



Monetary Authority of Singapore

MEPS+

**PRINCIPLES FOR
FINANCIAL MARKET INFRASTRUCTURES
DISCLOSURE**

Table of Contents

I.	Executive Summary	4
II.	Summary of Major Changes Since Last Disclosure	6
III.	General Background on the FMI	7
IV.	Principle-By-Principle Summary Narrative Disclosure	12
V.	List of Publicly Available Resources	73

DISCLOSURE FOR NEW MAS ELECTRONIC PAYMENT AND BOOK-ENTRY SYSTEM (“MEPS+”)

Responding Institution: Monetary Authority of Singapore (“MAS”)

Jurisdiction(s) in which the FMI operates: Singapore

Authority(ies) regulating, supervising or overseeing the FMI: MAS

The date of this disclosure is: 29 December 2022

This disclosure can also be found at the MAS website (www.mas.gov.sg).

For further information, please contact Information Technology Department at meps@mas.gov.sg.

I. Executive Summary

1 MEPS+ is the real-time gross settlement system used for settlement of Singapore Dollar inter-bank funds transfers, Singapore Government Securities¹ (“SGS”) and MAS Bills². In this regard, MEPS+ is a systemically important payment system (“SIPS”), a central securities depository (“CSD”), and a securities settlement system (“SSS”). It is owned and operated by the MAS. Participants of the system include commercial banks and financial market infrastructures (“FMIs”).

2 MAS has adopted the standards set out in the CPMI-IOSCO’s *Principles for Financial Market Infrastructures*³ (“PFMI”) to ensure the safety and efficiency of MEPS+ and to support the stability of the financial system in Singapore. This disclosure⁴ presents MAS’ updated responses to the standards in the PFMI for the period from August 2020 to December 2022.

3 The PFMI provides guidance for addressing key risks in FMIs, such as legal, credit, liquidity, general business, custody, investment, and operational risks, amongst others. The risks identified for MEPS+ are operational, credit, liquidity and legal risks, with the key risk being operational risk.

4 The legal basis for the operation of MEPS+ is established through legislation and contractual agreements. They provide:

- legal authority for MAS to operate MEPS+; and
- legal certainty that all transactions settled in MEPS+ are final and irrevocable notwithstanding the insolvency of a participant.

5 The apex of the MEPS+ governance structure is the MAS Board. The Chairman’s Meeting, a Board Committee chaired by the MAS Chairman, approves major policies and strategies relating to MEPS+. The Board Risk Committee serves as an independent body to provide oversight and guidance on the management of

¹ SGS are issued by MAS in its capacity as the Singapore Government’s fiscal agent, and comprise SGS (Market Development) bonds, SGS (Infrastructure) bonds, Singapore Savings Bonds (“SSBs”) and Treasury Bills (“T-Bills”). SGS (Market Development) bond, SSBs and T-Bills issuances are governed by the Government Securities (Debt Market and Investment) Act 1992, while SGS (Infrastructure) bond issuances are governed by the Significant Infrastructure Government Loan Act 2021. More information can be found on <https://www.mas.gov.sg/bonds-and-bills>.

² Including MAS Bills and MAS Floating Rate Notes (FRNs). MAS Bills and MAS FRNs are issued by MAS pursuant to the MAS Act. More information can be found on <https://www.mas.gov.sg/bonds-and-bills>.

³ The Committee on Payments and Market Infrastructures (“CPMI”) and the International Organisation of Securities Commissions (“IOSCO”) promulgated the PFMI in 2012 to ensure that FMIs supporting financial markets are robust and resilient to withstand financial shocks. As a member of the CPMI and the IOSCO, MAS is expected to adopt and adhere to the requirements in the PFMI. Principle 6 (Margin), Principle 14 (Segregation and portability) and Principle 24 (Disclosure of market data by trade repositories) are not applicable as MEPS+ is not a central counterparty or trade repository.

