



Market Assessment Report Cool Dry Season

26 November 2019 to 25 February 2020

This Report is prepared by the
Philippine Electricity Market Corporation –
Market Assessment Group for the
Market Surveillance Committee

PEMC *Go*

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Market Assessment Report for Cool Dry Season 2020

This report assesses the results of the integrated Luzon and Visayas operations of the Wholesale Electricity Spot Market (WESM) for the Cool Dry Season 2020 (26 November to 25 February 2020) and how the market performed compared with the previous year. This report provides an overview of the results of market performance, trends, and drivers which in turn provide the means to assess competition and conditions in the WESM, as well as the bidding behavior of trading participants.

Part I. Highlights

- Considerably high level of market prices was recorded for the December 2019 billing month averaging at PhP5,932/MWh which was the highest monthly average on record for all Decembers since 2014. This was driven by higher level of outage capacity during the period which resulted in an unusual narrow supply margin in December amidst the expected low level of demand related to the observance of holidays.
 - The price spike trigger¹ was breached during the December 2019 billing month during the following trading intervals: 27 November (1800H), 3 December (0900H and 1000H), 4 December (1700H and 1800H), 10 December (1800H), 15 December (1800H), and 16 December (0800H and 0900H). Observations on these market trigger events were provided to the Energy Regulatory Commission (ERC).
- On the other hand, lower average price was noted in January 2020 at PhP2,956/MWh and in February 2020 at PhP3,280/MWh compared to previous year's figures at PhP4,725/MWh in January 2019 and PhP4,065/MWh in February 2019. It may be recalled that these months in 2019 were marked by high level of planned outages, on top of the forced outages, to ensure adequate supply for the May 2019 National and Local Elections.
- Sustained high price and price creep up triggers were not breached during the season.

Part II. Assessment of the Market

- The market price outcome for majority of the time, at 67 percent, during the Cool Dry Season of 2020 was a result of normal pricing condition (Figure 1).
 - Price Substitution Methodology (PSM) was applied to 28 percent of the price outcomes due to frequent congestion events on Samboan-Amlan line 1 throughout the cool dry season. In January 2020, frequent congestion was noted on Sta. Rita – Batangas line 2.

¹ Following the approved price thresholds for price trigger events as provided in MSC Resolution No. 2020-04

- Prices issued with pricing error notices affected 3 percent of the price outcomes mainly due to inappropriate input data affecting Luzon and Visayas prices and schedules.
- Administered Pricing was implemented in Luzon for 106 trading intervals in January 2020 (from 12 January at 1900H to 17 January at 0400H) which placed the region under SO-initiated market intervention related to multiple tripping of major transmission lines due to eruption of Taal Volcano. Meanwhile, 9 trading intervals in Visayas (25 December 2019, from 0100H to 0900H) were placed under SO-initiated market intervention due to multiple tripping of line and generators because of typhoon “Ursula”.
- Secondary price cap² was not imposed during the period.

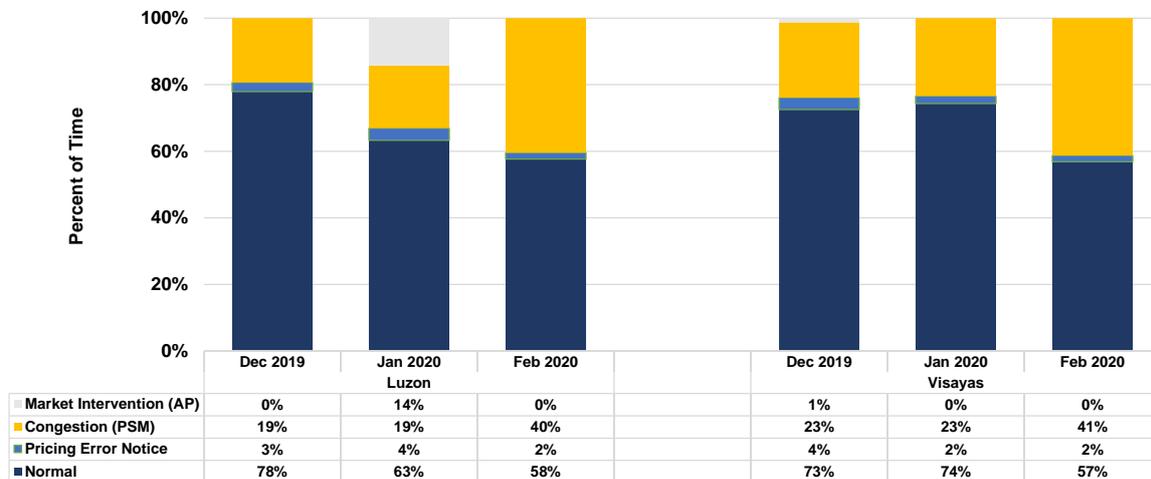


Figure 1. Summary of Pricing Conditions

Part III. Market Outcome

i. Price and Supply Margin

a. Supply Margin and Price

- Supply margin averaged at 2,368 MW during the cool dry season of 2020. This was higher compared to 2,160 MW in the same period last year.
- The January 2020 billing month saw a high level of supply margin at 2,754 MW resulting in average market price at PhP2,956/MWh (Figure 2).

² Secondary price cap is imposed when the 120-hour rolling average price exceeds PhP9,000/MWh.

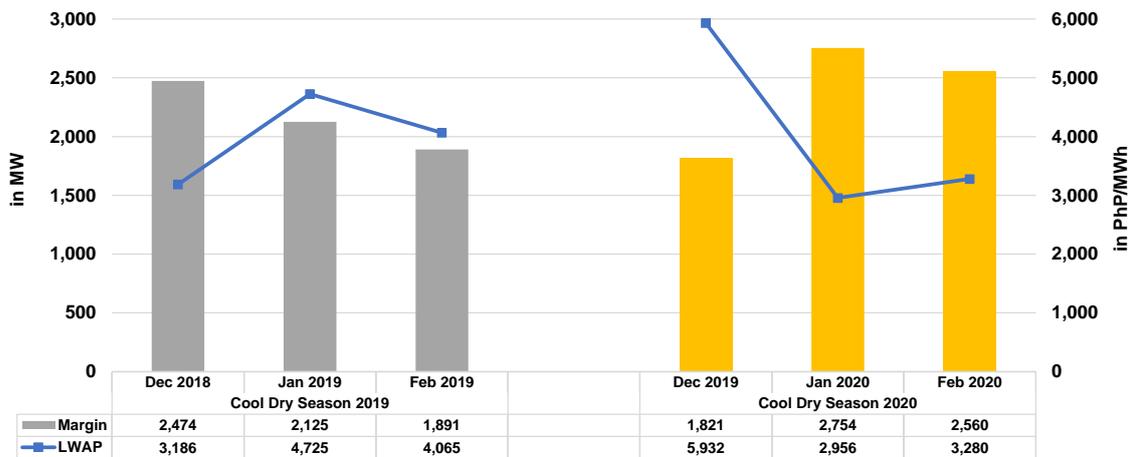


Figure 2. Average Supply Margin and Average Price

- On the other hand, December 2019 saw a relatively low supply margin at 1,821 MW which corresponded to higher average price at PHP5,932/MWh. It was observed that prices drastically increased during the peak hours of December 2019 (Figure 3) especially during 1800H (Figure 4).

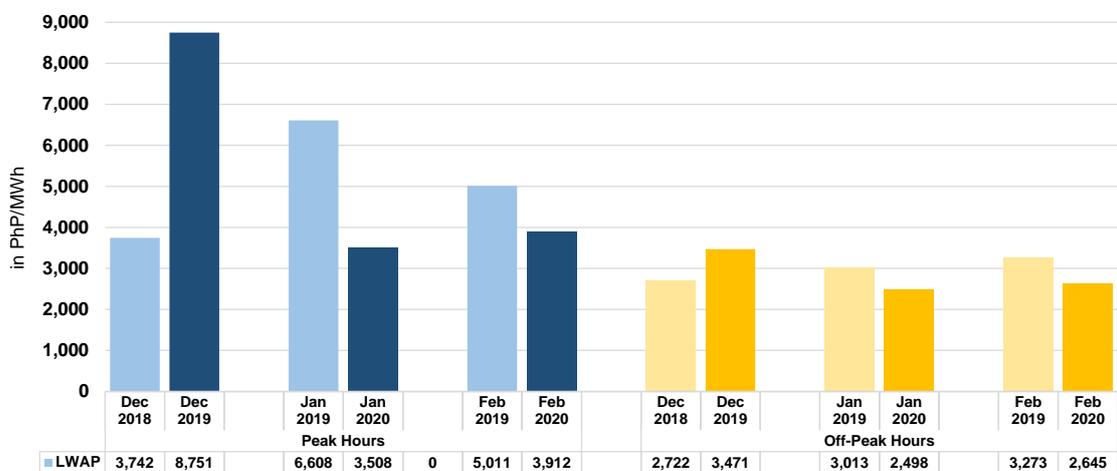


Figure 3. Average Price, by Hour Type³

³Peak hours include 0900H-2100H from Mondays to Saturdays and 1900H-2000H on Sundays and Holidays. Off-peak hours include 0100H to 0800H and 2200H to 2400H from Mondays to Saturdays and 0100H to 1800H and 2100H to 2400H on Sundays and Holidays

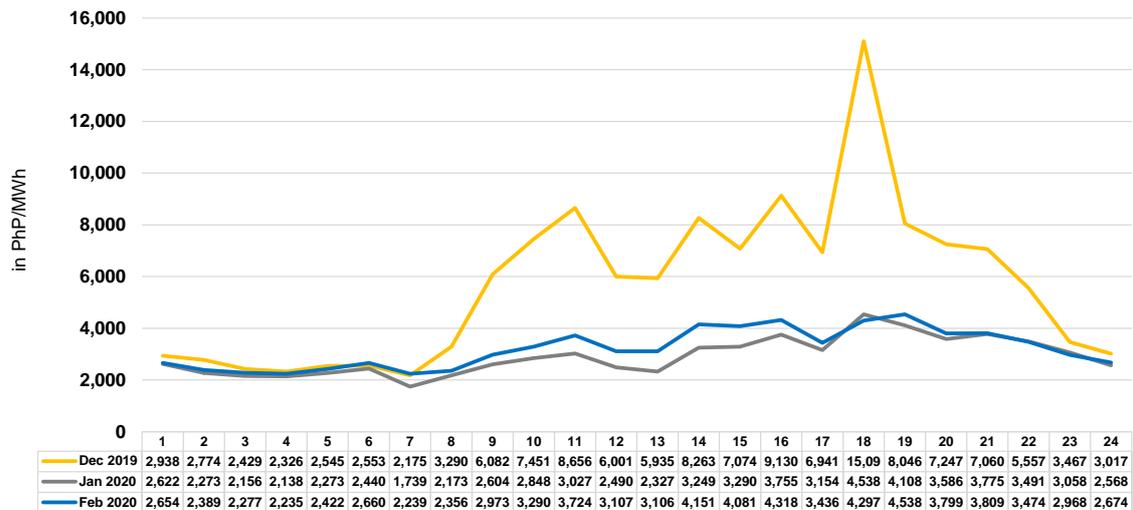


Figure 4. Average Price, Hourly Profile

- About 82 percent of the prices were ranging from PhP0/MWh up to below PhP5,000/MWh (Figure 5).
- Prices above PhP10,000/MWh during December 2019 were mostly set by the following plants: Bauang DPP, San Roque HEP, Anda CFTPP, Limay CCGT, and Millennium GTPP.

