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MONTHLY MARKET ASSESSMENT REPORT

For the Billing Period 26 December 2011 to 25 January 2012

PHILIPPINE ELECTRICITY MARKET CORPORATION

MARKET ASSESSMENT GROUP (MAG)

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Monthly Market Assessment Report

This report assesses the results of the integrated Luzon and Visayas market operation for the period 26 December to 25 January 2012 and how the market performed compared with the previous billing period[1].

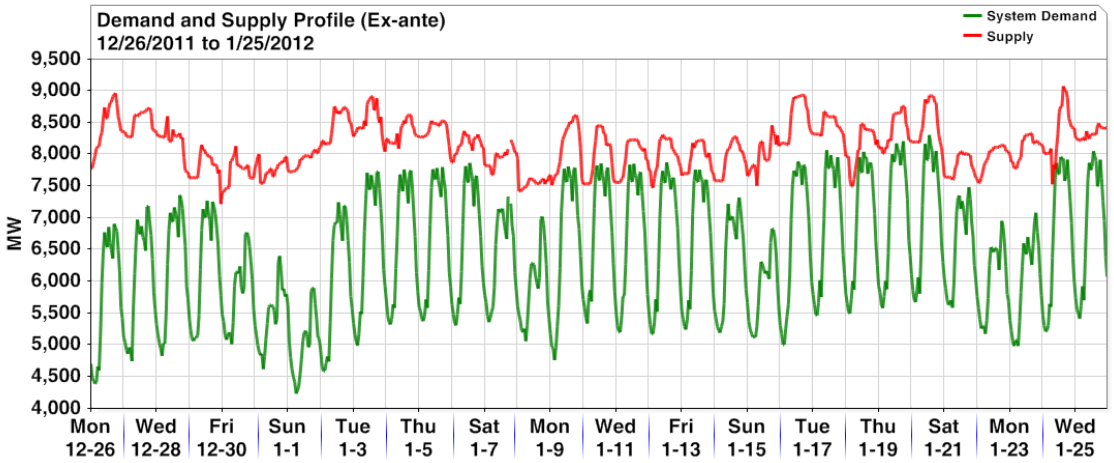
Supply and Demand Situation

The monthly average system demand[2] (ex-ante) significantly decreased by 4.3 percent (6,699 to 6,411 MW) with the hourly demand ranging from a minimum of 4,236 MW to a maximum of 8,307 MW *(Table 1)*. This was brought about by the prolonged night time at the end of the Christmas season that contributed to the cold weather along with a number of holidays during the billing period in review. Consequently, the monthly peak demand declined by 2.9 percent from 8,554 MW on December 13, 2011 at trading interval 1800H (Tuesday) to 8,307 MW on January 20, 2012 (Friday) trading interval 1400H. Examining the demand of each region, the average regional demand in Luzon and Visayas decreased by 4 percent (5,617 MW to 5,392 MW) and 5.8 percent (1,081 MW to 1,019 MW), respectively *(Table 2)*.

Similarly, the monthly average system supply[3] showed a decrease from the previous billing period by 3 percent (8,398 MW to 8,142 MW) *(Table 1).* The system supply during the period ranged from 7,223 MW to 9,076 MW. Plant outages affected the supply as average regional supply in Luzon declined by 3.7 percent (6,873 MW to 6,616 MW) while the average supply in Visayas had a minimal 0.1 percent increase or an average of 1 MW *(Table 3).*

In general, there was an adequate supply margin during the one-month period, averaging 1,732 MW with minimum of 116 MW and maximum of 3,689 MW. This was higher by 1.9 percent from the previous billing period's average margin of 1,699 MW *(Table 1)*.

Figure 1. Demand and Supply (Ex-ante), January 2012



[1] Billing Period may also pertains to *billing month* which covers from the 26th day of the previous month to 25th day of the current month.
[2] The system demand is equal to the total scheduled MW of all load resources in Luzon and Visayas plus losses.
[3] The supply is equal to the total offered capacity of all generator resources in Luzon and Visayas adjusted for any security limit provided by the System Operator. Other constraints considered during MMS simulation such as generator offered ramp rates may result to lower supply.

Table 1. Demand and Supply Summary (Ex-ante), Dec 2011 and Jan 2012

	December 2011 (In MW)			January 2012 (In MW)			% M-on-M Change (Dec 2011 - Jan 2012)		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Demand	8,554	4,426	6,699	8,307	4,236	6,411	(2.9)	(4.3)	(4.3)
Supply	9,282	7,456	8,398	9,076	7,223	8,142	(2.2)	(3.1)	(3.0)
Supply/Demand Variance	3,763	8	1,699	3,689	116	1,732	(2.0)	1,314.2	1.9

Note: The derived values were non-coincident.

Table 2. Regional Demand Summary (Ex-ante), Dec 2011 and Jan 2012

	December 2011 (In MW)			January 2012 (In MW)			% M-on-M Change (Dec 2011 - Jan 2012)		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Luzon	7,114	3,627	5,617	7,007	3,503	5,392	(1.5)	(3.4)	(4.0)
Visayas	1,452	710	1,081	1,360	733	1,019	(6.4)	3.1	(5.8)

Note: The derived values were non-coincident.

Table 3. Regional Supply Summary (Ex-ante), Dec 2011 and Jan 2012

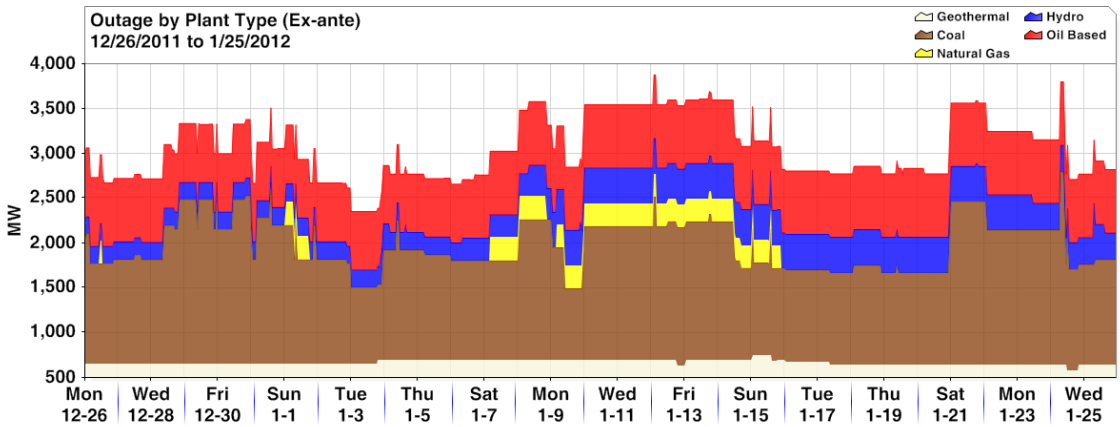
	December 2011 (In MW)			January 2012 (In MW)			% M-on-M Change (Dec 2011 - Jan 2012)		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Luzon	7,773	5,954	6,873	7,436	5,747	6,616	(4.3)	(3.5)	(3.7)
Visayas	1,689	1,343	1,525	1,669	1,356	1,526	(1.2)	1.0	0.1

Note: The derived values were non-coincident.

Plant Outages

Figure 2 shows the system capacity on outage by plant type. The maximum capacity on outage (3,509 MW) occurred on January 24, 2012 at trading intervals 0800H to 1000H. On the other hand, the minimum capacity on outage was registered at 1,997 MW on January 3, 2012 trading intervals 2000H to 2100H. The average capacity on outage was 2,710 MW.

Figure 2. Plant Capacity on Outage, January 2012



Figures 3 and 4 below show the outage capacity by plant type at ex-ante compared with the outage schedule based on NGCP-SO's CY2012 Grid Operating and Maintenance Program (GOMP).

In Luzon, the monthly average capacity on outage in January was higher by 3 percent than the previous billing period *(Table 4)*. The capacity on outage (during ex-ante) posted an average of 2,546 MW, ranging from 1,794 MW to 3,394 MW.

Also in Luzon, the January 2012 billing period showed a higher level of capacity on outage vis-a-vis the GOMP due to the instances of many outages not related to planned outages (due to forced outages). GOMP indicated an average capacity on planned outage at 1,021 MW in Luzon (*Table 5*). It was observed that several power plants that were declared to be on planned outage by NGCP-SO such as Pagbilao 1, Masinloc 1, Magat 1, Angat M 2, Binga 4, and Bacman 4 were not originally included in the GOMP. Meanwhile, the planned outages of Bakun HEP, Binga 3, QPPL, San Lorenzo 1, Sta. Rita 2, and Masinloc 2 were consistent with the GOMP schedule.

Coal plants registered the highest outage capacity with an average of 1,232 MW while natural gas plants had the lowest average outage capacity with 77 MW.

Figure 3. Plant Outage Capacity, January 2012 – Luzon

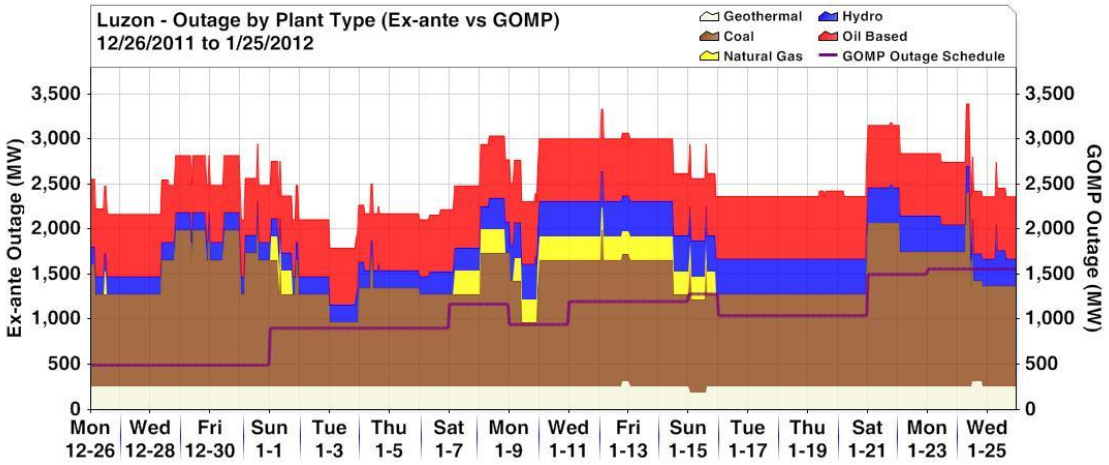


Table 4. Luzon Regional Outage Summary (Ex-ante), Dec 2011 and Jan 2012

Resource Type	December 2011 (In MW)			January 2012 (In MW)			% M-on-M Change (Dec 2011 - Jan 2012)		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Coal	1,818	712	969	2,148	712	1,232	18.2	0.0	27.1
Natural Gas	516	0	216	265	0	77	(48.7)		(64.4)
Geothermal	371	253	270	316	194	253	(14.8)	(23.3)	(6.3)
Hydro	498	197	300	681	197	307	36.8	0.0	2.4
Oil Based	752	692	716	752	632	677	0.0	(8.7)	(5.4)
TOTAL	3,547	1,880	2,471	3,394	1,794	2,546	(4.3)	(4.6)	3.0

Note: The derived values by resource type were non-coincident. The total values were derived based on aggregate hourly outage.

