RCP PAPER NO.	:	**EMC/RCP/XXX/2025/394**
SUBJECT	:	**EXEMPTION FROM AUTOMATIC FINANCIAL PENALTY SCHEME FOR DEVIATING GENERATION REGISTERED FACILITIES ON FREE GOVERNOR CONTROL**
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Executive Summary

The Automatic Financial Penalty Scheme (AFPS) was introduced by the EMA in the Singapore Wholesale Electricity Market to incentivise compliance with dispatch schedules, thereby enhancing system reliability and stability.

The current Market Rules provide AFPS exemption for deviating Generation Registered Facilities (GRFs) operating under free governor control and responding positively to a power system disturbance event. This paper re-examines if this exemption should be extended to apply to such deviating GRFs in the absence of a power system disturbance event.

Frequency fluctuations in the electricity system can occur for various reasons, even without a power system disturbance event. A GRF operating under free governor control acts autonomously, as its governors provide immediate primary frequency response without direct manual intervention. GRFs are also required to comply with the minimum capability requirements and standards of the Transmission Code.

EMC considers that as long as a GRF on free governor control responds positively to frequency changes in the power system, and complies with the minimum capability requirements and standards outlined in the Transmission Code, the GRF's deviation should not be penalised and accordingly exempted from AFPS.

EMC would like to seek the views of the industry on the proposed rule modifications. We appreciate receiving comments by **8 August 2025**.

1. Introduction

This paper reviews the proposal to exempt Generation Registered Facilities (GRFs) on free governor control from Automatic Financial Penalty Scheme (AFPS) which have deviated from its scheduled load while responding positively to frequency changes in the power system, even in the absence of a power system disturbance.

2. Background

2.1 Introduction to AFPS

The AFPS was introduced in the Singapore Wholesale Electricity Market (SWEM) as part of the Energy Market Authority's (EMA) policy decision on "Review of Policy on Direct Supply of Electricity by Generating Sets to Onsite Loads".

With the AFPS, the market will impose financial penalties on GRFs, which are subject to the Power System Operator's (PSO) central dispatch, whenever they deviate from their schedules by more than 10MW. The detailed explanation of the computation of the penalty value and collection of the AFPS is provided in Annex 1.

The aim of the AFPS is to incentivise generators to comply with dispatch schedules and therefore reduce the need for PSO to manually intervene with dispatch schedules.

2.1.1 Existing Exemptions to AFPS

Under the AFPS, penalties will be imposed on Gencos with deviating GRFs, which are those GRFs that have deviated from their dispatch schedules by more than 10MW, except for the following reasons:

- The GRF's deviation is to help maintain the security or reliability of the power system
- The GRF's deviation is out of the Genco's control
- The GRF's deviation is required/permitted under governing documents such as Transmission Code, the Market Rules and System Operation Manual

Specifically, GRFs are exempted from the AFPS under the following scenarios, as expressly provided for under Section 3.7.3 of Chapter 5 of the Market Rules.

a. The GRF is operating **under Automatic Generation Control (AGC)** throughout the dispatch period,

b. The GRF is **issued dispatch instructions by the PSO** to deviate from its dispatch schedules and such instructions have been complied with,

c. The GRF is undergoing **re-commissioning tests** that have been approved by the PSO,

d. The GRF experienced a **forced outage** which **caused** the GRF to **automatically disconnect** from the transmission system. The GRF will be exempted from AFPS for that dispatch period and the dispatch period after,

e. The GRF is being **started up or shut down**. For the avoidance of doubt, if a GRF fails to synchronise, it is not considered as being started-up and thus not exempted from the AFPS,

f. The GRF is performing **fuel changeover** as required under the Transmission Code or in compliance with the PSO's directions,

g. The GRF is operating **under Free Governor Control** throughout the dispatch period and is responding positively to a power system disturbance.

2.2 Current Market Rules

Section 3.7.3.8 of Chapter 5 of the Market Rules states that:

- "…such *generation registered facility* shall be deemed to be a deviating *generation registered facility* unless the deviation occurred in respect of *dispatch period(s)* where the *generation registered facility* was on free governor control and responding positively to a *power system* disturbance."

According to the above, if a GRF is operating on free governor control, and its governor mechanism adjust power output in response to frequency fluctuation, resulting in a deviation from their schedule by more than 10MW, the GRF remains subject to AFPS in the absence of a power system disturbance.

2.2.1 GRF operating modes

All GRFs are required to operate with free governor control enabled at all times. GRFs on free governor control utilise an internal governor mechanism (governors) within a generator to automatically adjust output in response to real-time frequency fluctuations in the power system.

GRFs on free governor control operate autonomously, as its governors respond instantly to local frequency deviations without reliance on ex-ante dispatch schedules or real-time AGC instructions issued by the PSO. These governors provide immediate primary frequency response without direct manual intervention.

