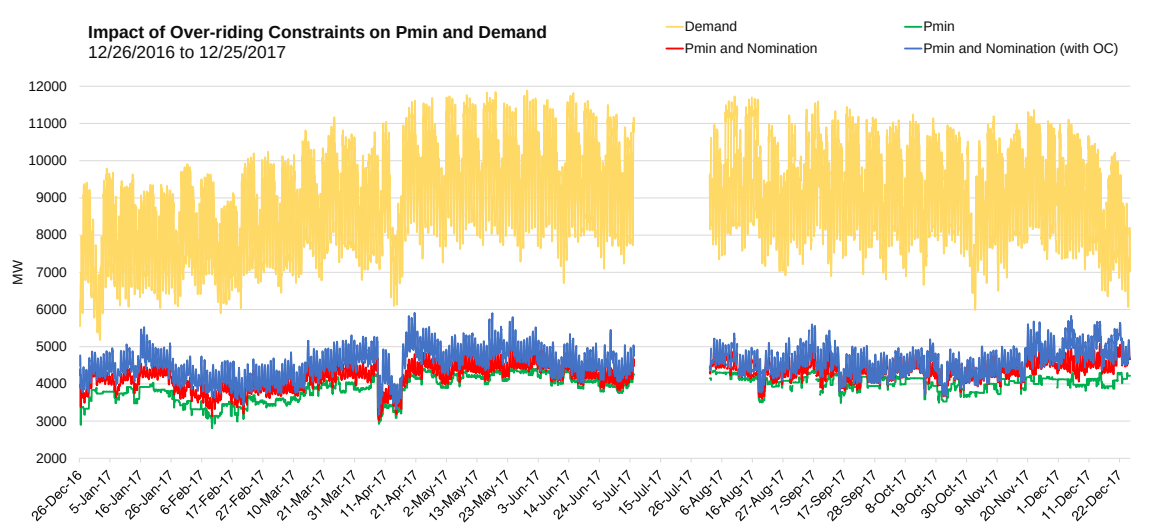


Table 83. Impact on Pmin Summary

Impact of Over-riding Constraints on Pmin (Percent of Time) - 2017													
Increase/Decrease in Pmin Level (Price Taker)	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**June**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Total**
Below 0MW	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.4	1.5	1.5	0.3	0.4
>0MW to 50MW	0.0	1.7	0.6	0.3	0.0	7.1	0.0	8.4	4.8	45.7	28.2	7.6	9.2
>50MW to 100MW	0.1	3.9	14.5	0.7	0.0	18.4	0.0	11.1	5.3	15.9	9.7	5.8	7.4
>100MW to 150MW	8.7	2.2	7.6	5.1	0.1	8.6	3.9	26.2	5.6	11.6	12.6	9.1	8.2
>150MW to 200MW	4.2	5.8	7.5	3.4	0.4	16.8	2.3	19.3	29.5	4.3	19.5	6.7	10.2
>200MW to 250MW	7.8	17.1	12.8	3.6	7.1	18.0	34.8	15.2	8.9	6.8	7.9	4.9	10.7
>250MW to 300MW	10.3	7.0	25.0	7.4	8.3	10.1	13.7	8.6	10.0	5.6	5.0	2.4	9.1
>300MW to 350MW	22.4	17.1	7.6	5.5	10.6	9.3	9.0	5.3	10.4	2.4	1.2	6.5	9.1
>350MW to 400MW	9.8	14.0	7.3	6.2	14.9	3.9	10.9	2.9	8.0	0.6	0.8	6.0	7.0
>400MW to 450MW	8.6	7.8	7.9	17.3	17.8	3.2	9.0	1.8	4.2	2.8	3.5	11.5	8.1
>450MW to 500MW	11.0	8.2	6.1	7.0	13.3	2.6	2.7	0.8	4.8	1.0	2.0	6.2	5.8
>500MW to 550MW	6.6	6.9	2.1	7.1	8.9	1.2	2.3	0.2	2.5	1.1	1.6	6.2	4.1
>550MW to 600MW	2.3	3.6	0.4	9.4	7.8	0.7	2.0	0.2	3.2	0.7	1.2	9.5	3.6
>600MW to 650MW	1.9	2.7	0.4	7.1	5.3	0.0	3.9	0.0	1.4	0.1	1.1	4.2	2.3
>650MW to 700MW	1.9	1.2	0.0	4.8	2.2	0.0	2.3	0.0	0.8	0.0	2.4	4.5	1.7
>700MW to 750MW	0.8	0.7	0.0	4.6	1.3	0.0	0.0	0.0	0.0	0.0	0.3	2.0	0.9
>750MW to 800MW	0.5	0.1	0.0	1.9	0.3	0.0	0.4	0.0	0.0	0.0	0.4	3.2	0.6
>800MW to 850MW	0.5	0.1	0.0	2.2	0.0	0.0	1.2	0.0	0.0	0.0	0.8	1.1	0.5
>850MW to 900MW	1.2	0.0	0.0	0.9	0.3	0.0	0.4	0.0	0.0	0.0	0.1	1.4	0.4
>900MW to 950MW	0.4	0.0	0.0	0.7	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.2
>950MW to 1000MW	0.8	0.0	0.0	4.8	1.1	0.0	1.2	0.0	0.0	0.0	0.1	0.4	0.7

Table 84. Impact on Supply Summary – 2017

Over-riding Constraints Impact on Supply (Percent of Time) - 2017													
Increase/Decrease in Supply (Offer with Limit)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
-900MW to -800MW	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
-800MW to -750MW	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
-750MW to -700MW	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
-700MW to -650MW	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
-650MW to -600MW	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
-600MW to -550MW	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
-550MW to -500MW	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
-500MW to -450MW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
-450MW to -400MW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
-400MW to -350MW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
-350MW to -300MW	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
-300MW to -250MW	0.0	0.0	1.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.1
-250MW to -200MW	0.0	0.0	0.7	0.3	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.0	0.1
>-200MW to -150MW	0.0	0.0	0.4	0.1	0.0	0.0	0.0	0.0	0.0	2.1	0.0	0.0	0.2
>-150MW to -100MW	0.0	0.0	0.3	0.8	0.0	0.1	0.0	0.0	0.3	1.0	0.1	0.0	0.2
>-100MW to -50MW	0.0	0.0	0.9	0.3	0.0	1.3	0.4	0.2	0.3	1.8	0.4	0.0	0.5
>-50MW to >0MW	0.1	2.6	17.9	3.6	0.7	16.4	0.0	0.4	1.0	4.6	1.2	0.3	4.3
>0MW to 50MW	1.1	4.6	12.7	7.7	0.1	11.7	4.3	10.9	5.1	46.5	28.5	7.7	12.2
>50MW to 100MW	9.7	3.0	9.5	7.5	0.6	12.6	1.6	12.7	5.8	15.5	10.1	6.0	8.1
>100MW to 150MW	7.4	6.9	14.3	13.6	18.2	22.0	35.2	25.8	8.2	10.6	13.4	9.4	14.0
>150MW to 200MW	12.1	15.1	18.6	15.3	9.6	12.9	24.6	20.3	32.6	3.9	18.8	7.4	15.3
>200MW to 250MW	24.6	13.3	6.4	7.3	6.7	9.4	12.1	14.3	9.6	5.4	8.2	5.6	10.1
>250MW to 300MW	10.8	17.2	7.5	8.1	16.0	4.8	13.3	8.6	10.8	1.5	5.0	4.3	8.8
>300MW to 350MW	9.9	9.4	4.9	12.0	13.1	2.7	3.5	4.3	8.2	0.7	1.6	6.9	6.7
>350MW to 400MW	9.7	10.1	3.4	8.5	14.4	3.5	2.3	1.0	6.5	0.3	0.4	6.0	5.8
>400MW to 450MW	6.5	7.0	0.7	3.5	7.4	1.5	2.0	1.0	2.3	2.8	6.0	11.4	4.6
>450MW to 500MW	2.2	5.4	0.4	2.2	6.7	0.8	0.8	0.2	3.8	1.0	2.3	6.5	2.9
>500MW to 550MW	3.0	2.6	0.1	2.7	1.9	0.0	0.0	0.2	1.8	1.4	2.2	7.6	2.1
>550MW to 600MW	1.5	0.8	0.0	1.9	0.4	0.0	0.0	0.2	3.5	0.4	1.2	9.5	1.7
>600MW to 650MW	0.8	1.7	0.0	2.2	0.7	0.0	0.0	0.0	0.3	0.0	0.1	3.5	0.8
>650MW to 700MW	0.3	0.5	0.0	1.2	0.3	0.0	0.0	0.0	0.0	0.0	0.1	4.6	0.6
>700MW to 750MW	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.1
>750MW to 800MW	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.1
>800MW to 850MW	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.1
>850MW to 900MW	0.3	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
>900MW to 950MW	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.1
>950MW to 1000MW	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
>1000 MW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 85. Summary of Commissioning Levels (MW) – 2017

Plant Name	Node ID	Registered Capacity	Registration Date	Start Date of Over-Riding Events	Number of Over-Riding Events for 2017	Commissioning levels, MW[1] (Min-Max)
MASINLOC BATTERY	1MSNLO_BATG	10	July 2, 2016	July 11, 2016	1,095	10
Sub-Total (Battery)		**10.0**			**1,095**	
ACNPC BIOMASS	1ACNPC_G01	3.2	July 27, 2017	September 15, 2017	1,983	0.2-1.7
ASEAGAS BIOMASS	3LIAN_G01	7.3	August 26, 2016	September 5, 2016	6,841	0.5-.5.2
BICOL BIOMASS	3BBEC_G01	5	September 7, 2016	November 5, 2016	4,288	1.8-4.4
GIFT BIOMASS	1GIFT_G01	12	January 20, 2016	January 26, 2016	4,098	9-11
IPOWER BIOMASS	1IPOWER_G02	12	September 8, 2017	September 8, 2017	2,334	5-11
Sub-Total (Biomass)		**39.5**			**19,544**	
PAGBILAO CFTPP	3PAGBIL_G03	436	July 27, 2017	August 3, 2017	1,047	21-420
	3SLPGC_G01				252	150
SLPGC CFTPP	3SLPGC_G02				237	20-150
	1SMC_G01	150	November 4, 2016	December 1, 2016	2,439	4.5-150
	1SMC_G02	150	March 14, 2017	May 19, 2017	2,266	4.5-150
SMC LIMAY CFTPP	1SMC_G03	150	November 9, 2017	November 26, 2017	610	4.5-150
Sub-Total (Coal)		**886.0**			**6,851**	
MARIS CANAL HEP	1MARIS_U01	3.8	October 14, 2017	October 17, 2017	1,289	5
	1MARIS_U02	3.8	October 14, 2017	October 30, 2017	1,245	5
UDDIAWAN HEP	1SMBELL_G01	1.8	November 11, 2016	February 4, 2017	7,166	0.1-1.7
Sub-Total (Hydro)		**9.4**			**9,700**	
SLPGC GTPP	3SLPGC_G03				183	3-30
	3SLPGC_G04				177	3-32
Sub-Total (Oil-Based)		**0.0**			**360**	
ARMENIA SOLAR	1ARMSOL_G01	7.1	April 8, 2016	March 31, 2016	612	0.1-6.4
BOSUNG SOLAR	1BOSUNG_G01	1.0	June 22, 2016	July 9, 2016	4,391	0.1-0.8
CALATAGAN SOLAR	3CALSOL_G01	49.7	February 22, 2016	February 24, 2016	4,581	0-47.9
CLARK SOLAR	1CLASOL_G01	18.0	March 9, 2016	March 11, 2016	624	1-16.1
CURRIMAO SOLAR	1MAEC_G01	16.3	February 20, 2016	February 20, 2016	634	0-15.9
DALAYAP SOLAR	1DALSOL_G01	5.9	April 8, 2016	March 31, 2016	603	0-5.4
FCRV SOLAR	1CABSOL_G01	9.1	March 15, 2016	March 19, 2016	4,289	0.1-8.4
HERMOSA SOLAR	1YHGRN_G01	12.6	January 20, 2016	February 5, 2016	42	0.5-10.1
LIAN SOLAR	3ADISOL_G01	1.6	March 10, 2016	March 16, 2016	4,149	0-1.6
MARIVELES SOLAR	1MARSOL_G01	16.0	March 15, 2016	March 15, 2016	1,697	0-14.3
MEC SOLAR	3MEC_G01	32.9	January 6, 2015	March 9, 2015	3,966	1-25
MORONG SOLAR	1BTNSOL_G01	5.0	March 14, 2016	March 23, 2016	4,360	0-203
PALAUIG SOLAR	1ZAMSOL_G01	5.0	March 10, 2016	March 23, 2016	4,371	0-4.5
SAN ILDEFONSO SOLAR	1BULSOL_G01	15.0	March 11, 2016	March 16, 2016	4,301	0-12.3
SAN RAFAEL SOLAR	1SPABUL_G01	1.2	March 15, 2016	March 31, 2016	4,338	0-3.5
SUBIC SOLAR	1SUBSOL_G01	7.4	April 15, 2016	April 16, 2016	4,411	0-26.9
VALENZUELA SOLAR	2VALSOL_G01	7.2	March 3, 2016	February 24, 2016	4,298	0.1-6.8
Sub-Total (Solar)		**210.9**			**51,667**	
Total (Luzon)		**1,156**			**89,217**	
HPCO BIOMASS	6HPCO_G02	18.6	November 14, 2017	November 13, 2017	109	5-15
Sub-Total (Biomass)		**18.6**			**109**	
PEDC CFTPP	8PEDC_U03	150	August 19, 2016	August 20, 2016	671	15-150
Sub-Total (Coal)		**150.0**			**671**	
VILLASIGA MHEP	8SUWECO_G01	8	January 4, 2016	March 12, 2016	7,899	0.1-8.1
Sub-Total (Hydro)		**8.0**			**7,899**	
BOHOL DPP	7BDPP_G01				11	1-4
CALUMANGAN DPP	6CENPRI_U04				5	6.4
PB 104	7TAPAL_PB4				29	2-6.5
Sub-Total (Oil-based)		**0.0**			**45**	
CADIZ SOLAR	6HELIOS_G01	108.12	February 29, 2016	March 12, 2016	143	0.1-99.5
COSMO SOLAR	8COSMO_G01	5.67	May 25, 2016	June 16, 2016	4,074	0-8.1
FTOLEDO SOLAR	5TOLSOL_G01	49	June 29, 2016	June 30, 2016	3,204	0-45
ISLASOL II SOLAR	6CARSOL_G01	27.2	March 1, 2016	March 12, 2016	3,071	0.1-24.1
SEPALCO SOLAR	4SEPSOL_G01	45	March 15, 2016	March 24, 2016	4,311	0.1-40.1
SILAY SOLAR	6SLYSOL_G01	20	March 8, 2016	March 12, 2016	1,677	0-18.5
SN CARLOS SUN SOLAR	6SACSUN_G01	46.8	March 8, 2016	March 12, 2016	3,636	0.2-24
Sub-Total (Solar)		**301.8**			**20,116**	
Total (Visayas)		**478.4**			**28,840**	
Grand Total (LUZON & VISAYAS)		**1,634.2**			**118,057**	

XVI. GENERATION MIX[33]

A. Generation Mix by Plant Type

Coal plants accounted for majority or 47.7 percent of the system-wide generation mix for the current year based on actual generation (metered quantity), followed in distant second by natural gas plants which accounted for 26.9 percent. Geothermal plants figured-in at third, with 11.8 percent of the system-wide generation mix this year. Hydro plants came next, contributing 7.6 percent, while oil-based plants comprised the next 2.3 percent. The 10-MW Masinloc battery energy storage also contributed to the generation mix this year.

Coal plants recorded higher generation in April, May and June, accounting for 49.8 percent, 49.6 percent and 50.4 percent, respectively of the total metered quantity during said months. However, the highest monthly contribution of coal plants to the generation mix was at 50.6 percent in July, as other plant types decreased in their actual generation during the month. Meanwhile, coal plants demonstrated low generation from February to March and in November, during which months, high outage capacity among coal plants was noted. Higher generation of natural gas plants was noted from July to September, consistent with their low outage capacity on these months. November also saw higher generation from natural gas plants, which corresponded to the decrease in the contribution of coal plants during the period, while lower generation was observed in February and April when their outage capacity was also quite high.

