



CONSULTATION PAPER FOR PROPOSED MODIFICATIONS TO THE TRANSMISSION CODE

Closing date for submission of representations:
10 FEB 2022, 5 p.m.

10 JAN 2022

ENERGY MARKET AUTHORITY
991G Alexandra Road
#01-29 Singapore 119975
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1 Introduction

- 1.1. The Transmission Code sets out the rights and obligations of the Transmission Licensee, together with the rights and obligations of users of the Transmission System. The Transmission Code also sets out the technical requirements to be met by those who seek to connect and operate installations on the transmission system.

2 Proposed modifications to the Transmission Code

- 2.1. Pursuant to Section 1.6 of the Transmission Code, EMA seeks representations on the proposed modifications to the Transmission Code as set out in Appendix 1.
- 2.2. The proposed modifications are to include new/update the technical requirements relating to electricity import, generating unit and updating the reference to “Wholesaler Licensees” instead of “Wholesaler (Generation) Licensee” or “Wholesaler (Demand Side Participation) Licensee”, following the Wholesaler Licence Modification Final Determination Paper issued to the relevant licensees on 29 Jun 2021.

3 Invitation to submit representations

- 3.1. EMA invites written representations on the proposed modifications to the Transmission Code as set out in Appendix 1.
- 3.2. Please send your written representations by e-mail to:

EMA_ES@ema.gov.sg

Alternatively, you may send your written representations by post/fax to the following address:

*Electricity System Department
Industry Regulation Division
Energy Market Authority
991G Alexandra Road, #01-29
Singapore 119975.
Fax: (65) 6 835 8020*

Please use the form set out in Appendix 2 for your representations.

- 3.3. Anonymous representations will not be considered.
- 3.4. All representations must be in writing and must reach EMA by 5 pm on 10 FEB 2022.

- 3.5. EMA will acknowledge receipt of all submitted representations electronically. Please contact Mr Vincent Siow at 6376 7694 or Mr Yeo Eng Houw at 6376 7509 if you have not received an acknowledgement of your submitted representation within two business days. EMA reserves the right to make public all or any part of any representation and/or to disclose the identity of the party who made the representation. Where a respondent considers any part of his representation to be confidential, he shall clearly mark and place such part of his representation as an annex.
- 3.6. This Consultation Paper shall constitute notice of the proposed modifications to the Transmission Code set out in Appendix 1, for the purpose of Section 1.6 of the Transmission Code.

~ End ~

Table 1: Proposed Modifications to the Transmission Code

Modification Ref. No.	Clause	Original Text	Modified Text	Reasons
TC/2021/1	1.2.1	<p>This <i>Code</i> is applicable to:</p> <p>(a) The Transmission Licensee, who is subject to and required to comply with this <i>Code</i> by a condition of its electricity licence;</p> <p>(b) Generation Licensees who are subject to and required to comply with this <i>Code</i> by a condition of their electricity licence;</p> <p>(c) Wholesaler (Generation) Licensees who are subject to and required to comply with this <i>Code</i> by a condition of their electricity licence;</p> <p>(d) Wholesaler (Demand Response Programme) Licensees who are subject to and required to comply with this <i>Code</i> by a condition of their electricity licence;</p> <p>(e) Market Company Licensee who is subject to and required to comply with this <i>Code</i> by a condition of their electricity licence;</p> <p>(f) A <i>connected person</i> who is required to comply with this <i>Code</i> or certain provisions of this <i>Code</i> under the terms of a <i>Connection Agreement</i> or <i>Retailer Use of System Agreement</i> with the Transmission</p>	<p>This <i>Code</i> is applicable to:</p> <p>(a) The Transmission Licensee, who is subject to and required to comply with this <i>Code</i> by a condition of its electricity licence;</p> <p>(b) Generation Licensees who are subject to and required to comply with this <i>Code</i> by a condition of their electricity licence;</p> <p>(c) Wholesaler (Generation) Licensees who are subject to and required to comply with this <i>Code</i> by a condition of their electricity licence;</p> <p>(d) Wholesaler (Demand Response Programme) Licensees who are subject to and required to comply with this <i>Code</i> by a condition of their electricity licence;</p> <p>(e) Market Company Licensee who is subject to and required to comply with this <i>Code</i> by a condition of their electricity licence;</p> <p>(a) <u>A Licensee who is subject to this <i>Code</i> as a condition of its <i>electricity licence</i> and a <i>Licensee</i> defined in section 1.3.1 of this <i>Code</i>;</u></p> <p>⊕ (b) A <i>connected person</i> who is required to comply with this <i>Code</i> or certain provisions of this <i>Code</i> under the terms of a</p>	To provide clarity on the respective Licensees who are required to comply with this Code as a condition of its electricity licence.

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		<p>Licensee or by a condition of its electricity installation licence; and</p> <p>(g) The <i>Power System Operator</i>, either under the provisions of this <i>Code</i> or under the terms of the <i>Operating Agreement</i>.</p>	<p><i>Connection Agreement</i> or <i>Retailer Use of System Agreement</i> with the <i>Transmission Licensee</i> or by a condition of its electricity installation licence; and</p> <p>(g) (c) The <i>Power System Operator</i>, either under the provisions of this <i>Code</i> or under the terms of the <i>Operating Agreement</i>.</p>	
TC/2021/2	1.3.1	<p>“connection applicant” means, in respect of a <i>generation facility</i>, a Generation Licensee or Wholesaler (Generation) Licensee and, in respect of a consumer <i>installation</i>, a person acting through an <i>authorised person</i> but (for the avoidance of doubt) shall exclude a <i>sub-metered consumer</i></p>	<p>“connection applicant” means, (1) in respect of a <i>generation facility</i>, a <u>Generation Licensee</u> or <u>Wholesaler (Generation) Licensee</u>, (2) in respect of an <i>import facility</i>, the <u>Licensee responsible for it</u> and, (3) in respect of a consumer <i>installation</i>, a person acting through an <i>authorised person</i> but (for the avoidance of doubt) shall exclude a <i>sub-metered consumer</i></p>	<p>To update the reference to Wholesaler Licensees (following the Wholesaler Licence Modification Final Determination Paper issued on 29 Jun 2021).</p> <p>To also include Importer Licensee as a connection applicant for an import facility or an interconnector.</p>
TC/2021/3	1.3.1	New definition	<p>“electricity licence” has the same meaning as in <u>the Act</u>;</p>	<p>To provide clarity on the respective Licensees who are required to comply with this Code as a condition of its electricity licence.</p>
TC/2021/4	1.3.1	New definition	<p>“Licensee” means:</p> <p>(i) <u>a Generation Licensee</u>;</p> <p>(ii) <u>an Importer Licensee</u>;</p> <p>(iii) <u>a Market Company Licensee</u>;</p> <p>(iv) <u>a Transmission Licensee</u>;</p> <p>(v) <u>a Wholesaler Licensee</u>;</p>	<p>To provide clarity on the respective Licensees who are required to comply with this Code as a condition of its electricity licence.</p>

Modification Ref. No.	Clause	Original Text	Modified Text	Reasons
TC/2021/5	1.3.1.	New definition	<u>“Generation Licensee” has the same meaning as in the Act;</u>	To provide clarity on the respective Licensees who are required to comply with this Code as a condition of its electricity licence.
TC/2021/6	1.3.1	“generation facility” means one or more <i>generating units</i> , including its associated equipment such as switchgears, transformers and all auxiliary equipment;	“generation facility” means one or more <i>generating units</i> , including its associated equipment such as switchgears, transformers and all auxiliary equipment; <u>and one or more import facility, if any;</u>	To include import facility that is connected to generation licensee’s switchhouse as part of the definition.
TC/2021/7	1.3.1	“interconnector” means a set of feeder circuits for the transmission of electricity to or from the transmission system from or to an external system or external generation facility outside Singapore, and ‘interconnection’ shall be interpreted accordingly;	“interconnector” means a set of feeder circuits for the transmission of electricity to from between the transmission system <u>import facility and from or to</u> an external system or external generation facility outside Singapore, and ‘interconnection’ shall be interpreted accordingly;	To account for HVAC/HVDC configuration.
TC/2021/8	1.3.1	New definition	<u>“import” has the same meaning as in the Act;</u>	Related to the new definition of “import facility” and “Importer Licensee.”
TC/2021/9	1.3.1	New definition	<u>“import facility” means an installation in Singapore wherein electricity imported from an external system or external generation facility via High Voltage Direct Current (HVDC) or High Voltage Alternating Current (HVAC) interconnector is transmitted to the transmission system or HVDC switchhouse. A HVDC import facility shall comprise of a HVDC interconnector, HVDC station, a subsea cable landing point, HVDC cables, HVAC cables connecting to switchhouse, all auxiliary equipment, and an energy storage system if needed. Whilst a HVAC import facility shall comprise of a HVAC interconnector, subsea cable</u>	To include new definition for import facility.

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			<u>landing point, HVAC cables connecting to switchhouse, all auxiliary equipment, and an energy storage system if needed. Refer to Figure F1.3.1.a, b, c, and d for illustration.</u>	

Figure F1.3.1 a – HVAC Import Facility Connecting to Generation Licensee’s Switchhouse

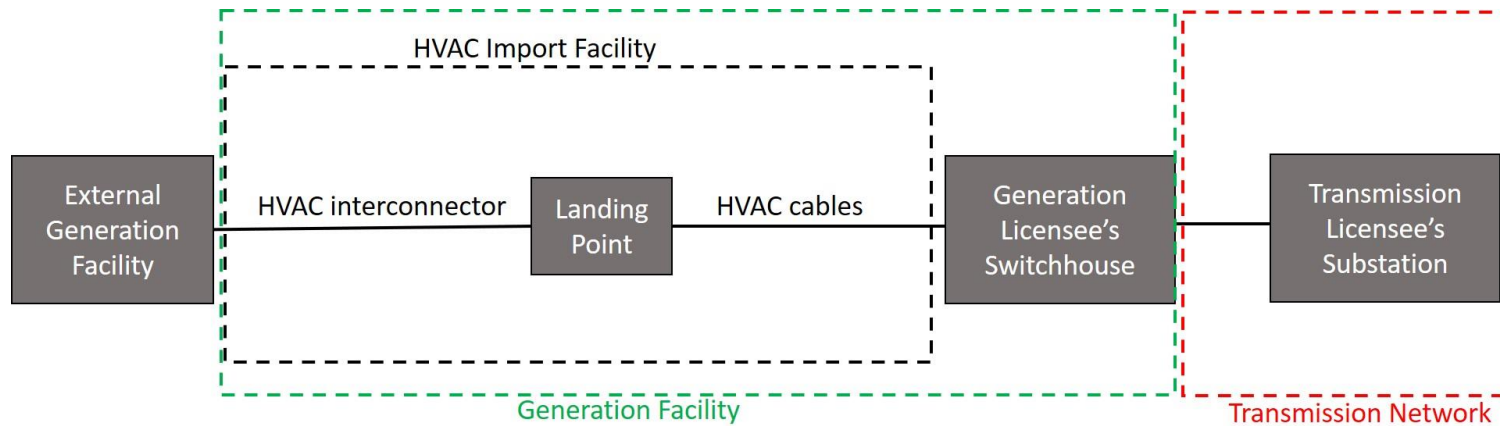


Figure F1.3.1 b - HVAC Import Facility Connecting Directly to Transmission Licensee's Substation