Table 5. Luzon Regional Outage Summary (GOMP), Dec 2011 and Jan 2012

Resource Type	December 2011			January 2012			% M-on-M Change		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Coal	1,292	645	1,028	789	330	556	(38.9)	(48.8)	(45.9)
Natural Gas	263	0	104	266	0	58	0.9		(43.9)
Geothermal	119	64	77	104	64	79	(12.6)	0.0	3.5
Hydro	349	159	199	330	102	224	(5.6)	(35.8)	12.6
Oil Based	60	0	10	360	0	103	500.0		925.8
TOTAL	1,790	1,131	1,418	1,562	496	1,021	(12.7)	(56.2)	(28.0)

Table 6 lists the January 2012 outages of coal and oil based plants in Luzon with outage duration of 3 or more consecutive days. All coal plants, except Sual, experienced parallel or successive shutdowns/outages (either forced outages or planned/unplanned[4]), making the coal plants major contributors to the total outage capacity. Calaca 1, Calaca 2, and QPPL remained on outage at the end of the billing period (a total capacity of 1,119 MW).

For the oil based plants, Limay 4 and Malaya 1 have been on outage since last year while Limay 2 has been on outage since the start of the year. Meanwhile, Limay 1 and 7 were not available at certain trading days due to the turbine/generator-related problems. A total of 450 MW of oil-based capacity remained on outage at the end of the billing period.

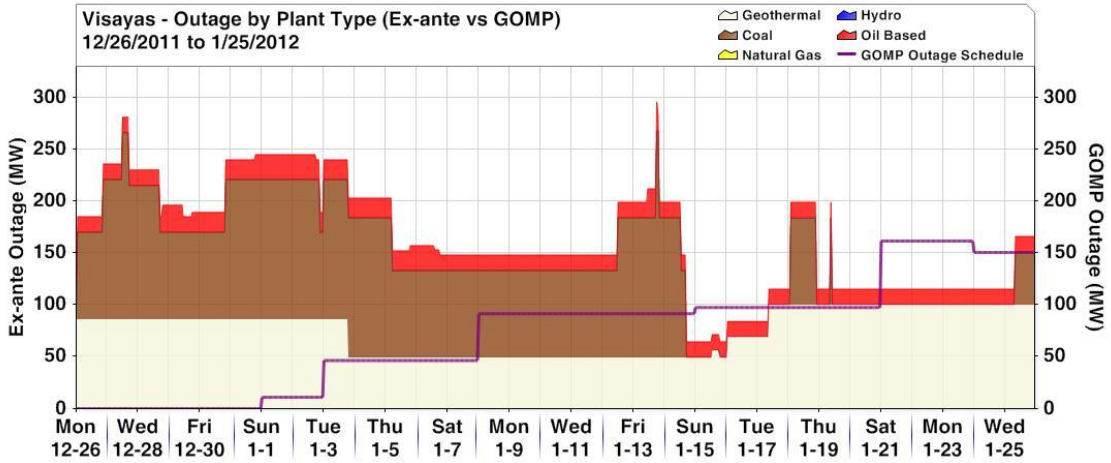
Table 6. Major Plant Outages, January 2012 - Luzon

Plant/Unit Name	Capacity (MW)	Date Out	Date In	Duration (Days)	Remarks
Coal Plants					
Masinloc 1	315	12/17/2011 0:30	1/3/2012 0:30	17.00	Maintenance
Masinloc 1	315	1/5/2012 23:54	1/9/2012 1:34	3.07	Boiler tube leak
Masinloc 2	315	1/9/2012 23:48	1/22/2012 2:26	12.11	Maintenance
Calaca 2	330	10/29/2011 9:50	12/29/2011 20:47	61.46	Emergency shutdown due to motor boiler feedpump trouble
Pagbilao 1	382	10/1/2011 0:51	12/30/2011 23:34	90.95	Maintenance outage
Pagbilao 1	382	1/3/2012 22:13	1/14/2012 11:01	10.53	Adjustment of turbine bearing 3 and 4.
Pagbilao 2	382	12/28/2011 8:21	1/5/2012 23:29	8.63	Condenser tube leak
Pagbilao 2	382	1/9/2012 22:09	1/24/2012 12:01	14.58	Emergency tripped due to condenser tube leak.
Calaca 1	330	8/29/2011 22:15			Emergency shutdown due to suspected reheater leak.
Calaca 2	330	1/21/2012 0:40			Boiler tube leak along 101R sootblower side.
QPPL	459	1/20/2012 23:34			Maintenance
Total	**1,119**				
Oil based Plants					
Limay 1	60	10/13/2011 18:01	12/28/2011 14:40	75.86	Static Frequency Converter trouble
Limay 7	60	12/13/2011 10:43	12/26/2011 13:30	13.12	Boiler hot gas leak
Limay 2	60	1/6/2012 16:01			Non-availability of programmable processor
Limay 4	90	4/15/2011 6:43			Generating bearing trouble
Malaya 1	300	8/15/2011 13:19			High furnace pressure
Total	**450**				

Note: Total Capacity on outage is the sum of outage capacity at the end of the billing period.

[4] Definition of the new outage criteria were based on NGCP-SO letter to Technical Committee last August 23, 2011 (TSD-2011-08-054)

Figure 4. Plant Capacity on Outage, January 2012 - Visayas



Similar to Luzon, power plant outages in Visayas was largely attributed to coal plants followed by geothermal plants. The average capacity on outage of Visayas during the billing period declined significantly by 28.7 percent from the previous billing period as seen in Table 7.

Table 7. Visayas Regional Outage Summary (Ex-ante), Dec 2011 and Jan 2012

Resource Type	December 2011 (In MW)			January 2012 (In MW)			% M-on-M Change (Dec 2011 - Jan 2012)		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Coal	333	0	113	218	0	72	(34.5)		(36.6)
Geothermal	122	86	87	100	50	75	(17.5)	(42.8)	(13.3)
Hydro	0	0	0	0	0	0			
Oil Based	56	10	30	28	15	17	(50.0)	50.0	(43.8)
TOTAL	433	112	230	296	65	164	(31.7)	(42.7)	(28.7)

Note: The derived values by resource type were non-coincident. The total values were derived based on aggregate hourly outage.

Table 8. Visayas Regional Outage Summary (GOMP), Dec 2011 and Jan 2012

Resource Type	December 2011			January 2012			% M-on-M Change		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Coal	51	0	27	109	0	36	114.6		34.5
Geothermal	0	0	0	36	0	26			
Hydro	0	0	0	0	0	0			
Oil Based	10	5	7	17	0	10	70.0	(100.0)	50.6
TOTAL	61	5	34	162	0	73	165.8	(100.0)	115.6

Table 9 shows the major plant outages in Visayas during the billing period. Coal plants on outage since the start of the billing period went back on line on January 14 when Cebu TPP2 and PEDC 1 were synchronized back to the grid. It was the prevalent outage of Northern Negros (NNGPP) that resulted in almost 50 MW capacities on outage during the billing period.

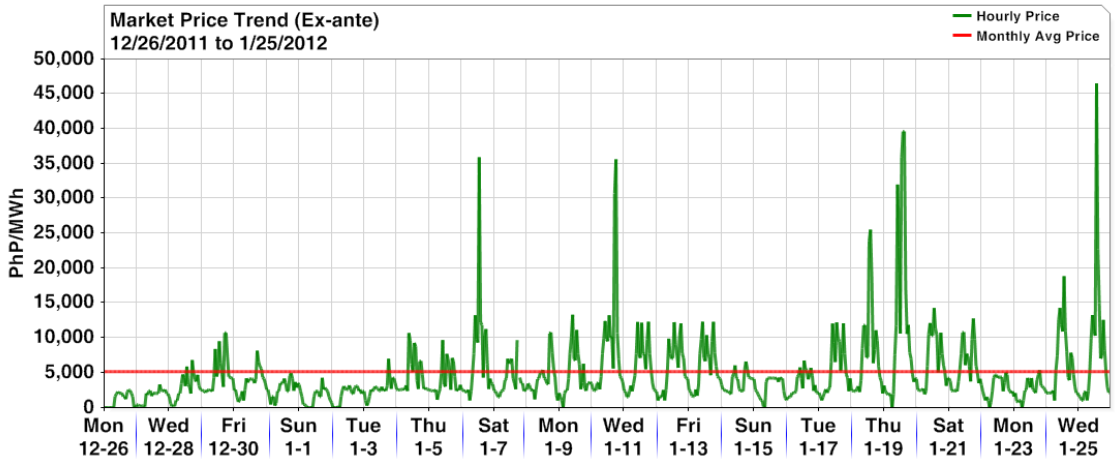
Table 9. Major Plant Outages, January 2012 - Visayas

Plant/Unit Name	Capacity (MW)	Date Out	Date In	Duration (Days)	Remarks
Coal plants					
Cebu TPP2	50.8	12/30/2011 19:08	1/2/2012 20:48	3.07	Economizer tube leak
Cebu TPP2	50.8	1/2/2012 23:03	1/5/2012 4:32	2.23	Boiler tube leak
Cebu TPP2	50.8	1/12/2012 11:10	1/14/2012 12:47	2.07	Boiler tube leak
PEDC 1	82	12/26/2011 0:14	1/14/2012 16:11	19.66	APMS
Cebu TPP2	50.8	1/25/2012 5:47			Calibration of plant equipment preparatory for unit performance test.
Total	**50.8**				
Geothermal Plants					
PGPP1 Unit 1	36.98	9/19/2011 0:01	1/3/2012 18:16	106.76	To conduct major rehab of the unit.
PGPP2 Unit 1	19.74	1/16/2012 0:59	1/26/2012 0:55	10.00	Planned PMS
NNGPP	49.5	7/1/2011 0:11			To conduct plant rectification
Leyte 1	31	1/17/2012 8:05			Due to high vibration
Total	**80.5**				
Oil Based Plants					
Bohol 1	4	12/29/2011 17:17	1/6/2012 13:04	7.82	Tripped due to radiator oil circuit pressure too low.
PB101 Unit 1	5	12/3/2010 18:01			Repair and rewinding of auxiliary transformer.
PB101 Unit 2	5	12/21/2011 14:27			Oil mist detector activated
PB101 Unit 4	5	12/3/2010 18:01			Repair and rewinding of auxiliary transformer.
Total	**15**				

Market Price Outcome

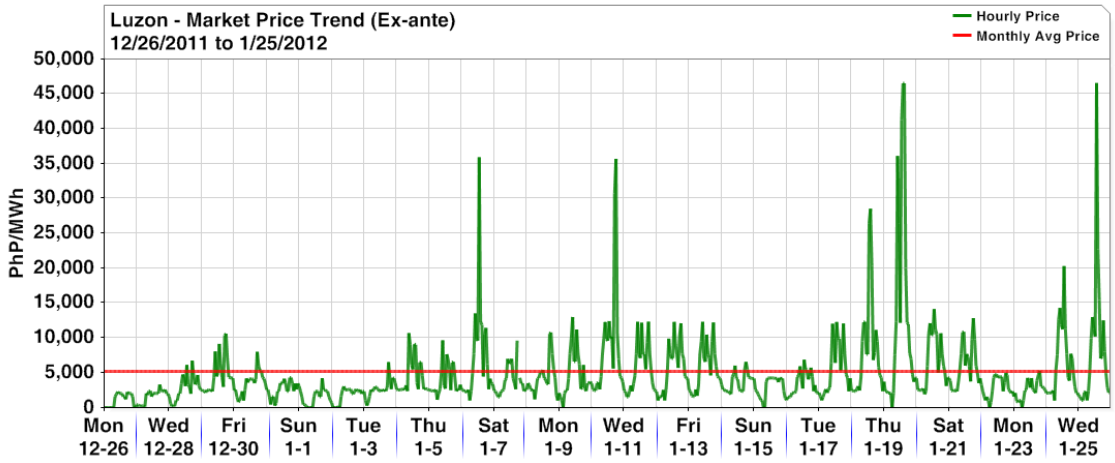
Although there was a decrease in system demand, the monthly average market price[5] in January 2012 escalated by 1.8 percent (PhP91/MWh more). The maximum price was posted at PhP46,547/MWh on January 25, 2012 trading hour 1400H while minimum price was registered at PhP0/MWh on several occasions especially in the first part of the billing period. Highly notable is the 28.1 percent decline in the maximum price from previous billing period with PhP64,696/MWh to current billing period with PhP46,547/MWh.