⁴ MAS has prepared this disclosure in accordance with the methodology set out in the *Principles for Financial Market Infrastructures: Disclosure Framework and Assessment Methodology* (“Disclosure Framework”) established by the CPMI and the IOSCO in April 2012, taking into consideration the minimum standards adopted from the PFMI that are applicable to MEPS+ as set out in *Standards For MAS-Operated Financial Market Infrastructures* issued by MAS in January 2015.

risks faced by MAS in the course of performing its functions, including the operations of MEPS+. The MAS Board has established operational standards and targets for MEPS+, as well as a risk management framework.

6 The risk management framework identifies key processes and procedures to monitor and mitigate operational risks in MEPS+, such as:

- design and review of the system to eliminate any single point of failure and to ensure sufficient capacity to handle the expected or sudden surge in transaction load;
- annual penetration test and system vulnerability assessment to identify potential threats and weaknesses;
- tight change management process to manage risks arising from changes to the system;
- real-time monitoring of the system's condition during MEPS+ operating hours and quarterly system health checks; and
- annual contingency drills with participants, MEPS+ vendors and other service providers to maintain a high state of contingency preparedness across the system, processes and people.

7 An annual risk assessment is conducted. The results are discussed with management and presented to the Board Risk Committee for endorsement and decision on whether additional risk mitigation measures are required.

8 As the operator, MAS does not face liquidity risk or credit risk because it does not act as a central counterparty or guarantee settlement. However, liquidity risk to MEPS+ participants can arise when a participant's inability to pay triggers knock-on effects on other participants' ability to meet their payment obligations in a timely manner. To address such liquidity risk, MAS provides the Intraday Liquidity Facility ("ILF"). To mitigate credit risk in extending ILF, MAS accepts SGS⁵ or MAS Bills as high quality collateral from participants in exchange for the intraday liquidity, subject to a haircut. MEPS+ also has automatic gridlock detection and resolution features which 'net-off' participants' payments and settle them simultaneously on a gross basis, provided that participants' end positions are positive. These measures reduce the overall liquidity needed by participants to settle their payment obligations.

⁵ All SGS, with the exception of SSBs, are eligible collateral.

II. Summary of Major Changes Since Last Disclosure

1 MAS updates the public disclosure of MEPS+ observance of PFMI on a biennial basis. This section highlights the major changes relevant to MEPS+ since the last disclosure in 2020⁶. The PFMI principles that are relevant to these changes are Principle 17 (Operational Risk), Principle 21 (Efficiency and Effectiveness) and Principle 22 (Communication Procedures and Standards).

Principle 17 (Operational Risk)

2 Improving the cyber resiliency of MEPS+ had been a key focus over the last two years. The key controls and measures that MAS had implemented or enhanced over the past two years are summarised in key consideration 17.5 under Section IV.

Principle 21 (Efficiency and Effectiveness) and/or Principle 22 (Communication Procedures and Standards)

3 In 2021, MAS issued SGS (Infrastructure) bonds on behalf of the Singapore Government to finance major long-term infrastructure and launched MAS Floating Rate Notes based on the Singapore Overnight Rate Average (SORA) to support the development of SORA-based markets. MEPS+ was enhanced to support the issuance and settlement of these new type of securities.

4 In August 2022, MAS and the MEPS+ participants successfully adopted the ISO 20022 messaging standard for payments in MEPS+, ahead of the global migration mandated by SWIFT. Implementing ISO 20022 allows more payment details to be carried in the payment messages and in a more structured manner. This facilitates inter-operability between cross-border and domestic payments, resulting in more automated processing and thus higher operational efficiency for the MEPS+ participants.

5 MAS and the industry continued to make progress on the development of the new Singapore Central Real-time Integrated Payments and Securities Settlement System (SCRIPS) that will replace MEPS+. SCRIPS will deliver a range of new features and capabilities for payments and settlement between financial institutions. It will also have capabilities to adapt to the evolving payments and securities landscape, improve operational efficiency and enhance resilience, reliability and security. SCRIPS is targeted to be implemented in 2024.

⁶ The MEPS+ PFMI Disclosure for 2020 can be found at: <https://www.mas.gov.sg/-/media/MAS/Singapore-Financial-Centre/Why-Singapore/MEPS/References/MEPSPLUS-PFMI-Disclosure-2020.pdf>.

