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MARKET STRUCTURE ISSUES IN THE PHILIPPINE POWER GENERATION SECTOR

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The recent literature on market power experiences in wholesale electricity markets is quite informative on the issue of the relationship between structure and firm behavior, in particular the exercise of market power by supplier firms. Given the nature of electricity markets, traditional concentration measures do not capture the aspects of market structure that provide incentives for players to unilaterally keep prices above competitive levels. This finding is of particular relevance to the Philippines, given that the country has embarked on a comprehensive restructuring of its power sector and had begun the operations of a wholesale electricity spot market in Luzon in 2006, with plans to implement the same in the Visayas in the near future. Analysis of supply (capacity) margins reveals market power potential in Visayas and Mindanao that are not flagged by concentration-based market power screens embodied in present regulations. Further analysis and modeling of spatial competition that can lead to local market power as suggested by the dominant firm-fringe competition model is recommended to be undertaken urgently by the regulator.

I. INTRODUCTION

The Philippines has embarked on a comprehensive restructuring of its power sector. The primary aims of the restructuring are to increase private sector participation in power sector activity and investments as well as to enhance industry efficiency.

The blueprint and enabling mechanisms for the restructuring are contained in R.A. 9136 or the Electric Power Industry Reform Act of 2001 (EPIRA).

From a vertically integrated industry, the power sector has been "unbundled" into its main components: generation, transmission, distribution and supply. EPIRA kept transmission and distribution as regulated activities but mandated that generation and supply shall be open and competitive sectors. The second major reform embodied in the EPIRA is the privatization of the generation assets (tangible as well as contracts with Independent Power Producers) of the National Power Corporation.

Because of the nature of electricity production, the potential for market power abuse in the sector is real. Market power abuses result in wealth transfers from consumers to producers and an overall welfare loss to the economy. Thus, monitoring and prevention of market power abuse is an important task of the power sector regulator.

This study analyzes the market structure of the Philippine generation sector using traditional concentration measures and supply margins. This determination is an essential first step in analyzing the potential for market power abuse in the Philippine generation sector.

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II. SIGNIFICANCE OF THE STUDY

The potential for market power abuse in a deregulated power sector was demonstrated most vividly by the California electricity crisis at the onset of this century. The experience spurred a flurry of investigation and research on the issue by federal and state regulators as well as academics, both in the U.S. and abroad. The California crisis revealed that competition and antitrust regulation as well as market power screens in place at that time were not sufficient to flag nor prevent the exercise of market power by a number of generation companies.

With the passage of EPIRA in 2001, the Philippines began its own process of power industry restructuring and deregulation. While greater reliance on competition and market forces in the generation sector was expected to increase efficiency and enhance investment, it also opened up the real possibility of market power abuse and consequent harm to consumers.

In fact, not more than three (3) months after the Wholesale Electricity Spot Market (WESM) officially began operations in Luzon in June 2006, allegations of anti-competitive behavior serious enough to require formal investigation were hurled at one of the market participants, the Power Sector Assets and Liabilities Management (PSALM) Corporation.[1] While the charges were eventually dismissed by the Energy Regulatory Commission, the fact remains that not all the conditions for perfect competition in generation were present when WESM operations started. As this situation has not substantially changed to date, the issue of market structure in generation continues to be a relevant one in efforts to ensure that anti-competitive behavior in the sector is prevented from occurring to the extent possible.

Cognizant that supplier concentration is a factor that could lead to market power abuse, Philippine lawmakers provided in EPIRA limits on the ownership of generation. Specifically, EPIRA Sec. 45 (a) states that:

> "No person, company, related group or IPP administrator, singly or in combination, can own, operate or control more than thirty percent (30%) of the installed capacity of a grid and/or twenty-five percent (25%) of the national installed generating capacity…"

As this study will attempt to show, however, ownership limitation is not sufficient to prevent potential market power abuse in electricity. Present regulations must be augmented by other measures to help regulators identify the existence of market power and promote true competition in the country's generation sector.

III. THEORETICAL FRAMEWORK

The Structure-Conduct-Performance (SCP) approach of Industrial Organization theory posits that there are important interrelationships between and among market structure, behavior, and performance of market participants.

While studies investigating the relationship between concentration and performance have established "at best weak evidence of a link between concentration and various proxies for barriers to entry and measures of market performance"[2], it has been found as well that many of these studies have had serious conceptual and measurement flaws (Carlton and Perloff, 2000).

The foregoing notwithstanding, a number of antitrust and anti-competition regulation, including those governing power markets in many jurisdictions, continue to use various

'traditional' measures of concentration in screening for the potential for market power abuse (e.g., market share indices). As explained in the next section, the nature of electricity markets, however, prevents these traditional measures of concentration from doing an effective job of screening for the existence of market power particularly in the generation sector.