Figure 5. Market Price Trend, January 2012



[5] 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.

Figure 6. Market Price Trend - Luzon, January 2012



Worthy of note is the monthly comparison of regional prices. Luzon increased by 3.8 percent from PhP5,026/MWh to PhP5,218/MWh while Visayas decreased significantly by 8.2 percent from PhP5,322 to PhP4,884/MWh *(Table 10)*. This situation indicated that there were instances of price disparities between Luzon and Visayas with Luzon having higher prices than Visayas *(Figures 6 and 7)*. Comparing figures 6 and 7 for January18-19, 2012, price spikes were observed in Luzon that may have influenced the month-on-month comparison and regional comparison.

Figure 7. Market Price Trend - Visayas, January 2012

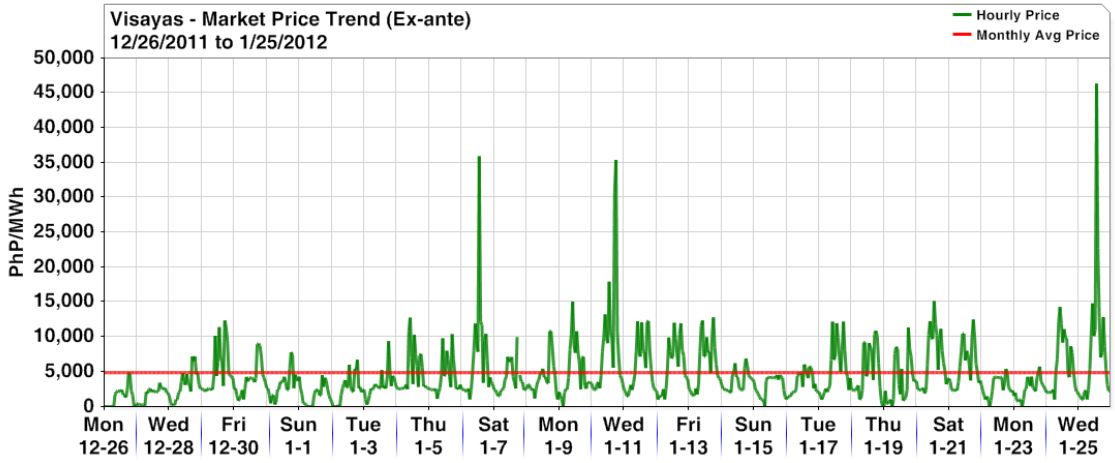


Table 10. Market Price Summary, December 2011 and January 2012

	December 2011 (In PhP/MWh)			January 2012 (In PhP/MWh)			% M-on-M Change (Dec 2011 - Jan 2012)		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Luz-Viz	64,696	0	5,074	46,547	0	5,165	(28.1)		1.8
Luzon	64,732	0	5,026	46,584	0	5,218	(28.0)		3.8
Visayas	64,716	0	5,322	46,357	0	4,884	(28.4)		(8.2)

Except for the price range of PhP2,000/MWh to PhP4,000/MWh that showed identical distribution for the two billing periods (at 40 percent) as shown in figure 8, all price distributions varied in the two billing periods. The current billing period had more

occurrences of price level above PhP20,000/MWh than the previous period *(Table 11)*. This pulled up the average monthly price in January 2012 as indicated in table 11. Higher average price in January 2012 were brought about by the supply condition affected by the plant outages along with the ramp rate limitations from few generators.

Figure 8. Market Price Distribution, December 2011 and January 2012

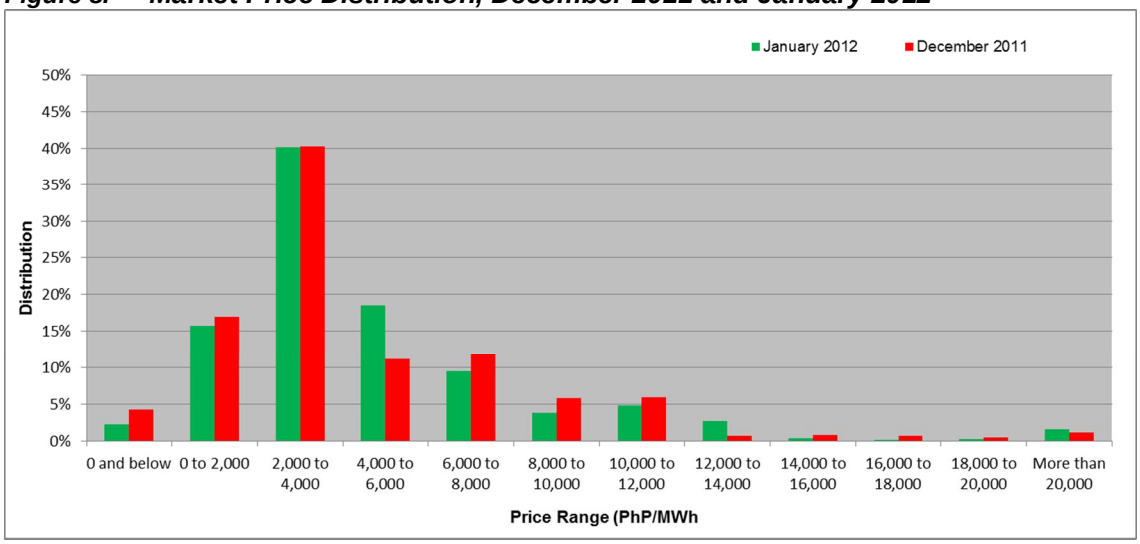


Table 11. Market Price Distribution, December 2011 and January 2012

Price Range (PhP/MWh)	% Distribution	
	December 2011	January 2012
0 and below	4.3	2.3
0 to 2,000	16.9	15.7
2,000 to 4,000	40.3	40.2
4,000 to 6,000	11.1	18.5
6,000 to 8,000	11.8	9.5
8,000 to 10,000	5.8	3.8
10,000 to 12,000	6.0	4.8
12,000 to 14,000	0.7	2.7
14,000 to 16,000	0.8	0.4
16,000 to 18,000	0.7	0.1
18,000 to 20,000	0.4	0.3
More than 20,000	1.1	1.6

Comparing regional prices for both billing periods, there was no significant change in maximum price in Luzon and Visayas. However, in the current billing period, Luzon had a higher average market price than Visayas whereas in the previous period, it was Visayas that had a higher average price.

Table 12. Regional Price Summary, December 2011 and January 2012

	Luzon (In PhP/MWh)			Visayas (In PhP/MWh)			% Difference		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
January 2012	46,584	0	5,218	46,357	0	4,884	(0.5)		(6.4)
December 2011	64,732	0	5,026	64,716	0	5,322	(0.0)		5.9

High Price Analysis

High prices were noted to have occurred in certain occasions during the billing period when the margin between supply and demand is relatively low or during extreme occasions when demand was greater than the supply (CVC – Undergeneration). The planned and forced outages of major coal plants, as discussed in previous section, contributed to the tightness of supply and demand condition.

In particular price spikes above PhP20,000/MWh occurred on January 6, 10, 18, 19, and 25. These trading intervals are shown in table 13 with corresponding Reserve Margin Index[6] (RMI).

Table 13. Hourly Price and Reserve Margin Index

Date	Trading Interval	Hourly Price	RMI RTD (%)	RMI RTX (%)
1/6/2012	14	35,924	3.82	3.36
1/10/2012	18	30,713	5.00	5.70
1/10/2012	19	35,642	4.68	4.45
1/18/2012	14	23,871	3.88	2.44
1/18/2012	15	25,543	5.17	3.24
1/19/2012	11	32,012	5.84	4.06
1/19/2012	12	22,980	9.38	8.05
1/19/2012	14	35,877	5.61	3.51
1/19/2012	15	39,612	6.95	5.03
1/19/2012	16	39,635	7.55	5.74
1/25/2012	14	46,547	1.77	1.10
1/25/2012	15	22,667	2.66	2.66

Note: Red font indicates ex-post prices for trading intervals with pricing error during ex-ante but without pricing error during ex-post

January 6, 1400H

System-wide congestion pricing error occurred during ex-ante brought about by the constraint along New Naga – Quiot 138kV line. The price substitution methodology (PSM) was accordingly applied during ex-ante with constrained-on-generator price of PhP45,000/MWh, unconstrained generator price of PhP35,000/MWh and estimated load reference price of PhP35,924/MWh. Moreover, demand and supply was tight with 3.82 percent RMI in ex-ante and 3.36 percent in ex-post.

January 10, 1800H and 1900H

System-wide pricing errors occurred at trading intervals 1800H (ex-ante) and 1900H (ex-ante and ex-post) due to undergeneration. Although there were positive RMIs during the ex-ante and ex-post as shown in Table 13, the market signaled undergeneration in the said trading intervals due to ramp limitations in the offers of Limay B and San Roque HEP. The resulting market prices in these trading intervals were PhP30,713/MWh and PhP35,642/MWh, respectively.

[6] Reserve Margin Index (RMI) calculates the percent difference of the offered capacity and the demand, including the reserve operating reserve requirement. However, the co-optimization of energy and reserve is not yet implemented.

January 18, 1400H and 1500H

Price disparities between Luzon and Visayas occurred in relevant trading intervals during the day due to the constraint at the Leyte-Luzon HVDC resulting from the maximization of the HVDC's transfer capability from Visayas to Luzon. It was noted the NGCP-SO limited the transfer capability of the HVDC from Visayas to Luzon at 150 MW *due to electrodes problem at Naga Converter Station* in trading intervals 0700H-2200H and eventually set the flow at 0 MW in trading intervals 2300H-2400H.