III. General Background on the FMI

General description of MEPS+ and the markets it serves

1 MEPS+ is a systemically important payment system in Singapore and it plays an important role in the stability of Singapore's financial system. As at November 2022, MEPS+ has sixty-three participants, comprising MAS, fifty-seven commercial banks, one finance company and four financial market infrastructures, namely CLS Bank International⁷ ("CLS"), The Central Depository (Pte) Limited⁸ ("CDP"), Singapore Exchange Derivatives Clearing Limited⁹ ("SGX-DC") and LCH Limited¹⁰.

2 MEPS+ provides banks in Singapore with a safe and efficient system for settlement of interbank funds transfers and scripless SGS and MAS Bills transactions. MEPS+ is also used for settlement of obligations arising from financial market transactions, such as foreign exchange trades by CLS members, cash-leg of securities trades by CDP members, and cheques and electronic fund transfer transactions cleared through the Singapore Automated Clearing House¹¹ ("SACH"). Participants are provided with real-time access to their account balances and holdings and statuses of their transactions, together with liquidity management tools for prioritisation of their transactions and management of their transaction queues.

General organisation of MEPS+

3 The apex of the MEPS+ governance structure is the MAS Board. The Chairman's Meeting ("CM"), a MAS Board Committee chaired by the MAS Chairman, approves major policies and strategies relating to payment and settlement system(s) operated by MAS. The Board Risk Committee ("RC") serves as an independent body to provide oversight and guidance on the management of risks faced by MAS in the course of performing its functions, including the operations of MEPS+.

4 The oversight of all MEPS+ operational matters is delegated to MAS' Managing Director ("MD"). A cross-department Management Critical Information Infrastructure Committee ("CIIC") chaired by the Deputy Managing Director (Corporate Development) aids the MD in overseeing the design, implementation, operations and risks associated with running MEPS+. CIIC also makes recommendations to MD and CM on strategic policies or initiatives relating to MEPS+, including any major system revamp.

⁷ CLS is a global multicurrency cash settlement system to mitigate foreign exchange settlement risk.

⁸ CDP provides integrated clearing, settlement, and depository facilities for its customers in the Singapore securities market, including both equities and fixed income instruments.

⁹ SGX-DC provides clearing services for derivatives products.

¹⁰ LCH Limited provides clearing services globally for a diverse range of asset classes, including equities, fixed income, foreign currency exchange, rates and repos.

¹¹ SACH is a clearing house for Singapore Dollar cheques, United States Dollar cheques and electronic debit and credit transfer transactions.

5 MAS' Information Technology Department ("ITD") and Data & Technology Architecture Department ("DTA"), supported by the Finance Department ("FD") manage the day-to-day operations of MEPS+. The primary responsibility for the risk management of MEPS+ rests with ITD and DTA, supported by FD. The Risk Management Department ("RiMD") and the Chief Cyber Security Officer's Office ("CCSO Office"), as second line risk managers for operational risks and technology and cyber risks respectively, undertake independent risk review and challenge in respect of MEPS+. The Payments Department ("PD") is responsible for the independent supervision of MEPS+. There are clear lines of responsibilities for the operations, risk management and supervision of MEPS+.

6 MEPS+ is subjected to regular audits by the Internal Audit Department ("IAD") and Auditor General's Office ("AGO"). The audit opinion and findings are reported to the MD and the Board Audit Committee ("AC"). In addition, PD conducts on-going supervision and periodic inspections of MEPS+ and its operations.

Legal and regulatory framework

- 7 The main legislations setting out the legal framework for MEPS+ are:
- Section 29A of the MAS Act 1970 ("MAS Act");
 - Payment Services Act 2019 ("PS Act");
 - Payment and Settlement Systems (Finality and Netting) Act 2002 ("FNA"); and
 - Electronic Transactions Act 2010 ("ETA").

Section 29A of the MAS Act

This provides MAS with the legal authority to establish and operate MEPS+, enter into agreements with participants, and to issue to the participants written rules for the operation of the settlement system, including those for the conduct of participants.

PS Act

The PS Act provides MAS with legal powers to designate payment systems if it is considered a systemically important payment system ("SIPS") or a system-wide important payment system ("SWIPS"), or where it is otherwise in the public interest to do so. MEPS+ is a SIPS and designated under the PS Act. The PS Act establishes the basis for the supervision of MEPS+ and its participants by MAS.

