Philippine Electricity Market Corporation

STUDY ON MINIMUM STABLE LOAD (PMIN) OF COMBINED CYCLE GAS TURBINE (CCGT) PLANTS

by the Technical Committee

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18/F Robinsons Equitable Tower, ADB Avenue, Ortigas Center, Pasig City, Philippines 1600
Trunk line: (+632) 631-8734, Telefax: (+632) 395-2704, www.wesm.ph

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LIST OF ACRONYMS

CCGT	Combined Cycle Gas Turbine
DOE	Department of Energy
ERC	Energy Regulatory Commission
GT	Gas Turbine
MMS	Market Management System
Pmax	Maximum Stable Load
Pmin	Minimum Stable Load
ST	Steam Turbine
TC	Technical Committee
WDS	WESM Design Study

1. INTRODUCTION

The WESM Manual on Dispatch Protocol and the Philippine Grid Code ("Grid Code") define the *minimum stable load* or Pmin as the minimum demand that a generating unit can safely maintain for an indefinite period of time.

In ERC Resolution No. 16, Series of 2014[1], Pmin refers to the minimum demand in MW that a generating unit, or generating block or module in the case of a combined cycle power plant, can reliably sustain for an indefinite period of time, based on the generator capability tests. This same definition was adopted in the WESM Manual on Registration, Suspension and Deregistration Criteria and Procedures ("WESM Registration Manual").

In the WESM, Pmin is included in the data for submission to the Market Operator, together with the *maximum stable load* (Pmax) and ramp rate. The information provided to the Market Operator must be consistent with the information contained in the Certificate of Compliance issued by the ERC[2].

Electricity markets in various parts of the world have different rules regarding Pmin. Some do not have Pmin, i.e. Pmin for all generating units is zero[3], while others have Pmin which is called dispatch minimum or minimum loading point[4].

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[1] ERC Resolution No. 16, Series of 2014

[2] WESM Manual on Registration, Suspension and Deregistration Criteria and Procedures. Section 2.5.4.4 *Generation Registered Capacities*.

[3] Other markets that do not have concept of Pmin include Australia National Electricity Market (ANEM), National Electricity Market of Singapore (NEMS) and New Zealand Electricity Market (NZEM). Similarly, PJM (USA) also does not have Pmin for real-time dispatch but there is a day-ahead market to facilitate unit commitment.

[4] Midcontinent Independent System Operator (MISO). Dispatch minimum is the minimum MW level at which a generation resource may operate under normal system.

Independent Electricity System Operator (IESO, Ontario, Canada). Minimum loading point is the minimum output of energy specified by the market participant that can be produced by a generation facility under stable conditions without ignition support.

Alberta Electric System Operator (AESO, Alberta, Canada). Minimum stable generation is the minimum generation level that an asset can be continuously operated at without becoming unstable.

In self commitment electricity markets similar to WESM, generators would usually manage their minimum loading requirements and their unit commitment decisions through their offers. During periods when a generator wanted to generate, they would offer low prices up to their minimum loading levels. However, at present, this is not how it works in the WESM.

Presently in the WESM, the first block of the energy offers, which consist of eleven offer blocks, is automatically set to correspond to the registered Pmin. The trading participant would then provide the corresponding offer price for the remaining ten blocks.

Pmin is a dispatch constraint and considering that a unit must be dispatched to at least the minimum operating quantity, each generator with valid offers in the market is scheduled at least to its Pmin value. Consequently, no matter what the market price outcome would be, the generation offered up to the Pmin of the unit will still be dispatched. This capacity is therefore just a price taker in the market. On the other hand, a generator scheduled beyond its Pmin based on its offer prices for the rest of its capacity is not a price taker for this capacity.

In 2013, Intelligent Energy Systems Pty Ltd (IES), the consultant commissioned by PEMC to conduct the WESM Design Study (WDS), recommended that the Pmin be set to zero in the market dispatch optimization (MDOM)[5]. Setting the Pmin to zero is consistent with the WESM set-up of self-commitment and would be beneficial noting that it would result to reduced fuel costs as more expensive units, rather than being dispatched at their Pmin, may not be dispatched at all. In the same study, it was noted that the term “set Pmin to zero” is used as a “*shorthand way of saying that the constraints in the MDOM that force generators to generate at or above their Pmin levels would set Pmin to zero”*. That is, the MDOM could dispatch a unit below its Pmin. To avoid this condition, a generator would have to appropriately construct its bids. In the first phase of the said study, the consultant argued that it is *“useful to maintain the Pmin constraints and maintain the ability to set Pmin to non-zero in order to enable the System Operator to force generators to be dispatched to specific output levels in situations where it is necessary to direct generators”.*

[5] WESM Design Study Phase 2. Section 11.4.