Thus, this study also uses supply margin analysis in evaluating the potential for market power abuse in generation. Supply margin analysis identifies electricity suppliers whose capacity is greater than the market's surplus capacity above peak demand; i.e., the market's supply margin. These firms are pivotal in meeting peak demand in the market and consequently are capable of exercising market power. They can do this by offering an extremely high price (theoretically infinite) when supply is tight (such as during the peak hours). Since their capacity is required to meet demand, they are sure to be dispatched at their offer price, thereby becoming the price setter at that particular trading interval.

While SMA is likely to tag the larger gencos as being pivotal suppliers, supply inelasticity at full output can enable even 'small' firms to exercise some degree of market power (Stoft, 2001). 'Small' gencos can also become pivotal suppliers when supply conditions change, such as when supply constricts due to unexpected generation outages and preventive maintenance shutdowns. Given that the WESM prices are set at different locational nodes, pivotal suppliers may also be determined by transmission constraints that effectively act as barriers to entry in certain areas of the electricity network.

The usefulness of SMA is predicated on the assumption that the dominant firm with competitive fringe model better characterizes some electricity markets than the model of perfect competition. The former considers the physical and technological constraints that are inherent in electricity markets and which may prevent generation from being perfectly competitive. Generation firms whose capacities are needed to meet peak demand are "dominant firms" in this model and they can become price setters since they will have to be dispatched if system equilibrium is to be achieved. These firms may pass the market share limits in present regulation but are identifiable using SMA. They are not necessarily large since transmission constraints can also cause some small firms to be pivotal suppliers in their area when locational or nodal pricing is adopted, such as in the Philippine case. Thus, the source of "dominance" of a generation company may be size and/or location.

Both size and location as reasons for the existence of a "dominant firm" are expected to exist in the Philippines. A good number of the country's plants were built at a time when the technology was not advanced enough to make small-scale generation as cost-effective as building larger plants. There are also several documented cases of transmission constraints that had prevented some gencos from being dispatched at optimum levels or which had resulted in nodal prices in some areas of the network that were much higher than elsewhere in the grid. The dominant firm with competitive fringe model predicts that, despite the existence of a number of competing firms in its market, the dominant firm may be able to exercise some monopoly power, especially if there are barriers to entry in the market.

The model has important implications on the type of structure-based market power screen that may work better in alerting regulators to the possibility of market power in the generation sector.

IV. REVIEW OF LITERATURE

The concern over anti-competitive behavior and market power abuse is not limited to electricity markets. At least in Germany and in the U.S., regulators are quick to respond to potential market power abuse. Regulation in these countries uses concentration measures as presumptive evidence of a potential market power concern (Matthes, 2005).

Market power as an issue in electricity markets is relatively recent, as deregulation and restructuring of what were historically considered monopoly endeavors are phenomena that appear to have begun only in the 1980s.[3]

As countries broke down their vertically-integrated utilities and allowed the generators more control over their activities, it is not surprising that they adopted similar metrics to flag potential market power problems. The Singapore Energy Market Authority, for example, used the Herfindahl-Hirschman Index[4] to trigger the need for an approval process for a merger transaction of its generation companies (EMA, 2004). The U.S. Federal Energy Regulatory Commission used, among others, a market share test to determine whether a generation company can be allowed to be a market-based (as against a regulated, cost-of-service) participant (107 FERC 61,018). A survey of levels of concentration in Europe used the HHI and 4- and 8-firm concentration ratios and concluded that high concentration levels in most of the European states required stricter competition rules to curb market dominance (Matthes, 2005).

The California power crisis, which saw wholesale electricity prices in the state rise from an average of $33/mwh in 1998 and 1999 (the first two years of restructuring) to more than $310/mwh in the two years succeeding with coincident rolling blackouts to boot, also sparked a flurry of research (not to mention a Congressional inquiry). Most of the studies found evidence of market power[5] and estimated taxpayer costs/inefficiencies/wealth transfers in the range of $6.2 billion (GAO, 2002) to $20 billion (Wolak, 2003a).

That the apparent incidence of market power abuse was accompanied by a decline in concentration given the requirement of generation disinvestment by California's public utilities was not lost on the researchers who studied the state's crisis. Such was also apparently found to be the case in England and Wales, although not to the crisis-extent that California experienced (Sweeting, 2001).

Wolak (2003b), among others, cited several key features of electricity markets that render it particularly vulnerable to market power and have implications on the adequacy of traditional measures of supplier concentration in identifying the potential for market power abuse:

> "It is difficult to conceive of an industry more susceptible to the exercise of market power than electricity. It possesses virtually all of the product characteristics that enhance the ability of suppliers to exercise unilateral market power. Supply must equal demand at every instant in time and each location of the network. It is very costly to store and the product is subject to extreme capacity constraints in the sense that it is impossible to get more than a pre-specified amount of energy from a given generation unit in an hour. Delivery of the product must take place through a potentially congested transmission network. Historically, how it has been priced to final consumers makes the wholesale demand extremely inelastic, if not perfectly inelastic, with respect to the wholesale price. The technology of electricity production historically favored large generation facilities… All of these factors (also) make

> wholesale electricity markets substantially less competitive the shorter the time lag is between the date the sale is negotiated and the date delivery of electricity occurs."[6]

These findings led the US Federal Energy Regulatory Commission (FERC) to adopt a second market power screen, the so-called "Supply Margin Analysis" or SMA (107 FERC 61,018). Further, both the market share and the SMA tests are prescribed to be 'indicative' rather than 'definitive' market power screens, and a genco which fails these screens is allowed to rebut the presumption of market power with additional information or voluntarily subject itself to cost-of-service regulation.