FNA

The FNA provides for the protection of payment and settlement systems from disruptions that may arise as a result of legal uncertainties during events such as the commencement of insolvency proceedings of a participant. As MEPS+ is a designated system under the FNA, there is legal certainty that all transactions settled in MEPS+, are final and irrevocable notwithstanding the

insolvency of a participant. Pursuant to sections 12 and 14 of the FNA, the “zero-hour” rule¹² does not apply, and no court in Singapore shall recognise or give effect to an order of the courts in a foreign jurisdiction to reverse or unwind transactions that have been settled in MEPS+.

8 The five main agreements governing MEPS+ are: (i) the MEPS+ Service Agreement; (ii) Terms and Conditions Governing the Operation of the Current Account of the Specified Institution; (iii) Terms and Conditions Governing the Operation of the Accounts for SGS and MAS Bills; (iv) Terms and Conditions Governing the MAS Intraday Liquidity Facility; and (v) PSA/ISMA Global Master Repurchase Agreement (“GMRA”). The rights and obligations of MAS (as the operator for MEPS+) and the MEPS+ participants are set out in the MEPS+ Service Agreement that MAS has entered into with each of the MEPS+ participants.

System design and operations

9 MEPS+ consists of two sub-systems, namely MEPS+ Interbank Funds Transfer (“MEPS+ IFT”) for the settlement of large value Singapore Dollar (“SGD”) interbank funds transfers, and MEPS+ Singapore Government Securities (“MEPS+ SGS”) for the custody and settlement of scripless SGS and MAS Bills transactions. It utilises the SWIFT network, SWIFT services and MT messaging standards as its messaging backbone.

Operating hours

10 MEPS+ operates on weekdays (excluding public holidays) from 0900 hours to 1900 hours.

Clearing and Settlement Processes

11 Prior to the start of MEPS+ operating hours, funds maintained by the MEPS+ participants in their current accounts with MAS are transferred to their RTGS accounts, where they may be used for the settlement of MEPS+ transactions. Where an intraday Minimum Cash Balance¹³ (“MCB”) requirement applies to a participant, only funds in excess of its intraday MCB requirement are transferred to the RTGS account to facilitate settlement of intraday MEPS+ payments.

12 MEPS+ participants use their existing SWIFT terminals and interfaces to submit payment instructions, manage queued transactions and perform online enquiries. Same day payment instructions will be settled instantaneously and irrevocably if the paying participant has sufficient balances in its RTGS account. Those that fail to settle due to insufficient funds in the paying participant’s RTGS account are queued. When funds are available, queued instructions are settled according to their assigned priority levels on a first-in-first-out basis. A gridlock detection and resolution mechanism runs

¹² A provision in the insolvency law of some countries whereby the transactions conducted by an insolvent institution after midnight on the date the institution is declared insolvent are automatically ineffective by operation of law.

¹³ Please refer to MAS Notice 758 <https://www.mas.gov.sg/regulation/notices/notice-758>.

every half hour to allow payments to be settled simultaneously on a multilateral gross basis, provided that the resulting positions of all accounts are positive. Queued payments which cannot be settled at the end of a business day are cancelled by MEPS+ and affected participants are informed of such cancelled payments through the appropriate SWIFT messages.

13 If the seller of SGS or MAS Bills has insufficient SGS or MAS Bills for delivery, the transaction is queued in MEPS+ SGS until sufficient SGS or MAS Bills are available. Once the seller has sufficient SGS or MAS Bills, MEPS+ SGS will earmark the SGS or MAS Bills for transfer to the buyer and generate a payment instruction to MEPS+ IFT on behalf of the buyer. If the buyer has insufficient funds in its RTGS account to pay for the SGS or MAS Bills purchase, the payment will be queued in MEPS+ IFT. When the funds become available, the amount will be debited from the buyer's RTGS account and credited to the seller's RTGS account, and transfer of SGS or MAS Bills to the buyer will be simultaneously effected on a delivery-vs-payment ("DVP") (Model 1¹⁴) basis.