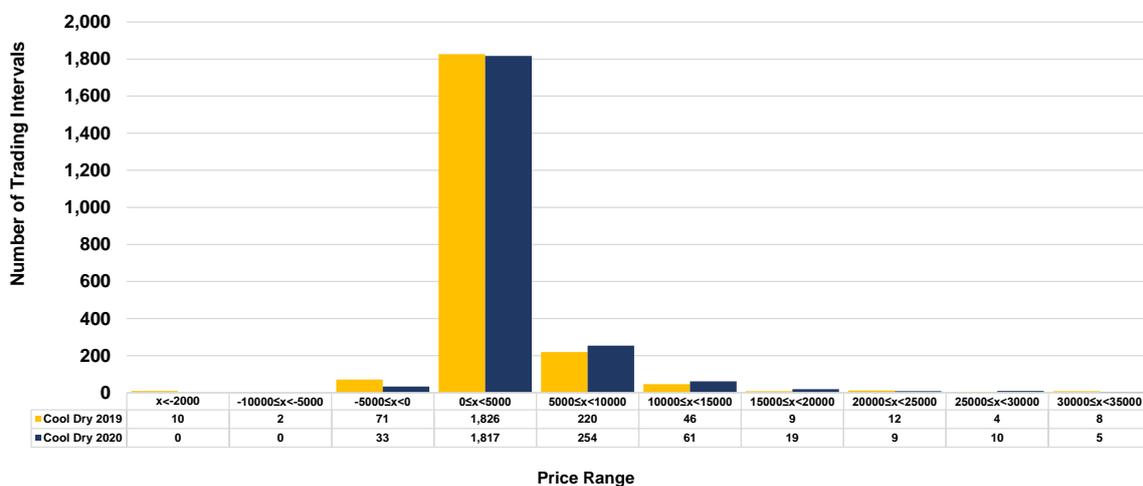


Figure 5. Price Frequency Distribution

- Based on the supply margin analysis⁴, 22 trading intervals during peak hours (Figure 6) and 2 trading intervals during off-peak hours (Figure 7) in the December billing month exceeded the upper price thresholds corresponding to their supply margin.

⁴ Following the approved price thresholds for interesting pricing events per season as provided in MSC Resolution No. 2020-04

- Meanwhile, all prices during January and February billing months fell within the upper and price thresholds.

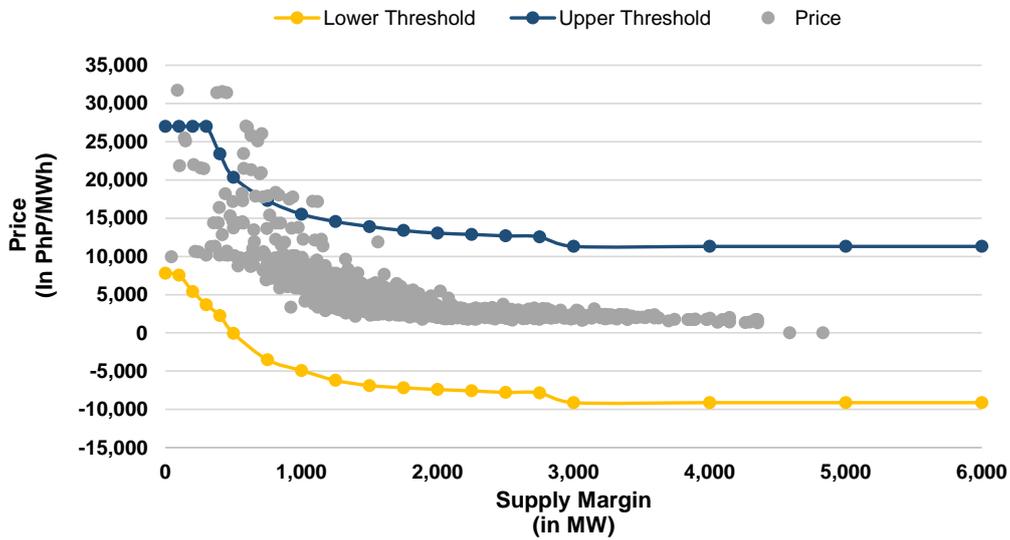


Figure 6. Supply Margin Analysis – Peak

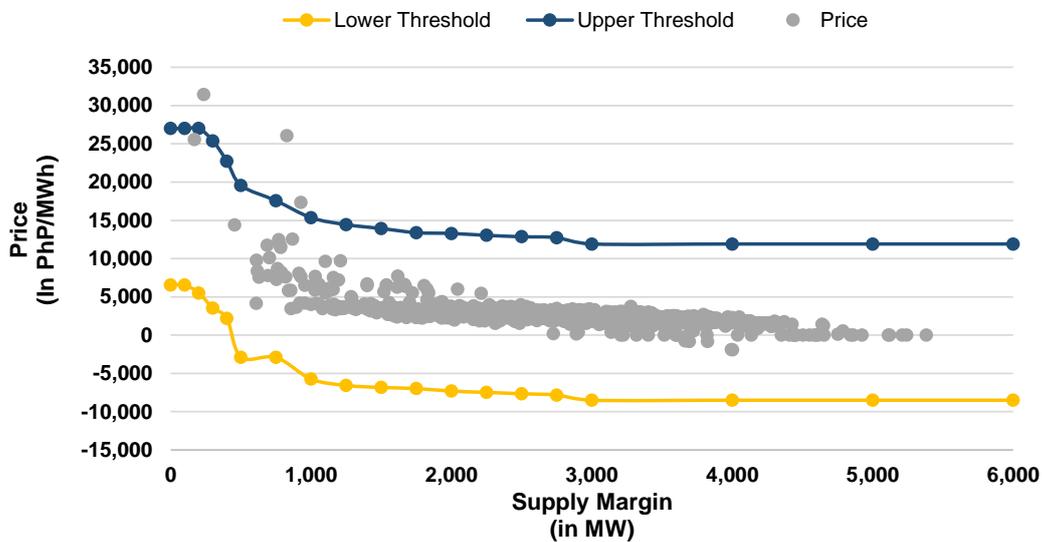


Figure 7. Supply Margin Analysis – Off-Peak

ii. Supply

a. Capacity Profile

- As seen in Figure 8, about 36 percent or 7,269 MW of the registered capacity involved majority of the plants (136 plants) which are less than 10 years in operations⁵.
- Plants aging 10 to 20 years and 20 to 30 years followed at 23 percent each (roughly around 4,600 MW) involving 28 plants and 32 plants, respectively.
- Twelve plants were more than 50 years in age contributing 470 MW in the registered capacity.

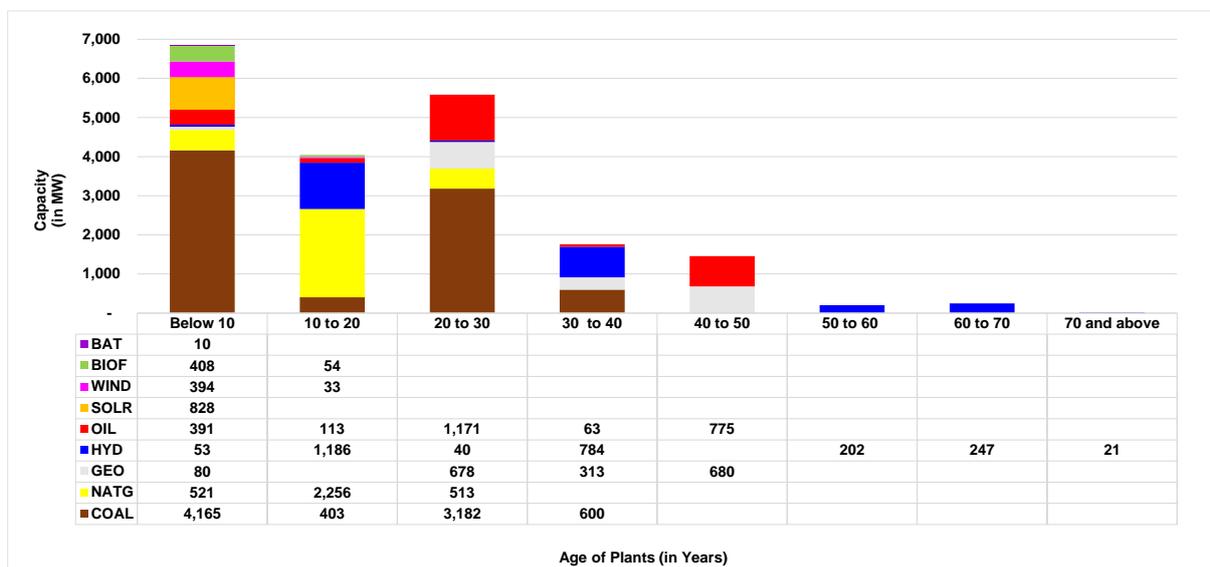


Figure 8. Age of Plants

- Capacity offered in the market accounted for 70 percent (20,167 MW) of the total registered capacity in WESM (Figure 9). About 13 percent (2,611 MW) were neither offered nor nominated in the market while 17 percent (3,379 MW) were on outage during the period. Accounting for security limits and ramp limitations, effective supply averaged at 12,903 MW or about 64 percent of the total WESM registered capacity.
- HVDC power flow was more frequently directed towards the Luzon region at 88 percent of the time.
- High level of outage was noted in December resulting in a lower available capacity.