This study contributes to the growing literature on market structure in power generation. It determines the concentration of suppliers in each of the major grids in the Philippines using modified HHI and concentration ratios. SMA is also undertaken to determine the existence of pivotal suppliers (dominant firms) that can potentially exercise market power in the wholesale electricity spot market.

V. RESEARCH METHODOLOGY

The present study calculates concentration ratios (i.e., the Herfindahl-Hirschman Index and the 4- and 8-firm ratios) using installed capacities of Philippine generation companies or plants as of December 2004[7]. Up until 2006, the government-owned National Power Corporation accounted for 75% of power generated in the country, and data on individual power plant 'sales' needed to construct the HH index and concentration ratios using market share are not available. Installed capacity is the next best option for calculating concentration in the power sector since during periods of peak demand when market power is most problematic, installed capacity will be numerically close to the economic definition of market share (Stoft, 2001).

The relevant markets are the major grids defined in EPIRA; i.e., Luzon, Visayas and Mindanao[8].

Supply margins using 2004 data in the identified markets are also computed. As discussed earlier, the inelasticity of supply at full output coupled with congestion or other transmission constraints that act as barriers to entry may produce a 'pivotal supplier' with potential market power. The supply margin is the amount of capacity that is equal to the market's surplus capacity above peak demand. It is computed by subtracting total installed capacity from 110% of peak demand.[9][10] High supply margins manifest excess capacity in the market and less ability to exercise market power. Conversely, low supply margins indicate tight capacity that may allow some generation companies with capacities exceeding the supply margin to exercise market power during peak hours.

Given their ability to collude, privately-owned generation capacities owned or controlled by affiliated groups are combined in the analysis.

VI. FINDINGS

Based on standards used by the US Department of Justice[11], the Luzon and Mindanao markets are unconcentrated, with HHI[12] well below the threshold of 1,000. The Visayas market exhibits moderate concentration (see Table 1).

While Luzon has 70 "plants"[13], the 20 largest plants account for 98% of the HHI. Visayas has 20 plants, the largest of which accounts for 76% of the HHI. Mindanao has 22 plants, half of which account for 92% of the HHI (see Appendix A).

Table 1
Concentration Ratios in the Philippine Generation Sector

	Modified HHI	Modified CR 4	Modified CR 8
Luzon	487.01	33.33	50.46
Visayas	1,655.20	63.06	78.13
Mindanao	803.32	47.62	69.89

Table 2 presents the supply margin analysis for the three major grids of the country. System peak is forecast beginning 2005 and is based on the projections of the National Transmission Corporation. 2004 installed and dependable capacities are from the Department of Energy, and forecast additions are based on a presentation of former DOE Secretary P. Lotilla in 2005. Dependable capacity is lower than installed capacity due to, among others, seasonal limitations (e.g., output from hydropower plants is lower during the dry season), plant age and condition, and planned outages for maintenance. The supply margin is computed as the difference between dependable capacity and 110% of peak demand. The table also shows the maximum size of plant allowed based on present regulation on installed capacity, and the maximum size of the plant currently operating in the grid.

As shown in Table 2, no firm fails the EPIRA market power screen (i.e., ownership limitation to 30% of regional grid capacity, 25% of national grid capacity), except for an NPC IPP in the Visayas in certain years (i.e., 2005-2007) which is proposed to be exempt from the market share limitation until privatized.[14] However, except for Luzon, the largest plants in Visayas (Tongonan Geothermal Plant) and Mindanao (Pulangi and Agus Hydropower Plants) have capacities that far exceed the supply margins in those grids. This indicates that these plants will be able to exercise some degree of market power in an electricity spot market, as their capacities are needed to satisfy the peak demand in those grids. The Mindanao supply situation is so tight that the 4 largest plants in the region have capacities that exceed the supply margin in most of the years under study. It is likely for this reason that a wholesale electricity spot market in Mindanao is not yet scheduled to be operated within the foreseeable future.