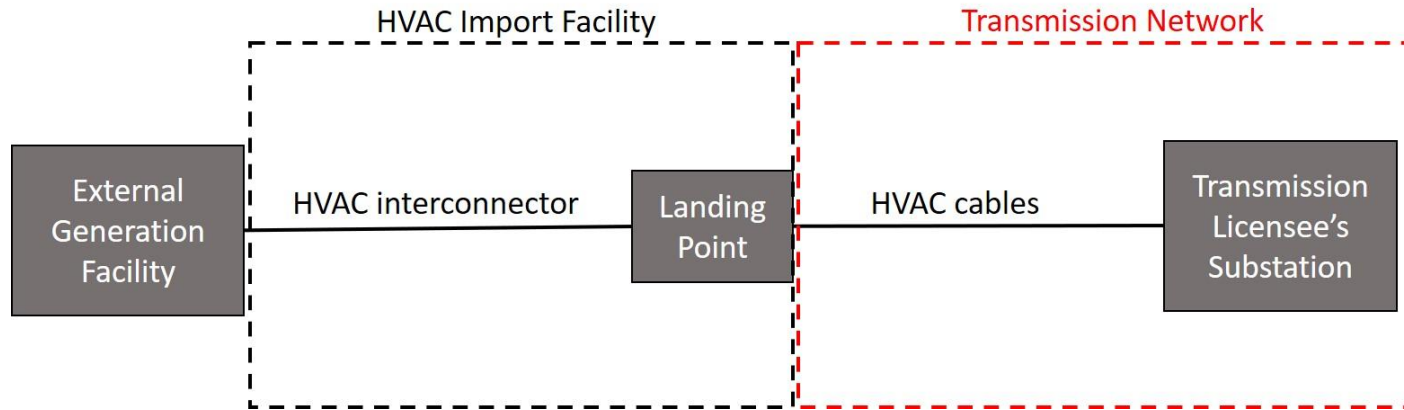


Figure F1.3.1 c - HVDC Import Facility Connecting to Generation Licensee's Switchhouse

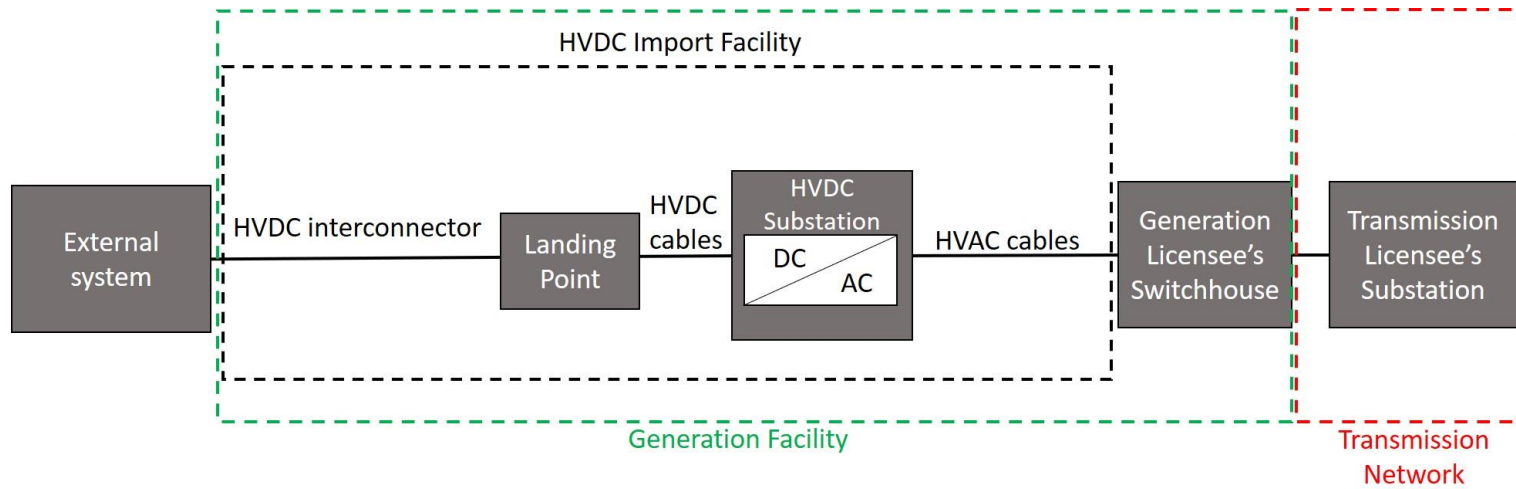
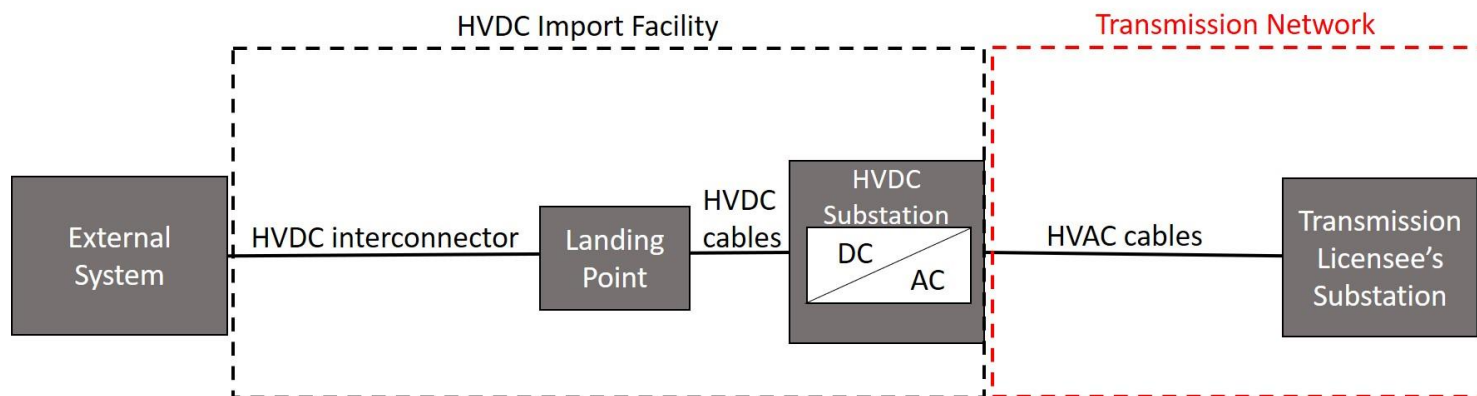


Figure F1.3.1 d - HVDC Import Facility Connecting Directly to Transmission Licensee’s Substation



Modification Ref. No.	Clause	Original Text	Modified Text	Reasons
TC/2021/10	1.3.1	New definition	<u>“Importer Licensee” means a person who is authorised by an <i>electricity licence to import electricity</i>;</u>	To provide clarity on the respective Licensees who are required to comply with this Code as a condition of its electricity licence.
TC/2021/11	1.3.1	New definition	<u>“Market Company Licensee” means the company which holds an <i>electricity licence</i> authorising it to operate any wholesale electricity market pursuant to section 42 of the Act;</u>	To provide clarity on the respective Licensees who are required to comply with this Code as a condition of its electricity licence.
TC/2021/12	1.3.1	“power system” means a system comprising the <i>transmission and distribution networks, generation and consumer installations, and external systems</i> connected to the <i>transmission system</i> ;	“power system” means a system comprising the <i>transmission and distribution networks, interconnectors, generation, energy storage and consumer installations, and external systems</i> connected to the <i>transmission system</i> ;	Interconnectors shall be included in the definition of and part of the power system.

Modification Ref. No.	Clause	Original Text	Modified Text	Reasons
TC/2021/13	1.3.1	“reserve” means generation capacity or load reduction capacity that can be called upon to replace scheduled energy supply that is or becomes unavailable as a result of an unexpected <i>outage</i> , or to augment scheduled energy as a result of unexpected <i>demand</i> or other contingencies	“reserve” means generation capacity, <u>import capacity, energy storage capacity</u> or load reduction capacity that can be called upon to replace scheduled energy supply that is or becomes unavailable as a result of an unexpected <i>outage</i> , or to augment scheduled energy as a result of unexpected <i>demand</i> or other contingencies	To include import capacity in the “reserve” definition as an import facility is required to provide reserve
TC/2021/14	1.3.1	New definition	<u>“substation” means an installation used by Transmission Licensee for the purpose of conveying electricity;</u>	To include new definition for substation.
TC/2021/15	1.3.1	New definition	<u>“switchhouse” means an installation used by Generation Licensee for connection of its generating unit(s) for the purpose of conveying electricity generated by the generating unit(s) to the transmission system;</u>	To include new definition for switchhouse.
TC/2021/16	1.3.1	New definition	<u>“Transmission Licensee” has the same meaning as in the Act;</u>	To provide clarity on the respective Licensees who are required to comply with this Code as a condition of its electricity licence.
TC/2021/17	1.3.1	New definition	<u>“Wholesaler Licensee” means a person who is authorised by an electricity licence to trade in any wholesale electricity market operated by the Market Company, for the purpose of:</u> <u>(i) selling electricity generated by the Licensee under the exemption set out in the Electricity (Electricity Generation Licence) (Exemption) (No. 2) Order;</u> <u>(ii) providing ancillary services or any electricity-related product or service through a load reduction.</u>	To provide clarity on the respective Licensees who are required to comply with this Code as a condition of its electricity licence.

Modification Ref. No.	Clause	Original Text	Modified Text	Reasons
TC/2021/18	4.1	Application for a New or Modified Generation/HVDC Facility Connection – General Conditions	Application for a New or Modified Generation/ HVDC Facility Connection – General Conditions	To exclude HVDC Facility in the title for 4.1 as this section does not refer to application for HVDC facilities. Application for connection of an interconnection is stated in section 4.8.1.
TC/2021/19	4.8.1	Application for Connection of an Interconnector The application procedures stipulated in section 4.1 shall apply for an <i>external party</i> wishing to connect to the <i>transmission system</i> through an <i>interconnector</i> .	Application for Connection of an Interconnector The application procedures stipulated in section 4.1 shall apply for an <i>Importer Licensee</i> <i>external party</i> wishing to connect to the <i>transmission system</i> through an <i>interconnector</i> .	The application of the connection of an interconnector should be carried out by the Importer Licensee.
TC/2021/20	4.8.2	Data Requirements The <i>external party</i> shall supply to the Transmission Licensee and <i>Power System Operator</i> , such information regarding the <i>external system</i> and <i>external generation facility</i> and <i>HVDC facility</i> as specified in Appendix C and/or Appendix D and/or Appendix J, as applicable.	Data Requirements The <i>Importer Licensee</i> shall supply to the <i>Transmission Licensee</i> and <i>Power System Operator</i> , such information regarding the <i>external system</i> and <i>external generation facility</i> , <i>interconnector</i> and <i>HVDC facility</i> as specified in Appendix C and/or Appendix D and/or Appendix J, as applicable.	Obligation to provide the required information is on the Importer Licensee as the Importer Licensee or external party has to gather the information from parties who own and/or operate the external system or external generation facility, as part of the connection process.
TC/2021/21	4.8.3	Limit of Power Transfer The power transmitted through an <i>interconnector</i> and the <i>spinning reserve</i> required to be provided (applicable to <i>external generation facility</i> only) shall not exceed the system stability, <i>security</i> and <i>reliability</i> limits or the firm transfer capability of the <i>interconnector</i> , whichever is lower, as determined by the <i>Authority</i> . The total power import through all <i>interconnectors</i> into the <i>transmission system</i>	Limit of Power Transfer The power transmitted through an <i>import facility</i> and the <i>spinning reserve</i> required to be provided (applicable to <i>external generation facility</i> only) shall not exceed the system stability, <i>security</i> and <i>reliability</i> limits or the firm transfer capability of the <i>interconnector</i> , whichever is lower, as determined by the <i>Authority</i> . The total power import through all <i>interconnectors</i> <i>import facilities</i> into the <i>transmission system</i> shall not be	The requirement applies to power transmitted through an import facility regardless whether it is from an external generation facility or an external system.