The price disparities were more significant in trading intervals 1400H-1500H. During the trading intervals, Luzon had non-congestion pricing errors due to the contingency constraint violations at the Meralco load-end transformers (Araneta and Zapote) during ex-ante and non-congestion pricing errors due to undergeneration during ex-post. It was noted that RMI at ex-post was lower than ex-ante which pronounced the pricing error. The resulting market re-run prices in Luzon in these trading intervals were PhP26,463/MWh and PhP28,545/MWh, respectively, compared with PhP9,134/MWh and PhP8,425/MWh of Visayas.

January 19, 1100H-1200H and 1400H-1600H

Similar to the previous trading day, price disparities between Luzon and Visayas occurred in relevant trading intervals during the trading day due to the constraint at the Leyte-Luzon HVDC. The transfer capability of the HVDC from Visayas to Luzon was set at 150 MW in trading intervals 0300H-1400H and 0 MW in trading intervals 1500H-1800H. Trading intervals 1100H-1200H and 1400H-1600 have significant price disparities.

Undergeneration condition in Luzon occurred in trading intervals 1100H and 1400H-1500H during the ex-ante and ex-post runs although the supply is sufficient to meet the demand as shown in Tables 14 and 15. The market re-run prices in these trading intervals were PhP36,104/MWh, PhP41,218/MWh and PhP46,526/MWh, respectively. While the non-congestion pricing errors were issued in Luzon during ex-ante, the prices in Luzon during trading intervals 1200H and 1600H were based on ex-post (PhP26,477/MWh and PhP46,526/MWh, respectively).

The undergeneration conditions were brought about by limitations on the ramp rate offers of San Roque HEP and Limay B.

Table 14. Regional Demand and Supply Condition (Ex-Ante)

Date	Trading Interval	Luzon (MW)			Visayas (MW)		
		Demand	Supply	Difference	Demand	Supply	Difference
1/19/2012	11	6,796	7,088	291	1,209	1,404	195
1/19/2012	12	6,682	7,147	465	1,202	1,496	293
1/19/2012	13	6,720	7,147	427	1,200	1,496	296
1/19/2012	14	6,930	7,146	216	1,245	1,506	261
1/19/2012	15	6,826	6,997	171	1,247	1,656	409
1/19/2012	16	6,793	6,997	205	1,236	1,656	420

Table 15. Regional Demand and Supply Condition (Ex-Post)

Date	Trading Interval	Luzon (MW)			Visayas (MW)		
		Demand	Supply	Difference	Demand	Supply	Difference
1/19/2012	11	6,904	7,124	220	1,238	1,415	177
1/19/2012	12	6,777	7,184	407	1,205	1,508	303
1/19/2012	13	6,748	7,217	469	1,207	1,508	301
1/19/2012	14	7,057	7,226	169	1,283	1,518	235
1/19/2012	15	6,950	7,083	133	1,272	1,657	385
1/19/2012	16	6,890	7,056	167	1,276	1,657	381

January 25, 1400H and 1500H

System-wide non-congestion pricing error due to undergeneration occurred in trading interval 1400H during ex-ante and ex-post. The low RMI coupled with the ramp limitation on the offer of hydro plant San Roque HEP caused the undergeneration condition. The market re-run price in this trading interval was PhP46,547/MWH (the highest price during the billing period).

In trading interval 1500H, system-wide congestion pricing error occurred during ex-ante due to the constraint along the New Naga-Quiot 138kV line (1500H) resulting in the application of PSM during ex-ante. The RMI for interval 1500H was also low, consequently, the price substitution produced estimated load reference price of PhP22,667/MWh from constrained on generator price of PhP35,000/MWh and unconstrained generator price of PhP22,000/MWh.

Pricing Errors and Market Intervention

The summary of the issuance of PEN, application of the PSM and declaration of market intervention (MI) is shown in Table 16.

The market results showed pricing errors occurred in Luzon about 23 percent of the time or in 174 trading intervals during the ex-ante process *(from 27% or 193 trading intervals of the of the previous billing period)*, which was primarily due to the violation of the contingency (N-1) requirement at MERALCO interchange substations in Zapote and Araneta. Meanwhile, system-wide pricing errors were issued in 9 trading intervals due to base case constraint at Tongonan GPP transformer, undergeneration *(generation deficiency)* conditions, artificial load shedding (*value of lost load*) at MERALCO loads in Zapote and Araneta, and input data concerns.

The ex-post market results, on the other hand, indicated system-wide pricing errors in 7 trading intervals likewise due to base case constraint at Tongonan GPP transformer, undergeneration *(generation deficiency)* conditions and input data concerns.

During ex-ante, the PSM was applied for the whole system (Luzon and Visayas) in 9 trading intervals due to (i) constraint in San Manuel - New San Manuel line as a result of N-1 contingency applied in San Manuel - San Jose 500kV line 2, (ii) constraint in New Naga - Toledo line, (iii) constraint violation in New Naga - Quiot line, and (iv) constraint in BPPC - Kadampat line as a result of N-1 contingency applied on San Manuel 230kV Tie line.

Table 16. PEN, PSM and MI Summary, January 2012

	Luz-Viz		Luzon		Visayas		Total	
	Freq.	% of Time	Freq.	% of Time	Freq.	% of Time	Freq.	% of Time
PEN (RTD)	9	1.2	174	23.4	1	0.1	183	24.6
PEN (RTX)	7	0.9	9	1.2		-	16	2.2
PSM (RTD)	9	1.2		-		-	9	1.2
PSM (RTX)	6	0.8		-		-	6	0.8
MI	1	0.1		-		-	1	0.1

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

Figure 9 and Table 17 shows the correlation of the hourly prices and demand in January 2012 and the previous billing period. In general, both periods showed positive relationship between price and demand although the level of significance is not that strong. With respect

to prices above PhP10,000/MWh, the relationship diminished considerably. This indicated that the high prices in both billing periods were not primarily driven by demand.

Figure 9. Market Price Distribution, December 2011 and January 2012

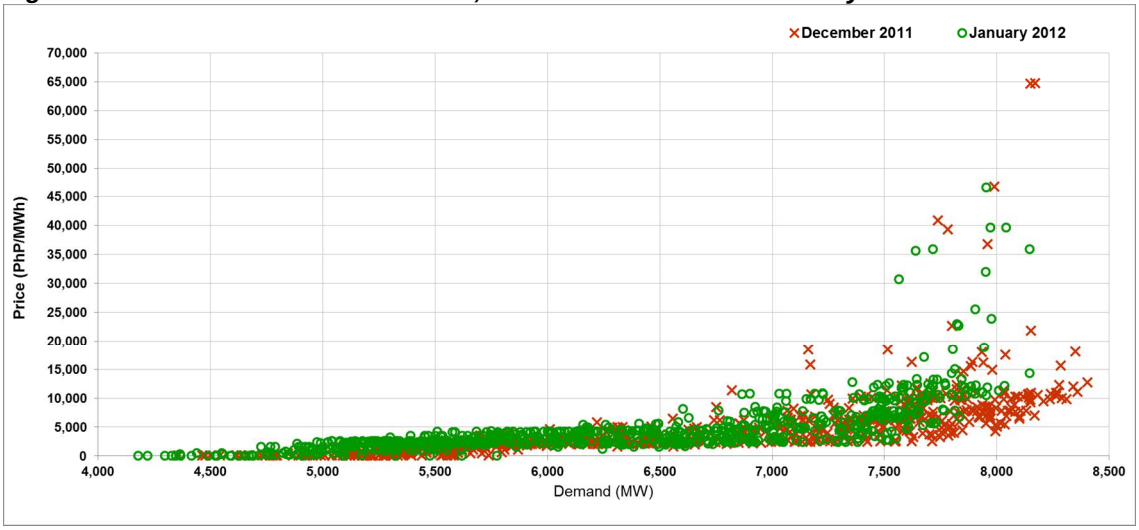


Table 17. Price and Demand Relationship, December 2011 and January 2012

	December 2011	January 2012	%M-on-M Change
All Prices	0.6105	0.6610	8.3
Prices >= PhP10,000	0.1318	0.3652	177.1

HVDC Scheduling

In January, constraint in the Leyte-Luzon HVDC occurred in 34 trading intervals during ex-ante and 38 trading intervals during ex-post. Most of the constraints occurred in relevant trading intervals when the transfer capability of the HVDC from Visayas to Luzon was set at lower level by NGCP-SO. The rest of the constraints occurred in relevant trading intervals where the transfer capability of the HVDC from Luzon to Visayas (150 MW) was maximized during the scheduling processes. There was no significant change in the month-on-month comparison in ex-ante, but in ex-post, January 2012 had the higher occurrences that HVDC limitation was met. *(Tables 18 and 19)*

Table 18. Summary of HVDC Limits Imposed by NGCP-SO and Results of HVDC Schedules (Ex-ante and Ex-post), January 2012

Results of HVDC Scheduling	HVDC Limit during Ex-ante (Visayas/Luzon) (No. of Trading Intervals)					HVDC Limit during Ex-post (Visayas/Luzon) (No. of Trading Intervals)				
	0/0	150/150	150/440	440/440	Total	0/0	150/150	150/440	440/440	Total
Visayas to Luzon		**28**	**680**	**1**	**709**		**29**	**674**	**1**	**704**
Limit Not Maximized		*5*	*679*	*1*	*685*		*4*	*674*	*1*	*679*
Limit Maximized [1\]		*23*	*1*		*24*		*25*			*25*
Luzon to Visayas			**27**		**27**			**32**		**32**
Limit Not Maximized			*17*		*17*			*19*		*19*
Limit Maximized [1\]			*10*		*10*			*13*		*13*
No Flow [1\]	**7**				***7***	**7**				***7***
TOTAL	**7**	**28**	**707**	**1**	**743**	**7**	**29**	**706**	**1**	**743**

Notes: 1\ with price separation

Table 19. Summary of HVDC Limits Imposed by NGCP-SO and Results of HVDC Schedules (Ex-ante and Ex-post), December 2011

Results of HVDC Scheduling	HVDC Limit during Ex-ante (Visayas/Luzon) (No. of Trading Intervals)					HVDC Limit during Ex-post (Visayas/Luzon) (No. of Trading Intervals)				
	150/35	150/180	150/200	150/440	Total	150/35	150/180	150/200	150/440	Total
Visayas to Luzon	**4**	**15**	**5**	**599**	**623**	**5**	**16**	**5**	**601**	**627**
Limit Not Maximized	*2*	*13*	*2*	*599*	*616*		*15*	*4*	*600*	*619*
Limit Maximized [1\]	*2*	*2*	*3*		*7*	*5*	*1*	*1*	*1*	*8*
Luzon to Visayas	**1**			**96**	**97**				**93**	**93**
Limit Not Maximized	*1*			*69*	*70*				*77*	*77*
Limit Maximized [1\]				*27*	*27*				*16*	*16*
TOTAL	**5**	**15**	**5**	**695**	**720**	**5**	**16**	**5**	**694**	**720**

Notes: 1\ with price separation

The maximum, minimum, and average HVDC flow from Luzon to Visayas (Luz-Vis) and Visayas to Luzon (Vis-Luz) is shown in table 18. There were occasions that Luz-Vis flow of 150 MW was maximized for the current and previous billing periods for both ex-ante and ex-post. The average flow of HVDC going from Luzon to Visayas was 94.7 MW (ex-ante) and 85.2 MW (ex-post) in the current period while the average flow in the previous period was 82.73 MW (ex-ante) and 84.62 MW (ex-post).

