The urgent need to increase baseload generating capacity in Mindanao

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The electric power crisis in Mindanao in the summer of 2012 and the current precariously low power reserves primarily resulted from insufficient baseload generating capacity in the region. The Mindanao grid has only 37.31 percent baseload generating capacity, whereas the Luzon grid and the Visayas grid have 63.94 percent and 71.88 percent, respectively (DOE 2012a). Thus, to meet power demand in Mindanao, even peaking plants (which are more expensive to run) have to act as baseload power plants and the reserve margin has to be very slim, thereby putting the security of the power grid at risk.

The solutions used to stem the crisis were at best stop-gap measures and some of these were controversial. The Department of Energy (DOE) issued a circular rationalizing the available capacities in the Mindanao grid. It also asked the operators of embedded power generators (i.e., generators which are directly connected to a distribution utility or DU network) to make their capacities available to the grid during peak hours. Newly privatized diesel-fired power barges were also deployed. Then some lawmakers and Mindanao officials accused private power producers and the National Grid Corporation of the Philippines (NGCP), the grid operator, of creating an artificial shortage to make a profit.1 When one looks closely at data, however, it becomes evident that the root of


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the problem is inadequate baseload capacity, which was exacerbated by the significant reduction in the available capacity of government-owned hydropower plants.

This Policy Notes explains how important baseload generating capacity is and argues that although the Mindanao electric power crisis has passed, it might stage a comeback given that there had been no additions to the baseload capacity recently. The Notes also recommends possible short-term and medium-to long-term actions.

**Base load and the required generating capacity**

Base load (or base demand) is the more or less constant part of the total demand in an electric power system per unit of time. To meet this base load, so-called baseload power plants are needed. Baseload power plants are generating plants that can produce energy at a constant rate and can be relied on to efficiently meet a region’s continuous demand for electric power.

The traditional baseload technologies are coal, geothermal, and nuclear. Hydroelectric power plants can only provide limited baseload capacity because the water level is not constant and may run really low when a long drought occurs. The intermittency of wind power and solar power also makes it difficult to meet base load from these sources. Moreover, the cost of generation from these sources, although declining in recent years, is still prohibitively high. Figure 1 illustrates the levelized cost of electricity from different sources in the case of US plants that will be in service in 2017.

Current knowledge dictates that intermittent sources are relied upon for base load when the plants are of appropriate capacities, abundant, and in strategic geographic locations such as large-scale wind farms that are geographically dispersed in strategic zones in a power grid to ensure system reliability. These factors, however, are not yet present in the Philippines.

The Mindanao region not only runs short of baseload generating capacity but also depends heavily on hydropower. More than 51 percent of generated power in Mindanao come from hydropower plants (Table 1). This makes the power system susceptible to reliability problems when drought occurs. The system is also easily affected by decreases in the available capacity of the hydropower plants in the face of worsening deforestation of the watersheds and the river siltation problems associated with it. Thus, the siltation of the Agus River and the Pulangui River and delays in the rehabilitation and maintenance of the Agus and Pulangui hydropower complexes worsened the electric power crisis.

To meet peak demand and at the same time maintain the security and reliability of the power grid, generation capacity must not only

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1. **Base load and the required generating capacity**
2. **Levelized cost of electricity**, a term usually used in investment analysis, means the price at which a generation technology recovers all costs, including the cost of equity.

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correspond to peak demand but also provide reserves for ancillary services needed in delivering electricity to the customers. The required reserve margin is at least 21 percent of peak demand (DOE 2012a). Based on the consolidated forecasts of distribution utilities submitted for the Philippine Distribution Development Plan 2010–2019, Mindanao peak demand could reach 1,428 MW next year (2013) and 1,823 MW in 2019. Given the reserve requirement, the total generating capacity requirements are therefore 1,728 MW in 2013 and 2,206 MW in 2019, but the recent developments in concluding power purchase agreements (PPAs), the earliest that additional baseload capacity could come online is in 2015. This will come from the 120-MW circulating fluidized-bed combustor boiler coal-fired power plant to be built in Sarangani. The plant is estimated to have a net-dependable capacity of 105 MW, of which 70 MW are covered by a PPA approved by the Energy Regulatory Commission (ERC) on July 30, 2012.