Modification Ref. No.	Clause	Original Text	Modified Text	Reasons
		shall not be more than the limit, as determined by the <i>Authority</i> .	more than the limit, as determined by the <i>Authority</i> .	
TC/2021/22	4.8.4	<p>Joint Operation Committee</p> <p>A Joint Operation Committee shall be formed with each of the <i>external parties</i>. The Joint Operation Committee shall comprise the <i>external party</i>, the Transmission Licensee and the <i>Power System Operator</i>. Regular meetings shall be conducted to update and address all system planning, operation and maintenance matters.</p>	<p>Joint Operation Committee</p> <p>A Joint Operation Committee shall be formed with each of the <i>external parties</i>. The Joint Operation Committee shall comprise the <i>external party</i> <u>for each external system</u>, the <u>Transmission Licensee</u>, the <u>Importer Licensee(s)</u> and the <i>Power System Operator</i>. Regular meetings shall be conducted to update and address all system planning, operational and maintenance matters.</p>	To include all relevant parties who should be part of the Joint Operation Committee.
TC/2021/23	4.8.5	<p>(a) <i>External generation facilities</i> shall be designed to ensure technical compatibility with the <i>power system</i> integrity. This shall include short circuit current contribution to the <i>network</i> and other specific requirements, which shall be determined by the Transmission Licensee and the <i>Power System Operator</i> on a case-by-case basis.</p> <p>(b) <i>Circuit breakers</i> shall be provided at both ends of the <i>interconnector</i>. Other equipment, which may be required, shall be determined by the Transmission Licensee and the <i>Power System Operator</i> on a case-by-case basis.</p> <p>(c) The number of feeder circuits forming the <i>interconnector</i> shall meet single contingency criterion.</p>	<p>(a) <i>External generation facilities</i> <u>Import facility</u> shall be designed to ensure technical compatibility with the <i>power system</i> integrity. This shall include short circuit current contribution to the <i>network</i> and other specific requirements <u>such as, but not limited to the design of the import facility and proposed technology</u>, which shall be determined by the <u>Transmission Licensee</u> and the <i>Power System Operator</i> on a case-by-case basis.</p> <p>(b) <i>Circuit breakers</i> shall be provided at both ends of the <i>interconnection</i>. Other equipment, which may be required, shall be determined by the <u>Transmission Licensee</u> and the <i>Power System Operator</i> on a case-by-case basis.</p> <p>(c) The number of feeder circuits forming the <i>interconnector</i> shall meet single contingency criterion. <u>For HVDC import facility, the</u></p>	<p>The requirement in 4.8.5 should apply to import facility regardless whether it is connected to an external generation facilities or external system</p> <p>To stipulate the performance and design requirements for interconnector/HVDC facility in (c), (d), (e) and (f)</p> <p>To make clear in (g) that the Importer Licensee shall provide the synchronizing facilities.</p>

Modification Ref. No.	Clause	Original Text	Modified Text	Reasons
		<p>(d) Synchronizing facilities shall be provided at both ends of an <i>interconnector</i> by the respective parties.</p>	<p><u><i>HVDC facility shall be designed to transmit at least 50% its rated capacity following a single pole outage.</i></u></p> <p>(d) <u><i>All interconnections used for non-trading activities shall ensure sufficient capacity to provide mutual support or meet frequency sensitivity requirement such that there is no overloading of the interconnection in the event of outage any single generating unit within Singapore. Whilst import facilities used for trading shall ensure sufficient capacity to meet frequency sensitivity requirement such that there is no overloading of the import facility in the event of outage any single generating unit within Singapore.</i></u></p> <p>(e) <u><i>For an import facility connected to an external generating facility, loss of the entire external generating facility shall not cause instability in the Singapore power system.</i></u></p> <p>(f) <u><i>The import facility design and operation shall conform to requirements in Appendix J, where applicable.</i></u></p> <p>(d)(g) <u><i>Synchronizing facilities at both ends of the interconnection shall be provided and maintained by the Licensee responsible for the interconnection. at both ends of an interconnector by the respective parties.</i></u></p>	
TC/2021/24	4.8.6	External generation facilities	<p>External generation facilities</p> <p>(a) <u><i>Importer Licensee shall be responsible for all its external generation facilities.</i></u></p>	To make clear that external generating units shall comply with the requirements stated in Appendix C4 and provide frequency sensitive

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		<p>(a) All <i>external generation facilities</i> shall comply with all technical requirements stated in this <i>Code</i>.</p> <p>(b) All <i>external generation facilities</i> shall be centrally dispatchable.</p> <p>(c) All <i>generating units</i> of <i>external parties</i> shall be <i>frequency</i> sensitive and shall contribute to system spinning <i>reserve</i> in the same manner as specified in Appendix F.</p> <p>(d) All <i>external parties</i> shall provide a central control system for dispatching of all their <i>generation facilities</i> in a manner such that the power transmitted through the <i>interconnector</i> shall be as instructed by real-time signals sent by the <i>Power System Operator</i>.</p> <p>(e) The <i>external party</i> responsible for an <i>external generation facility</i> shall be required to obtain approval from the <i>Authority</i> and the <i>Transmission Licensee</i>, if it intends to convert that <i>external generation facility</i> into an <i>external system</i>.</p>	<p>(b) (a) All <u>its external generation facilities</u> shall comply with <u>all technical requirements stated in this Code</u> <u>the Centrally Dispatched Generating Unit Minimum Capability Requirements stipulated in Appendix C4</u>.</p> <p>(c) (b) All <u>its external generation facilities</u> shall be centrally dispatchable.</p> <p>(d) (c) All <u>its external generation facilities</u> generating units of external parties shall <u>be provide frequency sensitive power transfer</u> and shall contribute to system spinning <i>reserve</i> in the same manner as specified in Appendix F.</p> <p>(e) (d) All <u>Each external parties</u> <i>Importer Licensee</i> shall provide a central control system for dispatching of all their <u>its external generation facilities</u> in a manner such that the power transmitted through the <u>its interconnector import facility</u> shall be as instructed by real-time signals sent by the <i>Power System Operator</i>.</p> <p>(f) (e) The external party <i>Importer Licensee</i> responsible for an external generation facility shall be required to obtain <u>prior</u> approval from the <i>Authority</i> and the <i>Transmission Licensee</i>, if it intends to convert <u>any or all of that</u> its external generation facility <u>facilities</u> into an <i>external system</i>.</p>	<p>power transfer (i.e. to provide reserve).</p> <p>The requirement for a central control system for despatch of external generation facilities or imported power as stipulated in clause (d) applies to Importer Licensees.</p> <p>To make clear in clause (e) that it is the Importer Licensee's responsibility to obtain approval from the Authority and the Transmission Licensee if it intends to convert its external generation facility into an external system.</p>

Modification Ref. No.	Clause	Original Text	Modified Text	Reasons
TC/2021/25	4.8.7	<p>Additional Technical Requirements for <i>External System</i></p> <p>(a) An <i>external party</i> shall provide adequate spinning <i>reserve</i> to cater for a sudden loss of the largest <i>generating unit</i> in its <i>external system</i> without causing any under <i>frequency</i> tripping of the <i>interconnectors</i> or in that <i>external system</i>. This shall allow the Area Control Error to return to zero at least every ten minutes.</p> <p>(b) An <i>external party</i> shall be responsible for <i>network</i> reinforcement and system protection in its <i>external system</i> to ensure stable and secure operation of the integrated system.</p> <p>(c) An <i>external party</i> shall be responsible for the provision of an Automatic Generation Control facility with <i>frequency</i> and tie-line biased control capability in the <i>external system</i> to enable control of power flow through the <i>interconnector</i> to be within $\pm 5\%$ tolerance.</p> <p>(d) An <i>external party</i> shall provide adequate reactive compensation in its <i>external system</i> to ensure minimum reactive and capacitive power flowing through the <i>interconnector</i>.</p> <p>(e) An <i>interconnector</i> shall be designed with adequate capacity and appropriate overload protection to cater for short time power flow</p>	<p>Additional Technical Requirements for an <i>External System</i></p> <p><u>(a) The <i>import facility</i> shall be centrally dispatchable.</u></p> <p><u>(b) The <i>import facility</i> shall be designed with Automatic Generation Control facility with frequency and tie-line biased control capability, such that the power transmitted through its <i>import facility</i> is as instructed by real-time signals sent by the <i>Power System Operator</i>.</u></p> <p>(a c) An <i>external party</i> shall provide adequate spinning reserve to cater for a sudden loss of the largest <i>generating unit</i> in its <i>external system</i> without causing any under <i>frequency</i> tripping of the <i>interconnectors</i> or in that <i>external system</i>. This shall allow the Area Control Error to return to zero at least every ten minutes.</p> <p>(b-d) An <i>external party</i> shall be responsible for <i>network</i> reinforcement and system protection in its <i>external system</i> to ensure stable and secure operation of the integrated system.</p> <p>(e-e) An <i>external party</i> shall be responsible for the provision of an Automatic Generation Control facility with <i>frequency</i> and tie-line biased control capability in the <i>external system</i> to enable control of power flow through the <i>interconnector</i> to be within $\pm 5\%$ tolerance.</p> <p>(d-f) An <i>external party</i> shall provide adequate reactive compensation in its <i>external system</i> to</p>	<p>Import facility connected from an external system is required to be centrally dispatched and contribute to system spinning reserve.</p>