Meanwhile, in both billing periods, there were more instances of HVDC flow going from Visayas to Luzon (Vis-Luz) than the Luzon-Visayas flow (see table 18 and 19). In January 2012, the 440 MW limit in Vis-Luz flow was reached on January 8, 2012 trading interval 0200H (Sunday). The RMI was 35.5 percent and there was about 1,944 MW supply margin with 2 units of Kalayaan Pump Storage Power Plant (KPSPP) on pump operations. Relative to the average flow of 220 MW in ex-ante and 214 MW in ex-post (*Table 20*), the degree of possibility of maximizing the 150 MW limitation, which occurred on January 18-19, 2012 was higher and may eventually restrict the flow and may result to price separations in Luzon and Visayas especially during peak hours.

Table 20. Summary of HVDC Schedules (Ex-ante and Ex-post), December 2011 and January 2012

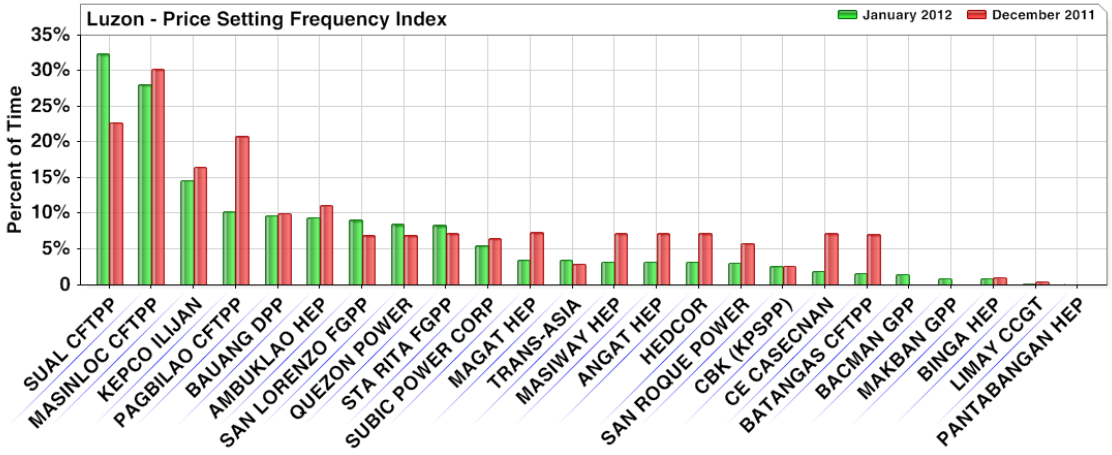
	Ex-ante (MW)			Ex-post (MW)		
	Max	Min	Ave	Max	Min	Ave
Luz-Vis						
January 2012	150	1.35	94.7	150	0.23	85.2
December 2011	150	0.8	82.73	150	0.31	84.62
Vis-Luz						
January 2012	440	1.41	219.75	423.38	4.99	213.67
December 2011	358.63	0.22	143.74	359.01	0.66	147.17

Price Setting Plants[7]

As shown in Figure 10, 23 plants from Luzon have been considered as price setters across all price levels in January. The coal plants Sual CFTPP (at 32%), Masinloc CFTPP (at 28%) and Pagbilao CFTPP (at 10%), natural gas plant Kepco Ilijan (at 15%) and oil based plant Bauang DPP (at 10%) remained the top five frequent price setters. It was noted that the Price Setting Frequency Index (PSFI) of Sual CFTPP increased significantly during the billing period compared with the previous billing period, On the other hand, Pagbilao CFTPP plant's PSFI decreased during the current billing period due to the shutdown of Pagbilao CFTPP units in several instances during the billing period.

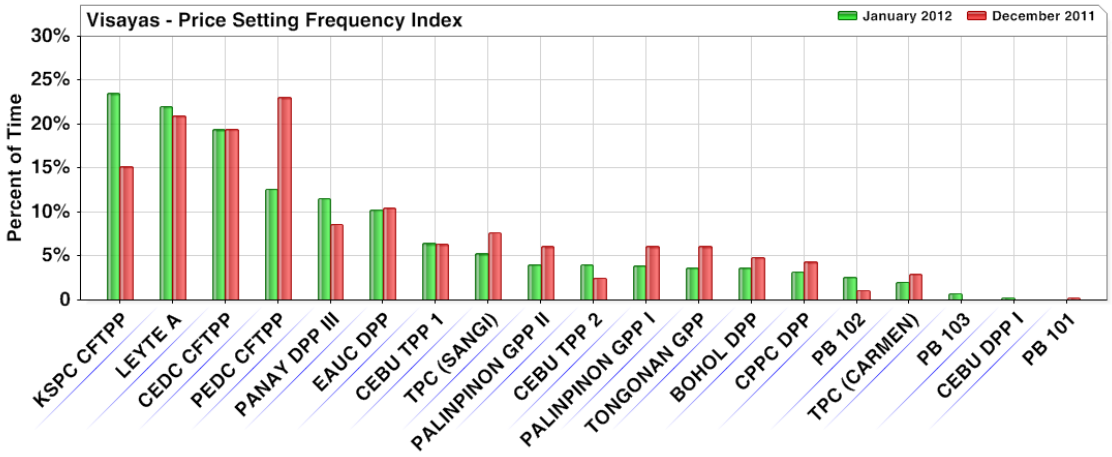
[7] A generator trading node is considered as a price setter when its last accepted offer price is between 95% to 100% of its nodal price. A generating plant is considered as price setter if at least one of its trading nodes was price setter in a given trading hour. The percentages stated in the price setting discussion represent the percent of time that a given plant was considered as price setter during the billing month.

Figure 10. Price Setting Frequency Index (Luzon Plants), Dec 2011 and Jan 2012



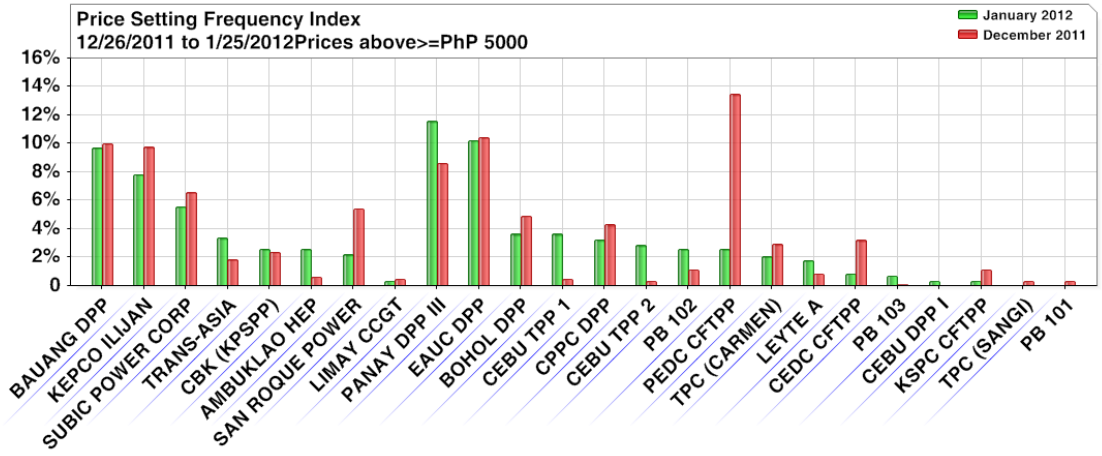
In Visayas *(Figure 11),* 19 plants have been considered as price setters across all price levels with coal plants KSPC CFTPP (at 24%), CEDC CFTPP (at 19%) and PEDC CFTPP (at 13%), and geothermal plant Leyte A (at 22%) as most frequent price setters. It was noted that the PSFI of coal plant KSPC CFTPP increased significantly during the billing period with the availability of the plant's two generating units during the billing period. On the other hand, the PSFI of PEDC decreased considerably due to the outage or unavailability of one of the plant's generating units during the billing period.

Figure 11. Price Setting Frequency Index (Visayas Plants), Dec 2011 and Jan 2012



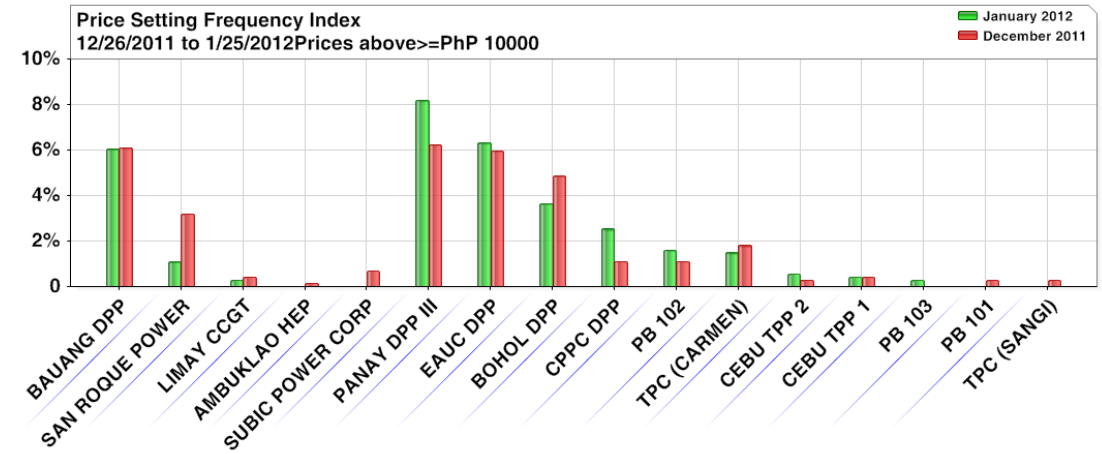
Looking at the PhP5,000/MWh and above price range, 24 plants have been considered as price setters composed of eight (8) plants from Luzon and sixteen (16) plants from Visayas *(Figure 12)*. During the billing period in review, the oil-based plants Bauang DPP (at 10%) and Subic (at 6%), and natural gas plant, Kepco Ilijan (at 8%) topped the price setting plants from Luzon. Meanwhile, the oil based plants Panay DPP (at 12%), EAUC (at 10%) and Bohol DPP (at 4%) were the top price setting plants from Visayas.

Figure 12. Price Setting Frequency Index (PhP5,000 and Above), December 2011 and January 2012



The number of price setters at the price level of PhP10,000/MWh and above was reduced to 12 plants in the current billing period: 3 plants from Luzon and 9 plants from Visayas *(Figure 13)*. The top 3 price setters included Panay DPP III, EAUC DPP, and Bauang DPP.