Table 2
Supply Margin Analysis

	2004	2005	2006	2007	2008	2009	2010	Compound Growth Rate
Luzon								
System Peak 1/	6,323	6,443	6,747	7,014	7,290	7,574	7,866	3.71%
Installed Capacity 2/ 4/	12,162	12,187	12,227	12,227	12,617	13,797	15,297	3.90%
Dependable Capacity 3/	10,871	10,896	10,936	10,936	11,326	12,506	14,006	4.31%
Supply Margin	3,916	3,809	3,514	3,220	3,307	4,174	5,353	
30% of installed grid capacity	3,648	3,656	3,668	3,668	3,785	4,139	4,589	
Largest firm capacity (MW) - Non-NPC	1,560	1,560	1,560	1,560	1,560	1,560	1,560	
Visayas								
System Peak 1/	1,025	1,096	1,167	1,242	1,323	1,409	1,499	6.54%
Installed Capacity 2/ 5/	1,721	1,834	1,924	1,954	2,354	2,354	2,404	5.73%
Dependable Capacity 3/	1,520	1,603	1,672	1,696	2,073	2,073	2,123	5.73%
Supply Margin	392	397	388	330	618	523	474	
30% of installed grid capacity	516	550	577	586	706	706	721	
Largest firm capacity (MW) – NPC IPP	611	611	671	671	671	671	671	
Mindanao								
System Peak 1/	1,177	1,263	1,344	1,434	1,533	1,642	1,762	6.96%
Installed Capacity 2/ 6/	1,665	1,715	1,925	1,983	2,101	2,301	2,301	5.54%
Dependable Capacity 3/	1,402	1,452	1,662	1,720	1,838	2,038	2,038	6.43%
Supply Margin	107	63	184	143	152	232	100	
30% of installed grid capacity	500	515	578	595	630	690	690	
Largest firm capacity – NPC plant	255	255	255	255	255	255	255	

1/ Source: Transco 2nd Regulatory Reset Rate Application (August 2005).
2/ Capacity additions based on Power Sector Reform Update of DOE Sec. R. Lotilla (July 2005).
3/ Assumes capacity additions are based on dependable capacities when latter not indicated.
4/ Capacity additions after 2006 are indicative.
5/ Bulk of 2008 and subsequent capacity additions are indicative.
6/ Capacity additions beginning 2007 are indicative.

VII. CONCLUSIONS AND POLICY IMPLICATIONS

The study finds that the market share limitations in the present law governing the power sector in the Philippines do not completely address the possibility that the market structure in generation will allow the exercise of monopoly power. The generation sector in the country has a number of large firms that pass the market share limitation test but actually have the ability to price their output at higher than competitive prices, given the constraints inherent in an electricity market. These firms are identifiable using supply margin analysis (SMA). The ERC should seriously consider augmenting the present market power screen with SMA.

Detection of market power that could persist for a significant amount of time (because of a lack of additional investment in generation that can increase the supply margin) may mean that the "dominant" or pivotal supplier firm should be subjected to cost-of-service regulation rather than be allowed to participate freely in the WESM and set abnormally high prices during the peak hours. While economic theory would frown at this market restraint given the sacrifice of the price signals to inform additional investment in the sector, excessive price increases at this developmental stage of the spot market in the country may cause more harm than good to the market. Furthermore, barriers to entry in the sector must come down first in order for the price signals to be effective. These barriers include the material delays in the privatization of NPC's generation assets and IPP contracts that result in two (2) government entities still dominating the supply of power in the spot market. Requiring urgent action as well are the excessive bureaucratic requirements and transmission constraints that discourage additional generation investment as well as endow market power in existing gencos in some areas of the network.

The definition for "market" used in the present study is not ideal. Based on the Transmission Development Plan 2004-2013, transmission constraints exist within each of the grids that will likely cause even firms that pass both the regional and national grid-based market share limitations and the SMA tests to have market power. Thus, as an area for urgent further study, the modeling and analysis of the system considering intra-grid transmission constraints should be undertaken to identify those firms.

REFERENCES

Aquino, C. (1987). *Executive Order 215*.

Borenstein, S, Bushnell, J. & Wolak, F. (2002). *Measuring market inefficiencies in California's restructured wholesale electricity market. American Economic Review*, December, 1367-1405. Retrieved from http://www.stanford.edu/~wolak

Borenstein, S., Bushnell, J., & Wolak, F. (2000). *Diagnosing market power in California's restructured wholesale electricity market*. Retrieved from http://www.stanford.edu/~wolak

Bushnell, J. & Wolak, F. (1999). Regulation and the leverage of local market power: Reliability must-run contracts in the California electricity market. *POWER Working Paper* PWP-070, University of California Energy Institute.

Carlton, D & Perloff, J. (2000). *Modern Industrial Organization* 3rd edition. Reading, MA: Addison-Wesley.