Modification Ref. No.	Clause	Original Text	Modified Text	Reasons
		<p>in the event of sudden tripping of the largest <i>generating unit</i> in the system or in the <i>external system</i> during partial availability of the <i>interconnector</i> circuits.</p>	<p>ensure minimum reactive and capacitive power flowing through the <i>interconnector</i>.</p> <p>(e g) An <u><i>import facility interconnector</i></u> shall be designed with adequate capacity and appropriate overload protection to cater for short time power flow in the event of sudden tripping of the largest <i>generating unit</i> in the system or in the <i>external system</i> during partial availability of the <i>interconnector</i> circuits.</p> <p><u>(h) All <i>import facility</i> shall be capable of frequency sensitive power transfer and shall contribute to system spinning reserve in the same manner as specified in Appendix F unless different arrangements for mutual support are agreed upon with the <i>Power System Operator</i>.</u></p>	
TC/2021/26	4.8.8	<p>Protection Requirements</p> <p>(a) An <i>external party</i> shall ensure that the <i>protection systems</i> on its external <i>generation facilities</i> and <i>interconnectors</i> comply with the requirements stated in section 6.3 and Appendix F or otherwise determined by the <i>Power System Operator</i> and/or the <i>Transmission Licensee</i> based on the specific <i>interconnector</i> facilities adopted.</p> <p>(b) An <i>interconnector</i> is to be equipped with under-frequency and over-current protection at each end by the respective parties. Power swing relays and out of step</p>	<p>Protection Requirements</p> <p>(a) An <u><i>Importer Licensee external party</i></u> shall ensure that the <i>protection systems</i> on its <u><i>external generation facilities that are directly connected to the transmission system</i></u> and <u><i>interconnectors import facilities</i></u> comply with the requirements stated in section 6.3 and Appendix F³ or otherwise determined by the <i>Power System Operator</i> and/or the <u><i>Transmission Licensee</i></u> based on the specific <i>interconnector</i> facilities adopted.</p> <p>(b) An <u><i>interconnector interconnection</i></u> is to be equipped with under-frequency and over-</p>	<p>Protection requirements for external generation facilities and interconnectors shall apply to Importer Licensees.</p>

Modification Ref. No.	Clause	Original Text	Modified Text	Reasons
		<p>relays, if required, shall be installed by the <i>external party</i> within the <i>external system</i> for system stability protection purpose. The settings for the under-frequency, power swing relays and out of step relays shall be provided by the <i>Power System Operator</i> and the <i>external party</i>. The settings for the over-current protection shall be provided by the Transmission Licensee and the <i>external party</i>.</p>	<p>current protection at each end by the respective parties. Power swing relays and out of step relays, if required, shall be installed by the <i>external party</i> within the <i>external system</i> for system stability protection purpose. The settings for the under-frequency, power swing relays and out of step relays shall be provided by the <i>Power System Operator</i> and the <i>external party</i>. The settings for the over-current protection shall be provided by the <u>Transmission Licensee</u> and the <i>external party</i>.</p>	
TC/2021/27	4.8.9	<p>Communication Requirements</p> <p>(a) An <i>external party</i> shall, in relation to its <i>external system</i> and <i>external generation facilities</i>, install, maintain and operate two independent voice communication links between the <i>external party's</i> Network Control Centre and <i>Power System Operator's</i> Control Centre. These voice links shall be the direct lines (to be provided by an independent service provider) associated with this Control Centre and shall be used for operational purposes only. All communication equipment/links as may be required by the protective relaying scheme shall be installed and maintained by the <i>external party</i>. Where required, such equipment or links shall be compatible with</p>	<p>Communication Requirements</p> <p>(a) An <i>external party</i> and <u>Importer Licensee</u> shall, in relation to its <i>external system</i> and <i>external generation facilities</i>, install, maintain and operate two independent voice communication links between the <i>external party's</i> Network Control Centre <u>or Importer Licensee's</u> Central Control Centre and <i>Power System Operator's</i> Control Centre. These voice links shall be the direct lines (to be provided by an independent service provider) associated with this Control Centre and shall be used for operational purposes only. All communication equipment/links as may be required by the protective relaying scheme shall be installed and maintained by the <i>external party</i> <u>or</u></p>	<p>The communication requirements shall apply to Importer Licensees in relation to its external system or external generation facilities.</p>

Modification Ref. No.	Clause	Original Text	Modified Text	Reasons
		<p>the applicable communication equipment or links of the Transmission Licensee and/or the <i>Power System Operator</i>.</p> <p>(b) An <i>external party</i> shall, in relation to its <i>external system</i> and <i>external generation facilities</i> install, maintain and operate a facsimile machine for operational purposes. Such facsimile machine shall have a dedicated telephone line and number, located in the <i>external party's</i> Network Control Centre. The <i>external party</i> and the <i>Power System Operator</i> shall inform each other of the number of their facsimile machine used for operational purposes.</p>	<p><u>Importer Licensee</u> where applicable. Where required, such equipment or links shall be compatible with the applicable communication equipment or links of the <u>Transmission Licensee</u> and/or the <i>Power System Operator</i>.</p> <p>(b) An <i>external party</i> <u>and Importer Licensee</u> shall, in relation to its <i>external system</i> and <i>external generation facilities</i> install, maintain and operate a facsimile machine for operational purposes. Such facsimile machine shall have a dedicated telephone line and number, located in the <i>external party's</i> Network Control Centre <u>or Importer Licensee's</u> Central Control Centre. The <i>external party</i>, <u>Importer Licensee</u> and the <i>Power System Operator</i> shall inform each other of the number of their facsimile machine used for operational purposes.</p>	
TC/2021/28	4.8.11	<p>Performance Monitoring Facilities of Interconnector:</p> <p>The Transmission Licensee shall provide, install and maintain at its own cost, high-resolution recorder(s) at the <i>interconnector</i> substations in the transmission system interfacing with an external party to monitor and record the <i>interconnector</i> performance during system disturbances. The recorder shall be capable of monitoring and recording, including:</p>	<p>Performance Monitoring Facilities of Interconnector:</p> <p>The <u>Transmission Licensee</u> shall provide, install and maintain at its own cost, high-resolution recorder(s) at the interconnector <u>interconnection</u> substations in the transmission system interfacing with an <u>import facility or external party system</u> to monitor and record the interconnector <u>interconnection</u> performance during system disturbances. The recorder shall be capable of monitoring and recording, including:</p>	<p>To provide clarity on the requirements for high-resolution recorder (s) including signals to be recorded/monitored which are already stated in Appendix F9. Hence the amendments are to make reference to Appendix F9.</p>

Modification Ref. No.	Clause	Original Text	Modified Text	Reasons
		<p>(a) <i>active and reactive power flow of each interconnector;</i></p> <p>(b) <i>substation busbar voltage and frequency;</i> and</p> <p>(c) <i>circuit breaker and protective devices status.</i></p> <p>The requirements of high-resolution recorder(s) are given in Appendix F. The Transmission Licensee, upon receiving notification from <i>PSO</i>, shall furnish such records/data in softcopy via email in the format as specified in Appendix F9.2(g) within 24 hours.</p>	<p>(a) <i>active and reactive power flow of each interconnector;</i></p> <p>(b) <i>substation busbar voltage and frequency at the interconnector connection point;</i></p> <p>(c) <i>circuit breaker and protective devices status;</i></p> <p>The requirements of high-resolution recorder(s) <u>including the signals to be recorded/monitored</u> are given in Appendix F9. The <u>Transmission Licensee</u>, upon receiving notification from the <i>PSO</i>, shall furnish such records/data in softcopy via email in the format as specified in Appendix F9.2(g) within 24 hours.</p>	
TC/2021/29	6.1.6	New Clause	<p>(a) <u>Any Generation Licensee or Importer Licensee that intends to retire any of its generating units or import facilities or discontinue any import of electricity, as the case may be, shall submit a written request to the Authority for approval not later than 60 months prior to the date of the intended retirement of the generating unit or import facility or discontinuation of import of electricity, and shall provide such information that the Authority requires to facilitate the Authority's decision in relation to whether to approve the retirement of the generating unit or import facility or discontinuation of import of electricity (including whether to approve the same subject to conditions), taking into consideration the protection of the interests of consumers with regard to the security, reliability, availability and continuity of supply of electricity. The Authority may, if it considers necessary or appropriate, approve the retirement of the generating unit or import</u></p>	To improve informational certainty to facilitate efficient and timely planning for the entry and exit of generation capacity, which in turn supports continued reliability of electricity supply to consumers.

Modification Ref. No.	Clause	Original Text	Modified Text	Reasons
			<p><u>facility or discontinuation of import of electricity subject to conditions.</u></p> <p>(b) <u>No Generation Licensee or Importer Licensee shall retire any of its generating units or import facilities or discontinue any import of electricity, as the case may be, unless it has obtained the written approval of the Authority and complied with all conditions of approval of the Authority under section 6.1.6(a). For the avoidance of doubt, a Generation Licensee or Importer Licensee is deemed not to have obtained the Authority's approval under section 6.1.6(a) if the Generation Licensee or Importer Licensee fails to comply with any condition of approval of the Authority under section 6.1.6(a).</u></p>	
TC/2021/30	6.6.3	The Transmission Licensee and connected person responsible for each HVDC facility connected to the transmission system shall ensure that the steady state tolerance on reactive power exchange with the transmission system expressed in MVar shall be no greater than +/- 5% of the rated MW of the HVDC facility.	The <u>Transmission Licensee and the Licensee responsible for the HVDC import facility</u> connected person responsible for each HVDC facility connected to the transmission system shall ensure that the steady state tolerance on reactive power exchange with the transmission system expressed in MVar shall be no greater than +/-5% of the rated MW of the HVDC <u>import facility</u> .	The Transmission Licensee and the Licensee responsible for the HVDC import facility shall meet the requirement in this clause.
TC/2021/31	6.6.4	New clause	<u>An interconnection shall be designed so that the tripping of a circuit at any load level does not result in voltage change at the connection point of more than 5% of nominal. Operation between zero flow and full output of the interconnection in either direction shall not cause the connection point steady state voltage to vary by more than 5% of nominal.</u>	To include this new clause for AC interconnectors reactive power requirements.

Modification Ref. No.	Clause	Original Text	Modified Text	Reasons
TC/2021/32	6.8.5	The configuration of the <i>HVDC facility</i> shall use a metallic earth return.	The configuration of the <i>HVDC facility</i> shall use a metallic earth return.	This requirement will be included in the new clause J2.11 (under TC/2021/72)
TC/2021/33	6.12.2	<p>The Generation Licensee shall provide the <i>Remote Terminal Unit(s)</i> for remote monitoring of their <i>generating units'</i> output and operating conditions as well as facilities for automatic control of generating unit's output from <i>Power System Operator's Energy Management System</i> as specified in Appendix H.</p> <p>(a) The Transmission Licensee and <i>connected person</i> responsible for each <i>HVDC facility</i> shall provide the <i>remote terminal unit(s)</i> for remote monitoring of their <i>HVDC facilities'</i> operating conditions, as well as facilities for automatic control of <i>HVDC facilities'</i> from <i>Power System Operator's Energy Management System</i> as specified in Appendix H.</p>	<p>The <u><i>Generation Licensee</i></u> shall provide the <i>Remote Terminal Unit(s)</i> for remote monitoring of their <i>generating units'</i> output and operating conditions as well as facilities for automatic control of generating unit's output from <i>Power System Operator's Energy Management System</i> as specified in Appendix H.</p> <p>(a) <u>The <i>Importer Licensee</i> shall provide the <i>Remote Terminal Unit(s)</i> for remote monitoring of its <i>external generation facility's</i> output and operating conditions as well as facilities for automatic control of generating unit's output from <i>Power System Operator's Energy Management System</i> as specified in Appendix H.</u></p> <p>(b) The Transmission Licensee <u><i>Licensee</i></u> responsible for the <i>import facility</i> and <i>connected person</i> responsible for each <i>HVDC facility</i> shall provide the <i>remote terminal unit(s)</i> for remote monitoring of their <u>its</u> <i>HVDC import facilities'</i> operating conditions, as well as facilities for automatic control of its <u>its</u> <i>HVDC import facilities'</i> from <i>Power System Operator's Energy Management System</i> as specified in Appendix H.</p>	To include a new clause (a) to specify the RTU monitoring requirement for Importer Licensee for external generation facilities.