The interim solution to address the recommendation of IES was the issuance of the DOE Circular No. DC2014-02-0004[6]. The Circular provides that generation companies with generating units that have fast start capability, as defined in the Grid Code, may be allowed to register a lower operating limit or Pmin of zero in the WESM.

On 23 October 2015, the DOE issued the Circular No. DC2015-10-0015[7] which provides the policies for further enhancement of the WESM design and operations. Section 2 of the Circular provides for the adoption, among others, of the removal of Pmin constraint, for all plants, in the market dispatch optimization model (MDOM). This will be addressed with the implementation of the new Market Management System (MMS) which is expected to be in operation sometime in 2017 or 2018.

While the implementation of the removal of the Pmin requirement in the WESM has yet to be implemented, and in the light of a recurring request by a combined cycle gas turbine (CCGT) plant to increase its Pmin, the Technical Committee (TC) initiated this review of Pmin specifically for CCGT plants in the Philippines.

1.1. OBJECTIVE

The objective of this report is to determine the basis of the technical Pmin of CCGT plants. Specifically, this report will review the following:

1. the procedure for setting the Pmin for CCGT plants, both for new registration and existing generator trading participants;
2. the established Pmin of CCGT plants in the Philippines; and
3. the case of Ilijan CCGT's request for Pmin increase as an example.

[6] DOE Circular No. DC2014-02-0004

[7] DOE Circular No. DC2015-10-0015

2. COMBINED CYCLE GAS TURBINE PLANTS IN THE PHILIPPINES

Combined cycle gas turbine plant is the dominant gas-based technology for intermediate and base-load power generation. CCGT plants generate electricity and use waste heat to produce steam that would generate extra electricity. The waste heat associated to the gas turbine exhaust is used in a heat recovery steam generator (HRSG) to produce steam that drives a steam turbine, which generates extra power.

Over the past few decades, development in technology has meant a noteworthy increase in the efficiency of CCGT. The CCGT electrical efficiency is anticipated to increase from the current 53-60% (lower heating value, LHV) to some 64% by 2020.

CCGT plants are designed to respond relatively quickly to changes in electricity demand and may be operated at 50% of the nominal capacity with a moderate reduction of electrical efficiency (50-52% at 50% load compared to 50-59% at full load). In general, because of the lower investment costs and the higher fuel (natural gas) cost vs. coal-fired power, CCGT plants are lower in the merit order for base-load operation, although the competition also depends on local conditions as variable fuel prices and environmental implications[8].

The gas turbine is one of the most efficient in converting gas fuels to electricity. More recently gas turbines have been more widely adopted for base load power generation, especially in combined cycle mode. Today, the most advanced CCGT plant can reach a net efficiency higher than 61% and a fuel utilization rate (including the use of commercial heat) of above 85% with CO_2 emissions of less than 325 g/kwh[9].

A basic combined cycle configuration is composed of one gas turbine and one steam turbine. This is normally called the module type. Another configuration where more gas turbines are associated to a single steam turbine is referred to as block type.

In the Philippines, there are four (4) CCGT plants, namely (a) Sta. Rita; (b) San Lorenzo; (c) Limay; and (d) Ilijan. Sta. Rita, San Lorenzo and Ilijan are located in South Luzon. Table 1

[8] Seebregts, A.J. *Gas-Fired Power*. Issue brief no. E02. International Energy Agency, 2010. Web. 4 Apr. 2016

[9] Seebregts, A.J. *Gas-Fired Power*.

shows the technical data (Pmax, Pmin) of the four CCGT plants based on its WESM registration.