Congress of the Philippines (1993). *Republic Act 7648.*

Congress of the Philippines (2001). *Republic Act 9136.*

Department of Energy. *www.doe.gov.ph*

Energy Market Authority of Singapore (2004). *Information paper: Guidelines on evaluation of merger and acquisition proposals in the electricity industry.* Retrieved from http://www.ema.gov.sg/download/informationpapers.php

Energy Regulatory Commission. *www.erc.gov.ph*

Fischer, R & Serra, P. (2000). Regulating the electricity sector in Latin America. *Economia* (1), 155-218. Retrieved from http://rru.worldbank.org/Paperslinks/Regulating-Electricity-Markets/

General Accounting Office of the US Congress (2002). *Restructured electricity markets: California market design enabled exercise of market power*. Retrieved from http://www.ksg.harvard.edu/hepg/Mergers_Market_Power.htm

Harvey, S. & Hogan, W. (2001a). *Identifying the exercise of market power in California*. Retrieved from http://www.ksg.harvard.edu/hepg/Mergers_Market_Power.htm

Harvey, S. & Hogan, W. (2001b). *Further analysis of the exercise of market power in the California electricity market*. Retrieved from http://www.ksg.harvard.edu/hepg/ Mergers_Market_Power.htm

Harvey, S. & Hogan, W. (2002). *Market power and market simulations*. Retrieved from http://www.ksg.harvard.edu/hepg/Mergers_Market_Power.htm

Hogan, W. (1998). *Competitive electricity market design: A wholesale primer*. Retrieved from http://rru.worldbank.org/Paperslinks/Regulating-Electricity-Markets/

Hogan, W. (2001). *Electricity market restructuring: Reforms of reforms*. Retrieved from http://rru.worldbank.org/Paperslinks/Regulating-Electricity-Markets/

Joskow, P. & Kahn, E. (2001). *Identifying the exercise of market power: Refining the estimates*. Retrieved from http://www.ksg.harvard.edu/hepg/Mergers_Market_Power.htm

Joskow, P. & Kahn, E. (2002). A quantitative analysis of pricing behavior in California's wholesale electricity market during Summer 2000. *Energy Journal*, 23(4), 1-35. Retrieved from http://www.ksg.harvard.edu/hepg/Mergers_Market_Power.htm

Manila Electric Company. *www.meralco.com.ph*

Marcos, F. (1972). *Presidential Decree 40*

Matthes, F, Poetzsch, S & Grashoff, K. (2005). *Power generation market concentration in Europe 1996-2000: An empirical analysis*. Oko-Institut e.V.

National Electrification Administration. *www.nea.gov.ph*

National Transmission Corporation. *www.transco.gov.ph*

Power Sector Assets and Liabilities Management Corporation. *www.psalm.gov.ph*

Rajareman, R & Alvarado, F. (2003). *(Dis)proving market power*. Retrieved from http://www.ksg.harvard.edu/hepg/Mergers_Market_Power.htm

Smeers, Y. (2004). *How well can one measure market power in restructured electricity systems?* Retrieved from http://www.ksg.harvard.edu/hepg/Mergers_Market_Power.htm

Stoft, S. (2001). *An analysis of FERC's hub-and-spoke market power screen*. Retrieved from http://www.ksg.harvard.edu/hepg/Mergers_Market_Power.htm

Stoft, S. (2002). *Power Utility Economics*.

Sweeting, A. (2001). *The effect of falling market concentration on prices, generator behavior and productive efficiency in the England and Wales electricity market*. Unpublished manuscript. http://rru.worldbank.org/Paperslinks/Regulating-Electricity-Markets/

US FERC, 107 FERC 61,018 available in http://www.elibrary.ferc.gov

USDOE (2000). *Horizontal market power in restructured electricity markets*. Retrieved from http://www.ksg.harvard.edu/hepg/Mergers_Market_Power.htm

Wholesale Electricity Spot Market. *www.wesm.ph*

Wolak, F. (1999). Market design and price behavior in restructured electricity markets: An international comparison. In T. Ito & A. Krueger (Eds.) *Competition Policy in the Asia Pacific Region*, EASE Volume 8 (pp. 79-134). Chicago: University of Chicago Press.

Wolak, F. (2003a). Measuring unilateral market power in wholesale electricity markets: The California market 1998 to 2000. *American Economic Review*, May 2003, 425-430.

Wolak, F. (2003b). *Managing unilateral market power in electricity*. Retrieved from http://www.stanford.edu/~wolak