Modification Ref. No.	Clause	Original Text	Modified Text	Reasons
TC/2021/34	6.12.3	<p>The Transmission Licensee, Generation Licensee, and <i>connected person</i> responsible for each <i>HVDC facility</i> shall provide all the equipment at their respective site, including the communication equipment. The Transmission Licensee shall provide data communication lines from the computer room in the control centers of the <i>Power System Operator</i> to the transmission substation, <i>HVDC facility</i> and <i>generating station</i> switchhouses as specified by the <i>Power System Operator</i> for the purposes of real-time power system monitoring and control. The <i>connected person</i> responsible for each <i>HVDC facility</i> shall be responsible for the data communication lines from their <i>HVDC facility</i> to the Transmission Licensee's termination box located in their <i>HVDC facility</i>. The Generation Licensee shall be responsible for the data communication lines from the Generation Licensee's equipment to the Transmission Licensee's termination box located in the <i>generating station's</i> switchhouse. The termination box, which shall be provided by the Transmission Licensee, shall also be used for termination of the Transmission Licensee's data communication lines. In the event of relocation of the termination box or diversion of the data communications lines, the Licensee that initiates the relocation or diversion shall bear all the costs necessary for the relocation or diversion including the costs incurred by any other affected Licensee to divert the data communication lines at the affected Licensee's end caused by the relocation or diversion. All the equipment at the site shall be equipped with battery backup of at least 4-hour operation time. In addition, the AC power shall also be backed</p>	<p>The <u><i>Transmission Licensee, Generation Licensee, and Importer Licensee and Licensee</i></u> responsible for each <u><i>import facility</i></u> <i>connected person</i> responsible for each <i>HVDC facility</i> shall provide all the equipment at their respective site, including the communication equipment. The <u><i>Transmission Licensee</i></u> shall provide data communication lines from the computer room in the control centers of the <i>Power System Operator</i> to the transmission substation, <u><i>import facility, HVDC facility</i></u> and <i>generating station</i> switchhouses as specified by the <i>Power System Operator</i> for the purposes of real-time power system monitoring and control. The <u><i>Licensee</i></u> responsible for each <u><i>import facility</i></u> <i>connected person</i> responsible for each <i>HVDC facility</i> shall be responsible for the data communication lines from their <u><i>import facility HVDC facility</i></u> to the <u><i>Transmission Licensee's</i></u> termination box located in their <u><i>import facility HVDC facility</i></u>. The <u><i>Generation Licensee</i></u> shall be responsible for the data communication lines from the <u><i>Generation Licensee's</i></u> equipment to the <u><i>Transmission Licensee's</i></u> termination box located in the <i>generating station's</i> switchhouse. The termination box, which shall be provided by the <u><i>Transmission Licensee</i></u>, shall also be used for termination of the <u><i>Transmission Licensee's</i></u> data communication lines. In the event of relocation of the termination box or diversion of the data communications lines, the <u><i>Licensee</i></u> that initiates the relocation or diversion shall bear all the costs necessary for the relocation or diversion including the costs incurred by any other affected <u><i>Licensee</i></u> to divert the data communication lines at the affected <u><i>Licensee's</i></u> end caused by the relocation or diversion. All the equipment at the site shall be equipped with battery backup of at least 4-hour</p>	<p>The monitoring and communication requirements will apply to import facilities.</p>

Modification Ref. No.	Clause	Original Text	Modified Text	Reasons
		up by the standby generator at the site, if the site is equipped with such a facility	operation time. In addition, the AC power shall also be backed up by the standby generator at the site, if the site is equipped with such a facility.	
TC/2021/35	6.12.4	The Transmission Licensee, Generation Licensee, and <i>connected person</i> responsible for each <i>HVDC facility</i> seeking to conduct any work on their <i>remote terminal unit</i> must submit to the <i>Power System Operator</i> for approval a written proposal that clearly states the nature, purpose and duration of the work.	The <u><i>Transmission Licensee, Generation Licensee, and Importer Licensee and Licensee</i></u> responsible for each <u><i>import facility</i></u> <i>connected person</i> responsible for each <i>HVDC facility</i> seeking to conduct any work on their <i>remote terminal unit</i> must submit to the <i>Power System Operator</i> for approval a written proposal that clearly states the nature, purpose and duration of the work.	To include Importer Licensee and Licensee responsible for each import facility in this requirement.
TC/2021/36	6.12.5	The Transmission Licensee, Generation Licensee, or <i>connected person</i> responsible for each <i>HVDC facility</i> shall submit to the <i>Power System Operator</i> a test report of the commissioning of the <i>remote terminal unit</i> .	The <u><i>Transmission Licensee, Generation Licensee,</i></u> <i>or connected person</i> responsible for each <i>HVDC facility</i> <u><i>Importer Licensee and Licensee</i></u> responsible for each <u><i>import facility</i></u> shall submit to the <i>Power System Operator</i> a test report of the commissioning of the <i>remote terminal unit</i> .	To include Importer Licensee and Licensee responsible for each import facility in this requirement.
TC/2021/37	6.15.1	The Transmission Licensee, Generation Licensees, Wholesaler (Generation) Licensees, Wholesaler (Demand Response Programme) Licensees, Market Company Licensee and connected person responsible for each HVDC facility shall put in place adequate cyber security measures to ensure that designated Critical Information Infrastructures (CIIs) are properly maintained, operated and secured, so as not to compromise, or cause any adverse impact, to the security, reliability and stability of the power system including interruption of electricity supply or electricity generation due to inadvertent system or equipment failure,	The <u><i>Transmission Licensee, Generation Licensees, Wholesaler (Generation) Licensees,</i></u> <i>Wholesaler (Demand Response Programme) Licensee,</i> <u><i>Market Company Licensee, Importer Licensee and Licensee</i></u> responsible for each <u><i>import facility</i></u> <i>connected person</i> responsible for each <i>HVDC facility</i> shall put in place adequate cyber security measures to ensure that designated Critical Information Infrastructures (CIIs) are properly maintained, operated and secured, so as not to compromise, or cause any adverse impact, to the security, reliability and stability of the power system including interruption of electricity supply or electricity generation due to inadvertent	To update the reference to Wholesaler Licensees (following the Wholesaler Licence Modification Final Determination Paper issued on 29 Jun 2021). To include Importer Licensee and Licensee responsible for each import facility in this requirement.

Modification Ref. No.	Clause	Original Text	Modified Text	Reasons
		human error or through malicious actions of other parties.	system or equipment failure, human error or through malicious actions of other parties.	
TC/2021/38	8.1.1	The Transmission Licensee shall be responsible for the annual development of proposals for the augmentation and expansion of the <i>transmission system</i> in accordance with guidelines and criteria set forth in this section of the Transmission Code. The plan shall take into account forecasts of <i>demand</i> made by the <i>Authority</i> , proposals for additional generation capacity or withdrawal of capacity advised by the <i>Authority</i> , requests by <i>Power System Operator</i> and proposals by consumers for forecast additional <i>demand</i> .	The <u><i>Transmission Licensee</i></u> shall be responsible for the annual development of proposals for the augmentation and expansion of the <i>transmission system</i> in accordance with guidelines and criteria set forth in this section of the Transmission Code. The plan shall take into account forecasts of <i>demand</i> made by the <i>Authority</i> , proposals for additional generation capacity or withdrawal of capacity advised by the <i>Authority</i> , <u>proposals for new or cessation of import facilities as advised by the <i>Authority</i></u> , requests by <i>Power System Operator</i> and proposals by consumers for forecast additional <i>demand</i> .	The plan should take into account the proposals for new import facilities as advised by the Authority.
TC/2021/39	8.2.1	Notwithstanding section 8.1.1, the Transmission Licensee may engage in the development proposals, at its own instigation, for the reinforcement or extension of the existing <i>transmission system</i> for reasons which include, but are not limited to:- (a) an increase in supply requirements of an existing licensee or consumer or Generation Licensee that already is connected to the <i>transmission system</i> ; and (b) the introduction of a new <i>connection point</i> or modification of an existing <i>connection point</i> between the electrical system of a consumer or Generation Licensee and the <i>transmission system</i> .	Notwithstanding section 8.1.1, the <u><i>Transmission Licensee</i></u> may engage in the development proposals, at its own instigation, for the reinforcement or extension of the existing <i>transmission system</i> for reasons which include, but are not limited to:- (a) an increase in supply requirements of an existing licensee, <u><i>Importer Licensee</i></u> , or consumer or <u><i>Generation Licensee</i></u> that already is connected to the <i>transmission system</i> ; and (b) the introduction of a new <i>connection point</i> or modification of an existing <i>connection point</i> between the electrical system of a consumer, <u><i>Importer Licensee</i></u> or <u><i>Generation Licensee</i></u> and the <i>transmission system</i> .	To allow the Transmission Licensee to engage in development proposals in relation to import facilities.

Modification Ref. No.	Clause	Original Text	Modified Text	Reasons
TC/2021/40	9.2.7	New Clause	<u>As and when required by the Authority, the Licensee responsible for the import facility shall at its own cost engage an independent auditor to conduct technical audit of its import facility or to review its standing operating procedures, or any other technical, operational matter as may be specified by the Authority, for the purpose of ensuring the stability, security and reliability of its import facility.</u>	The import facility shall be subject to technical audit or to review its SOP as and when required by the authority.
TC/2021/41	9.4.1	<p>The Generation Licensee shall implement measures to ensure that electricity cables belonging to the Transmission Licensee, which are laid in the <i>generating station</i> premises, are protected from damage by any earthworks carried out in the premises, including but not limited to the following:</p> <p>(a) providing clear markings of 400kV, 230kV and 66kV cables routes within the <i>generating station</i> premises;</p> <p>(b) establishing a standard operating procedure (“SOP”) for earthworks carried out within <i>generating station</i> premises in compliance with the cable damage prevention provisions in the Electricity Act; and</p> <p>(c) implementing, as part of the SOP, a Permit-to-Work (“PTW”) system to ensure that contractors seek the Generation Licensee’s approval before they commence earthworks.</p>	<p>The <u>Generation Licensee or Licensee</u> responsible for each <i>import facility</i> shall implement measures to ensure that electricity cables belonging to the <u>Transmission Licensee</u>, which are laid in the <i>generating station</i> premises <u>or import facility</u>, are protected from damage by any earthworks carried out in the premises, including but not limited to the following:</p> <p>(a) providing clear markings of 400kV, 230kV and 66kV cables routes within the <i>generating station or import facility</i> premises;</p> <p>(b) establishing a standard operating procedure (“SOP”) for earthworks carried out within <i>generating station</i> premises in compliance with the cable damage prevention provisions in the Electricity Act; and</p> <p>(c) implementing, as part of the SOP, a Permit-to-Work (“PTW”) system to ensure that contractors seek the <u>Generation Licensee’s or Licensee</u> responsible for the <i>import</i></p>	To include Licensee responsible for an import facility in this requirement for protection of Transmission Licensees’ cables within the import facility.