Table 1. Technical Data (Pmin, Pmax) of CCGT Plants[10]

Name of Plant (Plant ID)	**Pmax (MW)**	**Mode of Operation (@ Pmax)**	**Pmin** (upon registration in 2006)	**Current Pmin** (as of 2015)	**Mode of Operation (@ Pmin)**
Sta Rita (3STA-RI_G01)	257.3	1 GT + 1 ST	80	160	1 GT + 1 ST
Sta Rita (3STA-RI_G02)	255.7	1 GT + 1 ST	80	160	1 GT + 1 ST
Sta Rita (3STA-RI_G03)	265.5	1 GT + 1 ST	80	160	1 GT + 1 ST
Sta Rita (3STA-RI_G04)	264	1 GT + 1 ST	80	160	1 GT + 1 ST
San Lorenzo (3STA-RI_G05)	264.8	1 GT + 1 ST	80	160	1 GT + 1 ST
San Lorenzo (3STA-RI_G06)	261.8	1 GT + 1 ST	80	160	1 GT + 1 ST
Limay (1LIMAY_A)	270	3 GT + 1 ST	0	0	1 GT
Limay (1LIMAY_B)	270	3 GT + 1 ST	0	0	1 GT
Ilijan (3ILIJAN_G01)	600	2 GT + 1 ST	250	300	1 GT + 1 ST
Ilijan (3ILIJAN_G02)	600	2 GT + 1 ST	250	300	1 GT + 1 ST

2.1. Sta. Rita CCGT Plant

Sta. Rita CCGT plant, located in Sta. Rita, Batangas, is composed of four (4) modules of combined cycle generating units. Each module has a gas turbine coupled to a steam turbine in a single-shaft arrangement. Each coupled module has a Pmin of 160 MW, and is capable of a Pmax of approximately 260 MW. For the entire complex, Sta. Rita can be dispatched up to 1042 MW to the grid.

The gas turbines of the Sta. Rita CCGT plant operate using natural gas as the primary fuel source and liquid fuel (gas oil distillate, condensate and naphtha) as the back-up source.

[10] Current Pmin values were based on WESM Registered Capacity List as of 21 March 2016.

2.2. San Lorenzo CCGT Plant

San Lorenzo CCGT plant, located in San Lorenzo, Batangas, is composed of two (2) modules of combined cycle generating units. Similar to that of Sta. Rita, each module has a gas turbine coupled to a steam turbine in a single-shaft arrangement. Each coupled module has a Pmin of 160 MW, and is capable of a Pmax of approximately 260 MW. For the entire complex, San Lorenzo can be dispatched up to 526 MW to the grid.

The gas turbines of San Lorenzo CCGT plant operate with natural gas as the primary fuel source. However, as backup it can operate on liquid fuel (gas oil distillate, condensate and naphtha).

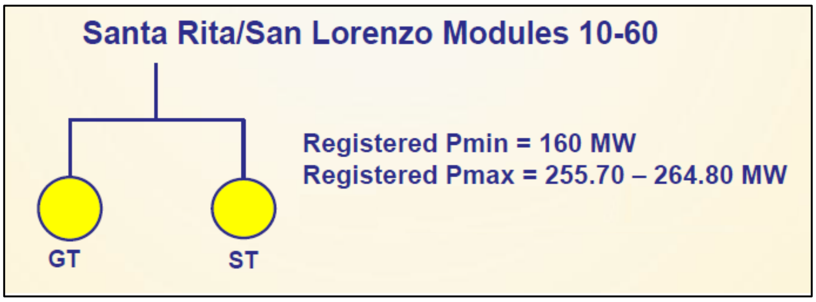

Figure 1. Sta. Rita/ San Lorenzo Modules[11]

2.3. Limay CCGT Plant

Limay CCGT plant, located in Limay, Bataan, is composed of two (2) combined cycle generating blocks. Each block is composed of three (3) gas turbine generating units which can be combined to a steam turbine generating unit. Each gas turbine is designed with a Pmin of 60 MW while the steam turbine has a Pmin of 90 MW. Altogether, each block has a capacity of 270 MW and for the entire complex, Limay can be dispatched up to 540 MW to the grid. With fast start capability, its Pmin is currently set to 0 MW.

[11] Figures 1 to 3 were taken from PEMC-TOD presentation during the TC Meeting No. 2014-03 held on 06 March 2014.

The gas turbines of Limay CCGT plant operate with diesel fuel.