Appendix A

	Name of Plant	Fuel	Installed Capacity	Dependable Capacity	Market Share	Square of market share	% contn to HHI	Owner
	LUZON							
1	*Sta. Rita and San Lorenzo	natural gas	1,560.00	1,500.00	12.83	164.54	34%	NON-NPC
2	Ilijan	natural gas	1,200.00	1,200.00	9.87	97.36	20%	NPC-IPP
3	Sual I	coal	647.00	573.00	5.32	28.30	6%	NPC-IPP
4	Sual II	coal	647.00	573.00	5.32	28.30	6%	NPC-IPP
5	Masinloc I and II	coal	600.00	600.00	4.93	24.34	5%	NON-NPC
6	Limay CCGT	gas turbine	590.00	540.00	4.85	23.54	5%	NPC-IPP
7	Quezon Power	coal	511.00	511.00	4.20	17.65	4%	NON-NPC
8	Pagbilao Unit 1	coal	382.00	382.00	3.14	9.87	2%	NPC-IPP
9	Pagbilao Unit 2	coal	382.00	382.00	3.14	9.87	2%	NPC-IPP
10	Magat	hydro	360.00	360.00	2.96	8.76	2%	NON-NPC
11	Kalayaan 3&4	hydro	350.00	350.00	2.88	8.28	2%	NPC-IPP
12	Malaya 2	oil thermal	350.00	350.00	2.88	8.28	2%	NPC-IPP
13	San Roque	hydro	345.00	85.00	2.84	8.05	2%	NPC-IPP
14	Hopewell GT	gas turbine	310.00	180.00	2.55	6.50	1%	NPC-IPP
16	Kalayaan	hydro	300.00	300.00	2.47	6.09	1%	NPC-IPP
17	Malaya 1	oil thermal	300.00	300.00	2.47	6.09	1%	NPC-IPP
18	Calaca 2	coal	300.00	270.00	2.47	6.09	1%	NON-NPC
19	Calaca 1	coal	300.00	260.00	2.47	6.09	1%	NON-NPC
20	Angat	hydro	245.00	226.00	2.01	4.06	1%	NPC
21	FPPC- Bauang Dsl	diesel	235.20	210.00	1.93	3.74	1%	NPC-IPP
22	Casecnan	hydro	140.00	140.00	1.15	1.33	0%	NPC-IPP
23	Duracom	diesel	133.38	113.00	1.10	1.20	0%	NON-NPC
24	Enron Subic 2	diesel	116.00	100.00	0.95	0.91	0%	NPC-IPP
25	Pinamucan(Enron)	diesel	110.80	97.00	0.91	0.83	0%	NPC-IPP
26	East Asia Diesel	diesel	109.00	109.00	0.90	0.80	0%	NON-NPC
27	Binga	hydro	100.00	100.00	0.82	0.68	0%	NPC-IPP
28	Pantabangan	hydro	100.00	80.00	0.82	0.68	0%	NON-NPC
29	Ambuklao	hydro	75.00	0.00	0.62	0.38	0%	NON-NPC
30	Bakun	hydro	70.00	70.00	0.58	0.33	0%	NPC-IPP
31	Edison Global (BEPZA)	diesel	64.20	50.00	0.53	0.28	0%	NPC-IPP
32	Magellan Cogen (CEPZA)	diesel	63.00	60.00	0.52	0.27	0%	NPC-IPP
33	MakBan 4	geothermal	55.00	55.00	0.45	0.20	0%	NON-NPC
34	Bac Man I-1	geothermal	55.00	45.00	0.45	0.20	0%	NON-NPC
35	Bac Man I-2	geothermal	55.00	45.00	0.45	0.20	0%	NON-NPC
36	MakBan 1	geothermal	55.00	40.00	0.45	0.20	0%	NON-NPC
37	MakBan 3	geothermal	55.00	40.00	0.45	0.20	0%	NON-NPC
38	MakBan 5	geothermal	55.00	40.00	0.45	0.20	0%	NON-NPC

Appendix A (cont'd)

	Name of Plant	Fuel	Installed Capacity	Dependable Capacity	Market Share	Square of market share	% contn to HHI	Owner
39	MakBan 6	geothermal	55.00	40.00	0.45	0.20	0%	NON-NPC
40	Tiwi 3	geothermal	55.00	35.00	0.45	0.20	0%	NON-NPC
41	Tiwi 1	geothermal	55.00	30.00	0.45	0.20	0%	NON-NPC
42	Tiwi 2	geothermal	55.00	30.00	0.45	0.20	0%	NON-NPC
43	Tiwi 5	geothermal	55.00	30.00	0.45	0.20	0%	NON-NPC
44	Tiwi 6	geothermal	55.00	30.00	0.45	0.20	0%	NON-NPC
45	MakBan 2	geothermal	55.00	20.00	0.45	0.20	0%	NON-NPC
46	Tiwi 4	geothermal	55.00	0.00	0.45	0.20	0%	NON-NPC
47	Trans Asia Power	diesel	52.00	52.00	0.43	0.18	0%	NON-NPC
48	FCVC DPP	diesel	32.00	32.00	0.26	0.07	0%	NON-NPC
49	Caliraya	hydro	32.00	0.00	0.26	0.07	0%	NPC-IPP
50	Angeles PI DPP	diesel	30.00	30.00	0.25	0.06	0%	NON-NPC
51	HEDCOR	hydro	25.35	25.35	0.21	0.04	0%	NPC-IPP
52	MakBan 7 (D)	geothermal	20.00	20.00	0.16	0.03	0%	NPC
53	MakBan 8 (D)	geothermal	20.00	20.00	0.16	0.03	0%	NPC
54	MakBan 9	geothermal	20.00	20.00	0.16	0.03	0%	NPC
55	MakBan 10	geothermal	20.00	20.00	0.16	0.03	0%	NPC
56	Bac Man II-1	geothermal	20.00	18.00	0.16	0.03	0%	NPC
57	Bac Man II (Botong)	geothermal	20.00	18.00	0.16	0.03	0%	NPC
58	Tarlac Electric	diesel	18.90	12.60	0.16	0.02	0%	NON-NPC
59	Botocan	hydro	17.00	0.00	0.14	0.02	0%	NPC-IPP
60	Mini-Hydro	hydro	16.21	16.21	0.13	0.02	0%	NON-NPC
61	MakBan Ormat	geothermal	15.73	6.00	0.13	0.02	0%	NPC-IPP
62	NMHC	hydro	12.10	6.00	0.10	0.01	0%	NPC-IPP
63	Masiway	hydro	12.00	11.00	0.10	0.01	0%	NPC
64	NIA-Baligatan	hydro	6.00	6.00	0.05	0.00	0%	NON-NPC
65	San Antonio	natural gas	3.00	3.00	0.02	0.00	0%	NON-NPC
66	Buhi-Barit	hydro	1.80	1.80	0.01	0.00	0%	NON-NPC
67	Manito	geothermal	1.50	1.50	0.01	0.00	0%	NON-NPC
68	Cawayan	hydro	0.40	0.40	0.00	0.00	0%	NON-NPC
69	Sucat 3	oil thermal		0.00	0.00	0.00	0%	NPC
70	Sucat 2	oil thermal		0.00	0.00	0.00	0%	NPC
			12,161.57	**10,870.86**	**100.00**	**487.01**	**100%**	
	VISAYAS							
1	Tongonan II & III (Leyte A)	geothermal	610.80	578.40	35.49	1,259.55	76%	NPC-IPP
2	*Panay Power Corp., Toledo Power Corp., Mirant	diesel	249.48	187.00	14.50	210.13	13%	NON-NPC