While free governor control may contribute to the generator's own operational security, safety or reliability, its primary function is to help maintain overall stability of system frequency.

While operating on free governor control, a GRF can be in one of two mutually exclusive operating modes:

- AGC: GRFs operating under AGC allows the PSO to centrally adjust the output of GRFs automatically via electronic commands so as to balance generation and load in real-time.
- Local control: GRFs operating on local control function independently of AGC, as the PSO cannot centrally modify their output using automated electronic commands. A GRF cannot simultaneously be on both AGC and local control, as these are mutually exclusive operational modes. Instead, GRFs on local control have direct control over their own generation, adjusting their output based on internal settings or local decisions.

Throughout this paper, the discussion of GRFs operating on free governor control refers specifically to those on local control. GRFs operating under AGC are excluded from discussion as they are already exempted from AFPS according to Section 3.7.3.1 of Chapter 5 of the Market Rules.

2.2.2 Power system disturbance

The PSO considers power system disturbances as events where the power system experiences tripping or forced outages.

GRFs are expected to comply with real-time dispatch schedules. If a GRF operating under free governor control deviates from its scheduled load, the PSO investigates whether the deviation is due to a legitimate power system disturbance event (i.e., tripping or forced outages) before deciding if the event of deviation could be potentially exempted from AFPS.

This paper evaluates whether the exemption of AFPS for GRF on free governor control should be extended beyond a power system disturbance event. The detailed analysis of this issue can be found in the following sections of this paper.

3. Analysis

3.1 Performance Standards for GRFs under the Transmission Code

Firstly, the frequency of the electricity system shall normally be maintained at 50 ± 0.2 Hz and shall not be permitted to rise above 50.5 Hz or fall below 49.5 Hz without correction action being taken[1].

Further to the above, Appendix C4.1(e) of the Transmission Code states that:

- "… the speed governor deadband shall be within the range of ± 0.05 Hz. However, the governor shall respond to full frequency deviation once system frequency deviation exceeds this deadband."

As stated in the Transmission Code, there exists a governor frequency deadband. Governors will not react to system frequency deviations within this governor deadband. This is designed to prevent unnecessary adjustments due to minor frequency fluctuations, therefore enhancing system stability. Essentially, once the system frequency deviates large enough, the governors will actively adjust power output to restore back to system's normal operating frequency.

Appendix C4 of the Transmission Code further outlines the minimum capability requirements and standards of a centrally dispatched generating unit (i.e., GRF). GRFs are required to comply with these minimum capability requirements and standards.

The detailed requirements contained in Appendix C4.1 (e) of the Transmission Code is provided in Annex 2.

3.3 Penalties Despite Complying with Governor Performance Standards

Frequency fluctuations in the electricity system occur for various reasons. Even without a power system disturbance event, the system frequency deviation may occur and exceed the governor frequency deadband. Solar intermittency is one of these causes.

GRFs operating on free governor control will have to respond to the system frequency deviation as required under the Transmission Code and may potentially deviate from dispatch schedules by more than 10MW, in the event that the system frequency deviation falls out of the governor frequency deadband range. This is due to the automatic corrective action of the governors adjusting power output to maintain the system frequency at normal state.

The governors' real-time corrective actions trigger automatically, responding to system conditions in a way that is beyond the direct manual control of the operator. They comply with the Transmission Code's standards and requirements for governors installed in GRFs.

Given that governors are in-built mechanism installed within GRFs, such output deviations should be recognised as a consequential outcome of governors responding to real-time system frequency fluctuations.

In the absence of a power system disturbance, a GRF operating on free governor control in such a situation is currently classified as a deviating GRF and therefore subject to the AFPS, all despite positively responding to maintain system stability.

This paper argues that it is fair to broaden and extend the exemption of AFPS beyond a power system disturbance event for a GRF that is on free governor control, in compliance with the requirements and standards set out in the Transmission Code and contributes positively to the security and reliability of the power system.

[1] Market Rules, Appendix 5B, Section B.1.1

4. Proposed Market Rule Modifications

Table 1 below provides a summary of the proposed rule modifications. To effect the changes as expressed in Section 3 of this paper, EMC has drafted rule modifications as set out in Annex 3.

Table 1: Summary of Proposed Market Rule Modifications

S/N	Chapter / Section	Proposed Modifications	Reasons for Modifications
1	Chapter 5, Section 3.7.3.8	Remove dependency on the occurrence of a power system disturbance event, and include occurrence of frequency change as a determining criterion when assessing deviating GRFs.	Allow GRFs on free governor control to be exempted from AFPS if its governors are responding positively to frequency changes in the power system, beyond a specific power system disturbance event, while also complying with the Transmission Code requirements.

5. Consultation

EMC would like to seek industry views on the proposal, including potential implications to the proposed rule modifications, or any additional cases not covered in Section 3 of the analysis.

We appreciate receiving comments by 8 Aug 2025.