⁵ Based on registration date or commercial operations date

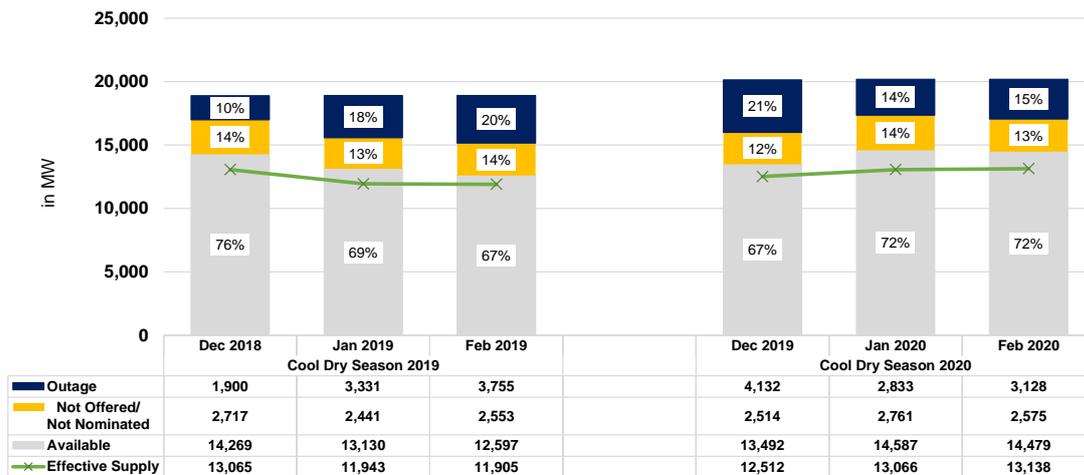


Figure 9. Capacity Profile

b. Capacity and Generation Mix

- In Luzon, coal plants and natural gas plants accounted for about 42 percent and 20 percent of registered capacity, respectively, by the end of the period (Figure 10). These figures grew to 51 percent and 31 percent when measured in terms of actual generation indicating high dispatch and utilization driven by low-priced offers in the market.
- On the contrary, lower shares in generation mix were noted in hydro and oil-based plants.
- Share of coal plants recorded year-on-year increase with the entry of Meralco Powergen Corporation’s SBPLC CFTPP (455 MW) and SMC’s Masinloc CFTPP unit 3 (335 MW).
- Participation of non-scheduled generating units was almost unchanged from 2019 to 2020.

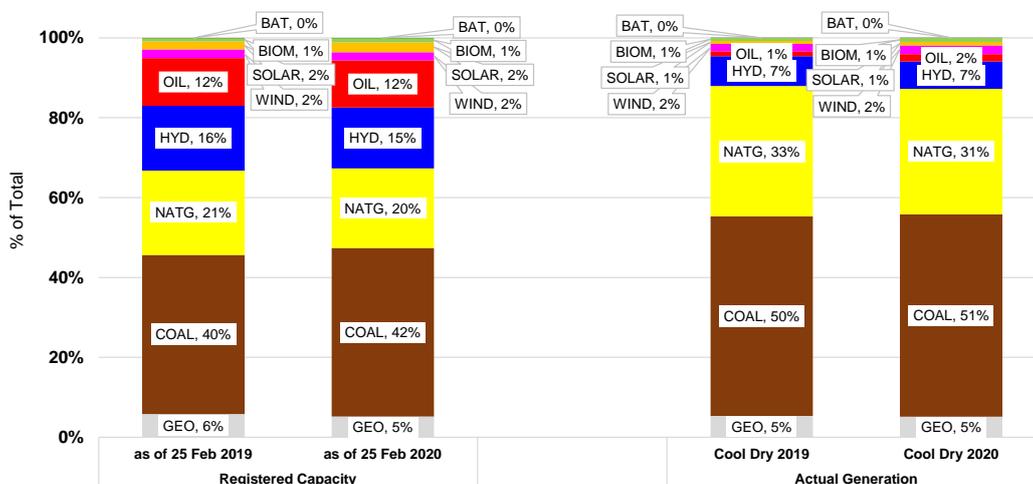


Figure 10. Capacity and Generation Mix – Luzon

- In Visayas, geothermal plants and coal plants accounted for 25 percent and 38 percent of registered capacity, respectively (Figure 11). Similarly, these shares increase to 43 percent and 47 percent when measured in terms of actual generation denoting high dispatch and utilization driven by low-priced offers in the market.
- Oil-based plants likewise observed low utilization at 2 percent compared to 15 percent share in registered capacity due to its higher-priced offers in the market.
- Year-on-year, there was a higher share of oil-based plants with the entry of Isabel DPP (70 MW) and AP's Therma DPP (44 MW) and biomass plants with the entry of Biscom Biomass (30 MW), North Negros Biomass (25 MW), SNBP Biomass (25 MW), and CABI Biomass (23.5 MW).

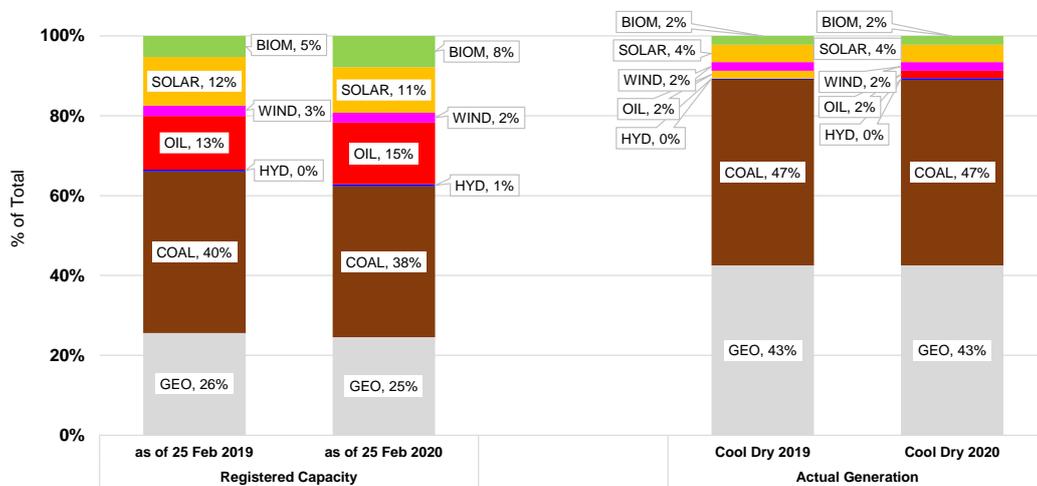


Figure 11. Capacity and Generation Mix – Visayas

c. Outage Capacity

- Coal plants accounted for 63 percent of the outage capacity this season (Figure 12). In Figure 13, most of coal plants' outages were planned (59 percent) which mainly involved Calaca CFTPP unit 2 (300 MW), Mariveles CFTPP unit 2 (316 MW), QPPL CFTPP (460 MW), and Sual CFTPP unit 1 (647 MW).
- Aside from planned outages, outages during the season were mostly forced involving Malaya TPP unit 1 (300 MW), SBPL CFTPP (455 MW), Tiwi GPP unit A (59 MW), Makban GPP unit 5 (55 MW), Calaca CFTPP unit 1 (300 MW), and PEDC CFTPP unit 3 (150 MW).
- Deactivated shutdown purely involved geothermal plant Makban GPP unit 6 (55 MW).
- Appendix A provides the details of the plant outages during the season which lasted for more than 5 days.

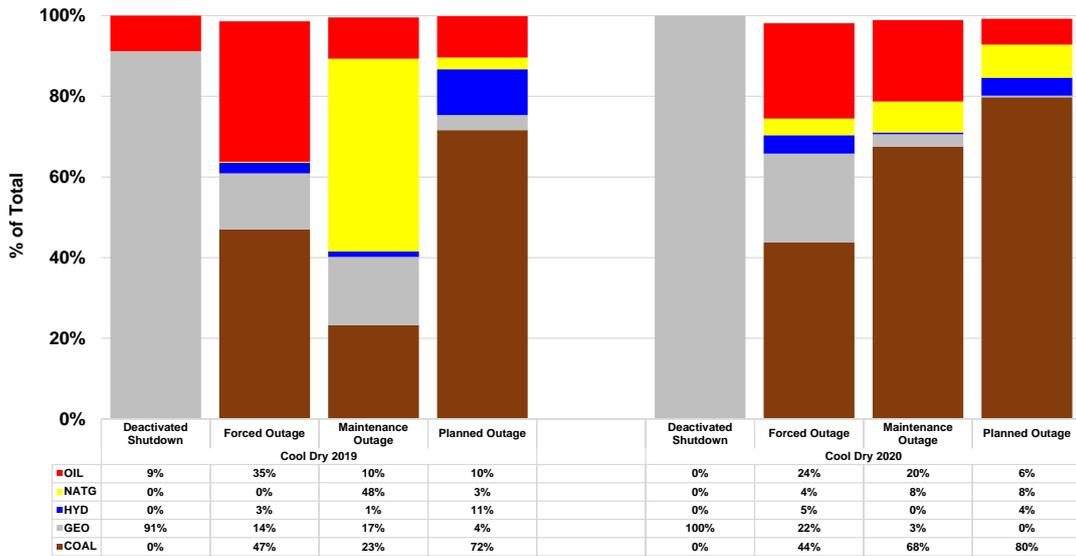


Figure 12. Outage Capacity by Plant Type

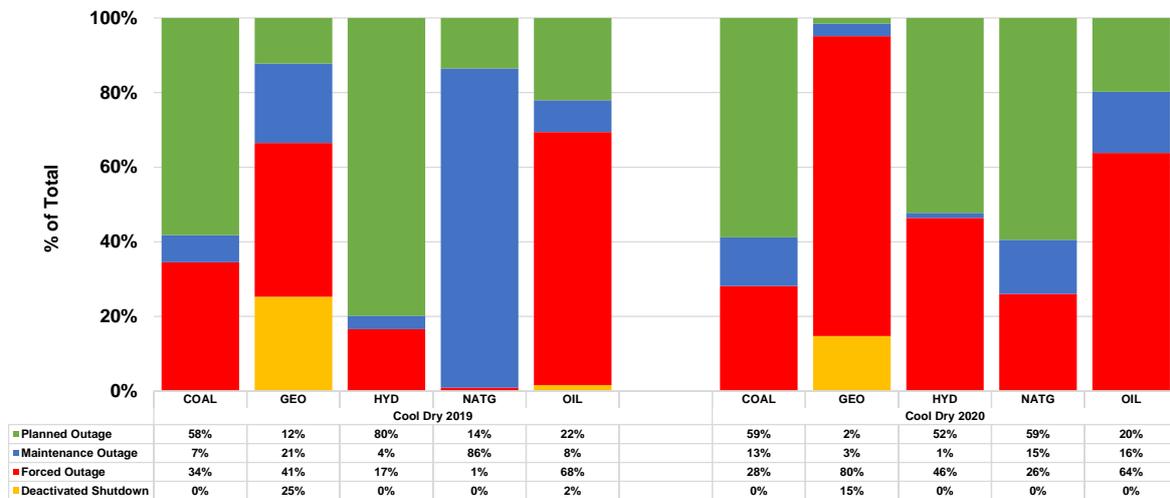


Figure 13. Outage Capacity by Outage Type

iii. Demand

- Demand averaged at 10,535 MW close enough to previous year’s 10,137 MW consistent with the minimal change in year-on year average monthly temperature (Figure 14).