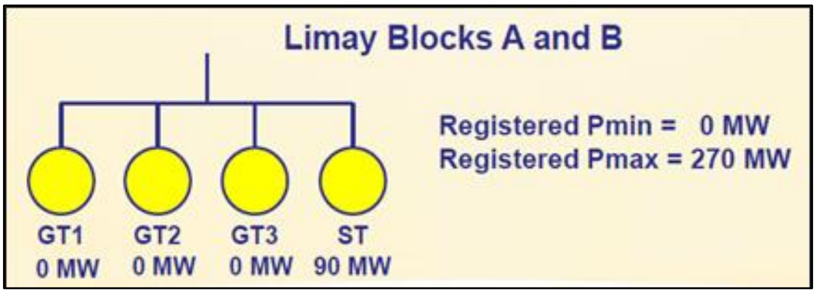

Figure 2. Limay Blocks A and B

2.4. Ilijan CCGT Plant

Ilijan CCGT plant, located in Brgy. Ilijan, Batangas City, is composed of two (2) combined cycle generating blocks. Based on its registration application documents, each block is composed of two (2) gas turbine generating units combined to a single steam turbine generating unit.

Each gas turbine is designed with a Pmin of 190 MW and is capable of a Pmax of 200 MW. On the other hand, the steam turbine has a stable load of 110 MW when coupled with one (1) gas turbine and has a stable load of 220 MW when coupled to two (2) gas turbines. Each block of two (2) gas turbines plus a steam turbine can operate in various combinations. With one (1) gas turbine plus a steam turbine, it can operate at 300 MW. With two (2) gas turbines plus a steam turbine it can operate between 420 MW to 600 MW. For the entire complex, Ilijan can be dispatched up to 1200 MW to the grid.

The gas turbines of Ilijan CCGT plant operate with natural gas as the primary fuel source with diesel oil as backup.

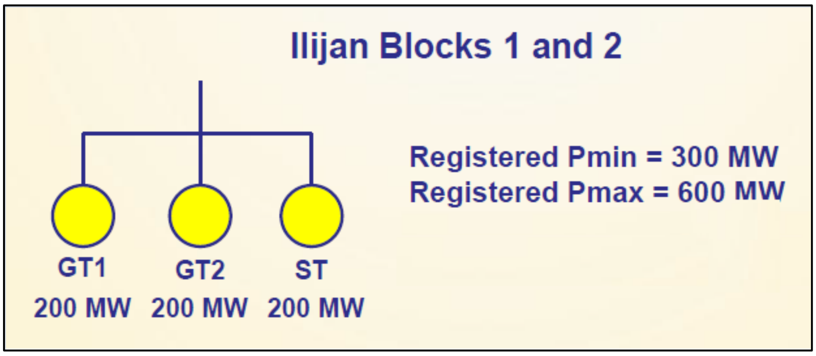

Figure 3. Ilijan Blocks 1 and 2

3. SETTING THE MINIMUM STABLE LOAD

The Pmin of each generating unit is specified in its Certificate of Compliance as issued by the ERC. The Pmin is submitted upon registration with the WESM. Table 2 shows the historical change in the Pmin of the four (4) CCGT plants currently registered in the WESM.

Table 2. Historical Change in Pmin of Ilijan[12]

Trading Participant	Plant ID	Pmin (from)	Pmin (to)	Approved Date	Effective Date
PSALM Corporation	1LIMAY_A	0	40	1-Aug-06	9-Aug-06
PSALM Corporation	1LIMAY_A	40	60	30-Mar-07	7-Apr-07
Panasia Energy, Inc.	1LIMAY_A	60	0	11-Mar-14	19-Mar-14
PSALM Corporation	1LIMAY_B	0	40	1-Aug-06	9-Aug-06
PSALM Corporation	1LIMAY_B	40	60	30-Mar-07	7-Apr-07
Panasia Energy, Inc.	1LIMAY_B	60	0	11-Mar-14	19-Mar-14
First Gas Power Corp.	3STA-RI_G01	80	160	18-Aug-06	26-Aug-06
First Gas Power Corp.	3STA-RI_G02	80	160	18-Aug-06	26-Aug-06
First Gas Power Corp.	3STA-RI_G03	80	160	18-Aug-06	26-Aug-06
First Gas Power Corp.	3STA-RI_G04	80	160	18-Aug-06	26-Aug-06
FGP Corporation	3STA-RI_G05	80	160	18-Aug-06	26-Aug-06
FGP Corporation	3STA-RI_G06	80	160	18-Aug-06	26-Aug-06
PSALM Corporation	3ILIJAN_G01	250	350	26-Jul-06	3-Aug-06
PSALM Corporation	3ILIJAN_G01	350	300	21-Feb-07	1-Mar-07