Geothermal plants demonstrated higher generation during the first half of the year, and hit their lowest in July and August, as reflected in their contribution to the total generation mix at 9.7 percent and 9.4 percent. This trend followed the surge in outage capacity among the Visayas geothermal plants during this period, related to the intensity 5 earthquake in the region on 06 July. Hydro plants recorded lower generation from April to July, but comprised a high of 9.8 percent and 10.5 percent of the total metered quantities for January and February, respectively. Oil-based plants accounted for 3.9 percent and 3.3 percent of the generation mix during the April and May billing months, while posting its lowest in January at 0.5 percent.

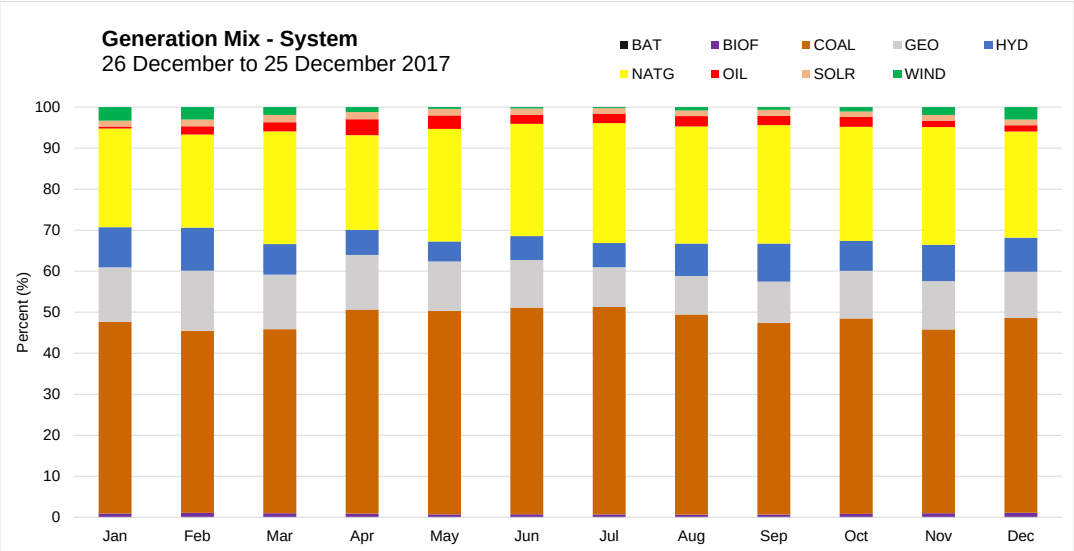
Preferential dispatch plants – biomass, solar and wind plants, accounted for the remaining 0.9 percent, 1.5 percent and 1.4 percent, respectively, of the total generation mix for 2017. The seasonality of preferential dispatch plants is reflected in their monthly contribution to the generation mix, with solar plants recording increases in generation during the months leading to summer (February to March) and during the summer months (April to June) as well. Meanwhile, wind plants recorded an increase in their generation during the first and last quarters of the year – seasons marked with cooler temperatures. On the other hand, higher generation was observed from biomass plants during the first and fourth quarters, indicating that a number of biomass plants were generally off-season in the second and third quarters.

Table 86. Generation Mix – System

	Generation Mix (%) based on Metered Quantity - System, 2017												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
BAT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BIOF	0.9	1.1	1.0	0.9	0.7	0.7	0.7	0.6	0.7	0.8	1.0	1.1	0.9
COAL	46.7	44.4	44.9	49.8	49.6	50.4	50.6	48.8	46.7	47.6	44.8	47.5	47.7
GEO	13.3	14.7	13.3	13.3	12.1	11.6	9.7	9.4	10.1	11.6	11.8	11.2	11.8
HYD	9.8	10.5	7.5	6.1	4.9	5.8	5.9	7.9	9.3	7.3	8.8	8.3	7.6
NATG	24.1	22.7	27.5	23.1	27.4	27.4	29.2	28.6	28.9	27.8	28.7	25.9	26.9
OIL	0.5	2.0	2.2	3.9	3.3	2.2	2.3	2.5	2.2	2.4	1.6	1.5	2.3
SOLR	1.4	1.7	1.8	1.8	1.6	1.5	1.3	1.3	1.5	1.3	1.4	1.4	1.5
WIND	3.3	3.0	1.9	1.2	0.4	0.3	0.3	0.8	0.7	1.1	1.9	3.0	1.4

[33] Generation based on metered quantity (energy injected) by resource type per billing month

Figure 52. Generation Mix – System



Looking at the regional generation mix in Luzon showed almost the same trend as the system-wide generation mix. Coal plants contributed the largest portion in the Luzon generation mix at 48.6 percent, followed by natural gas plants at 31.8 percent, hydro plants at 8.9 percent, geothermal plants at 5.7 percent and oil-based plants at 2 percent. Wind plants came next at 1.4 percent, followed by biomass and solar plants at 0.8 percent each.

On the other hand, geothermal plants dominated the Visayas generation mix based on metered quantity at 44.6 percent, closely followed by coal plants at 43 percent. Solar plants held the next largest, though distant at 5.3 percent, oil-based plants at 3.6 percent, wind plants at 1.6 percent and biomass plants at 1.3 percent. The Visayas hydro plants contributed the remaining 0.6 percent.

Figure 53. Generation Mix – Luzon

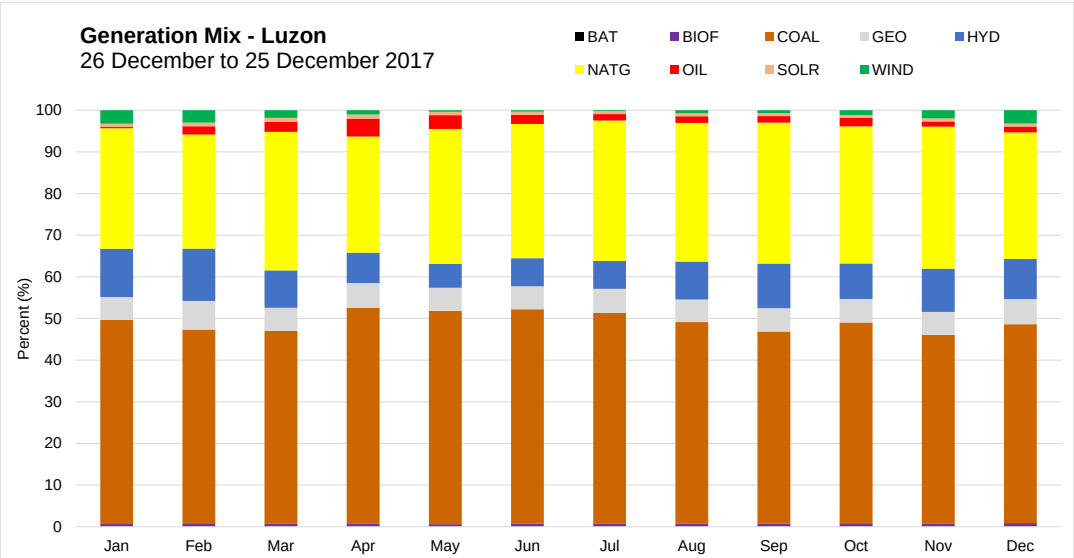


Table 87. Generation Mix – Luzon

	Generation Mix (%) based on Metered Quantity - Luzon, 2017												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
BAT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BIOF	0.7	0.8	0.8	0.8	0.6	0.7	0.8	0.8	0.8	0.8	0.8	0.9	0.8
COAL	49.0	46.5	46.2	51.8	51.2	51.5	50.6	48.4	46.1	48.2	45.3	47.7	48.6
GEO	5.4	6.9	5.5	5.9	5.6	5.5	5.8	5.4	5.6	5.7	5.5	6.0	5.7
HYD	11.6	12.6	9.0	7.3	5.7	6.7	6.7	9.1	10.7	8.5	10.4	9.7	8.9
NATG	29.0	27.4	33.3	27.9	32.4	32.2	33.7	33.3	33.8	32.9	34.1	30.4	31.8
OIL	0.3	2.0	2.4	4.3	3.3	2.2	1.5	1.6	1.6	2.1	1.3	1.4	2.0
SOLR	0.8	0.9	1.0	1.0	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.8
WIND	3.2	3.0	1.8	1.0	0.4	0.3	0.2	0.7	0.7	1.1	2.0	3.2	1.4

Figure 54. Generation Mix – Visayas

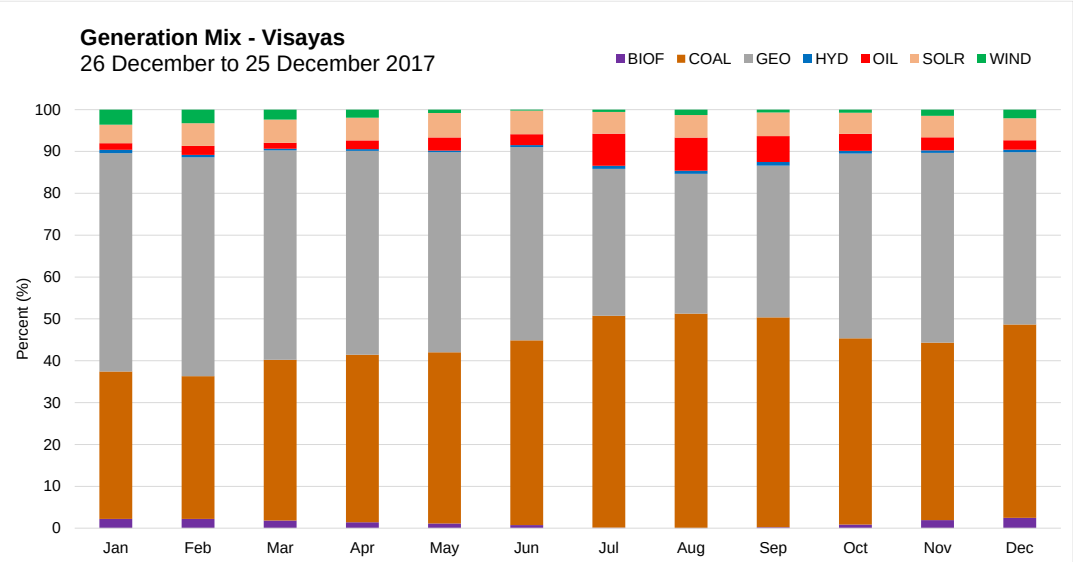


Table 88. Generation Mix – Visayas

	Generation Mix (%) based on Metered Quantity - Visayas, 2017												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
BIOF	2.2	2.2	1.9	1.4	1.1	0.7	0.1	0.0	0.2	0.9	1.9	2.5	1.3
COAL	35.2	34.1	38.4	40.0	40.9	44.1	50.6	51.2	50.1	44.5	42.4	46.2	43.0
GEO	52.2	52.3	50.0	48.7	47.8	46.1	35.1	33.4	36.3	44.1	45.3	41.2	44.6
HYD	0.8	0.6	0.4	0.4	0.4	0.5	0.8	0.7	0.8	0.7	0.6	0.6	0.6
OIL	1.6	2.2	1.4	2.1	3.1	2.6	7.7	7.9	6.2	4.0	3.1	2.2	3.6
SOLR	4.4	5.4	5.5	5.4	5.8	5.6	5.2	5.4	5.7	5.0	5.1	5.3	5.3
WIND	3.6	3.3	2.4	2.0	0.8	0.2	0.5	1.3	0.7	0.8	1.5	2.1	1.6

XVII. SPOT MARKET EXPOSURE[34]

A. Generator Spot Market Exposure[35]

As shown in Table 89, the monthly generator spot market exposure during the year ranged from a low of 15.3 percent to a high of 22.8 percent, accounting for a total of 19 percent of the total energy injected during the year. This was higher than last year's generator spot exposure of 16.7 percent. Monthly trend in generator spot exposure showed higher spot

[34] The spot market exposure is the difference between the total energy transacted in the market and the bilateral contract quantity (BCQ). This measures the extent by which trading participants are exposed to the hourly spot price volatility in the market.

[35] The generator's spot market exposure is equivalent to the percentage of energy injected not covered by the bilateral contracts entered into between generators and customers.

exposure levels from January to February (22.8 percent and 22.3 percent), April to June (21.3 percent, 19.8 percent and 18.9 percent), August (18.4 percent) and December (22.1 percent), respectively. On the other hand, the lowest monthly spot exposure level was recorded in March at 15.3 percent, followed by the 16.3 percent posted during the July billing month. Meanwhile the remaining 81 percent were metered quantities covered by bilateral contracts. This was conversely lower than last year's 83.3 percent.

Figure 55. Generator's Spot Market Exposure – System

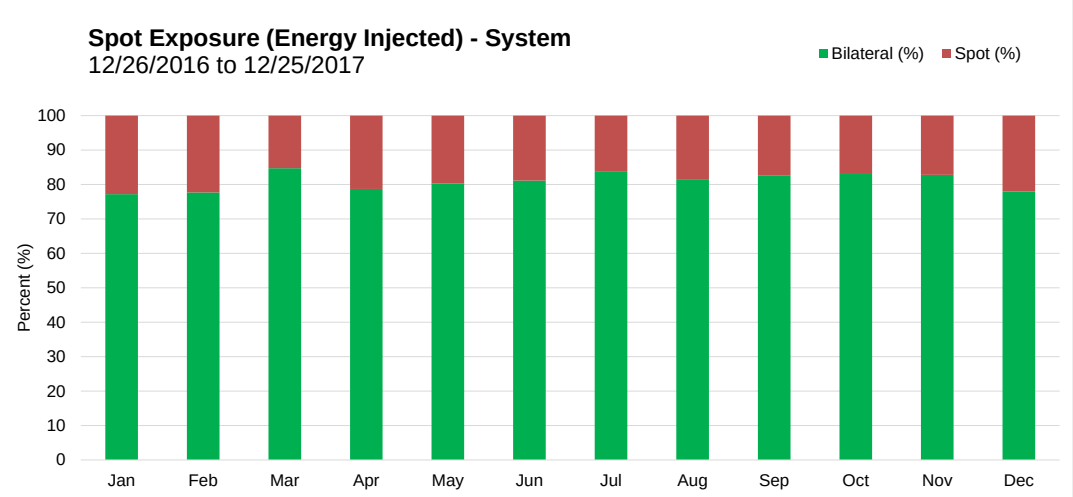


Table 89. Generators' Spot Market Exposure – System, 2017

	Generators' Spot Exposure by Billing Month - 2017												
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Metered Qty (MWh)	5,540,153	5,689,016	5,541,565	6,344,677	6,719,146	6,825,961	6,259,876	6,634,928	6,572,431	6,348,577	6,429,605	6,057,669	74,963,604
Bilateral Qty (MWh)	4,275,466	4,420,342	4,695,581	4,992,975	5,391,238	5,536,617	5,237,884	5,411,376	5,434,134	5,272,648	5,322,593	4,721,079	60,711,933
Spot Market Qty (MWh)	1,264,687	1,268,674	845,985	1,351,702	1,327,909	1,289,344	1,021,992	1,223,552	1,138,297	1,075,929	1,107,011	1,336,590	14,251,671
Bilateral Qty (%)	77.2	77.7	84.7	78.7	80.2	81.1	83.7	81.6	82.7	83.1	82.8	77.9	81.0
Spot Market (%)	22.8	22.3	15.3	21.3	19.8	18.9	16.3	18.4	17.3	16.9	17.2	22.1	19.0

Table 90. Year-on-Year Comparison of Generators' Spot Market Exposure

	Year-on-Year Comparison of Generator's Monthly Spot Exposure (%) - System												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
2017	22.8	22.3	15.3	21.3	19.8	18.9	16.3	18.4	17.3	16.9	17.2	22.1	19.0
2016	12.7	11.6	12.4	15.4	16.6	13.6	14.8	19.7	18.4	20.9	21.6	22.4	16.7
(%) Change	10.1	10.7	2.8	6.0	3.1	5.3	1.5	(1.2)	(1.1)	(3.9)	(4.3)	(0.3)	2.3

In Luzon, the generator spot market exposure was recorded at 16.5 percent while the remaining 83.5 percent accounted for the bilateral contract quantities of the total metered quantities in the region across the year. These were increases from the previous year's spot exposure level at 14 percent and bilateral contract quantities at 86 percent.

The monthly trend of generator spot exposure during the year demonstrated higher spot exposure levels from January to February (19.5 percent, 19.6 percent, respectively), April (18.2 percent) and December (20.8 percent). Meanwhile, spot exposure levels were lowest in March and November at 11 percent and 13.9 percent respectively.