Table 1. Generating capacity mix in Mindanao in 2011°

<table>
<thead>
<tr>
<th>Fuel Type</th>
<th>Capacity (MW)</th>
<th>Installed</th>
<th>Dependable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>232</td>
<td>210</td>
<td></td>
</tr>
<tr>
<td>Oil-based (diesel)</td>
<td>622</td>
<td>469</td>
<td></td>
</tr>
<tr>
<td>Geothermal</td>
<td>108</td>
<td>102</td>
<td></td>
</tr>
<tr>
<td>Hydro</td>
<td>1,038</td>
<td>827</td>
<td></td>
</tr>
<tr>
<td>Solar</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Biomass</td>
<td>21</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2,022</td>
<td>1,616</td>
<td></td>
</tr>
</tbody>
</table>

° The figures exclude off-grid generation. Installed capacity is the total of the maximum capacities of the generating units in a power plant. Dependable capacity is lower than installed capacity because of factors such as the generating units’ efficiency ratios and temperature variations. What is made available or actually injected into a grid, however, can be lower than the dependable capacity when some generating units go offline due to scheduled maintenance or forced outages.

Source: Department of Energy

Figure 1. Average levelized costs of electricity in the United States (in 2010 prices, $ per MWh)

Notes:
CCS - carbon control and sequestration
CCC - conventional combined cycle
ACC - advanced combined cycle
CCT - conventional combustion turbine
ACT - advanced combustion turbine
PV - photovoltaic
Source: Annual Energy Outlook 2012, US Energy Information Administration

dependable capacity (Table 1) now is only 1,616 MW.

Since there had been no new generating capacity investments in Mindanao recently, the power system could run a reserve shortfall of 112 MW in 2013.
Meanwhile, the medium- to long-term demand for electricity in Mindanao is growing at a rate higher than the national growth rate. A consolidation of the 2010–2019 forecasts by DUs shows that the estimated Mindanao annual average growth rate (AAGR) of electricity demand is 4.28 percent in 2010–2019, which is higher than the national AAGR of 3.63 percent in 2010–2019. Thus, as early as possible, the government must implement short-term solutions for likely system peaks in summer 2013 and perhaps 2014, as well as medium- to long-term solutions for increasing generating capacity and managing demand.

**Recommended actions**

Before the recommendations are outlined here, it is helpful to analyze which among the solutions offered by others can be excluded from the policy options and the reasons for the exclusion. There are at least two offered solutions which can be excluded. First is the proposed government take-over of the privatized power barges and “their use as cheap baseload power instead of expensive ancillary power” as recommended by one legislator. The power barges referred to are Power Barge (PB) 117 and PB 118 owned by Therma Marine, Inc., which sells ancillary services to the NGCP and some output to electric cooperatives via bilateral supply agreements spurred by the crisis. These barges, however, are more precisely suited for delivering ancillary reserves and the Electric Power Industry Reform Act (EPIRA) of 2001 (Republic Act 9136) requires that the NGCP contract for these services in order to maintain grid security. Using PB 117 and PB 118 primarily to meet base load is an expensive proposition since these run on diesel. Besides, if these are to be withdrawn as ancillary services provider, other generating reserves with similar characteristics (i.e., nonintermittent and can be easily ramped up to full capacity or ramped down) still need to take their place.

Another suggested government action that must be excluded from the range of options is the total prohibition of cross-ownership between distributors and generators, as raised by local government unit (LGU) representatives during the April 13, 2012 Mindanao Power Summit. The EPIRA currently allows the sourcing of up to 50 percent of a DU’s total demand from its associated firm engaged in generation. The issue of total prohibition or at least reducing the cap on cross-ownership, however, may be more relevant in the Luzon grid where Meralco’s captive market is 75 percent of the distribution market. The same is not true in Visayas and Mindanao where DUs are relatively smaller and the embedded generation facilities can fill up the gap when the reliability of supply is threatened or transmission constraints exist. Nevertheless, the issue of whether the 50 percent cap on sourcing demand should be

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reduced (on the ground that it results in market power exercise) is an interesting issue that can be examined through further study.