[12] Data provided by PEMC Registration

Trading Participant	Plant ID	Pmin (from)	Pmin (to)	Approved Date	Effective Date
PSALM Corporation	3ILIJAN_G02	250	350	26-Jul-06	3-Aug-06
PSALM Corporation	3ILIJAN_G02	350	250	22-Sep-06	30-Sep-06
PSALM Corporation	3ILIJAN_G02	250	300	21-Feb-07	1-Mar-07

In August 2006, Pmin for all CCGT plants increased. For Sta. Rita and San Lorenzo CCGT plants, the Pmin of each module increased from 80 MW to 160 MW. This carried on until the present.

In 2006, the Pmin of Limay CCGT plant increased from 0 MW to 40 MW for each block. In 2007, the Pmin of Limay CCGT plant increased further to 60 MW for each block. However in 2014, Limay registered for a zero Pmin due to its fast start capability.

Ilijan CCGT plant on the other hand, started from 250 MW per block upon registration in 2006, increased to 350 MW in the same year, but is presently set to 300 MW. Recently, Ilijan CCGT plant requested to increase this to at least 420 MW per block.

Even after much inquiry, the TC was not able to collect complete documentation describing the procedures for each of these changes.

The WESM Registration Manual requires that the technical parameters of a generator be consistent with its Certificate of Compliance as issued by the ERC. Article III Section 2 of the ERC Resolution No. 16, Series of 2014, on the other hand, provides that new applications for Certificate of Compliance of new generation facilities other than self-generation facilities include a "*Certificate of Technical Requirements Compliance issued by NGCP to a Generation Company or Facility confirming a generating unit's capability to operate within its registered parameters through the conduct of Generating Unit Capability Test*"[13]. These registered parameters include the Pmin of the unit. Article III Section 3 of the same Resolution provides that renewal of Certificate of Compliance requires a five year operational history, if

[13] ERC Resolution No. 16, Series of 2015. Article III. Section 2. (a) (bb) (vi) (5).

applicable[14], and a report on the conduct of capability test if there is an addition, replacement or repowering of units[15].

As noted in the introduction in accordance with ERC Resolution No. 16, Series of 2014, the *minimum stable load* or Pmin for CCGT plants refers to the minimum demand in MW that a generating block or module can reliably sustain for an indefinite period of time, based on the generator capability tests. For the Sta. Rita and San Lorenzo CCGT plants, this definition is interpreted as the minimum load of one (1) gas trubine plus one (1) steam turbine single-shaft combination. On the other hand, for the Limay CCGT plant, each of the three (3) gas turbines can deliver a stable minimum load even without the steam trubine coupled to it, effectively running on simple cycle operation. For the Ilijan CCGT plant, this definition may be interpreted as the minimum load for a combination of two (2) gas turbines plus one (1) steam turbine in the block. However, historically, these blocks have been operated in one (1) gas turbine plus one (1) steam turbine mode of operation during maintenance outage of one (1) gas turbine.

As far as technical parameters in WESM registration is concerned, any change in any parameter shall be coursed through Market Operator in accordance with the latest Certificate of Compliance of the trading participant.

3.1. Generating Unit Capability Test

The Grid Code requires that a Generating Unit Capability Test be performed in order to establish the technical parameters, including the Pmax, Pmin and ramp rate of the plant which is also a requirement in the Certificate of Compliance issued by the ERC. In practice, this capability test is performed by the generating unit manufacturer. Many years after the installation of the unit, the manufacturer may not be available to perform this test. However, the procedure to perform this test should follow closely the manufacturer's specifications.