- While the Gross Domestic Product (GDP) declined by 0.2 percent in the first quarter of 2020, the first contraction since the fourth quarter of 1998⁶, it is important to note that the GDP calculation covered the month of March when quarantine measures were imposed to contain the spread of the coronavirus disease.

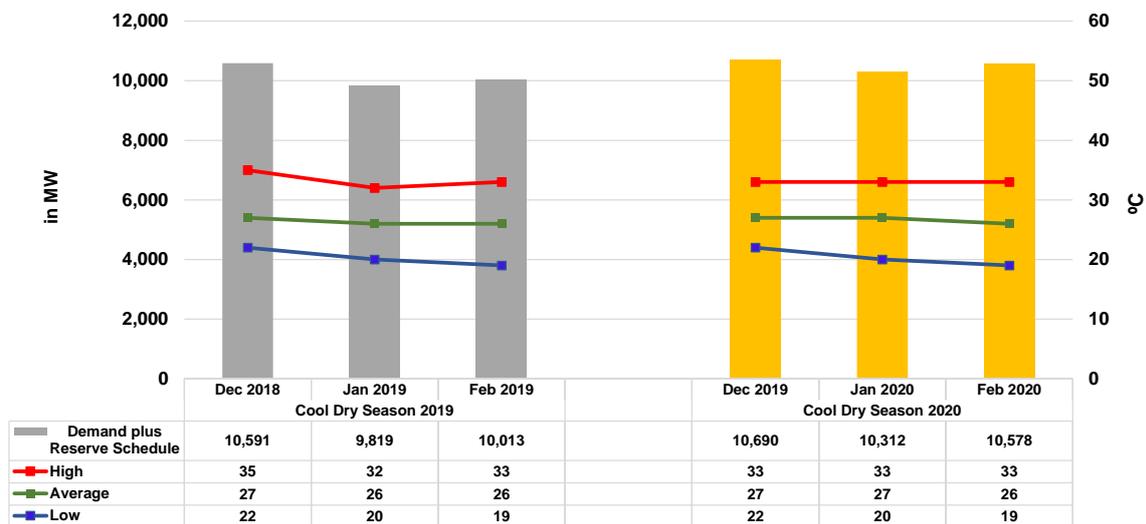


Figure 14. Demand and Temperature

Part IV. Competitiveness Analysis

- The determination of pivotal suppliers is a function of the capacity of the plant and the supply margin available in the given hour.
- Pivotal suppliers are monitored to indicate the level of market power a plant possesses to set prices in the market.
- When the RSI⁷ falls below 100, presence of pivotal supplier is noted.
- Consistent with the relatively tighter supply margin in December 2019 billing month, more frequent presence of pivotal suppliers was noted at about 31 percent of the time compared to mere 7 percent in the previous year (Figure 15).
- On the other hand, RSI falling below 100 during January and February 2020 billing months were much lower related to the wider supply margin in these months compared to previous year.

⁶ https://psa.gov.ph/system/files/Highlights_Q1-2020_NAP.pdf

⁷ The Residual Supply Index (RSI) calculated per generator as the ratio of the effective supply without the generator to the total effective supply. RSI of the whole market is the lowest RSI among all generating plants in the market.

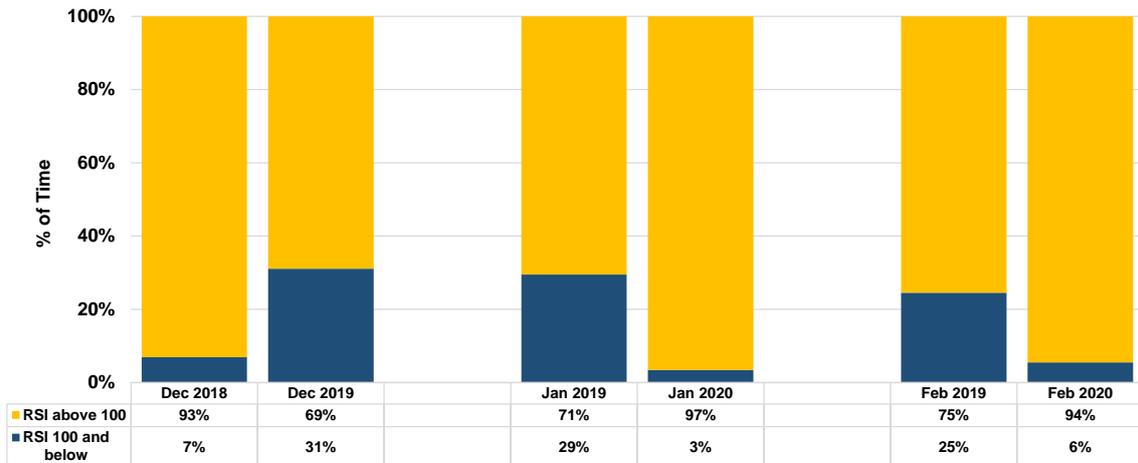


Figure 15. Residual Supply Index

- In December, San Roque HEP, Limay CCGT and Bauang DPP were concurrent pivotal suppliers and price setters at above PhP10,000/MWh during some intervals (Figure 16).

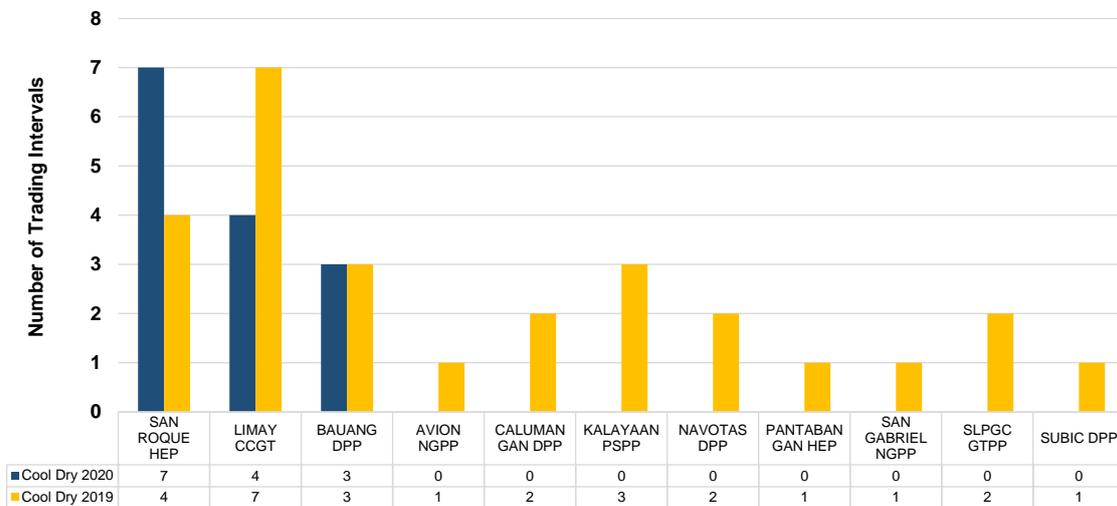


Figure 16. Concurrent Pivotal and Price Setting (at above PhP10,000/MWh) Plants

- Based on registered capacity, four firms namely San Miguel Corporation (SMC), Aboitiz Power (AP), First Gen Corporation (FGC), and Power Sector Asset and Liabilities Management (PSALM) dominated the market share based on registered capacity (Figure 17).
- Semirara Mining Power Corporation followed with only about 5 percent of the market share in registered capacity but with 13 percent share when measured

in terms of spot quantity and total trading amount denoting high exposure to the market at about 56 percent during the cool dry season.

- Similarly, PSALM obtained more than 21 percent of market share based on spot quantity and total trading amount given that 64 percent of its quantities were sold to the spot market.
- Meanwhile, SMC only sold 8 percent of its quantities in the market while FGC sold 15 percent.
- On the other hand, AP was a net buyer during the season due to its purchases in the market to cover its bilateral contracts.
- The HHI calculation indicated a moderately concentrated market when measured in terms of registered capacity, offered capacity, spot quantity and total trading amount. Meanwhile, when measured in terms of actual generation, HHI calculation hovered a little over the 1800-mark indicating a concentrated market.
- Year-on-year, Ayala Corporation (AC) Group obtained a higher market share in terms of registered capacity, from 0.8 percent to 3.6 percent, following the acquisition of shares of PHINMA Energy group which was cleared by the Philippine Competition Commission on 11 April 2019⁸. In addition, Meralco Powergen Corporation (MGEN), obtained 2.2 percent of the market share in terms of registered capacity with the entry of SBPLC CFTPP in April 2019.

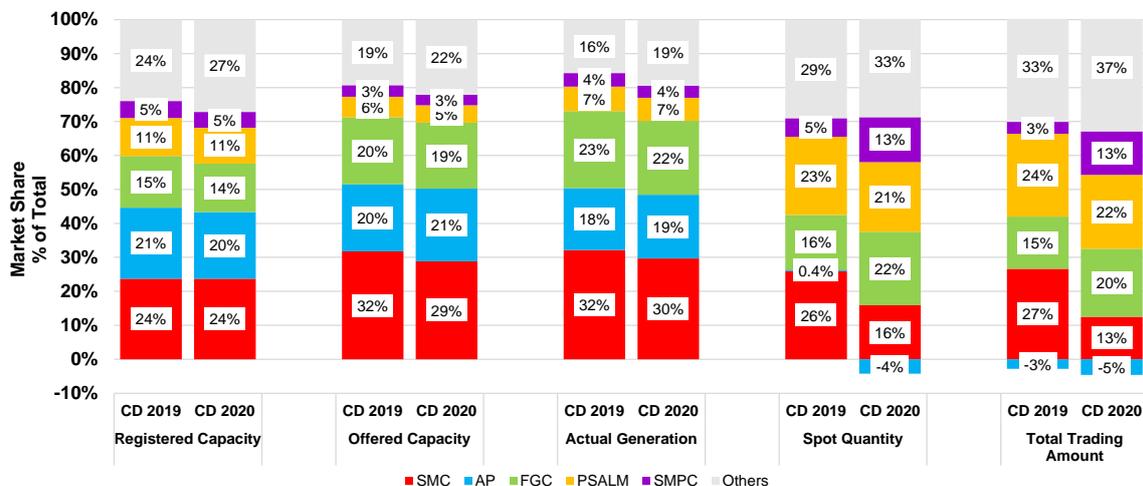


Figure 17. Market Share

⁸ Philippine Competition Commission Decision No. 13-M-007/2019

Part V. Generator Trading Behavior

- Difference Calculation⁹ represents the measure of magnitude of increase or decrease in price offer of a generator, a major participant group (by portfolio), or by plant type.
- In this report, the *Average Reference Price*, which is the weighted average price using the cool dry season 2019 prices, and the *Average Subject Price*, which is the weighted average price using cool dry season 2020 prices, were calculated per trading interval per plant type.
- It is important to note that the total offered capacity for each period may not be equal considering the entry of new plants, capacity on outage, capacity not offered in the market, and changes in registered capacity. In line with this, the *Average Difference* as well as *Percent Difference* is not calculated if either the *Average Reference Price* or *Average Subject Price* is not available.
- The supply curve per plant type (Figures 18 to 22) is established by stacking all the offers of plants, broken down to 1-MW block sizes, under the plant type arranged in monotonically increasing price for each trading interval. The hourly average supply curve is then calculated based on all the supply curves during the period per trading interval.

i. Difference Calculation by Plant Type

- Geothermal plants generally showed almost similar offer prices from previous year this cool dry season with minimal decrease noted for the remaining capacity above 400 MW-mark in the supply curve (Figure 18).
- In terms of the hourly offer profile, offers during trading intervals 0800H to 1500H, were lower this year than last year.