Appendix A (cont'd)

	Name of Plant	Fuel	Installed Capacity	Dependable Capacity	Market Share	Square of market share	% contn to HHI	Owner
3	Negros GPP1 (Palinpinon)	geothermal	112.50	99.00	6.54	42.73	3%	NPC
4	Tongonan GPP(Leyte 1 Geo)	geothermal	112.50	99.00	6.54	42.73	3%	NPC
5	Negros GPP2	geothermal	80.00	80.00	4.65	21.61	1%	NPC
6	Cebu Private Power	diesel	70.00	70.00	4.07	16.54	1%	NON-NPC
7	Cebu TPP2 (Salcon)	coal	56.80	55.00	3.30	10.89	1%	NPC-IPP
8	Cebu TPP1 (Salcon)	coal	52.50	50.00	3.05	9.31	1%	NPC-IPP
9	East Asia Utilities (MEPZA)	diesel	49.70	46.00	2.89	8.34	1%	NON-NPC
10	Cebu DPP1 (Salcon)	diesel	43.80	30.00	2.54	6.48	0%	NPC-IPP
11	Panay DPP1	diesel	36.50	25.00	2.12	4.50	0%	NPC
12	PB 103	diesel	32.00	24.00	1.86	3.46	0%	NPC
13	PB 104	diesel	32.00	24.00	1.86	3.46	0%	NPC
14	PB 101	diesel	32.00	24.00	1.86	3.46	0%	NPC
15	PB 102	diesel	32.00	24.00	1.86	3.46	0%	NPC
16	Cebu Land-based GT 1	gas turbine	27.50	25.00	1.60	2.55	0%	NPC-IPP
17	Cebu Land-based GT 2	gas turbine	27.50	25.00	1.60	2.55	0%	NPC-IPP
18	Bohol DPP	diesel	22.00	18.00	1.28	1.63	0%	NPC
19	PECO	diesel	19.85	14.50	1.15	1.33	0%	NON-NPC
20	PMDP	diesel	10.00	10.00	0.58	0.34	0%	NPC
21	Janopol	hydro	5.00	5.00	0.29	0.08	0%	Non-NPC
22	Mini-Hydro	hydro	4.61	4.61	0.27	0.07	0%	Non-NPC
23	Loboc HEP	hydro	1.20	1.20	0.07	0.00	0%	NON-NPC
24	Amlan HEP	hydro	0.80	0.80	0.05	0.00	0%	NPC
			1,721.04	**1,519.51**	**100.00**	**1,655.20**	**100%**	
	MINDANAO							
1	Pulangi 4	hydro	255.00	255.00	15.31	234.47	29%	NPC
2	Agus 6	hydro	200.00	165.00	12.01	144.23	18%	NPC
3	Agus 2	hydro	180.00	120.00	10.81	116.83	15%	NPC
4	Agus 4	hydro	158.10	158.10	9.49	90.13	11%	NPC
6	Western Mindanao Power Corp.	diesel	107.00	100.00	6.43	41.28	5%	NPC-IPP
7	Power Barge 117	diesel	100.00	100.00	6.00	36.06	4%	NPC-IPP
8	Mindanao PB Dsl II (Power Barge 118)	diesel	100.00	95.00	6.00	36.06	4%	NPC-IPP
9	NMPC I (Iligan Diesel Plant)	diesel	63.80	20.00	3.83	14.68	2%	NPC
10	*Davao Light and Talomo HEPP	diesel	62.39	43.60	3.75	14.04	2%	Non-NPC
11	Gen Santos (SPPC)	diesel	56.00	50.00	3.36	11.31	1%	NPC-IPP
12	Agus 5	hydro	55.00	55.00	3.30	10.91	1%	NPC