Below are the recommended actions.

**Short-term actions**
- **Continue the rehabilitation and sustain the operations of Agus and Pulangui hydropower plants.** The dredging operations for the Pulangui River must also be hastened. These efforts are meant to bring back or even upgrade the optimum capacities of the hydropower plants.

- **Minimize the bureaucratic (both at the national government and LGU levels) hurdles in the building up of electric cooperatives’ embedded generation capacities up to the extent allowed by law.** During the Mindanao Power Summit, the Association of Mindanao Rural Electric Cooperatives, Inc. (AMRECO) expressed their concern over bureaucratic delays in the processing of embedded generation capacity applications by some electric cooperatives.

- **Promote the interruptible load program for large consumers.** The ERC rules on the interruptible load program issued in 2010 allow a DU and a participating customer to agree via contract that the customer shall partially or fully de-load (i.e., be disconnected) for certain periods of time. The customer then operates its own power generators and the DU pays the customer a de-loading compensation, which can then be recovered by the DU from all its customers.\(^6\) This has been resorted to by the DU in Davao and must be promoted and replicated in other DUs. However, this should be strictly a short-term action only and should not lead to overinvestment in diesel-generating units because far too many de-loading compensation schemes could lead to high electricity prices.

- **Undertake a more aggressive information, education, and communication campaign in Mindanao regarding the power situation and power outlook.** Civil society groups must be responsible in how they analyze the power situation and feed information to the public. But the government has an even greater responsibility to inform and educate the public. To start with, the robustness of region-wide projections must be ensured and argued based on the point that these are gathered from the ground, i.e., consolidated from the demand forecasts by the Mindanao DUs themselves. Realistic expectations on the time frame for implementing renewable energy projects and adopting “cleaner” technology should also be emphasized. Transparency in how the NGCP releases information can also be improved. Posting not only current and week-ahead outlook but also historical data on the NGCP website can increase public trust. This practice readily empowers those who have the inclination and ability to analyze time-series data.

- **With respect to the pending PPAs, address the risk aversion problem in baseload power contracting.** There are pending PPAs that will

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\(^6\) The DOE announced on September 17, 2012 that its proposed interim electricity market for Mindanao will also utilize the interruptible load concept but the details of the proposed interim market have not yet been disclosed.
utilize coal technology but local leaders are severely risk-averse to locking in multiyear contracts with generating firms. Part of it owes to the expectation that renewable energy projects can adequately supply future requirements. But the reality is that fossil fuels are still the “bridge” fuel to a future where renewable energy provides enough baseload capacity. The risk aversion problem may be minimized through (i) a more effective communication to LGUs of the immediate need for baseload capacity and the intermittency of alternative renewable energy technologies; (ii) strict requirement for generating firms to adopt cleaner coal technology; and (iii) more enforceable regulatory rules on the performance obligation of DUs to provide adequate and reliable electricity supply to their customers.

Medium- to long-term actions

- **Come up with a definite decision on the privatization of Agus and Pulangui hydropower plants and implement a reforestation and watershed management program.** The ten-year ban on privatizing the Agus and Pulangui hydropower complexes has already lapsed and the EPIRA provides that the privatization of these complexes “shall be left to the discretion of PSALM in consultation with Congress.” Meanwhile, there is a current proposal that a government-owned and controlled corporation (GOCC) tentatively called Mindanao Power Corporation (MinPoCor), be created to take ownership of the hydropower complexes. In the economics literature, there are evidences suggesting that in the proper functioning of firms, it is not the ownership but the incentive that matters. For instance, in Bushnell and Wolfram (2005), operational efficiency improvements (using fuel efficiency as indicator) are examined in generating plants in the United States that changed ownership between 1998 and 2001. The study finds efficiency gains in privatized plants but at the same time reveals that such gains are matched by nonprivatized plants in states that adopted strong incentive regulation regimes.