Modification Ref. No.	Clause	Original Text	Modified Text	Reasons
			<u>facility's</u> approval before they commence earthworks.	
TC/2021/42	C1	Each Generation Licensee or Wholesaler (Generation) Licensee responsible for the generation facility, with the exception of solar photovoltaic systems, and seeking connection to the <i>transmission system</i> shall provide the information required in accordance with the format set forth in C.1.1 to C.1.3 of this Appendix for both primary and <i>alternate fuel</i> (for <i>generating units</i> that are capable of operating and required to operate on <i>alternate fuel</i>). For solar photovoltaic <i>generating unit</i> , the Generation Licensee or Wholesaler (Generation) Licensee shall provide the information required in accordance with the format set forth in C7 of this Appendix.	Each <u>Generation Licensee</u> or <u>Wholesaler</u> (Generation) <u>Licensee</u> responsible for the generation facility, with the exception of solar photovoltaic systems, and seeking connection to the <i>transmission system</i> shall provide the information required in accordance with the format set forth in C.1.1 to C.1.3 of this Appendix for both primary and <i>alternate fuel</i> (for <i>generating units</i> that are capable of operating and required to operate on <i>alternate fuel</i>). For solar photovoltaic <i>generating unit</i> , the <u>Generation Licensee</u> or <u>Wholesaler</u> (Generation) <u>Licensee</u> shall provide the information required in accordance with the format set forth in C7 of this Appendix.	To update the reference to Wholesaler Licensees (following the Wholesaler Licence Modification Final Determination Paper issued on 29 Jun 2021).
TC/2021/43	C7.1	Each Generation Licensee or Wholesaler (Generation) Licensee or connected person responsible for the solar photovoltaic <i>generating unit</i> at each site/facility, shall provide the information set forth in this Appendix. (a) Name of Generation Facility (b) Maximum Generation Capacity (Aggregated capacity of all solar photovoltaic modules' AC inverters at the point of connection to the grid) (kWac) (c) Total PV modules' capacity (kWp) (d) Voltage Level of <i>connection</i> point (e) <i>Generation Facility's</i> site address/Postal Code (f) Rated Power Factor <ul style="list-style-type: none"> • Over-excited (lagging) • Under-excited (leading) 	Each <u>Generation Licensee</u> or <u>Wholesaler</u> (Generation) <u>Licensee</u> or <u>Importer Licensee</u> or connected person responsible for the solar photovoltaic <i>generating unit</i> at each site/facility, shall provide the information set forth in this Appendix. (a) Name of Generation Facility (b) Maximum Generation Capacity (Aggregated capacity of all solar photovoltaic modules' AC inverters at the point of connection to the grid) (kWac) (c) <u>maximum ramping-up rate and maximum ramping-down rate</u> (e d) Total PV modules' capacity (kWp) (d e) Voltage Level of <i>connection</i> point (e f) <i>Generation Facility's</i> site address/Postal Code (f g) Rated Power Factor	To update the reference to Wholesaler Licensees (following the Wholesaler Licence Modification Final Determination Paper issued on 29 Jun 2021). To request the information on maximum ramping-up rate and ramping down rate to understand the output profile of solar photovoltaic generating unit.

Modification Ref. No.	Clause	Original Text	Modified Text	Reasons
		<p>(g) Solar photovoltaic module (for solar photovoltaic generating unit \geq 1MWac)</p> <ul style="list-style-type: none"> • Type of photovoltaic module: (Monocrystalline / Polycrystalline / Amorphous / CdTe / CIGS/CIS and Others, please specify) • Module Tilt Angle • Module Azimuth Angle <p>(h) Frequency and voltage protection settings</p> <p>(i) Reactive Power Control Capabilities (as per the inverters' settings)</p> <p>(j) Voltage reference point</p>	<ul style="list-style-type: none"> • Over-excited (lagging) • Under-excited (leading) <p>(g h) Solar photovoltaic module (for solar photovoltaic generating unit \geq 1MWac)</p> <ul style="list-style-type: none"> • Type of photovoltaic module: (Monocrystalline / Polycrystalline / Amorphous / CdTe / CIGS/CIS and Others, please specify) • Module Tilt Angle • Module Azimuth Angle <p>(h i) Frequency and voltage protection settings</p> <p>(i j) Reactive Power Control Capabilities (as per the inverters' settings)</p> <p>(j k) Voltage reference point</p>	
TC/2021/44	C7.2	Each Generation Licensee or Wholesaler (Generation) Licensee responsible for solar photovoltaic <i>generating unit(s)</i> with an aggregated installed capacity of 10MWac or above at each site/facility, and seeking connection to the <i>transmission system</i> shall provide to the Transmission Licensee and the Power System Operator (where applicable) a dynamic simulation model that fulfils the requirements set forth in the System Operation Manual.	Each <u>Generation Licensee</u> or <u>Wholesaler</u> (Generation) <u>Licensee</u> responsible for solar photovoltaic <i>generating unit(s)</i> with an aggregated installed capacity of 10MWac or above at each site/facility, and seeking connection to the <i>transmission system</i> shall provide to the <u>Transmission Licensee</u> and the <u>Power System Operator</u> (where applicable) a dynamic simulation model that fulfils the requirements set forth in the System Operation Manual.	To update the reference to Wholesaler Licensees (following the Wholesaler Licence Modification Final Determination Paper issued on 29 Jun 2021).
TC/2021/45	C7.3	New Clause	<u>Each Generation Licensee or Wholesaler Licensee or Importer Licensee or connected person responsible for each solar photovoltaic generating unit shall ensure that the maximum ramp up and down rate is controlled strictly within the limits stipulated by the Power System Operator. For the avoidance of doubt, in the event the Licensee intends to modify the output power profile of the solar photovoltaic generating unit</u>	To enhance system stability and security.

Modification Ref. No.	Clause	Original Text	Modified Text	Reasons
			<u>(including maximum ramp up and down rate), the Licensee shall submit the modification proposal to the Power System Operator for approval.</u>	
TC/2021/46	D1	The following information and data relating to <i>external systems</i> and <i>external generation facilities</i> shall be updated and submitted by the external party to Transmission Licensee and <i>Power System Operator</i> , upon application for interconnection and subsequently by end of February of each calendar year or upon any material change in the data previously submitted.	The following information and data relating to <i>external systems</i> and <i>external generation facilities</i> shall be updated and submitted by the <u>Importer Licensee</u> where applicable to <u>Transmission Licensee</u> and <i>Power System Operator</i> , upon application for interconnection and subsequently by end of February of each calendar year or upon any material change in the data previously submitted.	To replace with Importer Licensee as they are also required to provide information such as generation installed capacities, types, location and intended power transfer through interconnector.
TC/2021/47	Appendix E	TEST REQUIREMENTS FOR GENERATION FACILITIES, TRANSMISSION FACILITIES, CONSUMER INSTALLATIONS AND EXTERNAL SYSTEMS	TEST REQUIREMENTS FOR GENERATION FACILITIES, TRANSMISSION FACILITIES, CONSUMER INSTALLATIONS AND EXTERNAL SYSTEMS <u>IMPORT FACILITIES</u>	Changing of title to substitute external systems with import facility as the requirements in Appendix E is applicable to import facility.
TC/2021/48	E5.2	Witnessing by the <i>Power System Operator</i> and/or the Transmission Licensee (a) Where the <i>Power System Operator</i> and/or the Transmission Licensee, where applicable, is satisfied that a proposed <i>system test</i> in respect of which approval has been granted under section E.4 shall not affect the secure, stable and reliable operation of the <i>power system</i> , the <i>Power System Operator</i> and/or the Transmission Licensee, where applicable, at its discretion, may or may not send a representative to witness and supervise the performance of the	Witnessing by the <i>Power System Operator</i> and/or the <i>Transmission Licensee</i> (a) Where the <i>Power System Operator</i> and/or the <u>Transmission Licensee</u> , where applicable, is satisfied that a proposed <i>system test</i> in respect of which approval has been granted under section E.4 shall not affect the secure, stable and reliable operation of the <i>power system</i> , the <i>Power System Operator</i> and/or the <u>Transmission Licensee</u> , where applicable, at its discretion, may or may not send a representative to witness and supervise the performance of the proposed tests by the	To include Importer Licensees in the requirement for the Power System Operator to notify them of a system test which may impact their operations.

Modification Ref. No.	Clause	Original Text	Modified Text	Reasons
		<p>proposed tests by the person submitting the proposal pursuant to section E.4.</p> <p>(b) The person submitting the proposal pursuant to section E.4 and performing the <i>system test</i> shall ensure that only qualified and <i>competent persons</i> are permitted to perform the <i>system test</i>.</p> <p>(c) The person submitting the proposal pursuant to section E.4 and performing the <i>system test</i> shall be responsible for ensuring that proper and accurate entries are made of the test results in the relevant test reports.</p> <p>(d) The <i>Power System Operator</i> may notify the Transmission Licensee or Generation Licensees of the performance of system test where such system test, in the opinion of the <i>Power System Operator</i> may have an impact on the Transmission Licensee's or Generation Licensees' operation.</p> <p>(e) The Transmission Licensee, with inputs from the <i>Power System Operator</i>, where applicable, may notify third parties (excluding Generation Licensees) of the performance of the system test where such system test, in the opinion of the <i>Power System Operator</i> or the Transmission Licensee, may have an impact on third parties' operation.</p>	<p>person submitting the proposal pursuant to section E.4.</p> <p>(b) The person submitting the proposal pursuant to section E.4 and performing the <i>system test</i> shall ensure that only qualified and <i>competent persons</i> are permitted to perform the <i>system test</i>.</p> <p>(c) The person submitting the proposal pursuant to section E.4 and performing the <i>system test</i> shall be responsible for ensuring that proper and accurate entries are made of the test results in the relevant test reports.</p> <p>(d) The <i>Power System Operator</i> may notify the <u>Transmission Licensee</u>, <u>Importer Licensee</u> or <u>Generation Licensees</u> of the performance of system test where such system test, in the opinion of the <i>Power System Operator</i> may have an impact on the <u>Transmission Licensee's</u>, <u>Importer Licensee</u> or <u>Generation Licensees'</u> operation.</p> <p>(e) The <u>Transmission Licensee</u>, with inputs from the <i>Power System Operator</i>, where applicable, may notify third parties (excluding <u>Generation Licensees and Importer Licensee</u>) of the performance of the system test where such system test, in the opinion of the <i>Power System Operator</i> or the <u>Transmission Licensee</u>, may have an impact on third parties' operation.</p>	