On the other hand, Visayas spot exposure levels were notably higher when compared with Luzon. For the current year, spot exposure in the region was recorded at 32.4 percent. Monthly spot exposure trends showed spot exposure levels going as high as 39.4 percent (January) while the lowest was posted at 26 percent (August). Note that the first semester of the billing year, from January to June as well as the November billing month all posted spot exposure levels of above 30 percent. On the other hand, bilateral contract quantities were at 67.6 percent, with monthly levels closely maintained between a high of 74 percent (August)

to as low as 60.6 percent (January) of the total energy injected in the Visayas during the year. Year-on-year comparison showed an increase in the spot exposure level in the Visayas from last year's 31.8 percent. Conversely, bilateral contract quantities declined from last year's 68.2 percent.

Figure 56. Generator's Spot Market Exposure – Luzon

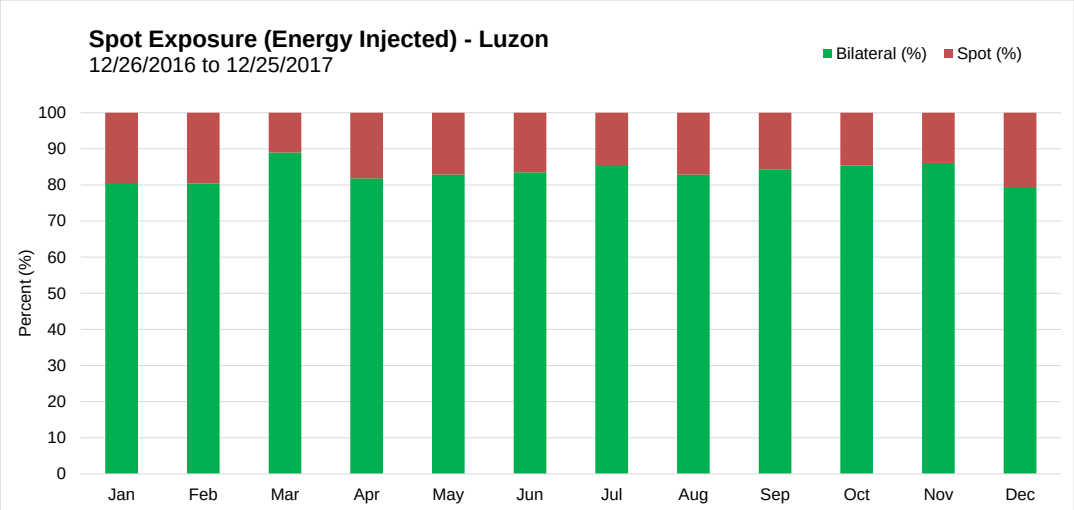


Table 91. Generators' Spot Market Exposure – Luzon, 2017

	Generators' Spot Exposure by Billing Month - Luzon, 2017												
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Metered Qty (MWh)	4,603,737	4,711,000	4,574,783	5,250,879	5,686,063	5,801,715	5,425,467	5,690,319	5,610,819	5,367,002	5,414,412	5,161,398	63,297,595
Bilateral Qty (MWh)	3,707,864	3,786,508	4,070,402	4,297,844	4,710,545	4,844,539	4,638,571	4,712,404	4,723,985	4,581,590	4,661,814	4,086,241	52,822,307
Spot Market Qty (MWh)	895,873	924,492	504,381	953,035	975,517	957,176	786,896	977,915	886,835	785,412	752,598	1,075,157	10,475,288
Bilateral Qty (%)	80.5	80.4	89.0	81.8	82.8	83.5	85.5	82.8	84.2	85.4	86.1	79.2	83.5
Spot Market (%)	19.5	19.6	11.0	18.2	17.2	16.5	14.5	17.2	15.8	14.6	13.9	20.8	16.5

Table 92. Year-on-Year Comparison of Generators' Spot Market Exposure – Luzon

	Year-on-Year Comparison of Generator's Monthly Spot Exposure (%) - Luzon												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
2017	19.5	19.6	11.0	18.2	17.2	16.5	14.5	17.2	15.8	14.6	13.9	20.8	16.5
2016	9.2	7.9	8.5	12.3	14.0	11.2	11.8	17.5	16.2	18.9	19.4	19.9	14.0
(%) Change	10.3	11.7	2.5	5.8	3.1	5.3	2.7	(0.3)	(0.3)	(4.3)	(5.5)	0.9	2.6

Figure 57. Generators Spot Market Exposure – Visayas

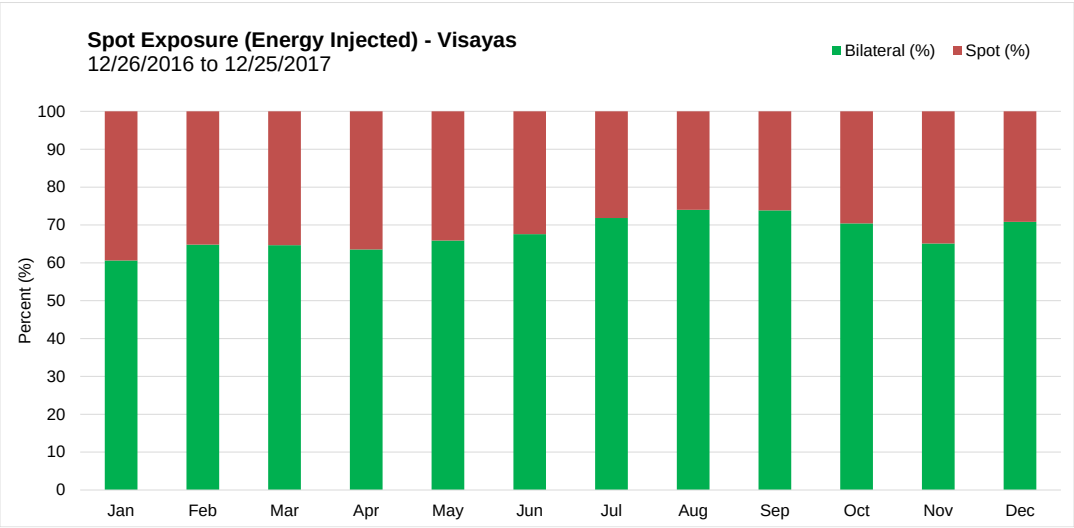


Table 93. Generators' Spot Market Exposure – Visayas, 2017

	Generators' Spot Exposure by Billing Month - Visayas, 2017												
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Metered Qty (MWh)	936,416	978,016	966,782	1,093,798	1,033,084	1,024,247	834,409	944,609	961,611	981,576	1,015,192	896,271	11,666,009
Bilateral Qty (MWh)	567,603	633,834	625,179	695,131	680,692	692,079	599,313	698,972	710,149	691,058	660,779	634,838	7,889,627
Spot Market Qty (MWh)	368,814	344,181	341,603	398,667	352,391	332,168	235,096	245,637	251,462	290,517	354,413	261,433	3,776,383
Bilateral Qty (%)	60.6	64.8	64.7	63.6	65.9	67.6	71.8	74.0	73.8	70.4	65.1	70.8	67.6
Spot Market (%)	39.4	35.2	35.3	36.4	34.1	32.4	28.2	26.0	26.2	29.6	34.9	29.2	32.4

Table 94. Year-on-Year Comparison of Generators' Spot Market Exposure - Visayas

	Year-on-Year Comparison of Generator's Monthly Spot Exposure (%) - Visayas												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
2017	39.4	35.2	35.3	36.4	34.1	32.4	28.2	26.0	26.2	29.6	34.9	29.2	32.4
2016	30.9	31.0	32.9	32.3	31.6	28.3	31.7	32.2	30.9	32.0	33.3	34.6	31.8
(%) Change	8.5	4.2	2.4	4.1	2.5	4.1	(3.6)	(6.2)	(4.7)	(2.4)	1.6	(5.4)	0.5

B. Impact of Preferential and Non-Scheduled Generation to Spot Exposure

Of the total energy injected for billing year 2017, about 4 percent were metered quantities from preferential and non-scheduled generating plants. Only 2.5 percent of this was covered by bilateral contracts while the bulk or 97.5 percent were spot quantities.

On the other hand, the remaining 96 percent corresponded to the metered quantities from scheduled generating plants. Of this, 84.3 percent were bilateral contract quantities and 15.7 percent were spot quantities.

Meanwhile, out of the total spot quantity during the year, 79.3 percent were attributable to scheduled plants while the remaining 20.7 percent corresponded to the spot quantity of preferential and non-scheduled plants. Higher spot exposure levels of preferential and non-scheduled plants were particularly noted during the first and last quarters of the year, when the seasonal generation of biomass and wind plants were also particularly high.

Year-on-year comparison showed that the spot exposure of preferential and non-scheduled generation this year is slightly lower than the previous year, accounting for 20.7 percent of the total spot quantity this year, from last year's 21 percent. Nevertheless, it should be noted that the said spot quantities from preferential dispatch plants are not necessarily exposed to the market price, but are paid according to the feed-in tariff (FIT) system.

Figure 58. Spot Market Exposure by Category – System

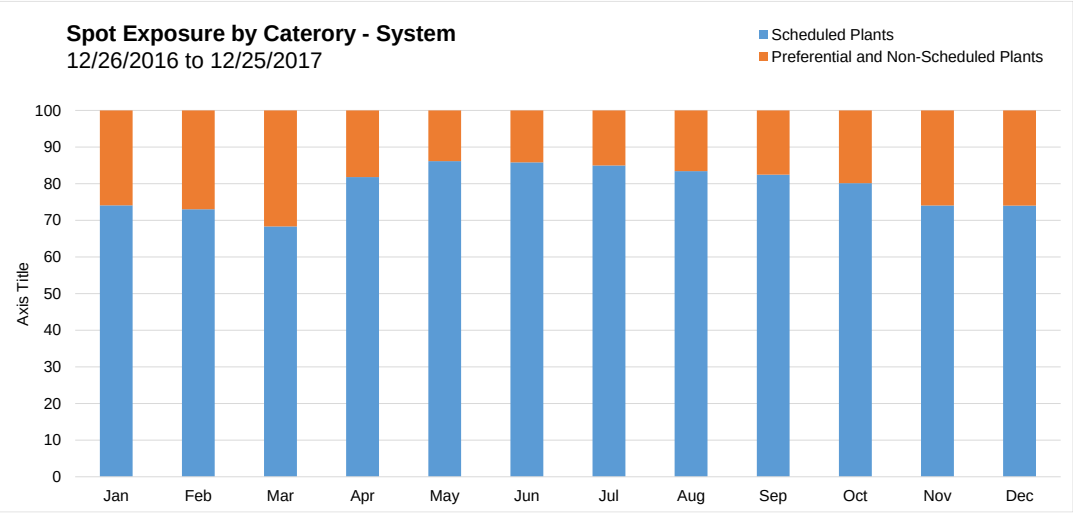


Table 95. Spot Market Exposure by Category

	Spot Market Quantity (MWh) by Category - System, 2017												
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	Scheduled Generating Plants												
Metered Quantity	5,208,013	5,344,464	5,270,338	6,092,663	6,527,304	6,636,066	6,100,106	6,424,809	6,364,194	6,127,130	6,135,306	5,703,855	71,934,249
Bilateral Quantity	4,270,873	4,417,614	4,692,227	4,986,589	5,382,936	5,529,369	5,231,482	5,403,972	5,425,220	5,264,729	5,315,447	4,714,336	60,634,795
Spot Quantity	937,140	926,850	578,111	1,106,074	1,144,368	1,106,697	868,624	1,020,837	938,974	862,401	819,859	989,519	11,299,454
Bilateral Qty (%)	82.0	82.7	89.0	81.8	82.5	83.3	85.8	84.1	85.2	85.9	86.6	82.7	84.3
Spot Market (%)	18.0	17.3	11.0	18.2	17.5	16.7	14.2	15.9	14.8	14.1	13.4	17.3	15.7
	Preferential and Non-Scheduled Generating Plants												
Metered Quantity	332,139	344,552	271,227	252,014	191,843	189,895	159,770	210,118	208,237	221,447	294,299	353,813	3,029,355
Bilateral Quantity	4,593	2,728	3,354	6,385	8,302	7,248	6,402	7,404	8,914	7,919	7,147	6,742	77,138
Spot Quantity	327,546	341,824	267,873	245,628	183,541	182,647	153,369	202,714	199,323	213,528	287,152	347,071	2,952,217
Bilateral Qty (%)	1.4	0.8	1.2	2.5	4.3	3.8	4.0	3.5	4.3	3.6	2.4	1.9	2.5
Spot Market (%)	98.6	99.2	98.8	97.5	95.7	96.2	96.0	96.5	95.7	96.4	97.6	98.1	97.5

Table 96. Spot Market Exposure (%) by Category

	Spot Exposure (%) by Category - System, 2017												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Total Spot Quantity (MWh)	1,264,687	1,268,674	845,985	1,351,702	1,327,909	1,289,344	1,021,992	1,223,552	1,138,297	1,075,929	1,107,011	1,336,590	14,251,671
Scheduled Plants - Spot Quantity (MWh)	937,140	926,850	578,111	1,106,074	1,144,368	1,106,697	868,624	1,020,837	938,974	862,401	819,859	989,519	11,299,454
Preferential and Non-Scheduled Plants - Spot Quantity (MWh)	327,546	341,824	267,873	245,628	183,541	182,647	153,369	202,714	199,323	213,528	287,152	347,071	2,952,217
Scheduled Plants - Spot Exposure (%)	74.1	73.1	68.3	81.8	86.2	85.8	85.0	83.4	82.5	80.2	74.1	74.0	79.3
Preferential and Non-Scheduled Plants - Spot Exposure (%)	25.9	26.9	31.7	18.2	13.8	14.2	15.0	16.6	17.5	19.8	25.9	26.0	20.7

Table 97. Year-on-Year Comparison of Spot Market Exposure – Preferential and Non-Scheduled Plants

	Year-on-Year Comparison of Spot Market Exposure - Preferential and Non-Scheduled Plants												
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Avg
2017	25.9	26.9	31.7	18.2	13.8	14.2	15.0	16.6	17.5	19.8	25.9	26.0	20.7
2016	26.5	35.5	31.2	21.8	16.1	18.5	17.9	16.6	18.1	15.9	21.8	24.2	21.0

C. Customer Spot Market Exposure[36]

About 17.7 percent of the total energy requirement of customers during the billing year was bought from the spot market, while 82.9 percent was covered by bilateral contracts. When compared with the previous year, the system-wide spot exposure of customers recorded an increase from 14.8 percent and correspondingly, a decline in the bilateral contract quantities from last year's 85.2 percent.

Monthly trend in the system-wide customer spot exposure indicates higher spot exposure levels during the January (21.2 percent), as well as the February and the December billing months (20.5 percent). Meanwhile, the monthly spot exposure level was lowest at 13.4 percent in May and 14.6 percent in July. These mirror the trend exhibited on the generator spot exposure as above discussed.

In Luzon, customer spot exposure accounted for 16.9 percent of the total energy withdrawn, while 83.1 percent was covered by bilateral contracts. Of this, 81.9 percent was contracted by the Luzon customers with the generators from Luzon, while the remaining 1.3 percent involved the bilateral contracting with Visayas generators.

When compared with the previous year, an increase of 1.6 percent in the spot exposure of Luzon customers was observed from the 14.4 percent customer spot exposure posted in 2016. Meanwhile, bilateral contracting within the Luzon region declined by 4.3 percent from last year's 85.2 percent, while contracting by the Luzon customers with Visayas generators increased by 2.7 percent from the 0.4 percent posted in 2016.

[36] The customer's spot exposure is equivalent to the percentage of energy withdrawn not covered by bilateral contracts. Customer MQ includes Kalayaan PSPP (pumping) and generators' station use.

On the other hand, customer spot exposure in the Visayas region was posted at 18.9 percent, higher by 1.6 percent from last year's 17.3 percent. Meanwhile, bilateral contracting in the region covered a total of 81.1 percent of the total energy withdrawn during the year, 68.7 percent of which were procured from generators within the region while the remaining 12.4 percent were contracted with generators from Luzon. When compared with the previous year, this reflects a decrease of 1.6 percent from last year's 82.7 percent. Bilateral contracting within region similarly declined by 4.3 percent from 73 percent in 2016, while contracting with Luzon generators increased by 2.7 percent from 9.8 percent.