⁹ The methodology for the Offer Pattern Analysis, which is comprised of two parts: Difference Calculation and Outlier Detection, was adopted by the Market Surveillance Committee in order to quantify the amount and evaluate the change in offers and if the same is within or outside the reference levels based on historical data of each generator.

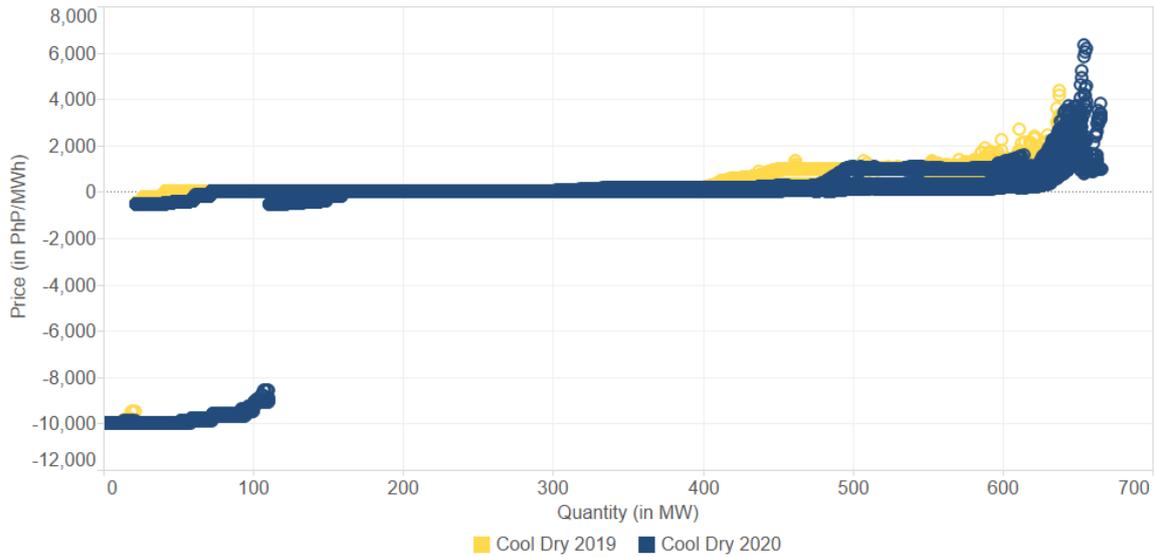


Figure 18. Average Supply Curve – Geothermal

- Coal plants likewise showed a year-on-year decrease in offer prices except for first 500 MW and last 200 MW in the supply curve (Figure 19).
- Notably, offer prices for the 3,000 MW up to 4,000 MW were much lower this year.
- In terms of hourly offer profile, significant decrease was noted from trading intervals 1100H to 2100H.

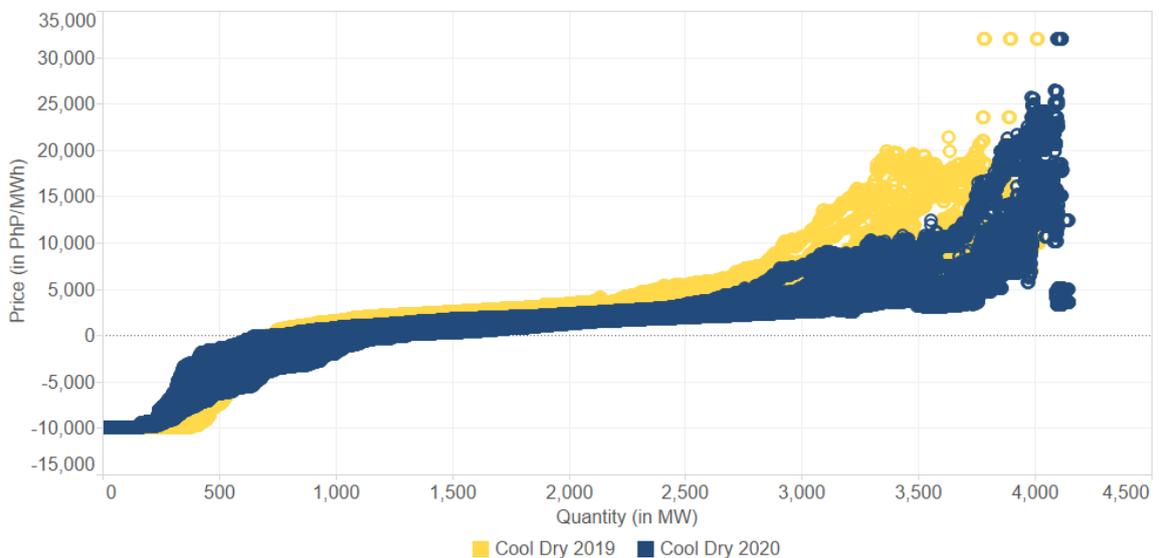


Figure 19. Average Supply Curve – Coal

- Natural gas plants recorded a significant increase in its weighted average offer prices particularly for the remaining capacities above 600 MW in the supply curve (Figure 20).

- Occurrence of 1-MW blocks offered at above PhP10,000/MWh, reaching as high as PhP32,000/MWh, were no longer recorded this year. In addition, capacity offered in the previous year was evidently higher.
- In terms of year-on-year hourly offer price comparison, natural gas plants recorded significant increase in offer prices for trading intervals 0900H to 2100H.

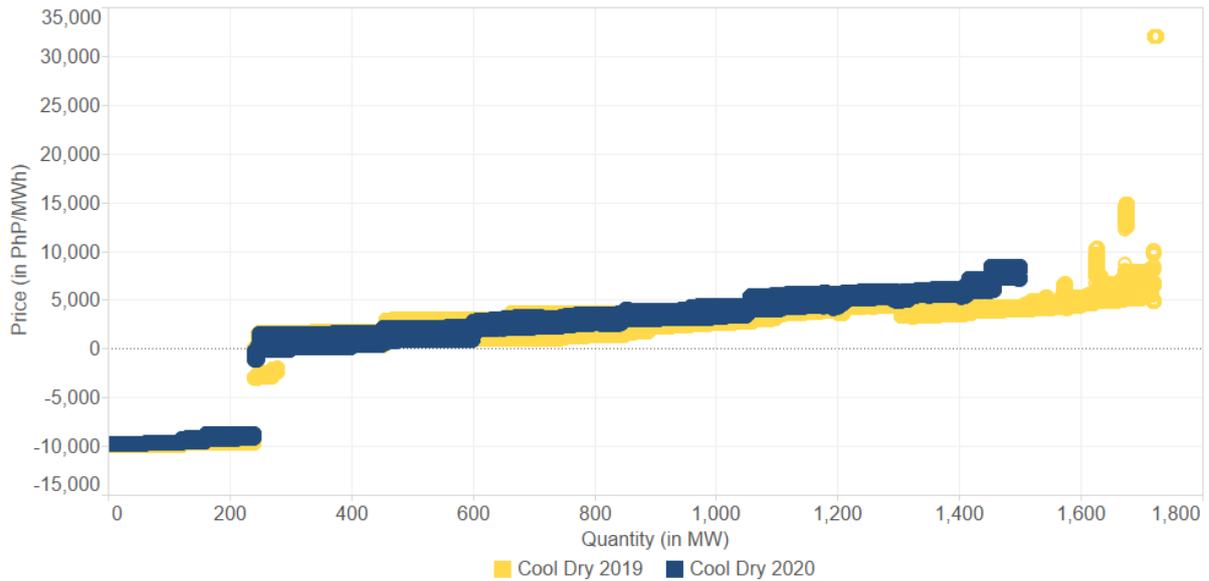


Figure 20. Average Supply Curve – Natural Gas

- Hydro plants demonstrated higher offer prices this year throughout its supply curve with more significant increase in offered capacities above 800 MW (Figure 21).
- Considerable year-on-year increases were noted during trading intervals 0100H to 0800H, 2300H and 2400H.

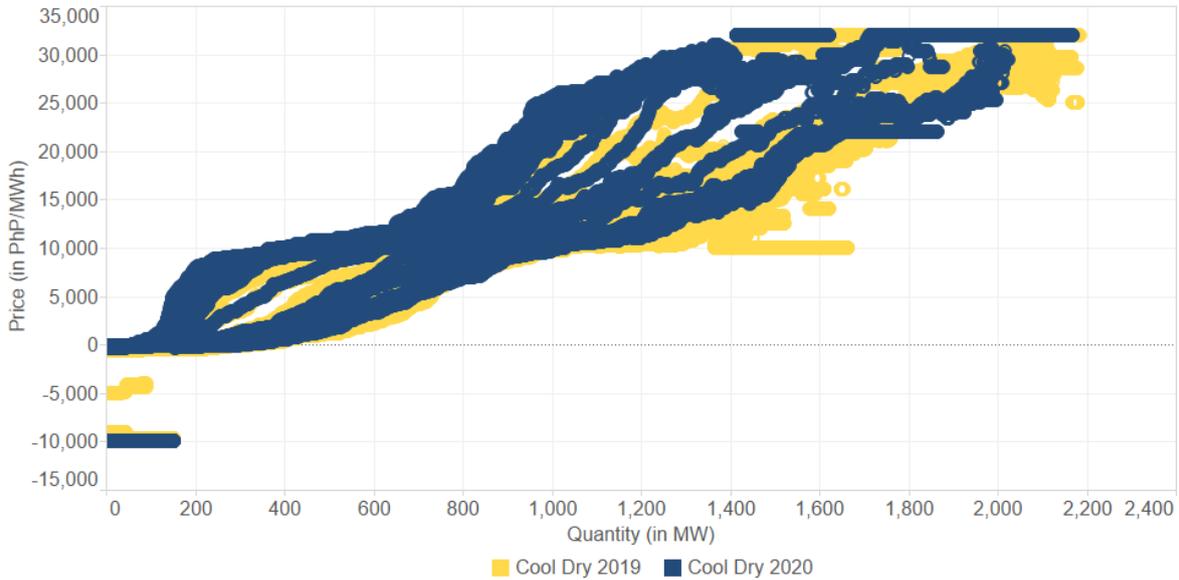


Figure 21. Average Supply Curve – Hydro

- Oil-based plants shifted its offers to lower level this year compared to previous year especially at the 200 MW to 1,000 MW range of the aggregated supply curve (Figure 22).
- In terms of hourly offer profile, the year-on-year decrease was noted throughout the day.