Modification Ref. No.	Clause	Original Text	Modified Text	Reasons
TC/2021/49	F2	Quality Assurance Conditions for Generation Facilities, Transmission Facilities, HVDC Facilities and Consumer Installations	Quality Assurance Power Quality Conditions for Generation Facilities, Transmission Facilities, <u>Import Facilities</u> HVDC Facilities and Consumer Installations	Amending the title as this requirement in Appendix F2 is related to power quality instead of quality assurance. The requirements should apply to Import Facilities instead of solely HVDC facilities.
TC/2021/50	F7.1	This section states the minimum spinning <i>reserve</i> requirement in terms of primary <i>reserve</i> for each <i>generating unit</i> which has a Completion Date after 1 January 2000.	This section states the minimum spinning <i>reserve</i> requirement in terms of primary <i>reserve</i> for each <i>generating unit</i> which has a Completion Date after 1 January 2000. <u>This section also applies to each import facility.</u>	The requirement in this section is also applicable to import facility for the purpose of providing primary reserve.
TC/2021/51	F7.2	For each <i>generating unit</i> which has a Completion Date before 1 January 2000 must endeavour to meet the minimum spinning <i>reserve</i> requirement subject to and in accordance with the provisions of section F.8, otherwise Generation Licensee shall submit the achievable spinning <i>reserve</i> capability to <i>PSO</i> for consideration.	For each <i>generating unit</i> which has a Completion Date before 1 January 2000 must endeavour to meet the minimum spinning <i>reserve</i> requirement subject to and in accordance with the provisions of section F.8 <u>for primary and alternate fuel</u> , otherwise <u>Generation Licensee</u> shall submit the achievable spinning <i>reserve</i> capability to <i>PSO</i> for consideration.	To provide clarity that generation unit must be capable of providing minimum spinning reserve for both primary and alternate fuel.
TC/2021/52	F7.3	Nothing in this appendix is intended to prevent a <i>generating unit</i> from being designed to provide spinning reserve in excess of the minimum requirement specified below.	Nothing in this appendix is intended to prevent a <i>generating unit</i> <u>or import facility</u> from being designed to provide spinning <i>reserve</i> in excess of the minimum requirement specified below.	Reserve requirements are also applicable to import facilities.
TC/2021/53	F7.4.1	The ability of a <i>generating unit</i> to release primary reserve is measured by artificially subjecting the <i>generating unit</i> to a test whereby “measured” frequency is of the form as illustrated in the following figure:	The ability of a <i>generating unit</i> <u>or import facility</u> to release primary reserve is measured by artificially subjecting the <i>generating unit</i> <u>or import facility</u> to a test whereby “measured” frequency is of the form as illustrated in the following figure:	Reserve requirements are also applicable to import facilities.

Modification Ref. No.	Clause	Original Text	Modified Text	Reasons																		
TC/2021/54	F7.4.2	<p><i>Primary Reserve</i> is defined as the change in MW output of the <i>generating unit</i> automatically by governor action in response to this change in <i>frequency</i>, measured at 9 seconds and sustainable for an additional 9 minutes and 51 seconds. If the change in MW output measured at 9 seconds is not sustained for the period of 9 minutes and 51 seconds, the <i>primary reserve</i> is the minimum change in MW output reached during that period.</p>	<p><i>Primary Reserve</i> <i>Primary reserve</i> is defined, for a <u><i>generating unit</i></u>, as the <u>automatic</u> change in MW output of the <i>generating unit</i> automatically by governor action in response to this change in <i>frequency</i>. <u>For an <i>import facility</i> or <i>energy storage system</i>, the <i>primary reserve</i> is defined as the automatic change in MW output in response to this change in <i>frequency</i>.</u> <i>Primary reserve</i> is measured at 9 seconds and sustainable for an additional 9 minutes and 51 seconds. If the change in MW output measured at 9 seconds is not sustained for the period of 9 minutes and 51 seconds, the <u><i>primary reserve</i></u> is the minimum change in MW output reached during that period.</p>	Reserve requirements are also applicable to import facilities.																		
TC/2021/55	F8	Spinning Reserve Requirements of Frequency Sensitive Plant	Spinning Reserve Requirements of Frequency Sensitive Plant/ <u>Import Facility</u>	Reserve requirements are also applicable to import facilities.																		
TC/2021/56	F8.1	<p>Each <i>generating unit</i> must be capable of providing minimum <i>primary reserve</i> as follows:</p> <table border="1"> <thead> <tr> <th></th> <th><u><i>Generating Unit MW Output</i></u> (MW) as a % of Rated MW capacity²</th> <th><i>Primary reserve</i> as a % of Rated MW Capacity²</th> </tr> </thead> <tbody> <tr> <td>(i)</td> <td>90</td> <td>5</td> </tr> <tr> <td>(ii)</td> <td>75 to Minimum Stable Load</td> <td>9</td> </tr> </tbody> </table>		<u><i>Generating Unit MW Output</i></u> (MW) as a % of Rated MW capacity ²	<i>Primary reserve</i> as a % of Rated MW Capacity ²	(i)	90	5	(ii)	75 to Minimum Stable Load	9	<p>Each <i>generating unit</i> <u>or <i>import facility</i></u> must be capable of providing minimum <i>primary reserve</i> as follows:</p> <table border="1"> <thead> <tr> <th></th> <th><u><i>Generating Unit MW Output</i></u> (MW) as a % of Rated MW capacity²</th> <th><i>Primary reserve</i> as a % of Rated MW Capacity²</th> </tr> </thead> <tbody> <tr> <td>(i)</td> <td>90</td> <td>5</td> </tr> <tr> <td>(ii)</td> <td>75 to Minimum Stable Load</td> <td>9</td> </tr> </tbody> </table>		<u><i>Generating Unit MW Output</i></u> (MW) as a % of Rated MW capacity ²	<i>Primary reserve</i> as a % of Rated MW Capacity ²	(i)	90	5	(ii)	75 to Minimum Stable Load	9	Reserve requirements are also applicable to import facilities.
	<u><i>Generating Unit MW Output</i></u> (MW) as a % of Rated MW capacity ²	<i>Primary reserve</i> as a % of Rated MW Capacity ²																				
(i)	90	5																				
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	<u><i>Generating Unit MW Output</i></u> (MW) as a % of Rated MW capacity ²	<i>Primary reserve</i> as a % of Rated MW Capacity ²																				
(i)	90	5																				
(ii)	75 to Minimum Stable Load	9																				

Modification Ref. No.	Clause	Original Text	Modified Text	Reasons
TC/2021/57	F8.2	The primary <i>reserve</i> requirements for each <i>generating unit</i> MW output between Minimum Stable Load and 75%, 75% and 90%, and 90% and 100% of its rated MW Capacity shall be linearly interpolated from the requirements for the <i>generating unit</i> MW outputs between Minimum Stable Load and 75%, 75% and 90%, and 90% and 100% of its rated MW Capacity ² respectively. Additional details are provided in the System Operation Manual.	The primary <i>reserve</i> requirements for each <i>generating unit or import facility</i> MW output between Minimum Stable Load and 75%, 75% and 90%, and 90% and 100% of its rated MW Capacity shall be linearly interpolated from the requirements for the <i>generating unit or import facility</i> MW outputs between Minimum Stable Load and 75%, 75% and 90%, and 90% and 100% of its rated MW Capacity ² respectively. Additional details are provided in the System Operation Manual.	Reserve requirement are also applicable to import facility. To remove duplication of footnote [2] within the Section. Footnote [2] is in Appendix F8.1 of the same section.
TC/2021/58	F8.3	Each <i>generating unit</i> must be capable of providing minimum contingency reserve of 10% of its Rated MW Capacity ² within 10 minutes and shall be verified through test stipulated in the System Operation Manual.	Each <i>generating unit (for primary and alternate fuel) or import facility</i> must be capable of providing minimum contingency reserve of 10% of its Rated MW Capacity ² within 10 minutes and shall be verified through test stipulated in the System Operation Manual.	To provide clarity that generation unit must be capable of providing minimum spinning reserve for both primary and alternate fuel. The minimum contingency reserve requirement is also applicable to import facility. To remove duplication of footnote [2] within the Section. Footnote [2] is in Appendix F8.1 of the same Section.
TC/2021/59	F9	Requirement for High Resolution Recorder for Performance Monitoring and Assessment of the Generation Facilities and Interconnectors	Requirement for High Resolution Recorder for Performance Monitoring and Assessment of the Generation Facilities and <u>Import Facilities</u> Interconnectors	Amending the title as the requirement in this section should apply to import facilities instead of interconnectors alone
TC/2021/60	F9.1	The high resolution recorder installed shall be suitable for both dynamic and transient recording. The recorder shall be able to set at	The high resolution recorder installed shall be suitable for both dynamic and transient recording. The recorder shall be able to set at minimum	As specified in Appendix J2.7, HVDC facilities are required to have Power Order Following Capabilities

Modification Ref. No.	Clause	Original Text	Modified Text	Reasons
		<p>minimum sampling rate of 50Hz and 1kHz for dynamic and transient recording respectively. The basic signal to be recorded / monitored includes, but not limited to, the following:</p> <p>For HVDC Facilities</p> <p>(a) <i>Active power (MW) and reactive power (MVar) flow at the point of connection of the HVDC facility with the transmission system</i></p> <p>(b) HVDC substation busbar voltage (both DC and AC voltages) and <i>frequency</i></p> <p>(c) <i>Circuit breaker and protection devices status</i></p>	<p>sampling rate of 50Hz and 1kHz for dynamic and transient recording respectively. The basic signal to be recorded / monitored includes, but not limited to, the following:</p> <p>For HVDC Facilities</p> <p>(a) <i>Active power (MW) and reactive power (MVar) flow at the point of connection of the HVDC facility with the transmission system</i></p> <p>(b) HVDC substation busbar voltage (both DC and AC voltages) and <i>frequency</i></p> <p>(c) <i>Circuit breaker and protection devices status</i></p> <p><u>(d) AGC pulses</u></p>	<p>such that they can follow control signal issued by the EMS. Hence, the high resolution recorder shall record/monitor AGC pulses.</p>
TC/2021/61	G2.3	<p>Under normal system operating condition, i.e. all <i>service connections</i> to the <i>generation facility</i> are available, the <i>service connections</i> shall be adequate to export the <i>generation facility</i> total installed generation capacity. Under the system operating condition where one <i>generation facility's service connection</i> is not available (scheduled or unscheduled), the remaining <i>generation facility's service connection(s)</i> shall be able to export 90% of its total installed generation capacity. Adequate <i>generation facilities' service connections</i> shall be provided to ensure system <i>security, stability and reliability</i>. Prolonged <i>outage</i> of two <i>generation facilities' service connections</i> shall not result in system being unable to meet the <i>demand</i>.</p>	<p><u>In the case of a <i>generation facility</i> of total installed generation capacity exceeding 10MW or solar photovoltaic generating facility of total installed generating capacity exceeding 10MWac connected for the sole purpose of conveying electricity to the grid, under</u> Under normal system operating condition, i.e. all <i>service connections</i> to the <i>generation facility</i> are available, the <i>service connections of the generation facility</i> shall be adequate to export <u>convey electricity up to the generation facility's total installed generation capacity and all connected import facility's capacity</u>. Under the system operating condition where one <i>generation facility's service connection</i> is not available (scheduled or unscheduled), the remaining <i>generation facility's service connection(s)</i> shall be able to <u>continuously export convey</u> 90% of its total installed generation capacity and all connected <i>import facility's capacity</i>. Adequate <i>generation</i></p>	<p>To amend section G2.3 to state clearly the requirements that generation facility of total installed generation capacity exceeding 10MW or solar photovoltaic generating facility of total installed generating capacity exceeding 10MWac connected for the sole purpose of conveying electricity to the grid shall have adequate number of service connections to convey the generation facility's total installed generation capacity and all connected import facility's capacity under normal system operating condition.</p> <p>In addition, the amendments are also to make clear that under system operating condition where one</p>