Annex 1: Penalty value and collection of the AFPS

The penalty value for a deviating GRF for any given dispatch period is, in effect, set at the rate of 0.5 x (USEP+HEUC) for each MW of deviation[2] from its schedule (in excess of 10 MW), subject to a minimum of $5000, as determined in accordance with the formula below:

Financial Penalty= Max {2 × (USEP + HEUC) × [½ × | EndScheduledQty – EndGeneration | × ½ hour – 2.5 MWh], $5000}

where:

EndGeneration is the GRF's gross generation output (in MW) at the end of a dispatch period

EndScheduledQty is the GRF's scheduled output (in MW) for a dispatch period

EMC will issue the preliminary and final financial penalty statement on the 6th and 10th business day after the trading day respectively, and will collect the penalty from the MPs on the 20th calendar day after the trading day through direct debit from the Genco's bank account.

The penalty collected from AFPS will be paid to consumers via the Monthly Energy Uplift Charge (MEUC).

[2] The MW deviation is measured by the absolute difference between the energy schedule (MW) and the actual generation output level at the end of dispatch period as captured by PSO's Energy Management System.

Annex 2: Transmission Code, Appendix C4.1 (e)

C4.1 All *generating units* of gross generating capacity exceeding 10MW or registered with the Energy Market Company as a *generation registered facility* shall be centrally dispatched. All centrally dispatchable *generating units*, shall be designed to have the following capabilities except where the Generation Licensees declare with technical justifications that certain capabilities are technically not possible and submit such request together with its supporting reasons for *PSO* consideration.

(e) Governor Response and Spinning Reserve

The Generation Licensee's *generating unit* shall be designed to possess the following capabilities:

- all *generating units* shall be *frequency* sensitive;
- capable of responding automatically to normal variation in the system *frequency* of ±0.5Hz;
- releasing the spinning *reserve* in the manner required by the *PSO* under the Market Rules and tested as per the verification tests stipulated in the System Operation Manual; and
- the speed governor must meet the following minimum requirements:
  - the speed governor must be capable of being set so that it can operate with governor droops within the range of 3% to 5%.
  - the speed governor deadband shall be within the range of ±0.05Hz. However, the governor shall respond to full *frequency* deviation once system *frequency* deviation exceeds this deadband;
  - where a *generating unit* becomes part of an electrical island i.e. is isolated from the rest of the system, but is still supplying loads in the island, the speed governor must be able to contribute its share to maintain *frequency* in the island, unless *PSO* considers, on a reasonable ground, that it is technically not feasible;

Annex 3: Proposed Rule Modifications

Existing Market Rules (1 January 2025)	Proposed Rule Change (Deletions represented by strikethrough text and additions represented by double underlined text)	Reasons for Modification
Chapter 5	**Chapter 5**	
3 OBLIGATIONS AND RESPONSIBILITIES	**3 OBLIGATIONS AND RESPONSIBILITIES**	
3.7 OBLIGATIONS OF GENERATORS	**3.7 OBLIGATIONS OF GENERATORS**	
3.7.3 If a *generation registered facility* deviates, in the manner and to the extent described in section D.3.1 of Appendix 5D, from its *real-time dispatch schedule* or its *short-term schedule* (as the case may be) which is deemed to be or is otherwise issued as the *dispatch instructions* issued by the *PSO*, such *generation registered facility* shall be deemed to be a deviating *generation registered facility* unless the deviation occurred in respect of *dispatch period(s)* where the *generation registered facility*: 3.7.3.1 was at all relevant times operating under *AGC*; ... 3.7.3.8 was on free governor control and responding positively to a *power system* disturbance. The automatic financial penalty scheme described in Appendix 5D shall apply to the *market participant* of such deviating *generation registered facility.*	3.7.3 If a *generation registered facility* deviates, in the manner and to the extent described in section D.3.1 of Appendix 5D, from its *real-time dispatch schedule* or its *short-term schedule* (as the case may be) which is deemed to be or is otherwise issued as the *dispatch instructions* issued by the *PSO*, such *generation registered facility* shall be deemed to be a deviating *generation registered facility* unless the deviation occurred in respect of *dispatch period(s)* where the *generation registered facility*: 3.7.3.1 was at all relevant times operating under *AGC*; ... 3.7.3.8 was on free governor control, <u>in accordance with the requirements referred to in the *transmission code*</u>, and responding positively to ~~*a power system* disturbance~~ <u>frequency changes in the *power system.*</u>	To provide that a generation registered facility operating on free governor control, in compliance with the transmission code, which has responded positively to frequency changes in the power system, should not be deemed to be a deviating generation registered facility for the purposes of the automatic financial penalty scheme.

Existing Market Rules (1 January 2025)	Proposed Rule Change (Deletions represented by strikethrough text and additions represented by double underlined text)	Reasons for Modification
	The automatic financial penalty scheme described in Appendix 5D shall apply to the *market participant* of such deviating *generation registered facility*.	