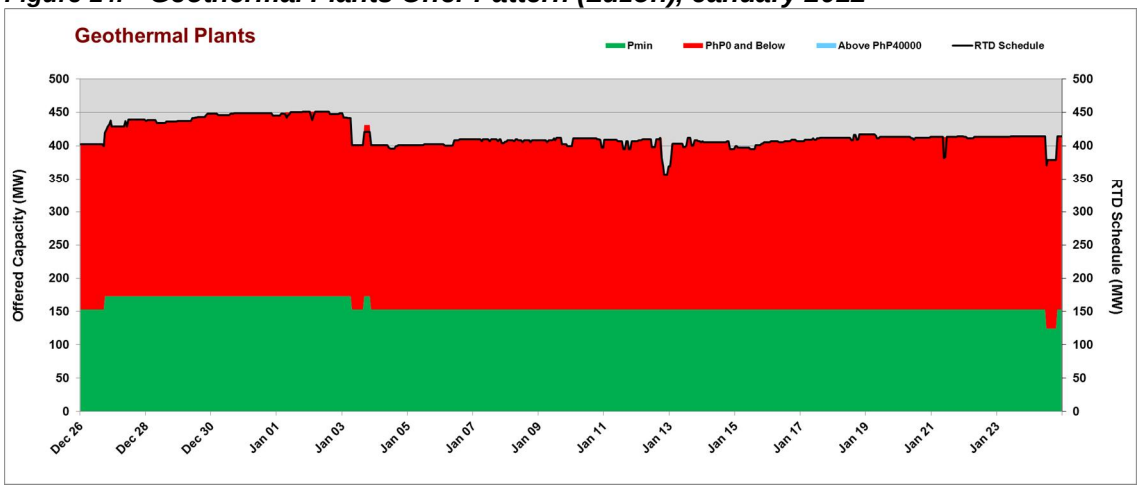
Figure 13. Price Setting Frequency Index (PhP10,000 and Above), December 2011 and January 2012



Generator Offer Pattern

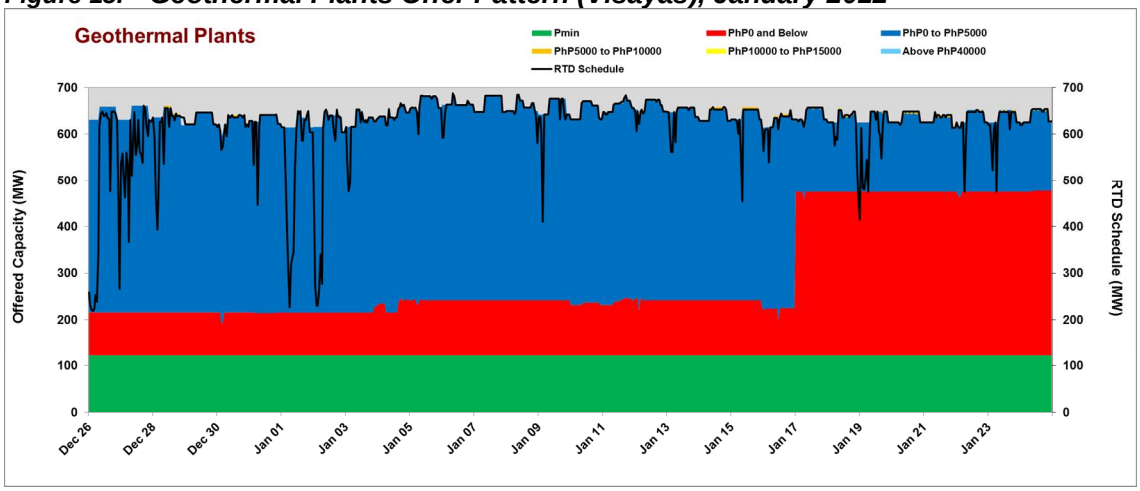
Geothermal plants in Luzon had the lowest price offer among the plant resources with offer prices of PhP0.00/MW and below, except on 1 trading interval on December 19 *(Figure 14)*. Consequently, most of the time, the maximum offered capacity of geothermal plants in Luzon were scheduled for dispatch.

Figure 14. Geothermal Plants Offer Pattern (Luzon), January 2012



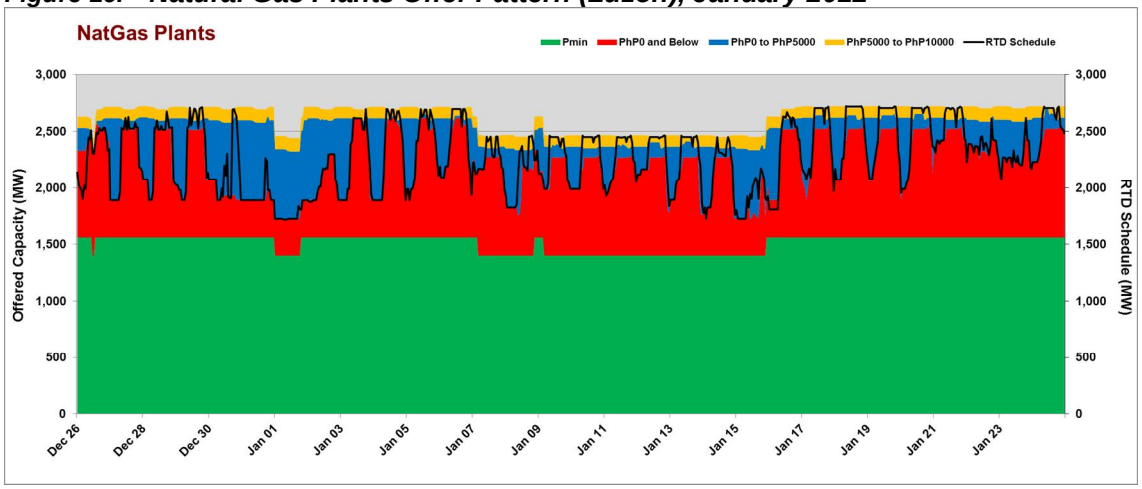
On the other hand, the offer prices of the geothermal plants in Visayas were mostly in the range of PhP0 to PhP5,000/MW, except in 2 occurrences on 30 December 2011 when the offer price went as high as PhP62,000/MW *(Figure 15)*. Also, offer price level of PhP10,000 to PhP15,000 was observed in trading intervals 1100H and 1900H of January 18, 2012.

Figure 15. Geothermal Plants Offer Pattern (Visayas), January 2012



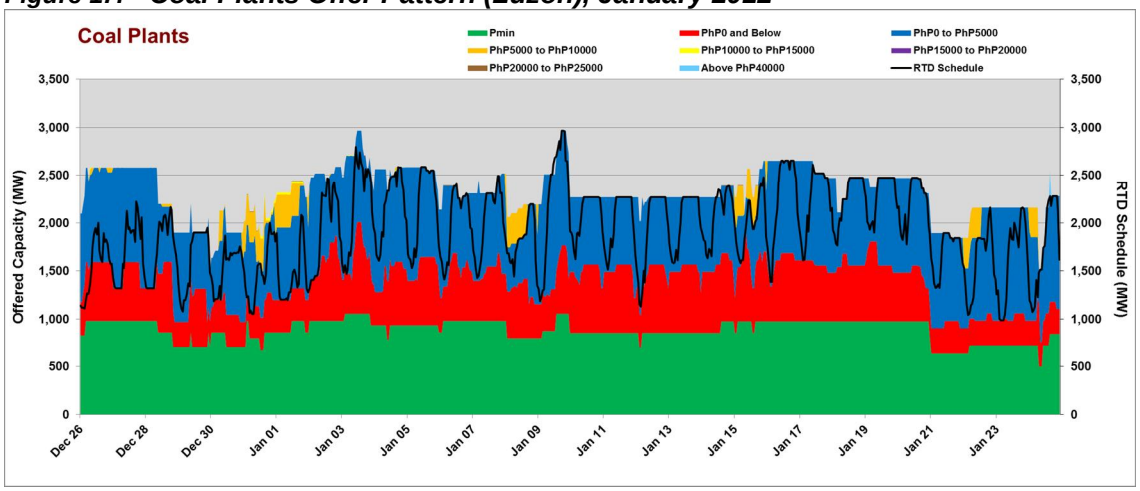
About 96% of the offered capacities (average of 2,534 MW) of natural gas plants were priced at PhP5,000/MW and below. The other 4% of the offered capacities (average of 97 MW) were priced above PhP5,000/MW *(Figure 16)*. As discussed earlier, natural gas plants had the lowest average capacity on outage, improving the level of capacity offered for the billing period with 2,631 MW.

Figure 16. Natural Gas Plants Offer Pattern (Luzon), January 2012



About 98% of the offered capacities of coal plants in Luzon (average of 2,280 MW) were priced at PhP5,000/MW and below *(Figure 17)*. Due to the outages of Calaca and Pagbilao CFTPP, the average offered capacity was 2,327 MW, way below the previous billing period's average offered capacity of 2,697 MW.

Figure 17. Coal Plants Offer Pattern (Luzon), January 2012



In Visayas, about 95% of the offered capacity of coal plants (average of 656 MW) were priced at PhP5,000/MW and below. The other 5% of the offered capacities (average of 33 MW) were priced above PhP5,000/MW, reaching as high as PhP62,000/MW *(Figure 18)*. Coal average offered capacity (689 MW) declined from previous billing period due to the outages of Cebu TPP2 and PEDC 1.

Figure 18. Coal Plants Offer Pattern (Visayas), January 2012

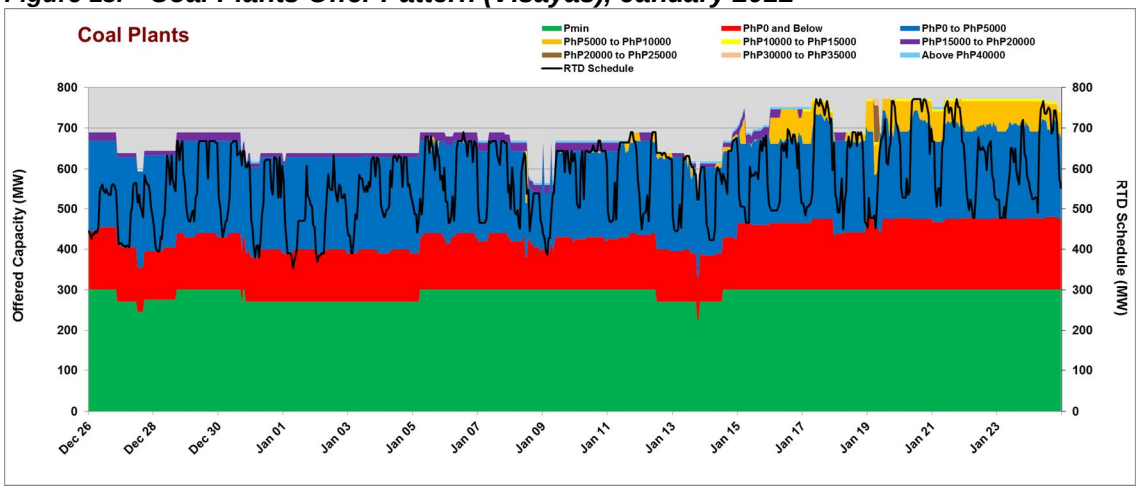
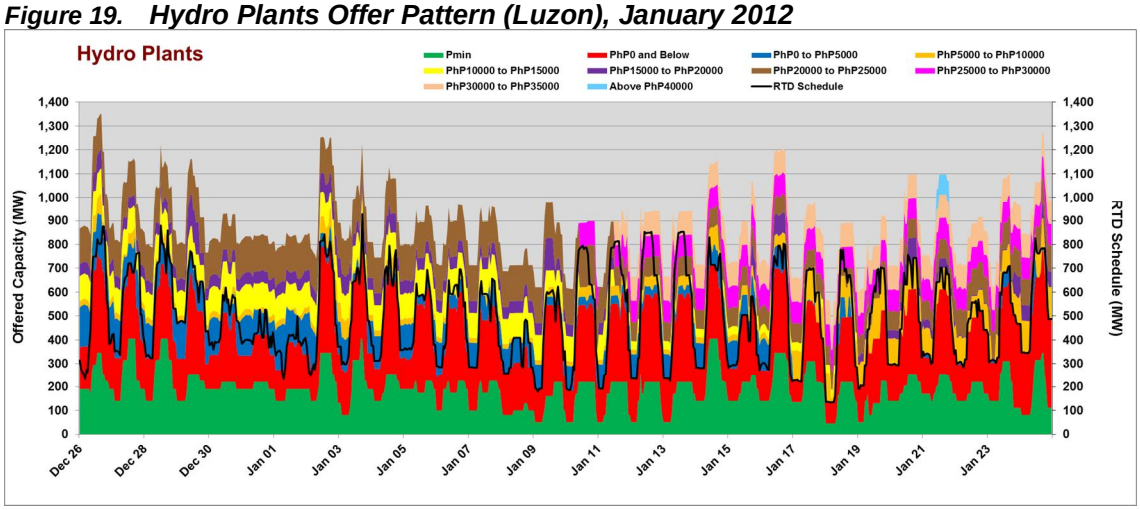