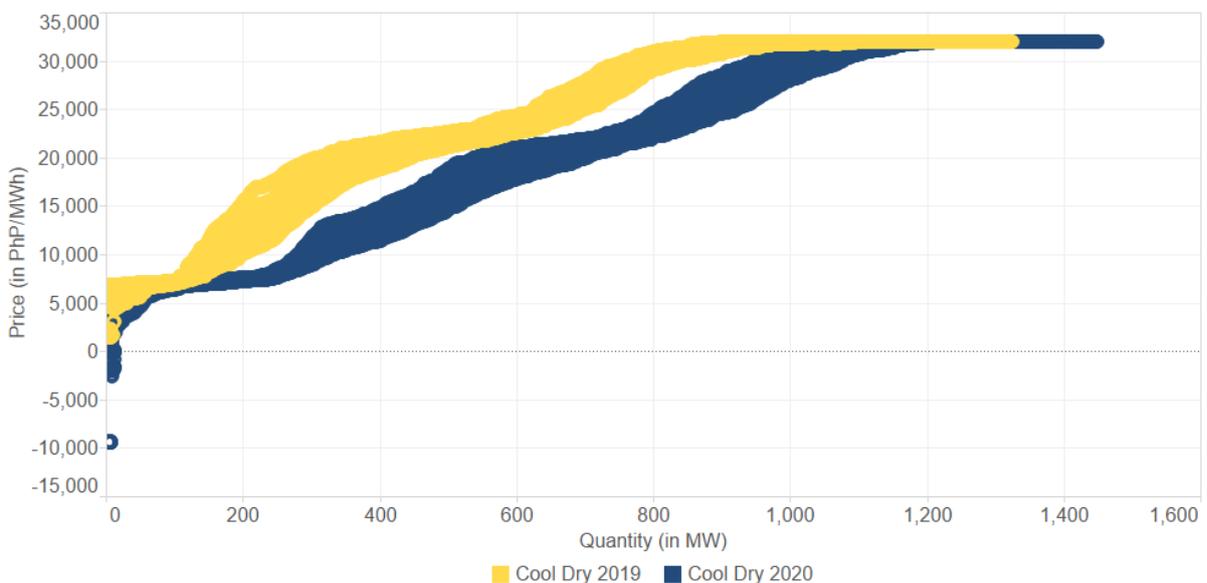


Figure 22. Average Supply Curve – Oil-based

ii. Bid Splitting

- Indication of bid splitting exists when there is significant divergence in offer trend where, often, majority of the capacity is priced at the lower spectrum while the remaining MW is left at the high side.
- Eight (8) plants demonstrated a bid splitting behavior in their offer strategy during the season which affected 1,400 generator-trading intervals.

Part VI. Spot Market Transactions

- Despite the higher market price recorded in December, spot exposure was notably lower during the said month at 13 percent compared to previous year’s 18 percent (Figure 23).

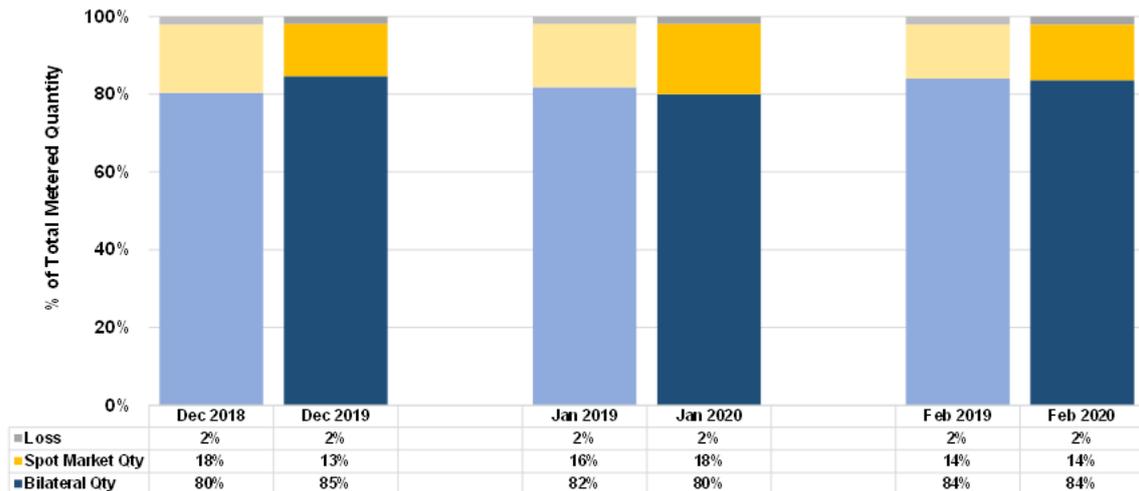


Figure 23. Spot Market Exposure

- Year-on-year comparison of the 24-hour trend of the percent spot exposure of generators was consistent with higher spot exposure during off-peak hours than during peak hours (Figure 24).
- Conversely, prices consistently went up during peak hours and went down during off-peak hours.
- In terms of correlation, the year-on-year decrease in spot exposure for peak hours was consistent with the year-on-year increase in LWAP recorded during these intervals.

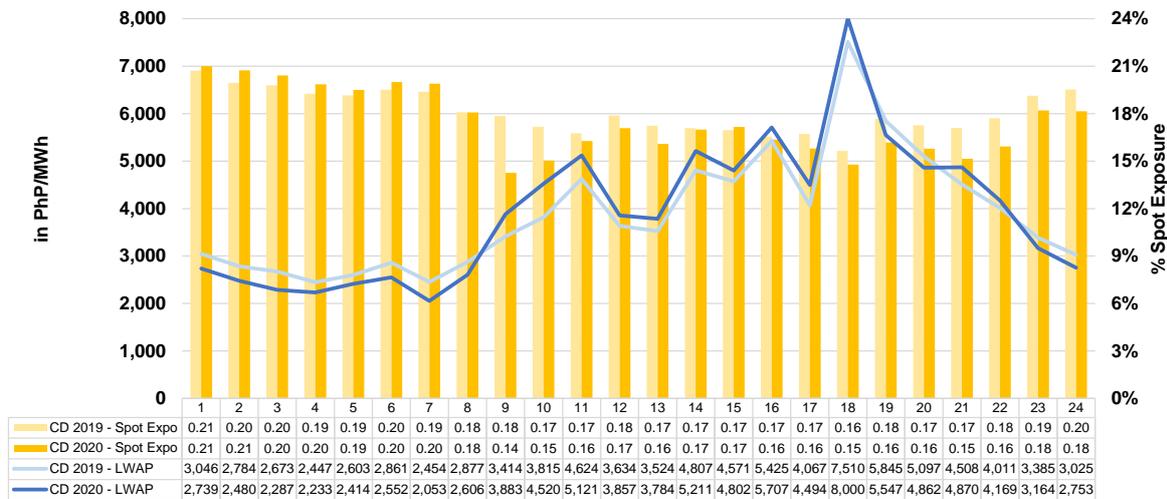


Figure 24. Hourly Spot Market Exposure and Market Price

- Around 75 percent of the spot quantities (per generator per trading interval) were below 200 MWh (Figure 25).
- Occurrences of spot quantities at around 2,000 MWh were noted in December following the over-declaration of bilateral contract quantity (BCQ) of a small-scale solar plant. On the average, a 278,765 percent deviation in the BCQ from the metered quantity was observed during these intervals. Based on IEMOP’s analysis of the incident, the system of the plant operator was not able to convert the value from kWh to MWh. Notwithstanding, the payables were offset with the receivable of the contracted party.

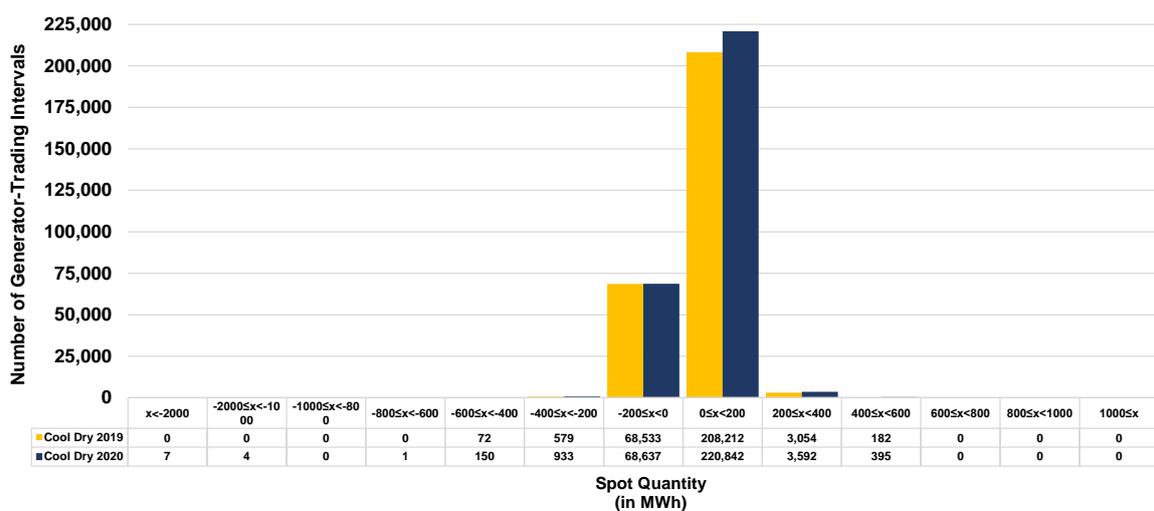


Figure 25. Spot Quantity Frequency Distribution

Part VII. Compliance Monitoring

- Provided in Figure 26 is the breakdown of the registered capacity based on the Compliance Monitoring and Assessment of PEMC’s Enforcement and Compliance Office. Appendix B provides more details of the breakdown of the registered capacity.
- About 67 percent of the total registered capacity in the WESM was offered in the market and/or was found compliant to the Must Offer Rule.
 - High level of compliance was observed involving Luzon’s wind and natural gas plants and sole battery facility as well as Visayas’ wind, coal, geothermal, and hydro plants.
- Outage-related concerns, including instances of de-rating, accounted for 11 percent of the registered capacity.
- Resource constraints, which involved geothermal, solar, and hydro plants, accounted for 6.3 percent.
- Registered capacity of plants which underwent Testing and Commissioning accounted for 4.4 percent.
- Capacities related to provision of Ancillary Services accounted for 4 percent.
- Only 0.3 percent of the registered capacity were non-compliant and were not justified.