Figure 59. Customers' Spot Market Exposure – System

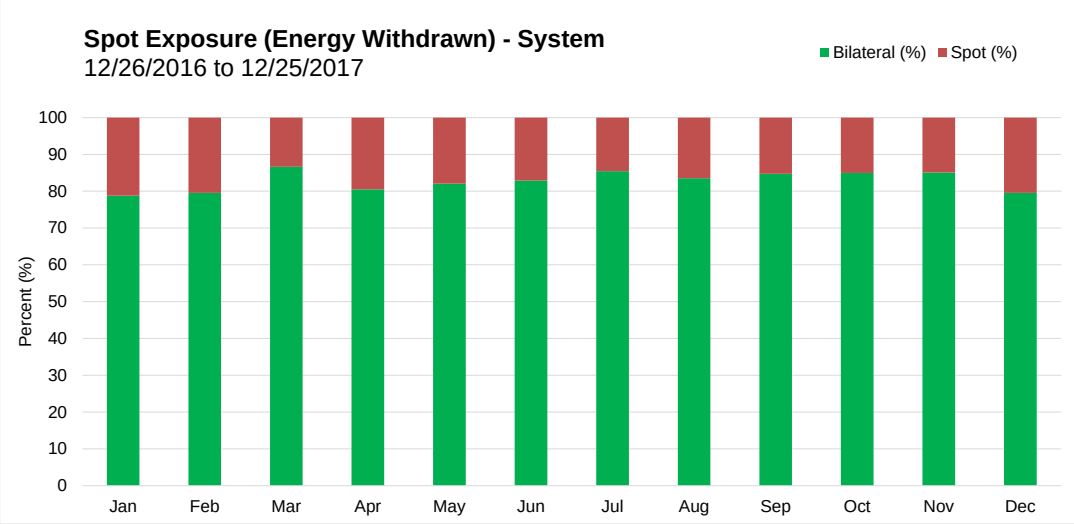


Table 98. Customers' Spot Market Exposure – System, 2017

	Customers' Spot Exposure by Billing Month - 2017												
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Metered Qty (MWh)	5,425,986	5,557,804	5,420,762	6,202,219	6,569,196	6,678,065	6,131,403	6,478,949	6,413,760	6,207,337	6,254,489	5,936,502	73,276,472
Bilateral Qty (MWh)	4,275,466	4,420,342	4,695,581	4,992,975	5,391,238	5,536,617	5,237,884	5,411,376	5,434,134	5,272,648	5,322,593	4,721,079	60,711,933
Spot Market Qty (MWh)	1,150,520	1,137,462	725,181	1,209,244	1,177,959	1,141,448	893,519	1,067,573	979,626	934,689	931,895	1,215,424	12,564,538
Bilateral Qty (%)	78.8	79.5	86.6	80.5	82.1	82.9	85.4	83.5	84.7	84.9	85.1	79.5	82.9
Spot Market (%)	21.2	20.5	13.4	19.5	17.9	17.1	14.6	16.5	15.3	15.1	14.9	20.5	17.1

Table 99. Year-on-Year Comparison of Customers' Spot Market Exposure – System

	Year-on-Year Comparison of Customers' Monthly Spot Exposure (%) - System												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
2017	21.2	20.5	13.4	19.5	17.9	17.1	14.6	16.5	15.3	15.1	14.9	20.5	17.1
2016	10.7	9.5	10.4	13.3	14.6	11.8	12.9	17.8	16.5	19.1	19.8	20.7	14.8
(%) Change	10.5	11.0	3.0	6.2	3.4	5.3	1.7	(1.3)	(1.2)	(4.1)	(4.9)	(0.2)	2.3

Table 100. Customers' Spot Market Exposure – Luzon, 2017

	Customers' Spot Exposure by Billing Month - Luzon, 2017												
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Metered Qty (MWh)	4,626,508	4,756,365	4,661,027	5,348,205	5,662,194	5,755,766	5,336,087	5,555,950	5,512,913	5,334,373	5,340,071	5,068,485	62,957,944
Total Bilateral Qty (MWh)	3,607,828	3,722,493	4,025,760	4,255,051	4,674,887	4,804,435	4,642,823	4,750,810	4,709,235	4,525,083	4,600,350	4,022,853	52,341,608
BCQ -Within Region (MWh)	3,592,877	3,665,857	3,953,299	4,176,238	4,595,147	4,724,920	4,581,212	4,677,726	4,636,947	4,451,843	4,526,135	3,957,637	51,539,837
BCQ-Other Region (MWh)	14,951	56,636	72,462	78,813	79,740	79,515	61,611	73,084	72,288	73,240	74,215	65,217	801,771
Spot Market Qty (MWh)	1,018,680	1,033,872	635,266	1,093,154	987,307	951,331	693,264	805,141	803,678	809,290	739,721	1,045,631	10,616,336
Total Bilateral Qty (%)	78.0	78.3	86.4	79.6	82.6	83.5	87.0	85.5	85.4	84.8	86.1	79.4	83.1
Bilateral-Within Region (%)	77.7	77.1	84.8	78.1	81.2	82.1	85.9	84.2	84.1	83.5	84.8	78.1	81.9
Bilateral-Other Region (%)	0.3	1.2	1.6	1.5	1.4	1.4	1.2	1.3	1.3	1.4	1.4	1.3	1.3
Spot Market (%)	22.0	21.7	13.6	20.4	17.4	16.5	13.0	14.5	14.6	15.2	13.9	20.6	16.9

Table 101. Year-on-Year Comparison of Customers' Spot Market Exposure – Luzon

	Year-on-Year Comparison of Customers' Monthly Spot Exposure (%) - Luzon												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
2017	22.0	21.7	13.6	20.4	17.4	16.5	13.0	14.5	14.6	15.2	13.9	20.6	16.9
2016	10.3	8.7	9.4	12.5	13.5	10.6	12.1	17.7	16.4	19.2	20.1	21.6	14.4
(%) Change	11.8	13.0	4.2	7.9	3.9	5.9	0.9	(3.2)	(1.8)	(4.0)	(6.2)	(0.9)	2.5

Figure 60. Customers' Spot Market Exposure – Luzon

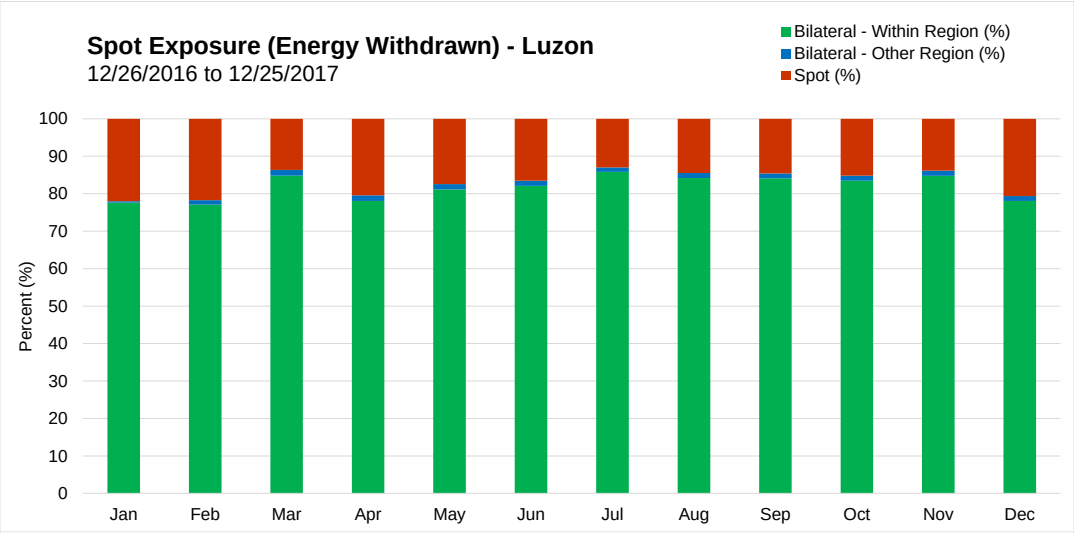


Figure 61. Customers' Spot Market Exposure – Visayas

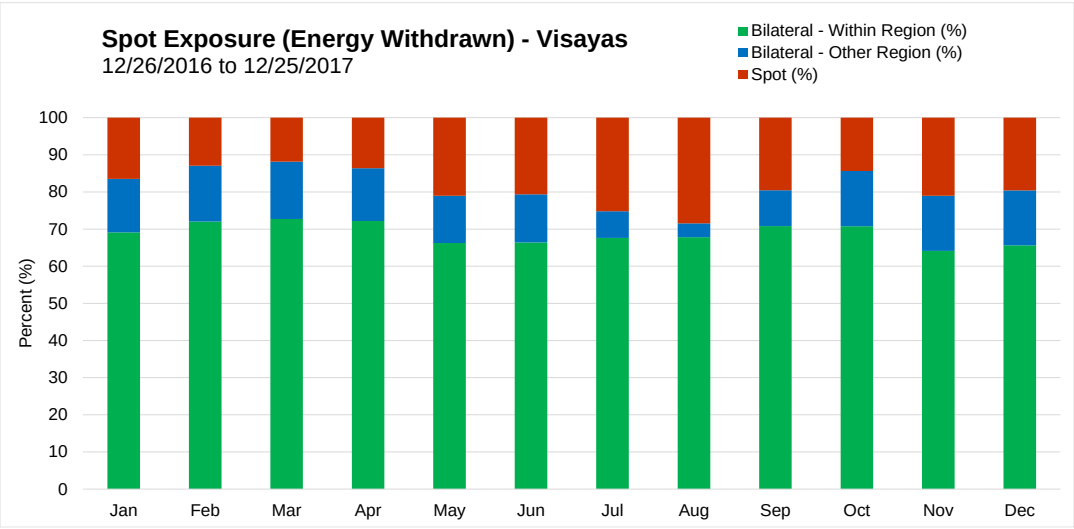


Table 102. Customers' Spot Market Exposure – Visayas, 2017

	Customers' Spot Exposure by Billing Month - Visayas, 2017												
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Metered Qty (MWh)	799,477	801,439	759,735	854,014	907,002	922,299	795,316	922,999	900,846	872,964	914,418	868,018	10,318,528
Total Bilateral Qty (MWh)	667,638	697,849	669,820	737,924	716,350	732,182	595,061	660,567	724,899	747,565	722,244	698,226	8,370,326
BCQ -Within Region (MWh)	552,651	577,198	552,717	616,318	600,953	612,563	537,702	625,888	637,861	617,818	586,564	569,621	7,087,856
BCQ-Other Region (MWh)	114,986	120,651	117,103	121,606	115,398	119,619	57,359	34,679	87,038	129,747	135,679	128,605	1,282,470
Spot Market Qty (MWh)	131,840	103,590	89,915	116,090	190,652	190,117	200,255	262,433	175,948	125,399	192,174	169,792	1,948,202
Total Bilateral Qty (%)	83.5	87.1	88.2	86.4	79.0	79.4	74.8	71.6	80.5	85.6	79.0	80.4	81.1
Bilateral-Within Region (%)	69.1	72.0	72.8	72.2	66.3	66.4	67.6	67.8	70.8	70.8	64.1	65.6	68.7
Bilateral-Other Region (%)	14.4	15.1	15.4	14.2	12.7	13.0	7.2	3.8	9.7	14.9	14.8	14.8	12.4
Spot Market (%)	16.5	12.9	11.8	13.6	21.0	20.6	25.2	28.4	19.5	14.4	21.0	19.6	18.9

Table 103. Year-on-Year Comparison of Customers' Spot Market Exposure – Visayas

	Year-on-Year Comparison of Customers' Monthly Spot Exposure (%) - Visayas												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
2017	16.5	12.9	11.8	13.6	21.0	20.6	25.2	28.4	19.5	14.4	21.0	19.6	18.9
2016	12.9	14.0	16.0	18.1	20.8	18.6	17.5	18.5	17.3	18.7	18.2	15.5	17.3
(%) Change	3.6	(1.1)	(4.2)	(4.6)	0.2	2.0	7.7	10.0	2.2	(4.3)	2.8	4.1	1.6

XVIII. MARKET CONCENTRATION

The market concentration indices measure the concentration of a market to assess if existing conditions facilitate or impede the development of competition. The less concentrated the market, the greater the possibility of effective competition.

The market share index, from which the Herfindahl-Hirschman Index (HHI) is computed, measures the monthly percentage of energy or capacity that a trading participant controls in the market. Calculation of system-wide market share was based on three major groupings: (i) by major participant group; (ii) by trading participants; and (iii) by generating plants.

A. Market Share

1. By Major Participant Group

By the end of the December billing month, the share of the four largest groups namely Aboitiz Power (AP), San Miguel Corporation (SMC), First Gen Corporation (FGC) and Power Sector Assets and Liabilities Management (PSALM) dominated the market with a combined market share of 67 percent. AP and SMC held the largest share with 19.9 percent each based on registered capacity by yearend. FGC came third at 15.5 percent, followed by PSALM with a market share of 11.7 percent. The Semirara Mining and Power Corporation (SMPC) group was at distant fifth with a share of 5.1 percent and Global Business Power Corporation (GBPC) at 4.6 percent.

SMC, which historically held the largest share of the market, dropped to second place beginning August this year, but regained the top spot tied with the AP group as of December attributable to the entry of the 150-MW coal facility of SMC Consolidated Power Corporation. Increase in SMC's market share was first observed in March from 19.2 percent to 19.9 percent, with the registration of the additional 150-MW unit of coal-fired plant SMC Limay. Meanwhile, the substantial increase in the market share of the AP group from 18 percent in July to 19.9 percent in August was on account of the entry in the market effective 27 July of the additional 436-MW unit of major coal plant Pagbilao. AP's market share further grew towards the end of the December billing month with the registration of the 2x176.2-MW coal-fired facility of Therma Visayas Inc (TVI) effective 23 December.

It is significant to note that on 17 December 2017, SMC Global Power Holdings acquired AES Philippines which owned and operated the 2x315MW Masinloc coal-fired power plant and the 10MW battery energy storage in Masinloc, Zambales. Said acquisition was approved by the Philippine Competition Commission (PCC) in its Decision dated 23 February 2018. Following the PCC Decision, for purposes of monitoring the major participant groups in the WESM, the market share of MPPCL will be transferred to SMC effective the March 2018 billing month.

Figure 62. Market Share by Major Participant Group based on Registered Capacity

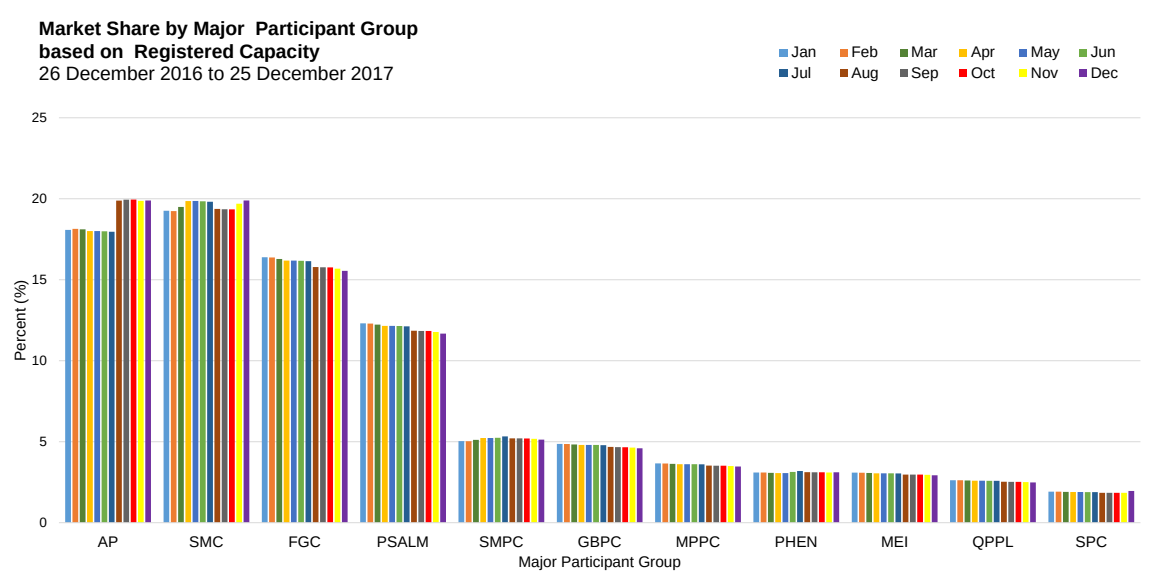


Table 104. Market Share by Major Participant Group based on Registered Capacity

	Market Share (%) by Major Participant Group based on Registered Capacity - System, 2017											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
AP	18.1	18.1	18.1	18.0	18.0	18.0	18.0	19.9	19.9	20.0	19.9	19.9
SMC	19.3	19.2	19.5	19.9	19.9	19.8	19.8	19.4	19.4	19.3	19.7	19.9
FGC	16.4	16.4	16.3	16.2	16.2	16.2	16.1	15.8	15.8	15.8	15.7	15.5
PSALM	12.3	12.3	12.2	12.2	12.2	12.1	12.1	11.9	11.8	11.8	11.8	11.7
SMPC	5.0	5.0	5.1	5.2	5.2	5.2	5.3	5.2	5.2	5.2	5.2	5.1
GBPC	4.9	4.9	4.8	4.8	4.8	4.8	4.8	4.7	4.7	4.7	4.6	4.6
MPPC	3.7	3.7	3.6	3.6	3.6	3.6	3.6	3.5	3.5	3.5	3.5	3.5
PHEN	3.1	3.1	3.1	3.1	3.1	3.1	3.2	3.1	3.1	3.1	3.1	3.1
MEI	3.1	3.1	3.1	3.0	3.1	3.0	3.0	3.0	3.0	3.0	3.0	2.9
QPPL	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.5
SPC	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.8	1.8	1.8	1.8	2.0
Other IPPs	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.5	1.6	1.6	1.6	1.7
VEC	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.5
AC	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
PCPC	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7
GAI	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
SCSEI	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
APC	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.4
AWOC	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
APEC	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
SPPPHI	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
FTSEC	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
PSC	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2
SEPLPI	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2
URC	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
PWEI	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
VMC	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
MEC	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
PHSOL	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
RC	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
SSPI	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
GFII	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

Meanwhile, in terms of offered capacity, SMC held the largest share of the market at 22 percent by December 2017. The AP group then followed at 20.9 percent, and FGC at 18.9 percent. GBPC, Masinloc Power Partners Limited, Inc. (MPPCL), and PSALM distantly followed at 5.9 percent, 5.3 percent and 5.2 percent, respectively. SMC's share was noticeably larger during the first half of the billing year mainly on account of the higher share based on offered capacity by major coal plant Sual during these months.