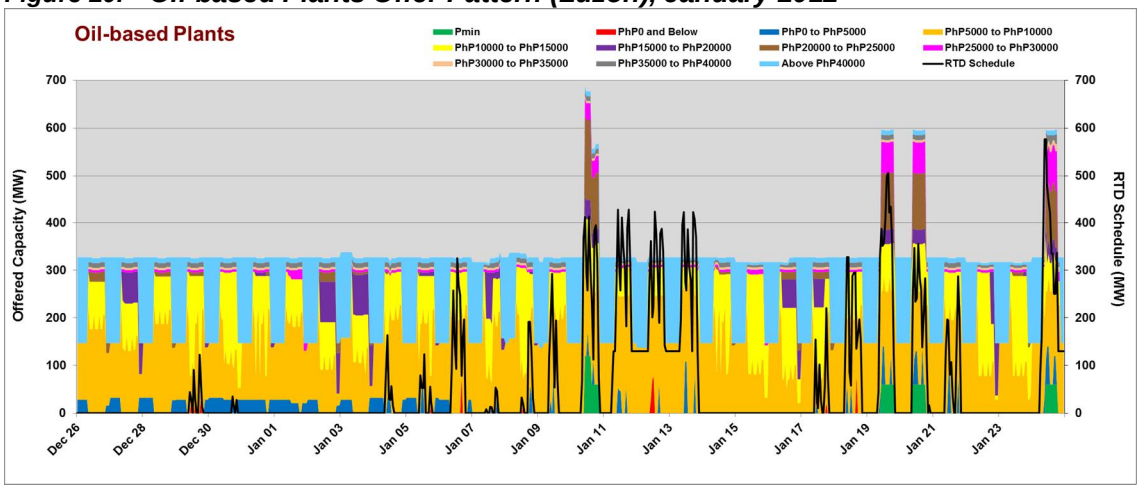
Figure 19 shows that there was consistency in the offer prices of hydro plants in Luzon during the billing period. The capacity offers, however, remained volatile ranging from 459 MW to 1,352 MW. Also, it was observed that in the middle of the billing month, the maximum capacity was offered at a higher price range of PhP30,000 to PhP35,000.

Figure 19. Hydro Plants Offer Pattern (Luzon), January 2012



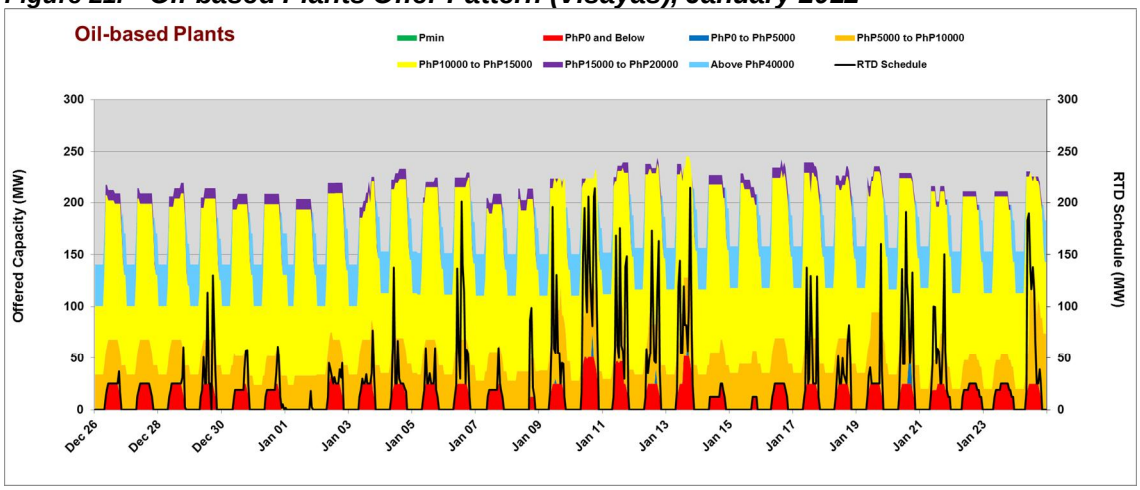
The offered capacity of the Luzon oil-based plants ranged from 312 MW to 687 MW while the offer prices ranged between PhP0.00/MW and PhP62,000/MW. The low capacity offers from oil-based plants in Luzon accounts to about 31% of the capacity gap in the region *(Figure 20).* Limay CCGT and Malaya TPP were scheduled/dispatched as must run units in certain trading intervals during the billing period due to tight supply and demand condition.

Figure 20. Oil-based Plants Offer Pattern (Luzon), January 2012



The capacity and price offers from oil-based plants in Visayas ranged from 141 MW to 245 MW and PhP0.0/MW to PhP60,000/MW, respectively *(Figure 21)*. There was a shift in the offer structure of one of the oil-based plants in Visayas during the billing period where the plantȘs capacity was offered at about PhP60,000/MW during off-peak hours.

Figure 21. Oil-based Plants Offer Pattern (Visayas), January 2012



Capacity Factor

During the current billing period, geothermal plants in Luzon showed 100 percent capacity factor based on offered capacity *(Table 22)*. Due to its low offer price (below PhP0.00/MW), almost all the time, the Luzon geothermal plantsȘ maximum offered capacity were being scheduled for dispatch in the system. It was also noted that due to outages and capacity gaps, the capacity factor of geothermal plants was 47 percent and 66 percent based on registered capacity and net of outages, respectively.

Natural gas plants consistently have capacity factors above 80 percent. A modest decline in natural gas plants was observed in month-on-month comparison in RTD schedule versus registered less outage capacity and offered capacity.

Figure 22. Capacity Factor (Luzon Plants), January 2012

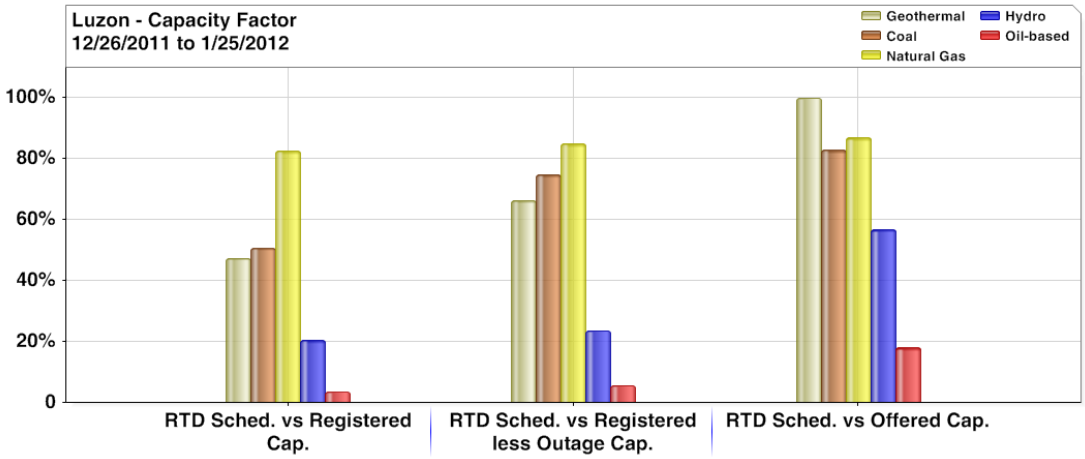


Table 21. Summary of Capacity Factor by Plant Type in Luzon, Dec 2011 and Jan 2012

Plant Type	RTD Sched. vs Registered Cap.			RTD Sched. vs Registered less Outage Cap.			RTD Sched. vs Offered Cap.		
	December 2011	January 2012	%Change	December 2011	January 2012	%Change	December 2011	January 2012	%Change
Coal	57%	51%	-11%	76%	75%	-2%	80%	83%	3%
Natural Gas	83%	83%	0%	90%	85%	-5%	91%	87%	-5%
Geothermal	47%	47%	0%	68%	66%	-3%	103%	100%	-3%
Hydro	24%	20%	-15%	27%	23%	-14%	62%	57%	-9%
Oil-based	4%	3%	-3%	6%	5%	-7%	20%	18%	-11%

Table 22. Capacity Factor by Plant Type in Luzon, January 2012

Plant Type	Total RTD Sched. (MW-Hr)	Total Registered Cap. (MW-Hr)	Total Registered less Outage Cap. (MW-Hr)	Total Offered Cap. (MW-Hr)	Capacity Factors		
					Registered Cap.	Registered less Outage Cap.	Offered Cap.
	(A)	(B)	(C)	(D)	(A / B)	(A / C)	(A / D)
Coal	1,430,627	2,828,601	1,913,215	1,727,275	51%	75%	83%
Natural Gas	1,698,481	2,057,057	2,000,064	1,954,949	83%	85%	87%
Geothermal	308,822	653,617	465,837	309,037	47%	66%	100%
Hydro	368,345	1,799,323	1,570,921	650,191	20%	23%	57%
Oil-based	45,138	1,331,456	828,400	252,755	3%	5%	18%

Visayas had only 3 major plant types, namely, geothermal, coal, and oil based plants *(Figure 23)*. In RTD schedule versus offered capacity, the capacity factors of geothermal and coal plants improved by 3 percent while oil based plants declined significantly by 19 percent. Taking into account prevalent offer structures of oil based plants in Visayas, the demand drove the capacity factor of oil based plants.