To minimize uncertainty in the industry, a decision has to be reached immediately and whatever the decision on ownership will be, it must incorporate a proper design of incentives. Considerations must include (but should not be limited to) the following:

(i) **Dampening of incentives to exercise market power.** The EPIRA prohibits a generation company from owning more than 30 percent of the installed capacity in a grid. Thus, the privatization of the Agus and Pulangui complexes, which compose 51 percent of installed capacity in the Mindanao grid, entails awarding them to more than one company. Proponents of MinPoCor say that Agus and Pulangui cannot be sold separately because they have the same water source and water rights. The literature, however, suggests that water rights conflicts by parties drawing from the same water source may be resolved through benefit sharing rather than water resource sharing, or in economic parlance, by transforming a zero-sum game of water resource sharing to a positive-sum game of water benefits sharing (Dombrowsky 2009).
contract or a regulatory rule can be designed to implement this. Moreover, a careful reading of the EPIRA implies that the “not more than 30 percent ownership” rule equally applies to the GOCC option. Therefore, more than one GOCC must be created if government ownership is the option to be adopted.

(ii) Incentives to reforest and manage the watersheds. Under the privatization option, reforestation and watershed management can be a condition in the contract award. This can also be a condition in the GOCC creation option.

(iii) The Philippine experience in operating public corporations and the inefficiencies associated with it. This is perhaps currently the most important consideration given the Philippine record in operating public corporations. In the first place, the wave of privatization in the Philippines was motivated by the fact that many public assets had been nonperforming (Patalinghug 1997). In the energy sector, the privatization of the National Power Corporation (NPC) was prompted by its huge losses.

A middle-ground solution that may be explored is the possibility of the government retaining the ownership of these hydropower plants, and then allowing concession contracts (a form of public-private partnership) for their rehabilitation, operation, and maintenance, and with attendant watershed management obligations. Hydropower concessions are not something new and in fact are being used in countries such as France, Nepal, Albania, Uganda, and Lao People's Democratic Republic. The concession period can also be considered a transition period for the eventual total privatization of these hydropower plants, or a test period for ascertaining whether or not continuing government participation in the generation sector is more efficient.

- *Facilitate the entry of new baseload capacity commitments*. The committed capacities in advanced stages of negotiation will still not be adequate to serve the projected peak demand and provide for a safe reserve margin. The timing of the start of operation of the committed power plants is also uncertain, which is understandable given that construction (a process which could take three to four years) has not yet started. There are a lot of uncertainties in the sector and to encourage new private investments, the government should address the uncertainties that are within its control, such as the decision on what to do with the hydropower complexes that will be the biggest competitor of new entrants.

In the event that no new investments are coming in, the government can also explore a concession arrangement. The government can build baseload-generating plants then hold competitive tenders for concessions to operate and maintain these plants. The EPIRA does not specifically prohibit the re-entry of the government in the generation sector. What is specifically provided is that the government must privatize NPC-owned assets (except the small power-generating units in missionary off-grid areas).
• **Accelerate the development of renewable energy projects.** The Philippines had a protracted rate-setting experience with the feed-in tariff (FIT) scheme. It was reported as possibly one of the most protracted efforts in the history of FIT policy. The FITs were approved in July 2012, four years after the Renewable Energy Act was passed in July 2008, and the process is still incomplete as the rate setting was done for only four technologies, namely, run-of-river hydro, biomass, wind, and solar. The FIT-setting for ocean renewable energy is deferred pending further study and data gathering. In contrast, Thailand and Japan had swifter actions in setting rules. Thailand’s FIT program was initiated in 2006 and implemented in early 2007 (Tongsopit and Creacen 2012). Japan approved the levels of FITs in June 2012 before the effectivity date of the guiding law, which was July 2012.

Developing the rules for awarding rights to install renewable energy systems also takes time. To illustrate, private sector developers have expressed interest in wind power amounting to a total of 220 MW (as of August 25, 2012) generation capacity but there are no rules yet on how the wind installation permits will be awarded by the government. Relative to other countries, it is obvious that our energy bureaucracy is not moving fast enough when it comes to deciding the policy, setting the rules, and evaluating applications. In order to accelerate investments in renewable energy, the government needs to accelerate also the laying out of the groundwork for renewable energy development.