Figure 63. Market Share by Major Participant Group based on Offered Capacity

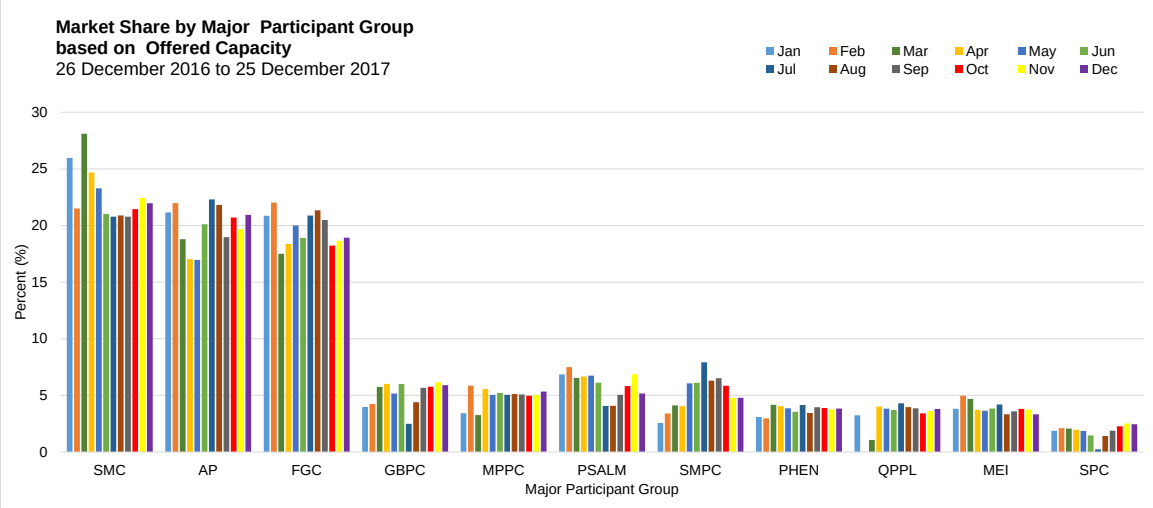


Table 105. Market Share by Major Participant Group based on Offered Capacity

	Market Share (%) by Major Participant Group based on Offered Capacity - System, 2017											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
SMC	26.0	21.5	28.1	24.7	23.3	21.0	20.8	20.9	20.8	21.4	22.4	22.0
AP	21.2	22.0	18.8	17.0	17.0	20.1	22.3	21.8	19.0	20.7	19.7	20.9
FGC	20.9	22.0	17.5	18.4	20.0	18.9	20.9	21.3	20.5	18.2	18.7	18.9
GBPC	4.0	4.2	5.7	6.0	5.2	6.0	2.5	4.4	5.7	5.8	6.2	5.9
MPPC	3.4	5.9	3.3	5.6	5.0	5.2	5.0	5.1	5.1	5.0	5.0	5.3
PSALM	6.8	7.5	6.5	6.7	6.7	6.1	4.1	4.1	5.1	5.8	6.9	5.2
SMPC	2.6	3.4	4.1	4.0	6.1	6.1	7.9	6.3	6.5	5.8	4.8	4.8
PHEN	3.1	3.0	4.2	4.0	3.9	3.6	4.1	3.4	3.9	3.9	3.8	3.8
QPPL	3.2	0.0	1.1	4.0	3.8	3.7	4.3	4.0	3.9	3.4	3.6	3.8
MEI	3.8	5.0	4.7	3.7	3.6	3.8	4.2	3.3	3.6	3.8	3.7	3.3
SPC	1.9	2.1	2.1	2.0	1.9	1.5	0.2	1.4	1.9	2.3	2.5	2.5
VEC	1.8	1.8	1.8	1.8	1.9	2.0	2.3	2.2	2.2	2.0	1.7	1.7
PCPC	1.0	1.3	1.2	1.2	0.8	1.1	0.4	0.8	1.1	1.0	0.2	1.1
APC	0.1	0.0	0.6	0.6	0.6	0.5	0.7	0.6	0.6	0.6	0.6	0.5
APEC	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1
Other IPPs	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1

The SMC group held the top spot in terms of system-wide market share based on actual generation, recording its share of the market at 20.6 percent. FGC closely figured at second place with its market share of 20.4 percent, followed by the AP group at 21 percent.

PSALM and SMPC rounded-up the fourth and fifth places with market shares of 6.8 percent and 6.4 percent, respectively.

SMC's share of the market based on actual generation was noticeably larger during the first half of the year, mainly on account of the higher market share level of major coal plant Sual during this period. It is noted that Sual 2 went on forced outage for the majority of the time during the second half of 2017, while Sual 1 also recorded several outage incidents in the same period. Meanwhile, drop in the market share of AP was noted from March to May, mainly attributable to the lower market share of GNPower in March and the lower market share of Pagbilao in April and May. It is noted that GNPower 1 and 2 both recorded long-duration planned outages in March while Pagbilao 1 was on planned outage for the whole months of April and May.

Figure 64. Market Share by Major Participant Group based on Actual Generation

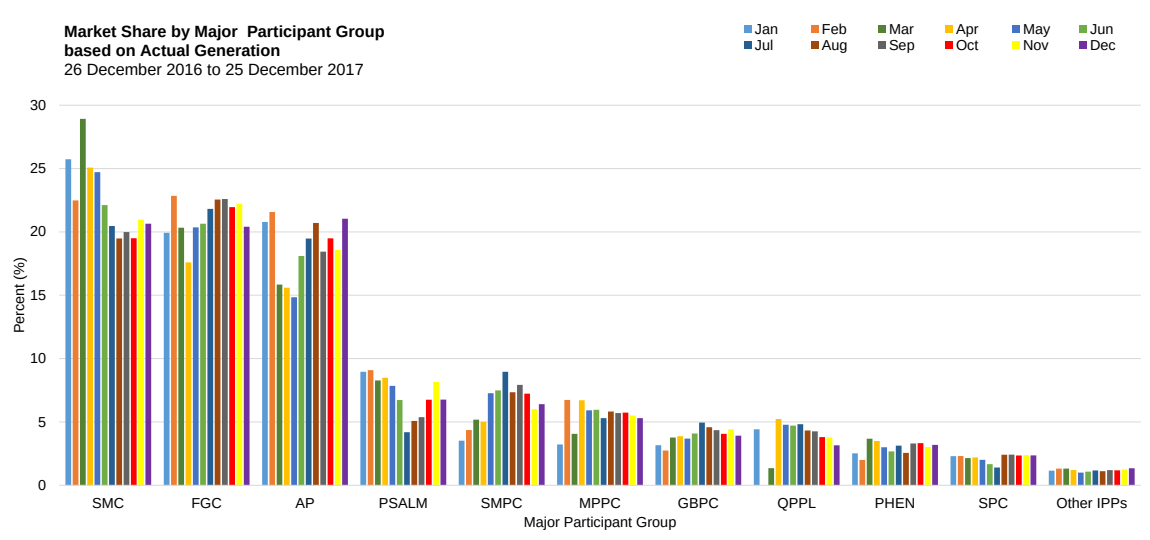


Table 106. Market Share by Major Participant Group based on Actual Generation

	Market Share (%) by Major Participant Group based on Actual Generation - System, 2017											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
SMC	25.7	22.5	28.9	25.1	24.7	22.1	20.5	19.5	20.0	19.5	21.0	20.6
FGC	19.9	22.8	20.3	17.6	20.4	20.6	21.8	22.6	22.6	22.0	22.2	20.4
AP	20.8	21.6	15.8	15.6	14.8	18.1	19.5	20.7	18.4	19.5	18.6	21.0
PSALM	9.0	9.1	8.3	8.5	7.9	6.7	4.2	5.1	5.4	6.8	8.2	6.8
SMPC	3.5	4.4	5.2	5.0	7.3	7.5	9.0	7.3	7.9	7.2	6.0	6.4
MPPC	3.2	6.7	4.1	6.7	5.9	6.0	5.3	5.8	5.7	5.7	5.5	5.3
GBPC	3.2	2.7	3.8	3.9	3.7	4.1	4.9	4.6	4.4	4.1	4.4	3.9
QPPL	4.4	0.0	1.3	5.2	4.8	4.7	4.8	4.3	4.3	3.8	3.8	3.2
PHEN	2.5	2.0	3.7	3.5	3.0	2.7	3.1	2.6	3.3	3.3	3.0	3.2
SPC	2.3	2.3	2.1	2.2	2.0	1.7	1.4	2.4	2.4	2.4	2.4	2.4
Other IPPs	1.2	1.3	1.3	1.2	1.0	1.1	1.2	1.1	1.2	1.2	1.2	1.3
PCPC	0.7	0.9	0.8	1.0	0.8	1.1	0.8	0.8	1.0	0.7	0.1	0.8
AC	1.2	1.1	0.7	0.4	0.2	0.2	0.1	0.3	0.3	0.5	0.8	1.2
APC	0.1	0.0	0.8	0.6	0.7	0.5	0.6	0.6	0.7	0.7	0.7	0.5
VEC	0.1	0.2	0.5	0.4	0.5	0.9	0.9	0.9	0.8	0.6	0.3	0.2
MEI	0.1	0.1	0.2	1.2	0.9	0.8	0.8	0.1	0.3	0.7	0.1	0.9
GAI	0.2	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.3	0.3	0.3	0.3
SCSEI	0.2	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
AWOC	0.4	0.4	0.3	0.2	0.1	0.0	0.1	0.1	0.1	0.1	0.2	0.3
PWEI	0.3	0.3	0.2	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.2
APEC	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2
SPPPHI	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
URC	0.2	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2
FTSEC	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
PSC	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
SEPLPI	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
MEC	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.0
PHSOL	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SSPI	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RC	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
VMC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Similar to previous years, PSALM retained the largest market share system-wide in terms of spot transaction during the billing year, recording its market share at 19.8 percent in December 2017. PSALM was followed by AP at 16.7 percent, FGC at 12.5 percent, SMC at 11.8 percent, and Phinma Energy (PHEN) at 6.4 percent.

The large market share of Visayas geothermal plant Leyte A, particularly during the first half of the billing year, influenced the large market share obtained by PSALM.

Figure 65. Market Share by Major Participant Group based on Spot Transaction

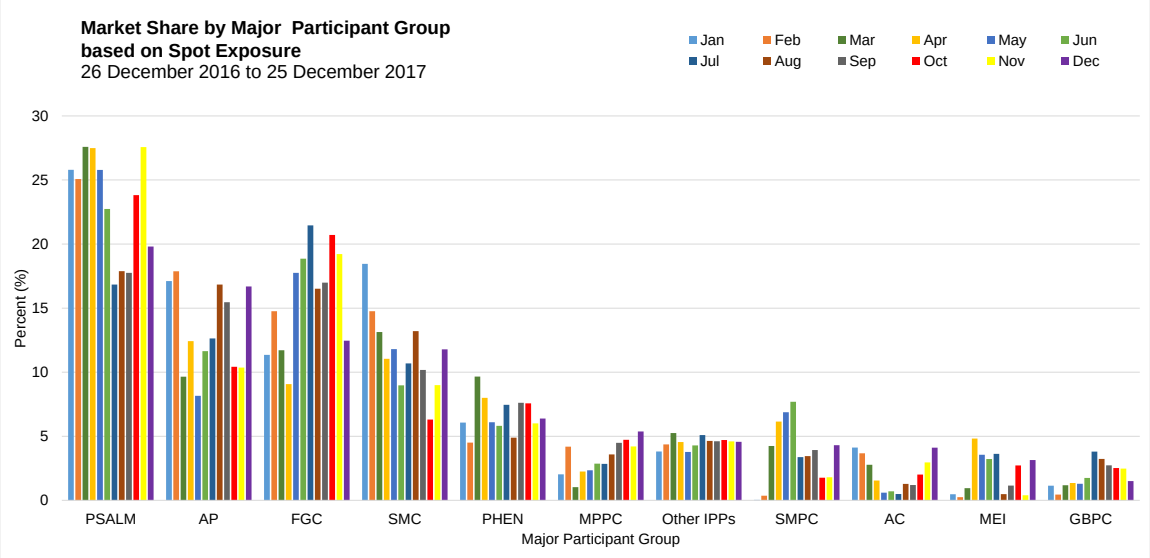


Table 107. Market Share by Major Participant Group based on Spot Transaction

	Market Share (%) by Major Participant Group based on Spot Transaction - System, 2017											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
PSALM	25.8	25.1	27.6	27.5	25.8	22.7	16.8	17.9	17.8	23.8	27.6	19.8
AP	17.1	17.9	9.6	12.4	8.2	11.6	12.6	16.8	15.5	10.4	10.4	16.7
FGC	11.4	14.8	11.7	9.1	17.8	18.9	21.5	16.5	17.0	20.7	19.2	12.5
SMC	18.5	14.8	13.1	11.0	11.8	9.0	10.7	13.2	10.2	6.3	9.0	11.8
PHEN	6.1	4.5	9.7	8.0	6.1	5.8	7.5	4.9	7.6	7.6	6.0	6.4
MPPC	2.0	4.2	1.0	2.3	2.3	2.9	2.8	3.6	4.5	4.7	4.2	5.4
Other IPPs	3.8	4.4	5.3	4.6	3.8	4.3	5.1	4.6	4.6	4.7	4.6	4.6
SMPC	0.0	0.4	4.2	6.1	6.9	7.7	3.4	3.5	3.9	1.8	1.8	4.3
AC	4.1	3.7	2.8	1.5	0.6	0.7	0.5	1.3	1.2	2.0	3.0	4.1
MEI	0.5	0.2	1.0	4.8	3.6	3.2	3.6	0.5	1.2	2.7	0.4	3.1
GBPC	1.1	0.5	1.2	1.4	1.3	1.8	3.8	3.2	2.7	2.5	2.5	1.5
SPC	0.9	1.0	0.7	1.1	1.2	1.0	1.3	2.2	2.1	1.8	1.6	1.3
APC	0.2	0.0	2.5	1.3	1.6	1.1	1.4	1.5	1.6	1.8	1.6	1.1
AWOC	1.3	1.3	1.1	0.8	0.4	0.2	0.3	0.5	0.3	0.3	0.8	0.9
GAI	0.8	1.0	1.4	1.3	1.2	1.2	1.2	1.0	1.1	1.1	1.1	0.9
URC	0.8	0.8	0.8	0.5	0.2	0.1	0.0	0.0	0.0	0.3	0.7	0.8
SCSEI	0.7	0.9	1.1	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.8	0.8
PWEI	1.0	0.9	0.8	0.6	0.3	0.1	0.2	0.6	0.3	0.3	0.5	0.6
APEC	0.4	0.5	0.6	0.4	0.5	0.4	0.2	0.3	0.7	0.7	0.6	0.6
VEC	0.3	0.4	0.4	0.7	1.0	2.4	2.8	3.6	3.3	2.6	1.1	0.6
SPPPHI	0.5	0.5	0.6	0.6	0.5	0.5	0.5	0.4	0.5	0.4	0.5	0.4
FTSEC	0.3	0.4	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3
PSC	0.3	0.4	0.5	0.4	0.4	0.4	0.4	0.3	0.4	0.3	0.3	0.3
PCPC	0.9	0.6	0.4	0.9	1.1	1.2	0.7	0.8	1.0	0.6	0.1	0.3
SEPLPI	0.3	0.3	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
MEC	0.2	0.2	0.3	0.3	0.3	0.2	0.2	0.3	0.2	0.2	0.2	0.2
SSPI	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
PHSOL	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.1
RC	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1
QPPL	0.1	0.0	0.1	0.0	0.8	0.2	0.2	0.2	0.3	0.2	0.3	0.1
VMC	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.1
GFII	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0

2. By Trading Participant

The succeeding Figure and Table show the top trading participants with their corresponding monthly market shares based on registered capacity. During the billing year, PSALM emerged as the trading participant with the largest share of the market at 11.7 percent in December 2017. Hydro plants Botocan, Caliraya, Casecnan, Hedcor and Kalayaan as well as geothermal plant Leyte A and oil-based plant Malaya are all under trading participant

PSALM. San Miguel Energy Corporation (SMEC), which trades the capacity of major coal plant Sual figured as the next top trading participant with a market share of 7 percent based on registered capacity during the December billing month.