The Certificate of Technical Requirements Compliance, as required by the ERC, is issued by the NGCP once the plant/unit has been tested as witnessed by System Operator. However, in accordance with the Certificate of Compliance, tests should be done by a third

[14] ERC Resolution No. 16, Series of 2015. Article III. Section 3. (a) (1) (cc)

[15] ERC Resolution No. 16, Series of 2015. Article III. Section 3. (a) (2) (ff)

party duly approved by the ERC. In cases when the test is initiated by the generator, the ERC still acknowledges the witnessing done by the System Operator. The result of the test will be submitted to the ERC based on actual data gathered during the testing.

3.2. Ilijan Plant as a Sample Case for Pmin Change

As described earlier, the Ilijan CCGT plant is composed of two (2) blocks, with each block composed of two (2) gas turbines and one (1) steam turbine combination. Upon registration, each block has a Pmin of 250 MW. In July 2006, PSALM requested that the Pmin for Block 1 be increased to 350 MW. The primary reason stated was that each unit requires a 48 hours shutdown before a restart. The requested Pmin of 350 MW will allow the plant to always operate at two (2) gas turbines and one (1) steam turbine, avoiding frequent shutdown and restart for any gas turbine. In March 2007, this Pmin was reduced to 300 MW, however no documentation was found by the TC describing the reason for this reduction.

For Ilijan Block 2, Pmin was also increased from 250 MW to 350 MW effective August 2006. In September 2006, PSALM requested a reduction of its Pmin to 250 MW for reason of "operational flexibility on 1 GT-1 ST mode"[16]. In March 2007, the Pmin was again increased to 300 MW, however no documentation was found by the TC describing the reason for the increase.

The series of changes in Pmin highlights the fact that the plant operator has requested both an increase and a decrease in Pmin for the same reason of flexibility in plant operation.

Very recently, South Premiere Power Corporation (SPPC), the Independent Power Producer Administrator and trader of Ilijan CCGT plant, requested that the Pmin for each Ilijan block be increased from 300 MW to 420 MW where two (2) gas turbines and one (1) steam turbine are operating. A plant performance test was conducted observing the performance of the plant at 400 MW, 420 MW and 600 MW loading for each block.

[16] Commercial operations change in registration data dated 21 August 2006.

However, the TC declared its opinion that the test should have been conducted starting at 300 MW (the current Pmin) and 350 MW (the requested Pmin for 2 GT + 1 ST in 2006).

On 26 May 2015, the TC transmitted its report on the conduct of the performance test of Ilijan to PEMC, incorporating its issues and concerns on the purpose of the test, test procedures and other concerns.

On the purpose of the test, the TC pointed that some grounds for conducting the performance test, as indicated in the ERC's letter of approval addressed to SPPC, are not directly related to the Pmin test. The TC also deemed that if the purpose of the test was to find the Pmin, the testing should have started from 420 MW down to the lowest designed MW level where all parameters were still at normal or stable values. The TC also opined that SPPC should have established first that Ilijan power station was not stable at the current 300 MW/block Pmin, thus the need for a new Pmin test.

As to the test procedures, one of the issues raised by the TC was the basis for setting the test block at 66% loading (400 MW). During the briefing prior to the conduct of the performance test, it was discussed that that the 66% was based on Ilijan's internal test results for 2 GT + 1 ST. The TC opined that Korea Electric Power Research Institute (KEPRI), the third party that would conduct the test, should have been asked to test for the real Pmin and not be limited at 66% based on the result of Ilijan's internal test. The TC got the impression that the test was conducted to validate an internal test instead of an independent Pmin test.

During the briefing, it was also raised that the Pmin, as defined in the WESM Registration Manual, should be based on 1 GT + 1 ST operation. However this mode of operation was not considered in the test procedures.

The TC was under the impression that Ilijan's focus was on its Energy Conversion Agreement (ECA) and that the reason for increasing the Pmin may not be a technical issue but a commercial one. The TC was also concerned with the possibility that the Pmin will be set for a 2 GT + 1 ST operation, which in this case is at least 400 MW. Suppose one (1) gas turbine is on forced outage, the plant is still capable to deliver 300 MW at 1 GT + 1 ST noting that historically, Ilijan has previously delivered at 300 MW. In this setup, outage of one (1) gas turbine will not affect the trading of capability in the market and no overriding requirement from System Operations will be implemented to ensure its dispatch in the grid. Also, trading strategies can be applied to the market whenever full availability of gas turbines are realized.