Modification Ref. No.	Clause	Original Text	Modified Text	Reasons
			<i>facilities' service connections</i> shall be provided to ensure system <i>security, stability and reliability</i> . Prolonged <i>outage</i> of two <i>generation facilities' service connections</i> shall not result in system being unable to meet the <i>demand</i> .	generation facility's service connection is not available (scheduled or unscheduled), the remaining generation facility's service connection(s) shall be able to continuously convey 90% of its total installed generation capacity and all connected import facility's capacity.
TC/2021/62	G2.4	New clause	<u>In the case of a <i>generation facility</i> of total installed generation capacity up to 10MW or solar photovoltaic <i>generating facility</i> of total installed generating capacity up to 10MWac connected for the sole purpose of conveying electricity to the grid, when all <i>service connections</i> to the <i>generation facility</i> are available, the <i>service connections</i> shall be adequate to convey electricity up to the <i>generation facility's</i> total installed generation capacity. In the event when any of the <i>generation facility's</i> service connection is not available (scheduled or unscheduled), the <i>generation facility</i> shall be able to export any amount of electricity to the grid, up to its installed generation capacity or be isolated from the grid in the case where the sole service connection is unavailable.</u>	To add a new section G2.4 to make clear the requirements that generation facility of total installed generation capacity up to 10MW or solar photovoltaic generating facility of total installed generating capacity up to 10MWac connected for the sole purpose of conveying electricity to the grid shall have adequate number of service connections to convey the generation facility's total installed generation capacity under normal system operating condition. In addition, it also makes clear that in the event when any of the generation facility's service connection is not available (scheduled or unscheduled), the generation facility shall be able to export any amount of electricity to the grid, up to its installed generation capacity or be isolated from the grid in the case where the sole service connection is unavailable.
TC/2021/63	G2.5	New clause	<u>In the case of a <i>generation facility</i> which is embedded within an existing consumer's</u>	To add a new section G2.5 to make clear the requirements that

Modification Ref. No.	Clause	Original Text	Modified Text	Reasons
			<u>installation, the net export of the consumer's installation will have to meet the requirements of the prevailing load connection scheme as per section 4.2.2 of this Code.</u>	generation facilities which are embedded within an existing consumer's installation shall adhere to the requirements of the prevailing load connection scheme as per section 4.2.2 of this Code.
TC/2021/64	H1.1	All generation and transmission facilities that are required to interface to the Energy Management System (EMS) of the PSO shall provide several or all of the following functions: (a) SCADA functions (b) Automatic Generation Control (AGC) functions	All generation, <u>import</u> and transmission facilities that are required to interface to the Energy Management System (EMS) of the PSO shall provide several or all of the following functions: (a) SCADA functions (b) Automatic Generation Control (AGC) functions	Import facility shall be designed to have built in AGC function.
TC/2021/65	H2.1	<i>Remote Terminal Units (RTU)</i> shall be provided as the field equipment to interface to the <i>EMS</i> system. The provision of this equipment shall meet the following requirements: (a) Each substation or switchhouse shall have a dedicated <i>RTU</i> with the condition that the <i>RTU</i> shall not have more than 2000 status points and not more than 200 measurement points. Should the number of status or measurement points exceed these limits then a second <i>RTU</i> shall be provided. Notwithstanding this if the retrieval of the entire database of the <i>RTU</i> by the <i>EMS</i> exceeds 30 seconds then a second <i>RTU</i> shall be provided. (b) A <i>generating station</i> shall have a dedicated <i>RTU</i> with the condition that the <i>RTU</i> shall not be controlling more than 4 <i>generating units</i> or a	<i>Remote Terminal Units (RTU)</i> shall be provided as the field equipment to interface to the <i>EMS</i> system. The provision of this equipment shall meet the following requirements: (a) Each substation or switchhouse shall have a dedicated <i>RTU</i> with the condition that the <i>RTU</i> shall not have more than 2000 status points and not more than 200 measurement points. Should the number of status or measurement points exceed these limits then a second <i>RTU</i> shall be provided. Notwithstanding this if the retrieval of the entire database of the <i>RTU</i> by the <i>EMS</i> exceeds 30 seconds then a second <i>RTU</i> shall be provided. (b) A <i>generating station</i> shall have a dedicated <i>RTU</i> with the condition that the <i>RTU</i> shall not be controlling more than 4 <i>generating units</i> or a total	Each import facility shall have a dedicated RTU.

Modification Ref. No.	Clause	Original Text	Modified Text	Reasons
		total of more than 1000MW. Should the number of <i>generating units</i> or total generating capacity exceed this, then a second <i>RTU</i> shall be provided.	of more than 1000MW. Should the number of <i>generating units</i> or total generating capacity exceed this, then a second <i>RTU</i> shall be provided. <u>(c) Each <i>import facility</i> shall have a dedicated <i>RTU</i> sited locally.</u>	
TC/2021/66	H3.3	It is the responsibility of the Transmission Licensee, Generation Licensee, Wholesaler (Generation) Licensee and <i>connected person</i> responsible for each <i>HVDC facility</i> to provide all the equipment at the remote site. The communication equipment shall include encryption devices to ensure secure communication on the communication lines. These encryption devices shall be of the same make and model as the devices installed at the PSO control centres.	It is the responsibility of the <u><i>Transmission Licensee, Generation Licensee, Importer Licensee, Licensee</i></u> responsible for each <u><i>import facility and Wholesaler Licensee</i></u> and <i>connected person</i> responsible for each <u><i>HVDC facility</i></u> to provide all the equipment at the remote <u>their respective</u> site. The communication equipment shall include encryption devices to ensure secure communication on the communication lines. These encryption devices shall be of the same make and model as the devices installed at the PSO control centres.	To update the reference to Wholesaler Licensees (following the Wholesaler Licence Modification Final Determination Paper issued on 29 Jun 2021).
TC/2021/67	H4.4	New clause	H4.4 HVAC <i>Import Facility</i> The following measurements and statuses shall be provided: <ul style="list-style-type: none"> • <i>Active power, reactive power</i>, voltage at point of connection within the <i>transmission system</i> • Status of any special protection schemes • Network element status signals (circuit breaker, isolator, earth switch) • Status and output of any reactive power devices, control mode and setpoint for any dynamic reactive power equipment 	To include the measurement/status monitoring requirement for a HVAC interconnector.

Modification Ref. No.	Clause	Original Text	Modified Text	Reasons
TC/2021/68	H4.5	New clause	<p>H4.5 HVDC <i>Import Facility</i></p> <ul style="list-style-type: none"> • <i>Active Power, reactive power, voltage at point of connection within the transmission system</i> • Status of any special protection schemes • Communication link status • Control mode • Network element status signals (circuit breaker, isolator, earth switch) • Status and output of any reactive power devices, control mode and setpoint for any dynamic reactive power equipment 	To include the measurement/status monitoring requirement for a HVDC interconnector.
TC/2021/69	H9	<p>Testing and Commissioning</p> <p>The following requirements are needed for testing and commissioning:</p> <ul style="list-style-type: none"> (a) To facilitate AGC testing, a mechanism (software or hardware) is needed to isolate the AGC signals from the turbine control. (b) Copies of all commissioning tests are to be submitted. (c) The Transmission Licensee, Generation Licensee, Wholesaler (Generation) Licensee or <i>connected person</i> responsible for each <i>HVDC facility</i> shall have qualified personnel on site during commissioning to confirm and verify all data sent to the <i>EMS</i>. 	<p><u>Testing and Commissioning of An AGC Interface</u></p> <p>The following requirements are needed for testing and commissioning <u>of a facility's AGC interface</u>:</p> <ul style="list-style-type: none"> (a) To facilitate AGC testing, a mechanism (software or hardware) is needed to isolate the AGC signals from the <u><i>generating unit or HVDC facility's active power controller turbine control</i></u>. (b) Copies of all commissioning tests are to be submitted. (c) The <u><i>Transmission Licensee, Generation Licensee, Wholesaler (Generation) Licensee, Importer Licensee or Licensee</i></u> responsible for each <u><i>import facility</i></u> or <i>connected person</i> responsible for each <i>HVDC facility</i> shall have qualified 	<p>To update the reference to Wholesaler Licensees (following the Wholesaler Licence Modification Final Determination Paper issued on 29 Jun 2021).</p> <p>To make clear that the testing and commissioning of an AGC interface is also applicable to HVDC facility</p>

Modification Ref. No.	Clause	Original Text	Modified Text	Reasons
		Copies of all final as-built drawings, parameters and data are to be submitted	<p>personnel on site during commissioning to confirm and verify all data sent to the <i>EMS</i>.</p> <p>Copies of all final as-built drawings, parameters and data are to be submitted</p>	
TC/2021/70	J1.1	<p>(d) Brief description of the configuration of the HVDC facility including:</p> <ul style="list-style-type: none"> • Technology (current/voltage source) • Number of poles • Pole configuration (e.g. monopole/bipole arrangement/back-to-back) • Return path arrangement 	<p>(d) Brief description of the configuration of the HVDC facility including:</p> <ul style="list-style-type: none"> • Technology (current/voltage source) • Number of poles • Pole configuration (e.g. monopole/bipole arrangement/back-to-back) • Return path arrangement <u>and rating</u> 	Return path arrangement and rating shall be submitted as part of the HVDC facility data before connection to the transmission system
TC/2021/71	J2.10	New clause	<p><u>HVDC Facility Voltage and Reactive Power Control</u></p> <p><u>The HVDC facility shall be operated in constant voltage control at the connection point with any constant Reactive Power output control mode or constant power factor output control always disabled, unless otherwise agreed with PSO.</u></p>	The HVDC facility shall provide continuous dynamic control of voltage at the connection point.
TC/2021/72	J2.11	New clause	<p><u>HVDC Facility Return Path Arrangement</u></p> <p><u>The configuration of the HVDC facility shall use the metallic return.</u></p>	To provide clarity that HVDC facility shall provide the metallic return (not to be confused with earth return).

Representations on the Proposed Modifications to the Transmission Code

Name: _____

Designation: _____

Company: _____

Email: _____

Role (Transmission Licensee/ Generation Licensee/ Retailer/ Consumer):

Submission Date: _____ (dd/mm/yy)

Modification Ref. No.	Section*	Comments

* Reference to the section of the Transmission Code where change has been made in the version dated on Aug 2021 as published on the EMA website.