South Premiere Power Corporation (SPPC), the trading participant for large generating natural gas plant Ilijan, held the third place with a market share of 6.5 percent in December, followed by FGP Corporation (FGPCSTRA), the trading participant for natural gas plant Sta. Rita at 5.7 percent.

Figure 66. Market Share by Trading Participant based on Registered Capacity

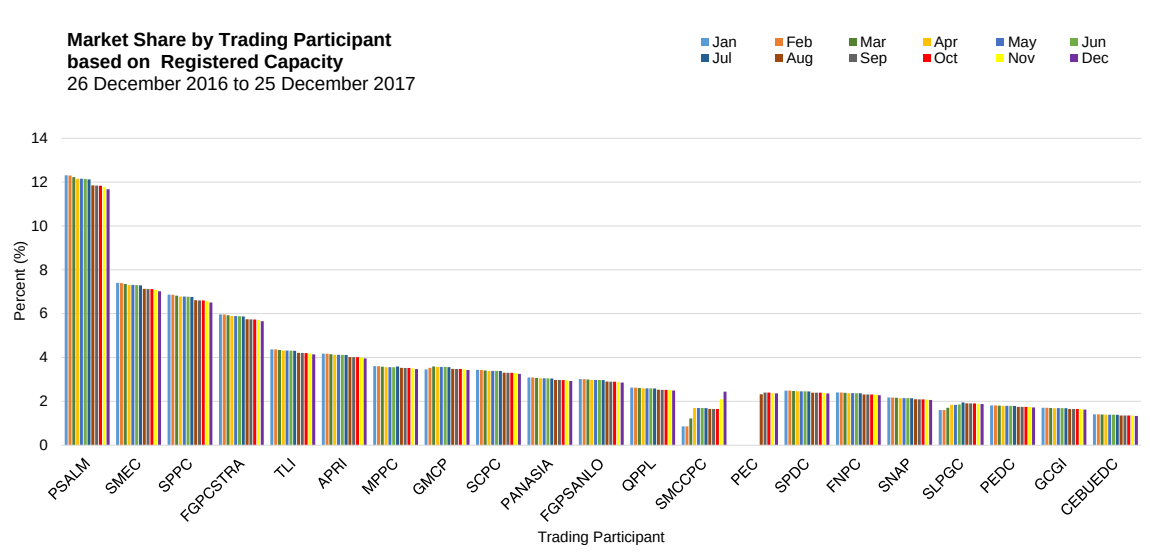


Table 108. Market Share by Trading Participant based on Registered Capacity

	Market Share (%) by Trading Participant based on Registered Capacity - System, 2017											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
PSALM	12.3	12.3	12.2	12.2	12.2	12.1	12.1	11.9	11.8	11.8	11.8	11.7
SMEC	7.4	7.4	7.4	7.3	7.3	7.3	7.3	7.1	7.1	7.1	7.1	7.0
SPPC	6.9	6.9	6.8	6.8	6.8	6.8	6.8	6.6	6.6	6.6	6.6	6.5
FGPCSTRA	6.0	6.0	5.9	5.9	5.9	5.9	5.9	5.7	5.7	5.7	5.7	5.7
TLI	4.4	4.4	4.3	4.3	4.3	4.3	4.3	4.2	4.2	4.2	4.2	4.1
APRI	4.2	4.2	4.1	4.1	4.1	4.1	4.1	4.0	4.0	4.0	4.0	4.0
MPPC	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.5	3.5	3.5	3.5	3.5
GMCP	3.5	3.5	3.6	3.6	3.6	3.6	3.6	3.5	3.5	3.5	3.5	3.4
SCPC	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.3	3.3	3.3	3.3	3.3
PANASIA	3.1	3.1	3.1	3.0	3.1	3.0	3.0	3.0	3.0	3.0	3.0	2.9
FGPSANLO	3.0	3.0	3.0	3.0	3.0	3.0	3.0	2.9	2.9	2.9	2.9	2.9
QPPL	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.5
SMCCPC	0.9	0.9	1.2	1.7	1.7	1.7	1.7	1.7	1.7	1.7	2.1	2.4
PEC								2.3	2.4	2.4	2.4	2.4
SPDC	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.4	2.4	2.4	2.4	2.4
FNPC	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.3	2.3	2.3	2.3	2.3
SNAP	2.2	2.2	2.2	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
SLPGC	1.6	1.6	1.7	1.8	1.8	1.9	1.9	1.9	1.9	1.9	1.9	1.9
PEDC	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.7	1.7	1.7	1.7	1.7
GCGI	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.6	1.6	1.6	1.6	1.6
CEBUEDC	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.3	1.3
SNAPBENGT	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.3	1.3	1.3	1.3	1.3
SLTEC	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.3	1.3	1.3	1.3	1.3
TMO	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.3	1.3	1.3	1.3	1.3
AHC	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
KSPC	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.1	1.1	1.1	1.1	1.1
1590EC	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
TPC	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

3. By Generating Plant

Major coal plant Sual (SMC) held the largest market share based on registered capacity by December 2017, recording its share of the market at 7 percent. Natural gas plants Ilijan (SMC) and Sta. Rita (FGC) came next with respective market shares of 6.5 percent and 5.7 percent during the December billing month. Major coal plant Pagbilao (AP), hydro plant Kalayaan (PSALM), oil-based plant Malaya (PSALM) and major coal plants Mariveles (AP), Masinloc (MPPCL) and Calaca (SMPC), and oil-based plant Limay (Millenium Energy Inc.) rounded-up the top 10 of plants with the largest market share by yearend.

Figure 67. Market Share by Generating Plant based on Registered Capacity

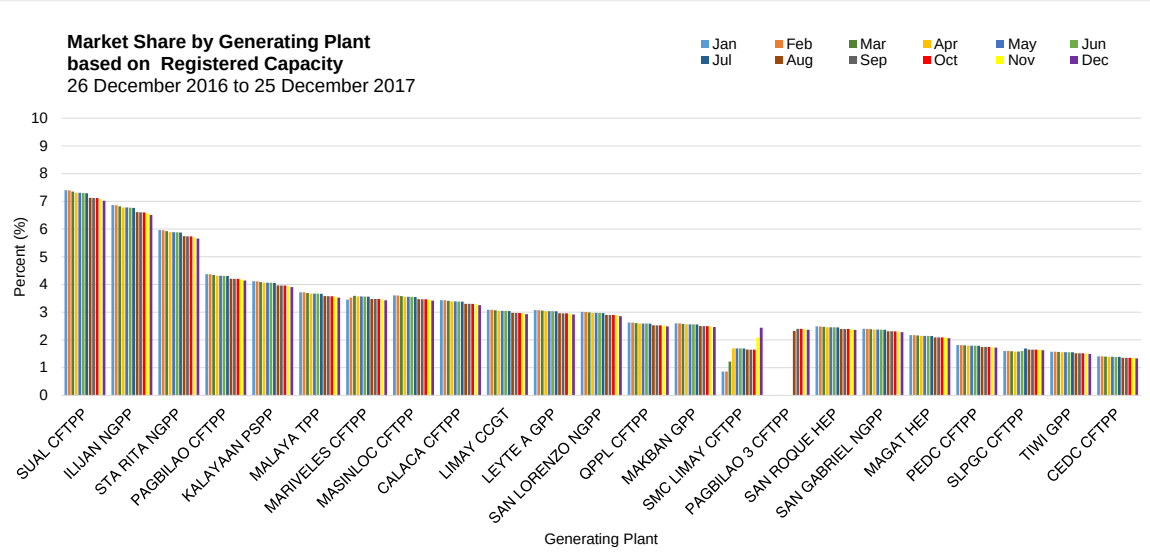


Table 109. Market Share by Plant based on Registered Capacity

	Market Share (%) by Generating Plant based on Registered Capacity - System, 2017											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
SUAL CFTPP	7.4	7.4	7.4	7.3	7.3	7.3	7.3	7.1	7.1	7.1	7.1	7.0
ILIJAN NGPP	6.9	6.9	6.8	6.8	6.8	6.8	6.8	6.6	6.6	6.6	6.6	6.5
STA RITA NGPP	6.0	6.0	5.9	5.9	5.9	5.9	5.9	5.7	5.7	5.7	5.7	5.7
PAGBILAO CFTPP	4.4	4.4	4.3	4.3	4.3	4.3	4.3	4.2	4.2	4.2	4.2	4.1
KALAYAAN PSPP	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.0	4.0	4.0	3.9	3.9
MALAYA TPP	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.6	3.6	3.6	3.6	3.5
MARIVELES CFTPP	3.5	3.5	3.6	3.6	3.6	3.6	3.6	3.5	3.5	3.5	3.5	3.4
MASINLOC CFTPP	3.6	3.6	3.6	3.6	3.6	3.6	3.5	3.5	3.5	3.5	3.4	3.4
CALACA CFTPP	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.3	3.3	3.3	3.3	3.3
LIMAY CCGT	3.1	3.1	3.1	3.0	3.1	3.0	3.0	3.0	3.0	3.0	3.0	2.9
LEYTE A GPP	3.1	3.1	3.1	3.0	3.0	3.0	3.0	3.0	3.0	3.0	2.9	2.9
SAN LORENZO NGPP	3.0	3.0	3.0	3.0	3.0	3.0	3.0	2.9	2.9	2.9	2.9	2.9
QPPL CFTPP	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.5
MAKBAN GPP	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.5
SMC LIMAY CFTPP	0.9	0.9	1.2	1.7	1.7	1.7	1.7	1.7	1.7	1.7	2.1	2.4
PAGBILAO 3 CFTPP								2.3	2.4	2.4	2.4	2.4
SAN ROQUE HEP	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.4	2.4	2.4	2.4	2.4
SAN GABRIEL NGPP	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.3	2.3	2.3	2.3	2.3
MAGAT HEP	2.2	2.2	2.2	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
PEDC CFTPP	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.7	1.7	1.7	1.7	1.7
SLPGC CFTPP	1.6	1.6	1.6	1.6	1.6	1.6	1.7	1.7	1.7	1.7	1.6	1.6
TIWI GPP	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.5
CEDC CFTPP	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.3	1.3
SLTEC CFTPP	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.3	1.3	1.3	1.3	1.3
NAVOTAS DPP	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.3	1.3	1.3	1.3	1.3
ANGAT HEP	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
KSPC CFTPP	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.1	1.1	1.1	1.1	1.1
BAUANG DPP	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1

B. Herfindahl-Hirschman Index (HHI)[37]

The resulting HHI across the billing year generally denoted a moderately concentrated market in terms of major participant group. However, higher HHI values almost bordering on the concentrated mark were observed from January to March based on offered capacity and actual generation. The varying conditions of supply availability as well as the offer behaviour of plants could have influenced the same.

As shown in Figure 68, regional calculation of market concentration for the duration of the HVDC unavailability from 07 July to 07 September signaled a concentrated market based on offered capacity and actual generation in the Visayas region. This followed the extremely high outage capacity during this period due to the intensity 5 earthquake that hit the Visayas.

Meanwhile, monthly HHI results by trading participant signaled a not concentrated market, while HHI results by generating plant also indicated a not concentrated market during the billing year.

Figure 68. HHI by Major Participant Group – System

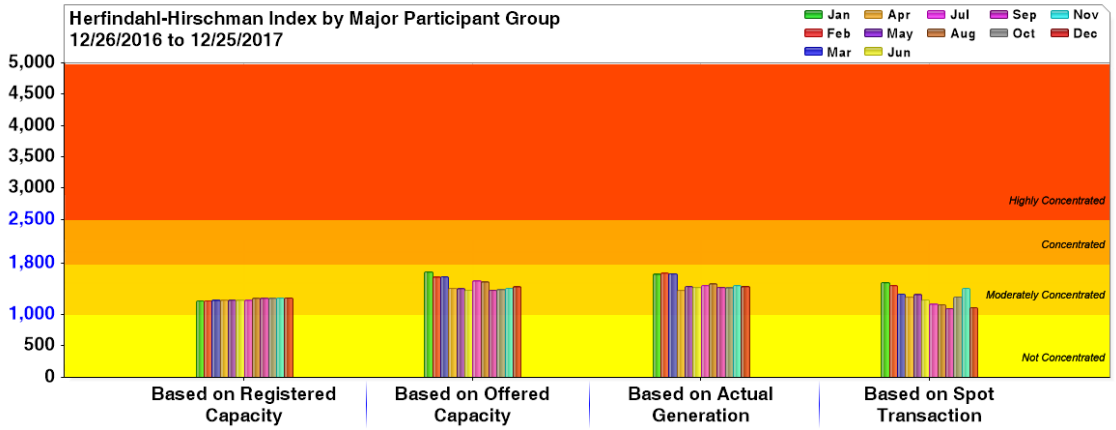
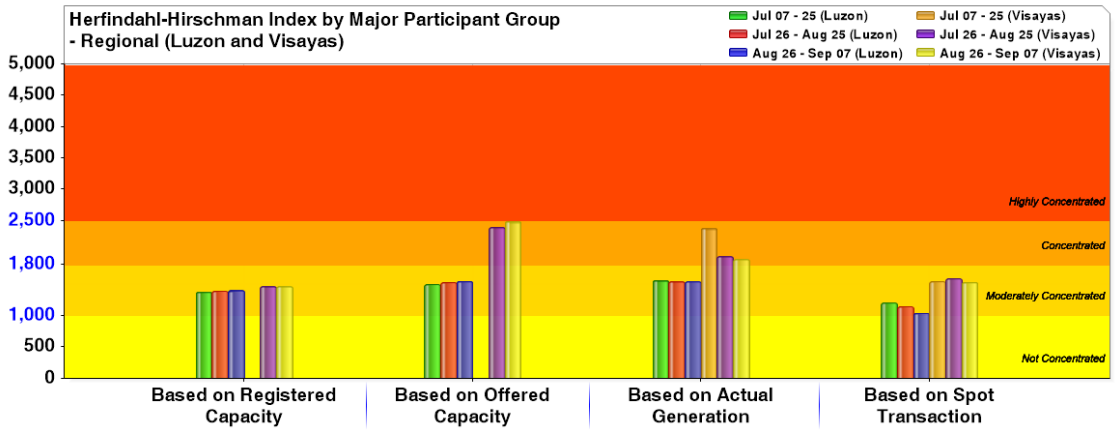


Figure 69. HHI by Major Participant Group – Regional



[37] The HHI measures the degree of market concentration that takes into account the relative size and distribution of participants in the market. Defined as the sum of squares of the participant's market share, 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 but less than 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 70. HHI by Participant – System

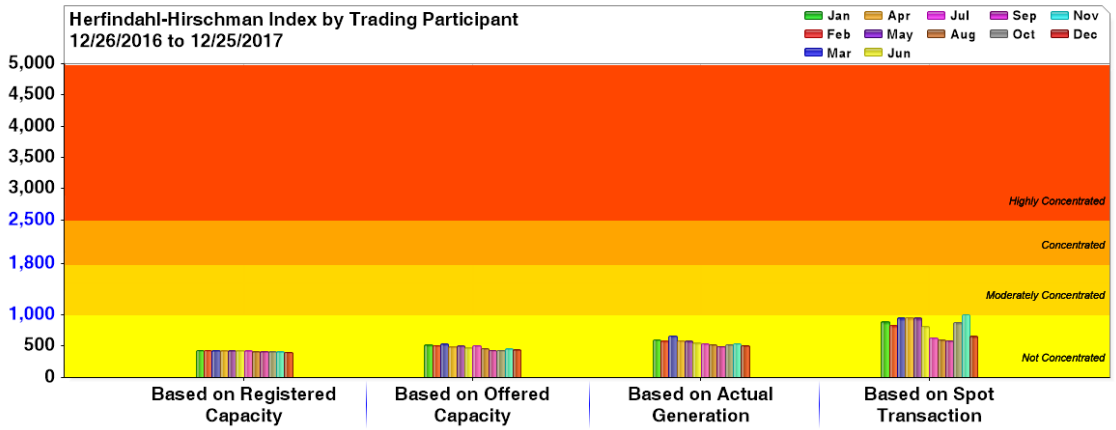


Figure 71. HHI by Plant – System

XIX. COMPLIANCE OF TRADING PARTICIPANTS WITH THE REAL-TIME DISPATCH SCHEDULE

For the period covered, the Market Surveillance Committee (MSC) observed a total of 48,260 resource trading intervals with deviation exceeding the dispatch tolerance limit in Luzon, and 9,155 total trading intervals in Visayas, that are recommended for the issuance of request for investigation. It may be noted that trading intervals with deviations exceeding the dispatch tolerance limit due to generator problem and non-compliance to dispatch instructions are recommended for the issuance of request for investigation.