Additional concerns noted by the TC were on the lack of a basis for the 400 MW minimum output. The TC noted that there was no intervening event why the Pmin of Ilijan had to be increased and no document for the current 300MW/block Pmin was available. In its report, the TC mentioned that the test conducted was not a Pmin test but a performance test on the pre-determined values of 420 MW and 400 MW.

The TC report was forwarded by PEMC to the ERC on 08 June 2015, for the Commission's consideration.

4. SUMMARY AND RECOMMENDATIONS

a. Setting of Pmin

The Pmin of each generating unit is submitted upon registration in the WESM and specified in its Certificate of Compliance as issued by the ERC. Based on historical records of WESM registration, the four (4) CCGT plants have previously requested and were granted changes in their Pmin. The TC reiterates that based on the WESM Registration Manual, any change in any technical parameter shall be coursed through the Market Operator in accordance with the latest Certificate of Compliance of the trading participant[17]. A Generating Unit Capability Test has to be conducted in order to establish the technical parameters, including the Pmin, among others, as required in the Grid Code.

b. Pmin of CCGT plant based on a module configuration

The setting of the Pmin for CCGT plants depends on the minimum stable load of the combined cycle configuration of the plant. The basic combined cycle configuration is a module composed of one (1) gas turbine and one (1) steam turbine. A block which is composed of multiple gas turbines coupled to a single steam may also be operated as a

[17] WESM Registration Manual. Section 3.3.1. *Registered Capacities*

module during an outage of one or more gas turbine. Considering such flexibility and in consideration of the current market design as far as registration is concerned, it is recommended that the Pmin setting for a CCGT plant be based on the capability of a module.

c. Zero Pmin for CCGT plants with fast start capability

In the current WESM plant registration, the Pmin of fast start plant is set to zero (0). Pmin zero, as discussed in the introduction of the report, meant removing the constraint in the MDOM. For non-fast start plants, Pmin is set based on respective minimum stable load per type of configuration (i.e., module or block type). Limay CCGT, though configured as block type, has the capability to run on simple cycle mode, enabling its fast start capability and thus, registered with zero (0) Pmin. For non-fast start CCGT, Pmin ranges from 50%-62% based on registered Pmax.

d. Set the Pmin at the minimum combined cycle configuration (1 GT + 1 ST)

The performance test conducted for Ilijan CCGT plant showed that each block can operate between 400 MW to 600 MW but no concrete record was presented to show that the CCGT plant is prohibited from operating at 300 MW or even 350 MW. Historically, Ilijan has at one stage requested to reduce its Pmin from 350 MW to 250 MW[18] "for reason of operational flexibility on 1GT + 1 ST mode"[19]. It is recommended that Ilijan's Pmin remain at a module configuration of 1 GT + 1 ST.

[18] See Table 2.

[19] Commercial operations change in registration data dated 21 August 2006.

ABOUT THE TECHNICAL COMMITTEE

Under Clause 1.7.2 of the WESM Rules, the Technical Committee shall from time to time as necessary and appropriate, and whenever the PEM Board directs: *(a) monitor technical matters relating to the operation of the spot market; xxx (c) Assist the PEM Board by providing expertise in relation to: xxx (3) any other matter of a technical nature relating to the spot market; and (d) from time to time if the Technical Committee in its discretion deems necessary or appropriate, propose amendments to the WESM Rules in relation to technical matters, in accordance with chapter 8 with a view to: (1) improving the efficiency and the effectiveness of the operation of the spot market; and (2) improving or enhancing the prospects for the achievement of the WESM objectives.*

Further, Section 4 of the Technical Committee Market Manual (TCMM) provides that the TC shall conduct technical reviews and studies in relation to (a) power plant technical parameters; and (g) any other matter of technical nature relating to the sport market.

The TC is currently composed of four (4) members, namely, Prof. Jordan Rel C. Orillaza and Engr. William C. Alcantara as Independent Members; Engr. Jaime V. Mendoza, Distribution Management Committee (DMC) Representative; and Engr. Fidel D. Dagsaan, Jr., Systems Operator (SO) Representative.

This report is prepared by the TC with the assistance of the MAG of the Philippine Electricity Market Corporation. [20]

[20] The MAG acts as the Technical and Administrative Secretariat of the TC

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