• **Seriously pursue specific demand-side management programs.** This recommendation applies as well to Luzon and Visayas. The interruptible load program is now in place. However, no additional programs have been set up. The proposed prepaid electricity scheme in Luzon remains a proposal. A concrete measure that holds promise is the “contractually committed demand response” program. In contrast with the interruptible load program where big power users switch on their own generating sets, under the contractually committed demand response program, big power users commit to reduce their consumption for a specific number of peak demand events per year and can be compensated for doing so. This needs a medium-term time frame because DUs and the grid operator will need to invest in advanced metering technology and the regulator will need to set up rules.

• **Strengthen the capacity of the regulator to deal with complex issues in the electric power**

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industry. Tracing bottlenecks in the bureaucratic processes often leads to the insufficient capacity of the ERC to deal with problems requiring regulatory interventions. Strengthening the business processes and the manpower complement of the ERC is a crucial step. Key informant interviews at the ERC in May 2012 revealed that the manpower complement in the agency is insufficient; for example, the division tasked to review the capital expenditure plans of electric cooperatives consists only of engineers since some economic specialists had already left the agency.

- Internalize the negative externalities in the development cost of coal-fired plants in order to reduce the investors’ preference for coal over “cleaner” technologies. The adverse environmental consequences of using coal are to be felt not only by present and future generations, which is why the negative externalities are called intergenerational. There are models of internalizing the negative externalities in other countries which can be studied. For instance, China is supposed to implement a carbon tax scheme by 2015.

- Explore the aggregation of demand and the use of large-volume auctions for baseload capacity contracting. Section 23 of the EPIRA obligates DUs to supply electricity in the least cost manner to its customers. Under the 2004 ERC rules on the DUs’ recovery of the generation component of costs, DUs are supposed to conduct public bidding for bilateral power supply contracts. A reading of ERC decisions on bilateral contracts will reveal that most electric cooperatives experience having only one complying bidder, if not an outright failure of bidding; thus, most supply deals are negotiated. Aggregation of demand and large-volume auctions for power supply requirement entail exploring the use of tested mechanisms in Brazil and Chile electricity markets. A similar recommendation was raised by del Mundo et al. (2011). However, in contrast with the recommendation by del Mundo et al. that this be an immediate policy response, it is suggested here that this be considered for the medium term. This is because there are important prerequisites that must be satisfied, namely, reliable and transparent DU demand forecasting and consolidation of forecasts, advanced lead time given the timeline in building power plants, and the participation of a reasonable number of generating firms to ensure competition.

- Pursue the interconnection of the Visayas and Mindanao grids. This will increase the reliability of supply in Mindanao because the excess supply in Visayas and Luzon can be used in the Mindanao region when demand peaks coincide with low available capacity. The interconnection infrastructure (which includes a 455-kilometer overhead line and a 23-kilometer submarine cable) will take about seven years to build. Therefore, a decision must be made as early as possible to minimize uncertainties in the region. Mindananoans object to the interconnection for fear of electricity price increases after the
The increase in power rates is indeed to be expected since the cost of generating electricity in Visayas and Luzon is higher than in Mindanao. However, a complete cost-benefit analysis must also consider the disastrous economic losses arising from rolling brownouts due to supply unreliability. The lack of interconnection, as well as the tight supply margin and the presence of only a few generation players, also makes the transition to a competitive electricity market in Mindanao very difficult.

Some quarters in Mindanao are also banking on the interconnection of Mindanao to Sabah (Malaysia) as a solution rather than on having a unified nationwide grid. The Philippines-Malaysia interconnection via Zamboanga and Sabah was indeed proposed as part of the ASEAN Vision 2020, but the background studies for such proposal are premised on the unification of the nationwide grid and the further development of the Philippine electricity market.

The proposed actions outlined above serve to address three major objectives in the Mindanao power system: maximize the existing capacity in order to avoid crisis-level situations; add new generation capacity in order to meet future demand; and expand the options for sourcing power in order to increase the reliability of supply. It will therefore be useful to highlight these objectives in dialogues between the officials in the energy bureaucracy and the stakeholders in Mindanao.

References


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