Effective 17 June 2017, the dispatch tolerance limit was revised based on Section 12.4.1 of the Dispatch Protocol Manual 12.0, which provides that “All scheduled and priority dispatch generating units shall not deviate beyond the dispatch tolerance limit of +1.5% or –3% of the dispatch target or +/–1 MW, whichever is higher.” In this regard, the Trading Participants’ compliance to the RTD schedule for the period 26 May – 16 June 2017 was still based on the dispatch tolerance limit of ±3% of the dispatch target as approved by the PEM Board per Resolution No. 2005-15.

The monthly breakdown of trading intervals with deviations exceeding the dispatch tolerance limit for Luzon is shown in Figure 72. The noticeable decrease in the number of trading intervals with deviation for Luzon starting July was attributable to the new dispatch tolerance limit. It may be noted that deviations of hydro and biomass plants which used to exceed the

previous ±3% dispatch tolerance limit, were found to be within the bounds of the new dispatch tolerance limit, particularly the +/–1 MW dispatch tolerance limit.

As shown in Table 110, the billing month of April recorded the highest number of trading intervals with deviation exceeding the dispatch tolerance limit in Luzon, mainly due to the high number of deviations from hydro plants (31.5 percent), followed by biomass plants (28.5 percent) and geothermal plants (16 percent).

Based on plant type, biomass plants recorded the most number of trading intervals with deviation exceeding the dispatch tolerance limit in Luzon. These are the cases when the biomass plants had deviations that are 10 MW and below but are not included by the System Operator in its Deviation Dispatch Monitoring Report, as these deviations are negligible to the grid. Nonetheless, the MSC included these deviations for the issuance of request for investigation.

Figure 72. Summary of Trading Intervals with Deviation on the RTD Schedule, per Resource – Luzon

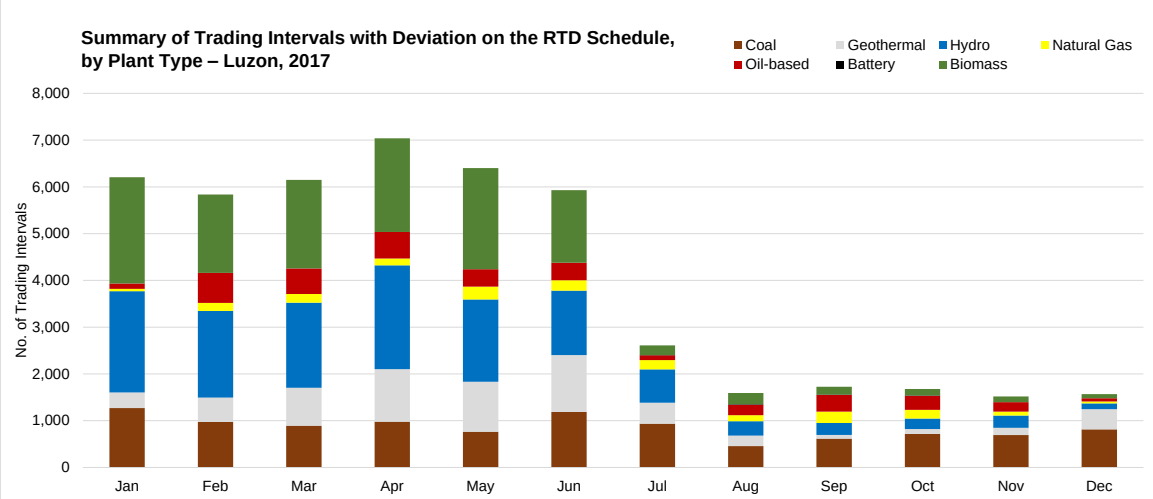


Table 110. Summary of Trading Intervals with Deviation on the RTD Schedule, per Resource – Luzon

	Summary of Trading Intervals with Deviation on the RTD Schedule - Luzon, 2017												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
Coal	1,269	973	893	979	765	1,190	936	456	616	717	692	814	10,300
Geothermal	336	520	811	1,124	1,067	1,213	449	226	80	104	155	432	6,517
Hydro	2,164	1,855	1,819	2,220	1,761	1,379	713	306	255	226	264	124	13,086
Natural Gas	51	172	186	144	274	221	198	129	242	184	83	41	1,925
Oil-based	113	641	547	568	371	375	101	221	355	299	202	68	3,861
Battery	0	0	0	0	0	0	5	13	11	10	0	0	39
Biomass	2,274	1,677	1,893	2,003	2,165	1,553	208	242	167	139	121	90	12,532
Total	**6,207**	**5,838**	**6,149**	**7,038**	**6,403**	**5,931**	**2,610**	**1,593**	**1,726**	**1,679**	**1,517**	**1,569**	**48,260**

The monthly breakdown of trading intervals with deviations exceeding the dispatch tolerance limit for Visayas is shown in Figure 73. As shown in Table 111, the billing month of December recorded the highest number of trading intervals with deviation exceeding the dispatch tolerance limit, attributable to biomass plants (50.5 percent) geothermal plants (41.1 percent), followed by coal plants (7.6 percent) and oil-based plants (0.8 percent).

As above-mentioned, it should be noted that due to power system disturbance brought about by the intensity scale 5 earthquake in the Visayas, the ERC declared market suspension in the region on 06 July (1700H) until 01 August (1600H). As such, as shown in Figure 73

below, a significant decrease in the number of trading intervals with deviation was observed specifically during the billing month of July in the Visayas region.

Figure 73. Summary of Trading Intervals with Deviation on the RTD Schedule, per Resource – Visayas

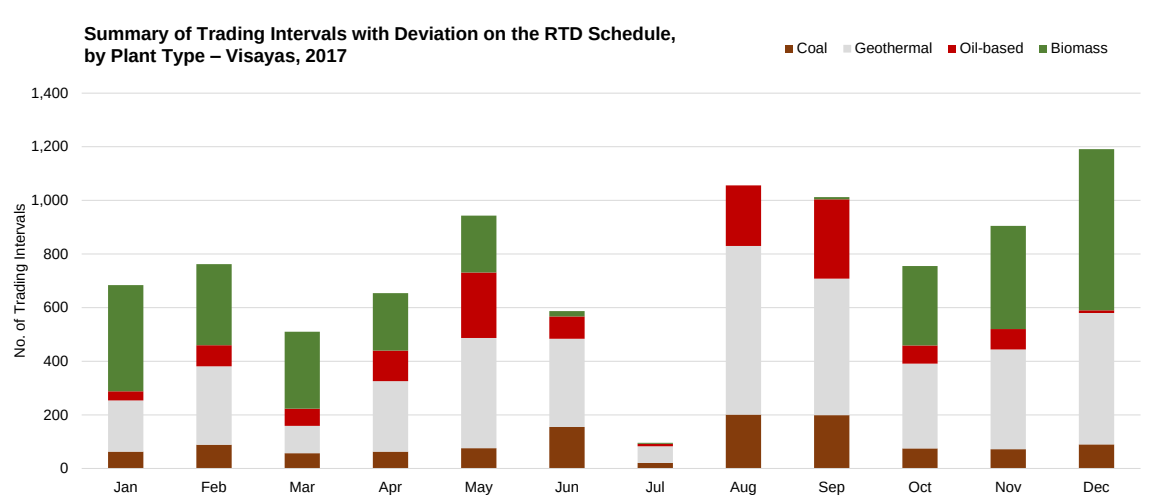


Table 111. Summary of Trading Intervals with Deviation on the RTD Schedule, per Resource – Visayas

	Summary of Trading Intervals with Deviation on the RTD Schedule - Visayas, 2017												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
Coal	63	89	57	63	76	155	21	201	199	75	72	90	1,161
Geothermal	191	292	102	263	411	329	62	629	509	316	372	490	3,966
Oil-based	34	79	64	114	244	83	9	226	296	68	76	10	1,303
Biomass	396	302	287	214	212	20	4	0	8	296	385	601	2,725
Total	**684**	**762**	**510**	**654**	**943**	**587**	**96**	**1,056**	**1,012**	**755**	**905**	**1,191**	**9,155**

APPENDIX 'A'

List of WESM Registered Capacities as of 25 December 2017 – Luzon

Market Participant Name	Region	Market Trading Node	Type	Classification	Max. Stable Load (Pmax, MW)
1590 Energy Corporation	Luzon	1BAUANG_G01	Oil-Based	Scheduled	200.0
Absolut Distillers Inc.	Luzon	3ADISOL_G01	Solar	Must dispatch	1.6
Alternergy Wind One Corporation**	Luzon	3AWOC_G01	Wind	Must dispatch	54.0
Anda Power Corporation	Luzon	1ANDA_G01	Coal	Scheduled	82.0
Angat Hydropower Corporation	Luzon	1ANGAT_A	Hydro	Scheduled	18.0
Angat Hydropower Corporation	Luzon	1ANGAT_M	Hydro	Scheduled	200.0
AP Renewables Inc.	Luzon	3MKBN_A	Geothermal	Scheduled	126.0
AP Renewables Inc.	Luzon	3MKBN_B	Geothermal	Scheduled	126.0
AP Renewables Inc.	Luzon	3MKBN_C	Geothermal	Scheduled	110.0
AP Renewables Inc.	Luzon	3MKBN_D	Geothermal	Scheduled	40.0
AP Renewables Inc.	Luzon	3MKBN_E	Geothermal	Scheduled	40.0
AP Renewables Inc.	Luzon	3ORMAT_G01	Geothermal	Scheduled	12.0
AP Renewables Inc.	Luzon	3TIWI_A	Geothermal	Scheduled	118.0
AP Renewables Inc.	Luzon	3TIWI_B	Geothermal	Scheduled	43.7
AP Renewables Inc.	Luzon	3TIWI_C	Geothermal	Scheduled	114.0
Aseagas Corporation	Luzon	3LIAN_G01	Biomass	Non-scheduled NRE	7.3
Asia Pacific Energy Corporation	Luzon	1APEC_G01	Coal	Scheduled	52.0
Asian Carbon Neutral Power Corp.	Luzon	1ACNPC_G01	Biomass	Non-scheduled	3.2
Bac-Man Geothermal Inc.	Luzon	3BACMAN_G01	Geothermal	Scheduled	120.0
Bac-Man Geothermal Inc.	Luzon	3BACMAN_G02	Geothermal	Scheduled	20.0
Bataan 2020, Inc.	Luzon	1BT2020_G01	Biomass	Priority Dispatch	13.0
Bicol Biomass Energy Corporation	Luzon	3BBEC_G01	Biomass	Priority Dispatch	5.0
Bosung Solartec, Inc.	Luzon	1BOSUNG_G01	Solar	Must dispatch	1.0
Bulacan Solar Energy Corp.	Luzon	1BULSOL_G01	Solar	Must dispatch	15.0
CIP II Power Corporation	Luzon	1CIP2_G01	Oil-Based	Scheduled	21.3
CW Marketing and Development Corporation	Luzon	3HDEPOT_G01	Solar	Must dispatch	1.5
Energy Development Corporation (additional facility)	Luzon	1BURGOS_G02	Solar	Must dispatch	3.7
Energy Development Corporation (additional facility)	Luzon	1BURGOS_G03	Solar	Must dispatch	2.7
EDC Burgos Wind Power Corporation	Luzon	1BURGOS_G01	Wind	Must dispatch	150.0
Enfinity Philippines Renewable Resources	Luzon	1CLASOL_G01	Solar	Must dispatch	19.8
First Gen Hydro Power Corporation	Luzon	1MASIWA_G01	Hydro	Scheduled	12.0
First Gen Hydro Power Corporation	Luzon	1PNTBNG_U01	Hydro	Scheduled	60.0
First Gen Hydro Power Corporation	Luzon	1PNTBNG_U02	Hydro	Scheduled	60.0
First Natgas Power Corporation	Luzon	3SNGAB_G01	Natural Gas	Scheduled	420.0
FGP Corporation (San Lorenzo)	Luzon	3STA-RI_G05	Natural Gas	Scheduled	264.8
FGP Corporation (San Lorenzo)	Luzon	3STA-RI_G06	Natural Gas	Scheduled	261.8
First Cabanatuan Renewable Ventures Inc.	Luzon	1CABSOL_G01	Solar	Must dispatch	9.1
First Gas Power Corporation (Sta Rita)	Luzon	3STA-RI_G01	Natural Gas	Scheduled	257.3
First Gas Power Corporation (Sta Rita)	Luzon	3STA-RI_G02	Natural Gas	Scheduled	255.7
First Gas Power Corporation (Sta Rita)	Luzon	3STA-RI_G03	Natural Gas	Scheduled	265.5
First Gas Power Corporation (Sta Rita)	Luzon	3STA-RI_G04	Natural Gas	Scheduled	264.0
GNPower Mariveles Coal Plant Ltd. Co.	Luzon	1MARVEL_G01	Coal	Scheduled	316.0
GNPower Mariveles Coal Plant Ltd. Co.	Luzon	1MARVEL_G02	Coal	Scheduled	316.0
Green Future Innovations, Inc.	Luzon	1GFII_G01	Biomass	Priority Dispatch	15.8
Green Innovations for Tomorrow Corporation	Luzon	1GIFT_G01	Biomass	Priority Dispatch	12.0
HEDCOR, Inc.	Luzon	1SLANGN_G01	Hydro	Must dispatch	2.4
HEDCOR, Inc.	Luzon	1NMHC_G03	Hydro	Must dispatch	1.2
HEDCOR, Inc.	Luzon	1NMHC_G01	Hydro	Must dispatch	3.8
Hedcor Sabangan, Inc.**	Luzon	1SABANG_G01	Hydro	Must dispatch	14.3
Isabela Biomass Energy Corporation**	Luzon	1IBEC_G01	Biomass	Priority Dispatch	18.3
Jobin-SQM Inc.	Luzon	1SUBSOL_G01	Solar	Must dispatch	29.3
Maibarara Geothermal, Inc.	Luzon	3MGPP_G01	Geothermal	Scheduled	20.0
Maibarara Geothermal, Inc.	Luzon	3MGI_G02	Geothermal	Scheduled	12.0
Majestics Energy Corporation**	Luzon	3MEC_G01	Solar	Must dispatch	32.9
Masinloc Power Partners Co. Ltd.	Luzon	1MSINLO_G01	Coal	Scheduled	315.0
Masinloc Power Partners Co. Ltd.	Luzon	1MSINLO_G02	Coal	Scheduled	315.0
Masinloc Power Partners Co. Ltd.	Luzon	1MSNLO_BATG	Battery	Scheduled	10.0
Mirae Asia Energy Corporation	Luzon	1MAEC_G01	Solar	Must dispatch	16.3
Montalban Methane Power Corp.	Luzon	2MMPP_G01	Biomass	Priority Dispatch	5.1
nv vogt Philippines Solar Energy Three, Inc.	Luzon	1ARMSOL_G01	Solar	Must dispatch	7.1
nv vogt Philippines Solar Energy Four, Inc.	Luzon	1DALSOL_G01	Solar	Must dispatch	5.9
National Irrigation Administration	Luzon	1NIABAL_G01	Hydro	Non-scheduled	6.0
Next Generation Power Technology Corp.	Luzon	1MARSOL_G01	Solar	Must dispatch	16.0
North Luzon Renewable Energy Corporation*	Luzon	1CAPRIS_G01	Wind	Must dispatch	81.0
North Wind Power Development Corporation*	Luzon	1NWIND_G01	Wind	Must dispatch	33.0
North Wind Power Development Corporation*	Luzon	1NWIND_G02	Wind	Must dispatch	18.9
One Subic Power Generation Corporation	Luzon	1S_ENRO_G01	Oil-Based	Scheduled	110.0