Figure 23. Capacity Factor (Visayas Plants), January 2012

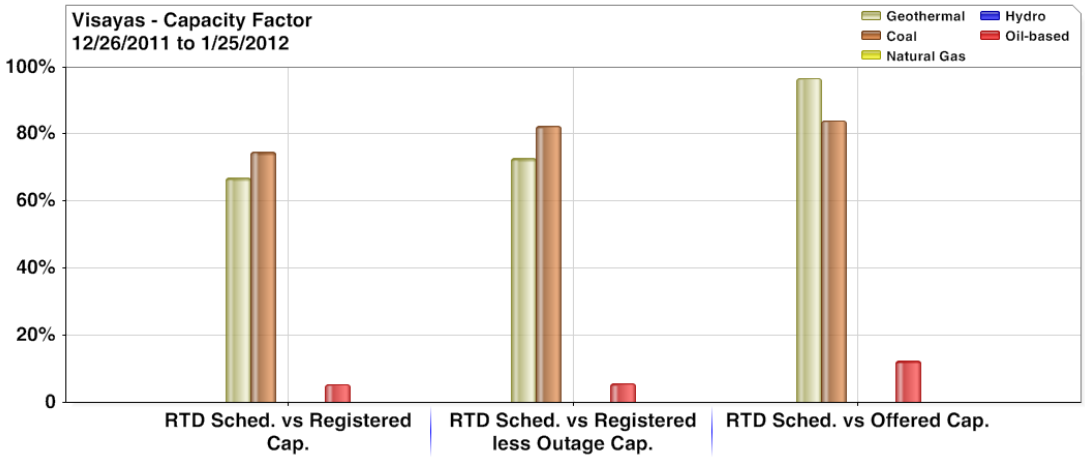


Table 23. Summary of Capacity Factor by Plant Type in Visayas, December 2011 and January 2012

Plant Type	RTD Sched. vs Registered Cap.			RTD Sched. vs Registered less Outage Cap.			RTD Sched. vs Offered Cap.		
	December 2011	January 2012	%Change	December 2011	January 2012	%Change	December 2011	January 2012	%Change
Coal	72%	75%	4%	80%	82%	2%	82%	84%	3%
Geothermal	65%	67%	3%	72%	73%	1%	94%	97%	3%
Oil-based	6%	5%	-18%	7%	6%	-18%	15%	12%	-19%

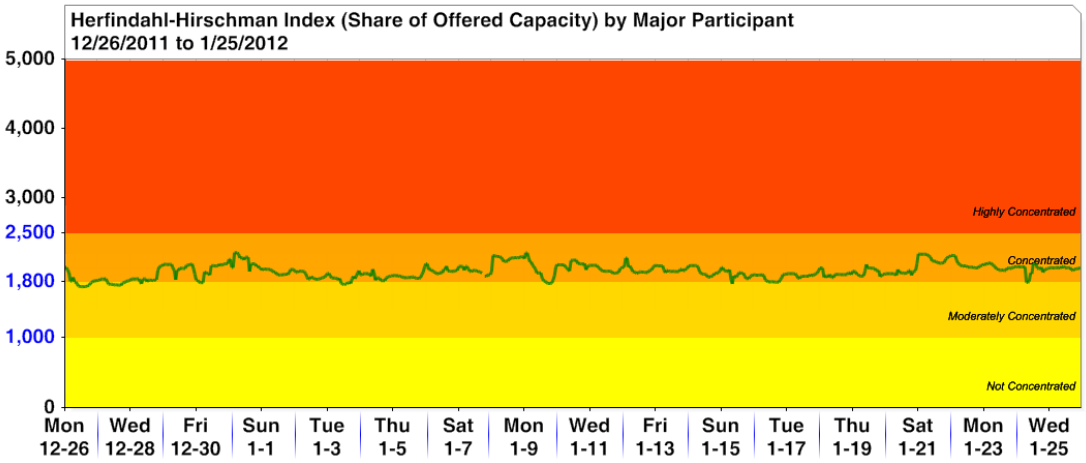
Table 24. Capacity Factor by Plant Type in Visayas, January 2012

Plant Type	Total RTD Sched. (MW-Hr)	Total Registered Cap. (MW-Hr)	Total Registered less Outage Cap. (MW-Hr)	Total Offered Cap. (MW-Hr)	Capacity Factors		
					Registered Cap.	Registered less Outage Cap.	Offered Cap.
	(A)	(B)	(C)	(D)	(A / B)	(A / C)	(A / D)
Coal	430,113	575,974	522,602	511,989	75%	82%	84%
Geothermal	462,770	692,327	636,569	478,713	67%	73%	97%
Oil-based	17,500	330,304	318,137	143,336	5%	6%	12%

Market Concentration

The Herfindahl-Hirschman Index (HHI) calculated based on offered capacity by major participants' grouping still indicated a concentrated to moderately concentrated market condition during the billing period *(Figure 24)*.

Figure 24. Hourly HHI based on Offered Capacity by Major Participant Grouping, January 2012



Compliance Monitoring

Compliance to Must Offer Rule

Continued non-compliance with the must-offer rule by generator trading participants was observed throughout the covered period. Figure 25 shows a high percentage of capacity gap[8] at around 61 percent and 68 percent of the total generator resource-trading intervals[9] in Luzon and Visayas, respectively.

Figure 25. Summary of Compliance Monitoring to Must Offer Rule, January 2012

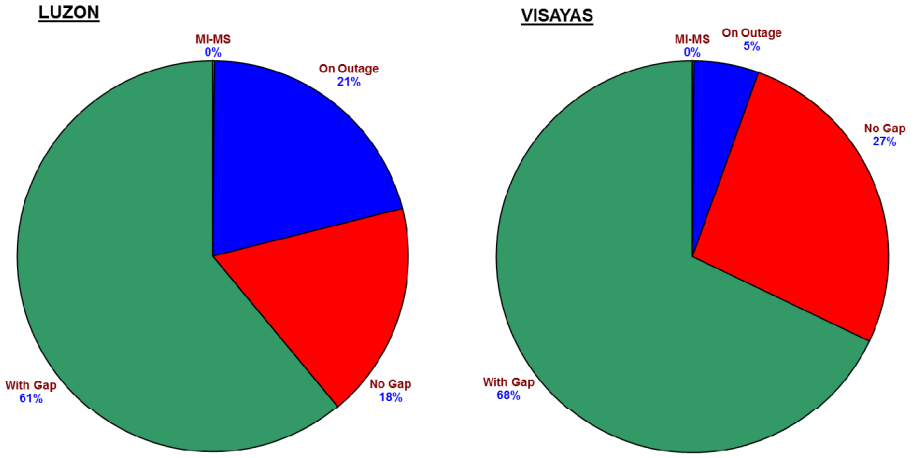
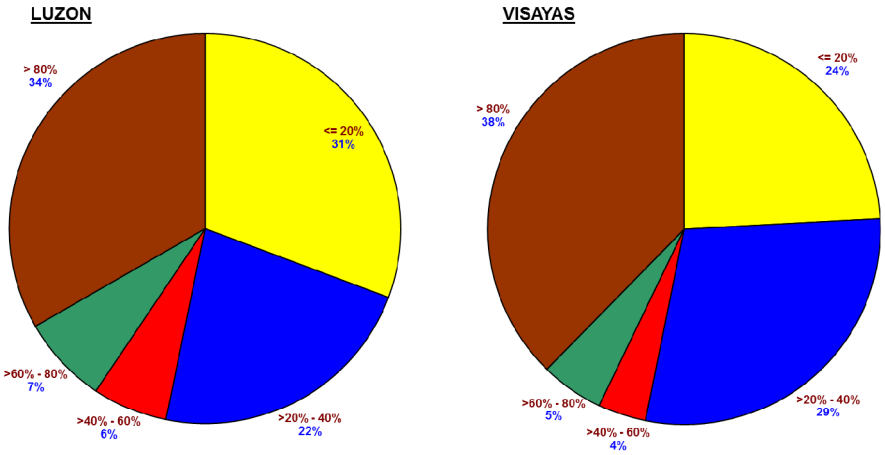


Figure 26 shows the proportion of the capacity gap to the registered capacity[10] net of outage capacity[11] and the corresponding frequency distribution of the generator resource-trading intervals with capacity gap. It shows that the proportion of the capacity gap above 80%

[8] Capacity gap - registered capacity less outage capacity less offered capacity, calculated for each generator resource node per trading interval.
[9] Total generator resource-trading intervals - calculated as the number of registered generator resource nodes multiplied by the total trading intervals in the billing month.
[10] Registered capacity - capacity of each generator resource node registered with the market.
[11] Outage capacity - validated outage capacity of each generator resource node per trading interval.

constitute about 34% and 38% of the relevant generator resource-trading intervals in Luzon and Visayas, respectively.

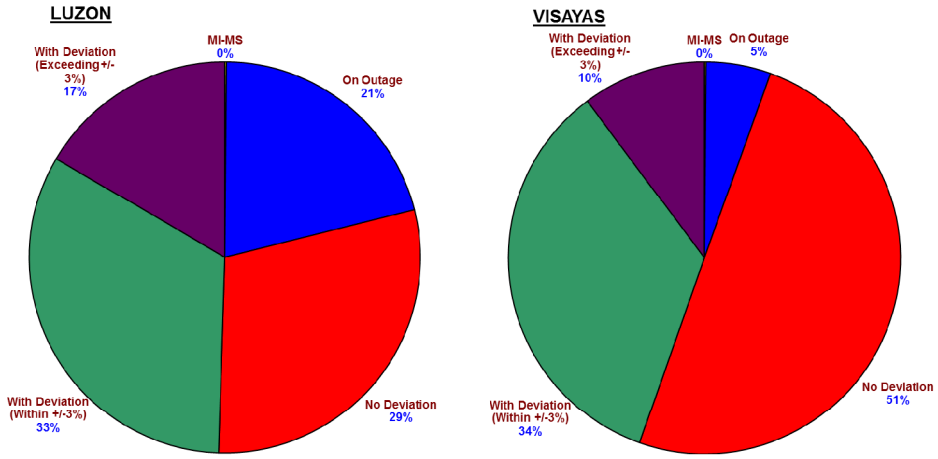
Figure 26. Distribution of Observed Capacity Gap, January 2012



Compliance to RTD Schedule

Figure 27 shows that around 17 percent and 10 percent of the total generator resource-trading intervals in Luzon and Visayas, respectively, have deviations between the RTD schedule[12] and actual dispatch[13] exceeding the +/-3% tolerance limit[14] in the billing period of January 2012.

Figure 27. Summary of Compliance Monitoring to RTD Schedule, January 2012



The summary of dispatch deviations exceeding the +/-3% in terms of percent deviation and frequency distribution is shown in Figure 28. Majority of the dispatch deviations were within +/-20% at about 73 percent and 62 percent of the relevant generator resource-trading intervals in Luzon and Visayas, respectively. Likewise noted was the frequency of dispatch deviations exceeding 80 percent at 11 percent and 29 percent in Luzon and Visayas, respectively.

[12] RTD schedule - target loading level of each generator resource node at the end of the trading interval.
[13] Actual dispatch - actual loading of each generator resource node at the end of the trading interval (based on minute 59 snapshot data.
[14] +/-3% tolerance limit - initial dispatch tolerance limits adopted per PEM Board Resolution No. 2005-15.

Figure 28. Distribution of Observed Deviation, January 2012