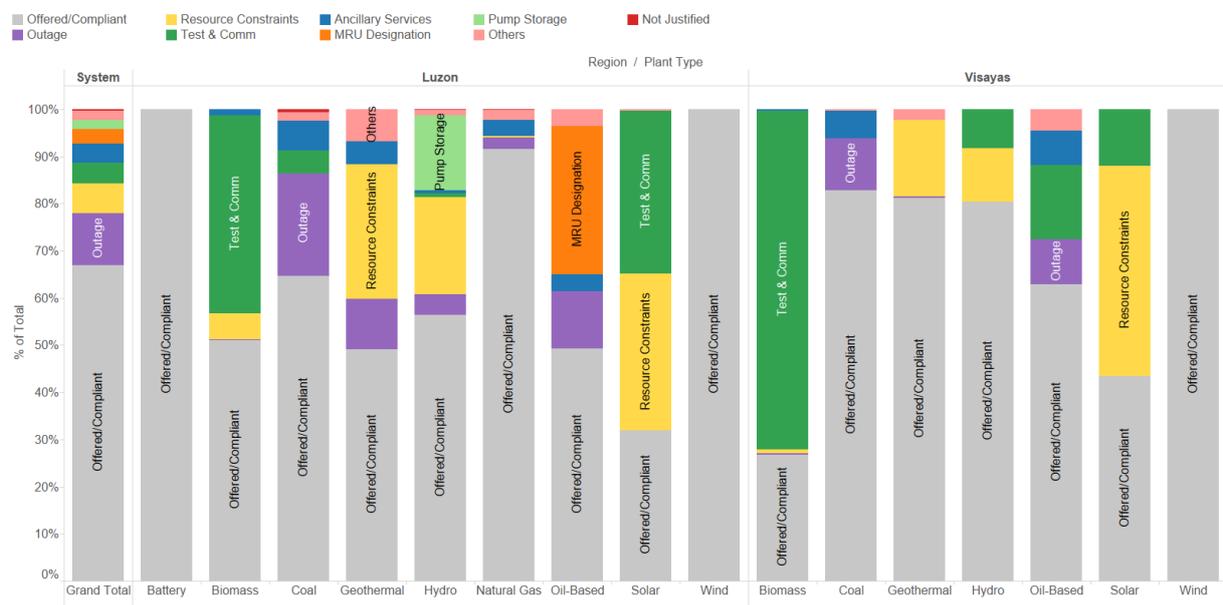


Figure 26. Compliance Monitoring of Capacity per Resource Type

Appendix A. Major Plant Outages

Region	Plant Type	Plant/ Unit Name	Major Participant Group	Capacity (MW)	Date Out	Date In	Duration (Days)	Outage Type	Remarks	Date Commissioned/ Commercial Operation
LUZON	GEO	Makban 6	AP	55	04/11/2013 22:44			Deactivated Shutdown	Conducted gas compressor test	Apr 1979
VISAYAS	GEO	PGPP2 Unit 4	FGC	20	06/27/2014 6:07			Forced Outage	Steam being utilized by Nasulo plant	Aug 1983
VISAYAS	GEO	Upper Mahiao 2	PSALM	32	09/03/2018 6:01	12/13/2019 15:30	466.40	Forced Outage	Tripped	Jul 1997
LUZON	OIL	SLPGC 4	SMPC	25	11/22/2018 11:56	12/11/2019 0:01	383.50	Maintenance Outage	On extended maintenance shutdown until 24 April 2019	Mar 2017
LUZON	GEO	Makban 5	AP	55	02/08/2019 16:08			Forced Outage	Low Steam Supply. Divert Steam Supply to unit 3	Apr 1979
VISAYAS	OIL	PB102 Unit 1	AC	6	04/28/2019 18:16	01/08/2020 16:39	254.93	Forced Outage	Internal fault	Apr 1981
LUZON	OIL	Malaya 1	PSALM	300	05/03/2019 18:21			Forced Outage	Declared unavailable due to motorization of unit generator caused by the non-opening of phase B of PCB 8-05CB08MAL	Aug 1975
LUZON	NATG	Avion 2	FGC	50.3	08/16/2019 0:01	12/26/2019 10:15	132.43	Forced Outage	Gas turbine trouble	Aug 2015
LUZON	COAL	GN Power 1	AP	316	09/20/2019 23:18	12/17/2019 11:14	87.50	Maintenance Outage	To facilitate correction of governor valves	May 2013
VISAYAS	GEO	PGPP1 Unit 1	FGC	37.5	10/04/2019 12:41	12/22/2019 0:06	78.48	Forced Outage	Auto-tripped. ongoing investigation on cause of tripping	Aug 1983
VISAYAS	GEO	Upper Mahiao 4	PSALM	32	10/04/2019 21:46	12/02/2019 17:19	58.81	Forced Outage	Affected by tripping of 138kV Colon-Calungcalung Line 1 and 2	Jul 1997
LUZON	COAL	Calaca 2	SMPC	300	10/17/2019 23:49			Planned Outage	Maintenance Outage until 02 March 2020	Sep 1984
LUZON	GEO	Makban 1	AP	63	10/21/2019 13:56	12/04/2019 6:03	43.67	Planned Outage	Annual Overhauling	Apr 1979
LUZON	COAL	Masinloc 2	SMC	344	10/30/2019 23:34	12/02/2019 16:31	32.71	Planned Outage	Planned Outage(GOP)	Jun 1998
LUZON	GEO	Tiwi 1	AP	59	10/31/2019 23:54			Forced Outage	Low steam supply. Divert steam supply to unit 2	Jan 1979
VISAYAS	GEO	Mahanagdong A	PSALM	5	11/05/2019 5:07	12/03/2019 1:19	27.84	Forced Outage	To facilitate replacement of exciter busted diode. ETD-- 07 Nov 2019 at 0500H.	Jul 1997
VISAYAS	GEO	Upper Mahiao 1	PSALM	32	11/07/2019 15:24	12/03/2019 0:09	25.36	Forced Outage	Ground fault.	Jul 1997
VISAYAS	GEO	Leyte 1	FGC	41	11/07/2019 19:52	11/30/2019 10:21	22.60	Forced Outage	Lube oil trip. block pressure low.	Jun 1983
LUZON	OIL	Limay 2	MEI	60	11/09/2019 0:05	01/03/2020 9:20	55.39	Planned Outage	Planned Outage	May 1993
VISAYAS	GEO	Upper Mahiao 3	PSALM	32	11/15/2019 0:31	11/29/2019 7:54	14.31	Maintenance Outage	Corrective maintenance for turbine bearing high vibration scheduled until Nov. 18	Jul 1997
LUZON	COAL	Pagbilao 3	AP	420	11/16/2019 0:59	12/25/2019 2:03	39.04	Planned Outage	Planned Outage (GOP)	Jul 2017
LUZON	COAL	SLTEC 2	AC	122.9	11/18/2019 0:01	01/04/2020 10:29	47.44	Planned Outage	Planned Outage until 22 December 2019 (GOP).	Aug 2015
LUZON	OIL	Limay 4	MEI	90	11/18/2019 0:01	01/05/2020 17:48	48.74	Planned Outage	Maintenance Outage until 18 December 2019	May 1993
LUZON	GEO	Tiwi 6	AP	57	11/18/2019 6:08	11/28/2019 0:17	9.76	Maintenance Outage	Maintenance Outage (APRI requested) until 25 November 2019..	Jan 1979
LUZON	HYD	Kalayaan 4	PSALM	180	11/19/2019 0:01	12/10/2019 1:12	21.05	Planned Outage	Planned Outage until 10 December 2019	May 2004
LUZON	HYD	Kalayaan 3	PSALM	180	11/19/2019 0:01	12/08/2019 4:02	19.17	Planned Outage	Planned Outage until 06 December 2019	May 2004
VISAYAS	GEO	Mahanagdong B	PSALM	5	11/19/2019 10:41	12/27/2019 19:35	38.37	Forced Outage	Due to condenser level high.	Jul 1997
LUZON	COAL	Sual 1	GBPC	647	11/23/2019 7:45	12/17/2019 19:20	24.48	Planned Outage	Planned Outage	Oct 1969
VISAYAS	COAL	TPC Sangi 1	GBPC	60	11/26/2019 3:18	12/17/2019 1:39	20.93	Forced Outage	Tube leak	Dec 2013
LUZON	GEO	Bacman 1	FGC	60	12/02/2019 9:13	12/17/2019 0:17	14.63	Forced Outage	Due to Typhoon Tisoy	Sep 1993
LUZON	GEO	Bacman 3	FGC	20	12/02/2019 10:11	12/16/2019 15:55	14.24	Forced Outage	Due to Typhoon Tisoy	Sep 1993
LUZON	GEO	Bacman 2	FGC	60	12/02/2019 10:13	12/16/2019 10:44	14.01	Forced Outage	Due to Typhoon Tisoy	Sep 1993
LUZON	GEO	Tiwi 6	AP	57	12/02/2019 10:26	12/16/2019 16:46	14.26	Forced Outage	Due to typhoon Tisoy	Jan 1979
LUZON	GEO	Tiwi 2	AP	59	12/02/2019 10:35	12/16/2019 18:29	14.33	Forced Outage	Due to typhoon Tisoy	Jan 1979
LUZON	GEO	Tiwi 5	AP	57	12/02/2019 11:45	12/16/2019 8:51	13.88	Forced Outage	On house load operation due to typhoon Tisoy	Jan 1979
VISAYAS	GEO	Upper Mahiao 3	PSALM	32	12/05/2019 0:07			Forced Outage	Emergency shutdown requested by customer to facilitate rotor transfer to Unit 2	Jul 1997
VISAYAS	GEO	Upper Mahiao 4	PSALM	32	12/05/2019 3:45	12/25/2019 13:01	20.39	Forced Outage	Loss of 125 DC supply in the control valve	Jul 1997
LUZON	COAL	SMC 2	SMC	150	12/06/2019 2:15	01/02/2020 12:13	27.42	Planned Outage	Planned Outage until 20 December 2019 (GOP)	Mar 2017
LUZON	COAL	Calaca 1	SMPC	300	12/06/2019 17:01	12/22/2019 22:07	16.21	Forced Outage	Emergency shutdown due to boiler tube leak	Sep 1984
LUZON	GEO	Makban 7	AP	20	12/07/2019 21:33	01/18/2020 16:52	41.80	Forced Outage	High Turbine Bearing vibration.	Apr 1979
LUZON	GEO	Makban 8	AP	20	12/10/2019 18:10	01/18/2020 21:39	39.15	Maintenance Outage	Maintenance outage.	Apr 1979
LUZON	OIL	SLPGC 3	SMPC	25	12/11/2019 23:00	12/26/2019 14:00	14.63	Maintenance Outage	Maintenance outage until December 27 2019	Mar 2017
LUZON	OIL	SLPGC 4	SMPC	25	12/11/2019 23:53	12/26/2019 14:01	14.59	Maintenance Outage	Maintenance outage until December 27 2019	Mar 2017
LUZON	OIL	Malaya 2	PSALM	350	12/13/2019 0:01	12/31/2019 16:01	18.67	Maintenance Outage	Maintenance outage until 31 December 2019	Apr 1979
LUZON	OIL	SLPGC 1	SMPC	150	12/13/2019 0:04	02/12/2020 10:14	61.42	Planned Outage	Maintenance Outage	Jan 2015
VISAYAS	OIL	PB102 Unit 4	AC	6	12/16/2019 17:51	01/02/2020 19:01	17.05	Forced Outage	High exhaust gas temperature	Apr 1981
VISAYAS	COAL	TPC Sangi 1	GBPC	60	12/17/2019 6:05			Forced Outage	Generator differential trip	Dec 2013