List of WESM Registered Capacities as of 25 December 2017 – Luzon (cont'd)

Market Participant Name	Region	Market Trading Node	Type	Classification	Max. Stable Load (Pmax, MW)
Pagbilao Energy Corporation	Luzon	3PAGBIL_G03	Coal	Scheduled	436.0
Panasia Energy, Inc.	Luzon	1LIMAY_A	Oil-Based	Scheduled	270.0
Panasia Energy, Inc.	Luzon	1LIMAY_B	Oil-Based	Scheduled	270.0
Pangea Green Energy Philippines, Inc.	Luzon	2PNGEA_G01	Biomass	Priority Dispatch	1.3
People's Energy Services Inc.	Luzon	3BART_G01	Hydro	Non-scheduled NRE	1.8
Petron Corporation	Luzon	1PETRON_G01	Coal	Scheduled	70.0
PetroSolar Corporation	Luzon	1PETSOL_G01	Solar	Must dispatch	45.5
Prime Meridian PowerGen Corporation	Luzon	3AVION_U01	Natural Gas	Scheduled	50.3
Prime Meridian PowerGen Corporation	Luzon	3AVION_U02	Natural Gas	Scheduled	50.3
PSALM Corporation	Luzon	1CASECN_G01	Hydro	Scheduled	165.0
PSALM Corporation	Luzon	1HEDCOR_G01	Hydro	Scheduled	30.0
PSALM Corporation	Luzon	3BOTOCA_G01	Hydro	Scheduled	20.8
PSALM Corporation	Luzon	3CALIRY_G01	Hydro	Scheduled	28.0
PSALM Corporation	Luzon	3KAL_G01	Hydro	Scheduled	180.0
PSALM Corporation	Luzon	3KAL_G02	Hydro	Scheduled	180.0
PSALM Corporation	Luzon	3KAL_G03	Hydro	Scheduled	180.0
PSALM Corporation	Luzon	3KAL_G04	Hydro	Scheduled	180.0
PSALM Corporation	Luzon	3MALAYA_G01	Oil-Based	Scheduled	300.0
PSALM Corporation	Luzon	3MALAYA_G02	Oil-Based	Scheduled	350.0
Quezon Power (Philippines) Ltd. Co.	Luzon	3QPPL_G01	Coal	Scheduled	459.0
RASLAG Corp.	Luzon	1RASLAG_G01	Solar	Must dispatch	9.0
RASLAG Corp.	Luzon	1RASLAG_G02	Solar	Must dispatch	13.1
Republic Cement & Building Materials, Inc.	Luzon	3RCBMI_G01	Oil-Based	Scheduled	5.5
Republic Cement & Building Materials, Inc.	Luzon	3RCBMI_G02	Oil-Based	Scheduled	5.5
San Jose City I Power Corporation	Luzon	1IPOWER_G01	Biomass	Priority Dispatch	10.8
San Jose City I Power Corporation	Luzon	1IPOWER_G02	Biomass	Non-scheduled	12.0
San Miguel Energy Corporation	Luzon	1SUAL_G01	Coal	Scheduled	647.0
San Miguel Energy Corporation	Luzon	1SUAL_G02	Coal	Scheduled	647.0
SEM-Calaca Power Corporation	Luzon	3CALACA_G01	Coal	Scheduled	300.0
SEM-Calaca Power Corporation	Luzon	3CALACA_G02	Coal	Scheduled	300.0
SMC Consolidated Power Corporation	Luzon	1SMC_G01	Coal	Scheduled	150.0
SMC Consolidated Power Corporation	Luzon	1SMC_G02	Coal	Scheduled	150.0
SMC Consolidated Power Corporation	Luzon	1SMC_G03	Coal	Scheduled	150.0
Smith Bell Mini-Hydro Corporation	Luzon	1SMBELL_G01	Hydro	Must dispatch	1.8
SN Aboitiz Power - Benguet, Inc.	Luzon	1BINGA_U01	Hydro	Scheduled	35.0
SN Aboitiz Power - Benguet, Inc.	Luzon	1BINGA_U02	Hydro	Scheduled	35.0
SN Aboitiz Power - Benguet, Inc.	Luzon	1BINGA_U03	Hydro	Scheduled	35.0
SN Aboitiz Power - Benguet, Inc.	Luzon	1BINGA_U04	Hydro	Scheduled	35.0
SN Aboitiz Power - Benguet, Inc.	Luzon	1AMBUK_U01	Hydro	Scheduled	35.0
SN Aboitiz Power - Benguet, Inc.	Luzon	1AMBUK_U02	Hydro	Scheduled	35.0
SN Aboitiz Power - Benguet, Inc.	Luzon	1AMBUK_U03	Hydro	Scheduled	35.0
SN Aboitiz Power - Magat, Inc.	Luzon	1MAGAT_U01	Hydro	Scheduled	95.0
SN Aboitiz Power - Magat, Inc.	Luzon	1MAGAT_U02	Hydro	Scheduled	95.0
SN Aboitiz Power - Magat, Inc.	Luzon	1MAGAT_U03	Hydro	Scheduled	95.0
SN Aboitiz Power - Magat, Inc.	Luzon	1MAGAT_U04	Hydro	Scheduled	95.0
SN Aboitiz Power - Magat, Inc.	Luzon	1MARIS_U01	Hydro	Non-scheduled NRE	3.8
SN Aboitiz Power - Magat, Inc.	Luzon	1MARIS_U02	Hydro	Non-scheduled NRE	3.8
Solar Philippines Calatagan Corporation	Luzon	3CALSOL_G01	Solar	Must dispatch	49.7
Solar Philippines Commercial Rooftop Projects, Inc.**	Luzon	2SMNRTH_G01	Solar	Must dispatch	1.2
South Luzon Thermal Energy Corporation	Luzon	3SLTEC_G01	Coal	Scheduled	121.0
South Luzon Thermal Energy Corporation**	Luzon	3SLTEC_G02	Coal	Scheduled	122.9
South Premiere Power Corporation	Luzon	3ILIJAN_G01	Natural Gas	Scheduled	600.0
South Premiere Power Corporation	Luzon	3ILIJAN_G02	Natural Gas	Scheduled	600.0
Southwest Luzon Power Generation Corporation**	Luzon	3SLPGC_G01	Coal	Scheduled	150.0
Southwest Luzon Power Generation Corporation**	Luzon	3SLPGC_G02	Coal	Scheduled	150.0
Southwest Luzon Power Generation Corporation**	Luzon	3SLPGC_G03	Oil-Based	Scheduled	23.0
Southwest Luzon Power Generation Corporation**	Luzon	3SLPGC_G04	Oil-Based	Scheduled	23.0
SPARC-Solar Powered Agri-Rural Communities Corporation	Luzon	1ZAMSOL_G01	Solar	Must dispatch	5.0
SPARC-Solar Powered Agri-Rural Communities Corporation	Luzon	1BTNSOL_G01	Solar	Must dispatch	5.0
SPARC-Solar Powered Agri-Rural Communities Corporation	Luzon	1SPABUL_G01	Solar	Must dispatch	1.2
Strategic Power Development Corporation	Luzon	1SROQUE_U01	Hydro	Scheduled	145.0
Strategic Power Development Corporation	Luzon	1SROQUE_U02	Hydro	Scheduled	145.0
Strategic Power Development Corporation	Luzon	1SROQUE_U03	Hydro	Scheduled	145.0
Therma Luzon, Inc.	Luzon	3PAGBIL_G01	Coal	Scheduled	382.0
Therma Luzon, Inc.	Luzon	3PAGBIL_G02	Coal	Scheduled	382.0
Therma Mobile, Inc.	Luzon	2TMO_G01	Oil-Based	Scheduled	66.0
Therma Mobile, Inc.	Luzon	2TMO_G02	Oil-Based	Scheduled	67.2
Therma Mobile, Inc.	Luzon	2TMO_G03	Oil-Based	Scheduled	57.0
Therma Mobile, Inc.	Luzon	2TMO_G04	Oil-Based	Scheduled	52.0
Trans-Asia Power Generation Corporation	Luzon	1T_ASIA_G01	Oil-Based	Scheduled	50.0
United Pulp and Paper Company, Inc.	Luzon	1UPPC_G01	Coal	Scheduled	5.0
Valenzuela Solar Energy, Inc.	Luzon	2VALSOL_G01	Solar	Must dispatch	6.7
Vivant Sta. Clara Northern Renewables Generation Corporatio	Luzon	1BAKUN_G01	Hydro	Scheduled	76.0
YH Green Energy, Incorporated	Luzon	1YHGRN_G01	Solar	Must dispatch	12.6
Total Registered Capacity (Pmax) - Luzon					**15,330.1**
TOTAL REGISTERED CAPACITY (Pmax) - SYSTEM					**18,764.0**

**Capacities are used for modelling purposes only. These are subject to change upon submission of the ERC Certification of plant specifications based on ERC's ocular technical inspection.

APPENDIX 'B'

List of WESM Registered Capacities as of 25 December 2017 – Visayas

Market Participant Name	Region	Market Trading Node	Type	Classification	Max. Stable Load (Pmax, MW)
Amlan Hydroelectric Power Corporation	Visayas	6AMLA_G01	Hydro	Non-scheduled NRE	0.9
Bohol I Electric Cooperative, Inc.	Visayas	7JANOPO_G01	Hydro	Non-scheduled NRE	5.0
Cebu Energy Development Corporation	Visayas	5CEDC_U01	Coal	Scheduled	82.0
Cebu Energy Development Corporation	Visayas	5CEDC_U02	Coal	Scheduled	82.0
Cebu Energy Development Corporation	Visayas	5CEDC_U03	Coal	Scheduled	82.0
Cebu Private Power Corporation	Visayas	5CPPC_G01	Oil-Based	Scheduled	70.0
Central Azucarera de San Antonio	Visayas	8CASA_G01	Biomass	Non-scheduled	4.0
Central Negros Power Reliability, Inc.	Visayas	6CENPRI_U02	Oil-Based	Scheduled	4.2
Central Negros Power Reliability, Inc.	Visayas	6CENPRI_U01	Oil-Based	Scheduled	4.2
Central Negros Power Reliability, Inc.	Visayas	6CENPRI_U03	Oil-Based	Scheduled	4.2
Central Negros Power Reliability, Inc.	Visayas	6CENPRI_U04	Oil-Based	Scheduled	6.4
Cosmo Solar Energy, Inc.	Visayas	8COSMO_G01	Solar	Must dispatch	5.7
East Asia Utilities Corporation	Visayas	5EAUC_G01	Oil-Based	Scheduled	49.6
Energy Development Corporation	Visayas	6NASULO_G01	Geothermal	Scheduled	48.3
First Farmers Holdings Corporation	Visayas	6FFHC_G01	Biomass	Priority Dispatch	13.0
First Toledo Solar Energy Corporation	Visayas	5TOLSOL_G01	Solar	Must dispatch	49.0
Green Core Geothermal Inc.	Visayas	6PAL1A_G01	Geothermal	Scheduled	112.5
Green Core Geothermal Inc.	Visayas	6PAL2A_U01	Geothermal	Scheduled	20.0
Green Core Geothermal Inc.	Visayas	6PAL2A_U02	Geothermal	Scheduled	20.0
Green Core Geothermal Inc.	Visayas	6PAL2A_U03	Geothermal	Scheduled	20.0
Green Core Geothermal Inc.	Visayas	6PAL2A_U04	Geothermal	Scheduled	20.0
Green Core Geothermal Inc.	Visayas	4LGPP_G01	Geothermal	Scheduled	107.0
Hawaiian-Philippine Company**	Visayas	6HPCO_G01	Biomass	Non-scheduled NRE	3.0
Hawaiian-Philippine Company**	Visayas	6HPCO_G02	Biomass	Non-scheduled NRE	18.6
Helios Solar Energy Corporation	Visayas	6HELIOS_G01	Solar	Must dispatch	108.1
KEPCO Salcon Power Corporation	Visayas	5KSPC_G01	Coal	Scheduled	103.0
KEPCO Salcon Power Corporation	Visayas	5KSPC_G02	Coal	Scheduled	103.0
Monte Solar Energy Inc.	Visayas	6MNTSOL_G01	Solar	Must dispatch	14.4
Negros Island Solar Power Inc.	Visayas	6CARSOL_G01	Solar	Must dispatch	27.2
Negros Island Solar Power Inc.	Visayas	6MANSOL_G01	Solar	Must dispatch	40.5
Palm Concepcion Power Corporation	Visayas	8PALM_G01	Coal	Scheduled	135.0
Panay Energy Development Corporation	Visayas	8PEDC_U01	Coal	Scheduled	83.7
Panay Energy Development Corporation	Visayas	8PEDC_U02	Coal	Scheduled	83.7
Panay Energy Development Corporation	Visayas	8PEDC_U03	Coal	Scheduled	150.0
Panay Power Corporation	Visayas	8GLOBAL_G01	Oil-Based	Scheduled	6.8
Panay Power Corporation**	Visayas	8PPC_G01	Oil-Based	Scheduled	72.0
Panay Power Corporation**	Visayas	8AVON_G01	Oil-Based	Scheduled	20.0
PetroWind Energy Inc.**	Visayas	8PWIND_G01	Wind	Must dispatch	36.0
First Soleq Energy Corp.	Visayas	4PHSOL_G01	Solar	Must dispatch	24.5
PSALM Corporation	Visayas	4LEYTE_A	Geothermal	Scheduled	538.0
San Carlos Bioenergy, Inc.	Visayas	6SCBE_G01	Biomass	Non-scheduled	8.3
San Carlos Solar Energy, Inc.	Visayas	6SACASL_G01	Solar	Must dispatch	19.8
San Carlos Solar Energy, Inc.	Visayas	6SACASL_G02	Solar	Must dispatch	19.8
San Carlos Sun Power, Inc.	Visayas	6SACSUN_G01	Solar	Must dispatch	46.8
Silay Solar Power, Inc.	Visayas	6SLYSOL_G01	Solar	Must dispatch	20.0
SPC Island Power Corporation	Visayas	7BDPP_G01	Oil-Based	Scheduled	16.2
SPC Island Power Corporation	Visayas	8PDPP_G01	Oil-Based	Scheduled	15.0
SPC Island Power Corporation	Visayas	8PDPP3_G01	Oil-Based	Scheduled	62.0
SPC Power Corporation	Visayas	5CDPPI_G01	Oil-Based	Scheduled	18.0
SPC Power Corporation	Visayas	5CDPPI_G02	Oil-Based	Scheduled	18.0
SPC Power Corporation	Visayas	7TAPAL_PB4	Oil-Based	Scheduled	26.0
Sta Clara Power Corporation	Visayas	7LOBOC_G01	Hydro	Non-scheduled NRE	1.2
Sulu Electric Power and Light (Phils.), Inc.	Visayas	4SEPSOL_G01	Solar	Must dispatch	45.0
Sunwest Water and Electric Company 2, Inc.	Visayas	8SUWECO_G01	Hydro	Non-scheduled	8.0
Therma Visayas, Inc.	Visayas	5THVI_U01	Coal	Scheduled	176.2
Therma Visayas, Inc.	Visayas	5THVI_U02	Coal	Scheduled	176.2
Toledo Power Company	Visayas	5TPC_G01	Oil-Based	Scheduled	40.0
Toledo Power Company	Visayas	5TPC_G02	Coal	Scheduled	145.0
PHINMA Energy Corporation	Visayas	8GUIM_G01	Oil-Based	Non-scheduled	3.0
PHINMA Energy Corporation	Visayas	8STBAR_PB	Oil-Based	Scheduled	20.0
PHINMA Energy Corporation	Visayas	8STBAR_PB2	Oil-Based	Scheduled	20.0
PHINMA Energy Corporation	Visayas	5PHNPB3_G01	Oil-Based	Scheduled	24.0
Trans-Asia Renewable Energy Corporation**	Visayas	8SLWIND_G01	Wind	Must dispatch	54.0
Universal Robina Corporation**	Visayas	6URC_G01	Biomass	Priority Dispatch	40.0
Victorias Milling Company,Inc.	Visayas	6VMC_G01	Biomass	Non-scheduled NRE	34.0
Total Registered Capacity (Pmax) - Visayas					**3,434.0**
TOTAL REGISTERED CAPACITY (Pmax) - SYSTEM					**18,764.0**

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