Appendix A (cont'd)

	Name of Plant	Fuel	Installed Capacity	Dependable Capacity	Market Share	Square of market share	% contn to HHI	Owner
13	Mindanao I (Mt. Apo)	geothermal	54.24	54.00	3.26	10.61	1%	NPC-IPP
14	Mindanao II (Mt. Apo)	geothermal	54.24	54.00	3.26	10.61	1%	NPC-IPP
15	Agus 7	hydro	54.00	54.00	3.24	10.51	1%	NPC
16	NMPC II	diesel	44.80	40.00	2.69	7.24	1%	NPC-IPP
17	Agus 1 Unit 1	hydro	40.00	0.00	2.40	5.77	1%	NPC
18	Agus 1 Unit 2	hydro	40.00	0.00	2.40	5.77	1%	NPC
19	*Mindanao Energy Systems and Bubunawan	diesel	25.90	25.90	1.56	2.42	0%	Non-NPC
20	Cotabato Light	diesel	10.00	7.50	0.60	0.36	0%	Non-NPC
21	Mini-Hydro	hydro	3.25	3.25	0.20	0.04	0%	NON-NPC
22	Agusan	hydro	1.60	1.60	0.10	0.01	0%	NON-NPC
			1,665.32	**1,401.95**	**100.00**	**803.32**	**100%**	

Source: NPC Systems Planning and Operations Statistics. Data on installed and dependable capacities are as of December 31, 2004. Ownership data were updated considering asset sales up to August 18, 2008.

Note: Except for the Agus and Pulangi plants in Mindanao, all NPC plants and NPC-IPP contracts are to be privatized.

NOTES

[1] http://www.wesm.ph/news.releases/2007/07/11/6514.news.release/

[2] Carlton, D. and J. Perloff (2000), Modern Industrial Organization 3rd edition, Addison-Wesley, p 257.

[3] The pioneer in electricity sector restructuring appears to be Chile, which passed its enabling legislation in 1982 (Fischer and Serra (2000)). In Europe, England and Wales were the first to restructure in 1990. The first U.S. states to undertake restructuring are California, Pennsylvania, New Jersey, Maryland, and the New England states in the late 1990s (Wolak (1999)).

[4] A common concentration measure in SCP studies, the Herfindahl-Hirschman Index (HHI) is just the sum of the squares of the market shares of firms.

[5] S. Borenstein, J. Bushnell, and F. Wolak (2000, 2002); P. Joskow and E. Kahn (2001a, 2001b). Studies that have critiqued the methodologies of these studies and concluded that there was insufficient proof to establish market power include Rajaraman and Alvarado (2003) and Harvey and Hogan (2001)

[6] Wolak, F. (2003), "Managing Unilateral Market Power in Electricity" in http://www.stanford.edu/~wolak, p. 1.

[7] Since 2004, there have been insignificant additions to national generation capacity. Only 303 MW have come online, with 232 MW (77%) of this amount constructed in Mindanao, and 75 MW in Luzon (a 50 MW coal plant in Pampanga and the 25 MW-capacity North Wind project).

[8] While the Luzon and Visayas grids are physically linked, the capacity of the existing wires is not sufficient to consider the two grids as one. Further, the market share screens in EPIRA consider them as distinct grids at present.

[9] 10% represents the minimum required reserves to ensure grid stability and reliability.

[10] A supply margin determined on the basis of installed capacity is overstated to the extent that installed capacity differs from dependable capacity. However, dependable capacity is a variable that changes based on, among others, the relevant time frame, the time of the year, and, unless an independent test is conducted, the operator's judgement. Of relevance too are the generators' scheduled and forced outages, which will make available capacity less than dependable capacity. The supply margin is thus not a constant figure and needs to be recomputed periodically by the regulator.

[11] The U.S. Department of Justice states that: "Markets in which the HHI is between 1000 and 1800 points are considered to be moderately concentrated, and those in which the HHI is in excess of 1800 points are considered to be concentrated. Transactions that increase the HHI by more than 100 points in concentrated markets presumptively raise antitrust concerns under the Horizontal Merger Guidelines issued by the U.S. Department of Justice and the Federal Trade Commission." http://www.usdoj.gov/atr/public/testimony/hhi.htm.

[12] Is understood to be a 'modified' HHI, even when not specifically labeled to be so.

[13] Recall that non-NPC (i.e., privately owned) generation facilities under common control were combined.

[14] ERC Draft Guidelines for the Determination of Installed Generating Capacity in a Grid and the National Installed Generating Capacity and Enforcement of the Limits on Concentration of Ownership, Operation or Control of Installed Generating Capacity Under Section 45 of R.A. 9136.