VISAYAS	COAL	Masinloc 1	SMC	315	12/19/2019 23:53	01/02/2020 22:01	13.92	Maintenance Outage	Maintenance outage until December 24 2019	Jun 1998
VISAYAS	COAL	CEDC 2	GBPC	82	12/21/2019 8:53			Maintenance Outage	SAF motor replacement	Jun 2010
VISAYAS	GEO	Mahanagdong A	PSALM	5	12/25/2019 10:31	02/04/2020 0:15	40.57	Forced Outage	Under assessment	Jul 1997
LUZON	COAL	Masinloc 3	SMC	335	12/28/2019 16:02	01/03/2020 19:23	6.14	Forced Outage	Tripped at 125MW load. On commissioning Test.	Mar 2019
LUZON	COAL	ANDA 1	APC	72	12/30/2019 0:06	01/19/2020 0:53	20.03	Maintenance Outage	Maintenance Outage until 19 January 2020.	Apr 2015
VISAYAS	COAL	PEDC 3	GBPC	150	12/31/2019 19:35	01/29/2020 22:58	29.14	Forced Outage	Coal feeder A and B problem. Scheduled for APMS at 2001H	Aug 2016
LUZON	COAL	SMC 1	SMC	150	01/03/2020 4:27	02/06/2020 18:40	34.59	Maintenance Outage	Maintenance Outage until 22 January 2020.	Nov 2016
LUZON	NATG	San Gabriel	FGC	420	01/04/2020 0:48	01/24/2020 23:13	20.93	Planned Outage	Planned Outage until 18 January 2020.	Mar 2016
LUZON	OIL	Limay 1	MEI	60	01/06/2020 0:01	02/23/2020 9:32	48.40	Planned Outage	Maintenance Outage until 20 February 2020	May 1993
VISAYAS	GEO	Mahanagdong B	PSALM	5	01/06/2020 21:02	02/04/2020 0:21	28.14	Forced Outage	AVR power fail indication.	Jul 1997
LUZON	COAL	GN Power 2	AP	316	01/07/2020 0:12			Planned Outage	Planned Outage until 23 February 2020	May 2013
VISAYAS	OIL	Bohol 2	SPC	4	01/08/2020 16:59	01/15/2020 13:56	6.87	Forced Outage	Fuel oil leak on cylinder 4	Sep 1978
LUZON	COAL	QPPL	QPPL	460	01/17/2020 23:58	02/20/2020 10:55	33.46	Planned Outage	Planned outage as per GOP	May 2000
LUZON	OIL	Limay 5	MEI	60	01/18/2020 0:07	01/23/2020 10:45	5.44	Planned Outage	Planned outage as per GOP.	Dec 1994
LUZON	GEO	Makban 1	AP	63	01/18/2020 23:08	02/01/2020 14:42	13.65	Forced Outage	Low Steam Supply.	Apr 1979
LUZON	COAL	SMC 2	SMC	150	01/19/2020 12:57	01/25/2020 15:51	6.12	Forced Outage	Boiler Tube Leak.	Mar 2017
LUZON	COAL	SBPL	MGEN	455	01/27/2020 20:48	02/16/2020 19:39	19.95	Forced Outage	Boiler de-sludging	Apr 2019
VISAYAS	OIL	CENPRI 3	Other IPPs	4.2	01/28/2020 13:01	02/19/2020 12:01	21.96	Forced Outage	Unable to cut-in due to PLC IO module problem	Mar 2016
VISAYAS	COAL	CEDC 3	GBPC	82	01/30/2020 0:52	02/19/2020 22:37	20.91	Planned Outage	APMS	Jan 2011
VISAYAS	GEO	Upper Mahiao 4	PSALM	32	02/02/2020 14:27			Forced Outage	Emergency cut-out.	Jul 1997
VISAYAS	GEO	Upper Mahiao 1	PSALM	32	02/02/2020 14:32	02/08/2020 13:23	5.95	Forced Outage	Emergency cut-out.	Jul 1997
LUZON	HYD	San Roque 3	SMC	145	02/03/2020 0:01	02/14/2020 0:01	11.00	Planned Outage	Maintenance Outage until 15 February 2020	May 2003
VISAYAS	GEO	Mahanagdong A	PSALM	5	02/04/2020 0:11			Forced Outage	Annual PMS of 230kV bus bar.	Jul 1997
VISAYAS	GEO	Mahanagdong A	PSALM	5	02/04/2020 0:15	02/12/2020 3:37	8.14	Forced Outage	Annual PMS.	Jul 1997
LUZON	HYD	Caliraya 1	PSALM	14	02/10/2020 0:01	02/15/2020 23:16	5.97	Maintenance Outage	Maintenance outage 15 February 2020	Oct 2002
LUZON	HYD	Caliraya 2	PSALM	14	02/10/2020 0:01	02/15/2020 23:16	5.97	Maintenance Outage	Maintenance outage 15 February 2020	Oct 2002
LUZON	COAL	SMC 4	SMC	150	02/10/2020 23:25			Planned Outage	Maintenance outage until 02 March 2020	Sep 2018
LUZON	HYD	Kalayaan 1	PSALM	180	02/13/2020 23:01			Forced Outage	Declared unavailable due to heavy water leak at perstock	Aug 1982
LUZON	HYD	Kalayaan 2	PSALM	180	02/13/2020 23:01			Forced Outage	Declared unavailable due to heavy water leak at perstock	Aug 1982
VISAYAS	GEO	Upper Mahiao 2	SMC	32	02/14/2020 16:04			Forced Outage	cut-in to the system	Jul 1997
LUZON	COAL	Masinloc 3	SMC	335	02/14/2020 23:36	02/24/2020 9:03	9.39	Planned Outage	Tripped while on house load operation started at 2334H.	Mar 2019
LUZON	NATG	Sta. Rita	FGC	257.3	02/15/2020 0:53	02/23/2020 3:29	8.11	Maintenance Outage	On Maintenance Outage	Jun 2000
LUZON	HYD	Kalayaan 3	PSALM	180	02/15/2020 1:22	02/21/2020 15:26	6.59	Forced Outage	On emergency shutdown due to Tubine bearing temp. high.	May 2004
LUZON	COAL	ANDA 1	APC	72	02/16/2020 13:17	02/22/2020 2:48	5.56	Forced Outage	Emergency shutdown due to high furnace pressure	Apr 2015
LUZON	OIL	SLPGC 4	SMPC	25	02/19/2020 7:01	02/25/2020 8:08	6.05	Forced Outage	Declared unavailable due to AVR diagnostic test	Mar 2017
LUZON	COAL	SLPGC 2	SMPC	150	02/19/2020 23:57			Planned Outage	Maintenance outage.	Jan 2015
LUZON	COAL	Pagbilao 1	AP	382	02/20/2020 19:31			Forced Outage	Tripped off due to Boiler tube leak.	Mar 1996
LUZON	COAL	SLTEC 1	AC	121	02/21/2020 23:50			Planned Outage	Maintenance Outage until 07 March 2020	Sep 2014
LUZON	OIL	Limay 1	MEI	60	02/23/2020 10:47			Forced Outage	Combustion problem.	May 1993
LUZON	COAL	SMC 2	SMC	150	02/25/2020 12:41			Forced Outage	Emergency shutdown to rectify the observed hotspot on the connectors of SPC Unit 2	Mar 2017

Appendix B. Details of ECO Compliance Monitoring

Region	Plant Type	OUTAGE							OTHERS						Not Justified	TOTAL
		Offered/ Compliant	Outage and Component Outages	De-Rating	Resource Constraints	Testing and Commissioning	Ancillary Services	Designated MRU Per DC2014-01- 0003	Pump Storage	Pending Legal Req., Regulatory, Force Majure, etc.	Co- generation	Security Limit	Start-Up/ Shutdown Process	Transmission- Related Constraints		
Luzon	Battery	100%														100%
	Biomass	51%	0.1%		5.4%	42.0%	1.3%									100%
	Coal	65%	20.4%	1.2%		4.9%	6.4%			0.1%	1.1%	0.2%	0.3%	0.0%	0.7%	100%
	Geothermal	49%	10.6%	0.0%	28.5%		4.8%			6.7%	0.2%	0.0%		0.0%		100%
	Hydro	56%	4.4%	0.1%	20.5%	0.9%	0.6%		15.9%	0.0%		1.0%		0.1%		100%
	Natural Gas	92%	2.0%	0.4%	0.3%		3.5%			1.7%		0.3%	0.1%		0.2%	100%
	Oil-Based	49%	6.8%	5.4%				31.5%		1.0%	0.1%	2.4%		0.0%		100%
	Solar	32%	0.0%		33.4%	34.5%						0.3%			0.0%	100%
	Wind	100%														100%
Visayas	Biomass	27%	0.3%		0.8%	71.8%	0.3%									100%
	Coal	83%	9.6%	1.5%			5.9%				0.1%	0.2%				100%
	Geothermal	81%	0.3%	0.1%	16.1%					2.2%		0.0%		0.1%		100%
	Hydro	80%			11.4%	8.3%										100%
	Oil-Based	63%	8.9%	0.7%		15.7%	7.3%			4.5%		0.0%		0.0%		100%
	Solar	43%			44.6%	12.0%										100%
	Wind	100%														100%
Grand Total	67%	9.9%	1.2%	6.3%	4.4%	4.0%	3.1%	2.0%	0.9%	0.4%	0.5%	0.1%	0.0%	0.3%	100%	