14 Similarly, payment obligations that arise from trading of SGD-denominated corporate debt in CDP between MEPS+ participants are also settled in MEPS+ IFT on a DVP basis. MEPS+ IFT also settles the participants' net obligations arising from the clearing of SGD cheques, Inter-Bank GIRO transactions and Fast And Secure Transfers ("FAST") transactions in the SACH. For each net settlement cycle, the SACH prepares an electronic file containing the net settlement obligations of each participant and sends this file to MEPS+ IFT for settlement via a leased line linkage between SACH and MEPS+ IFT, at the stipulated time within the MEPS+ operating hours.

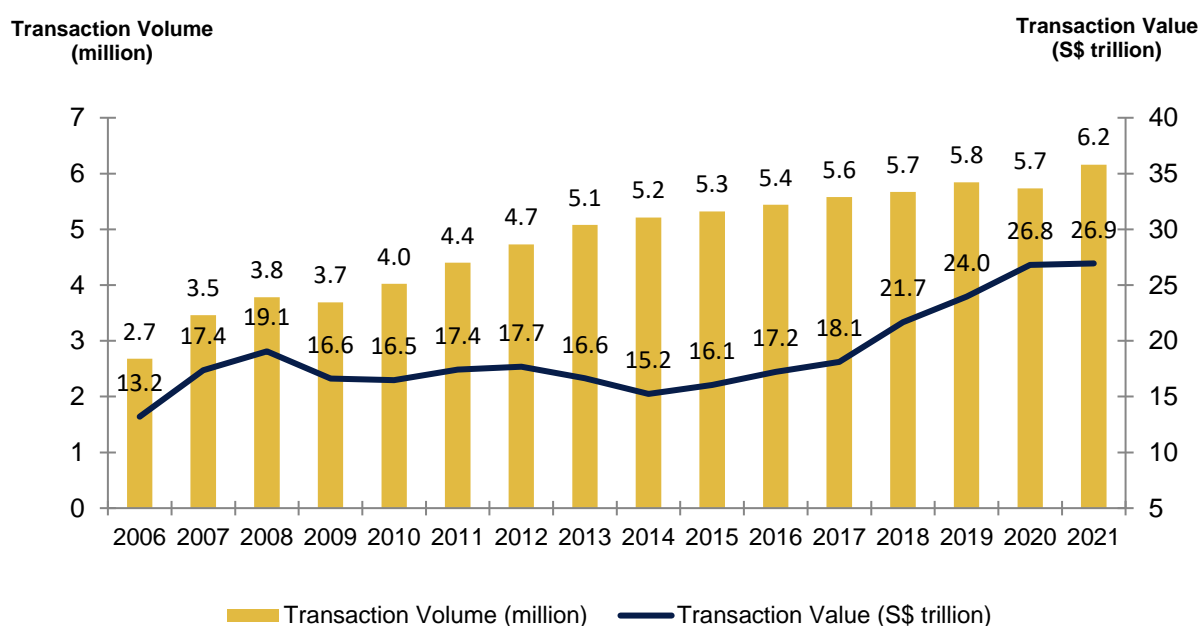
¹⁴ Please refer to BIS *Delivery versus payment in securities settlement systems* at www.bis.org/publ/cpss06.htm.

Statistics

Annual Volume and Value

15 In 2021, MEPS+ handled a total of 6.16 million transactions valued at S\$26.94 trillion. This works out to an average of about 24,300 transactions valued at about S\$106 billion daily. Key MEPS+ statistics are published on the MAS website¹⁵.

Chart 1: Annual Total Volume and Value of MEPS+ Transactions since 2006



System Availability¹⁶

16 In 2020 and 2021, MEPS+ IFT and SGS have achieved 100% availability.

¹⁵ The MEPS+ statistics can be found at <https://www.mas.gov.sg/regulation/payments/meps>.

¹⁶ MAS started reporting MEPS+ system availability in the MEPS+ PFMI Disclosure Report in 2020.

IV. Principle-By-Principle Summary Narrative Disclosure

Principle 1: Legal basis

An FMI should have a well-founded, clear, transparent, and enforceable legal basis for each material aspect of its activities in all relevant jurisdictions.

Key consideration 1.1: The legal basis should provide a high degree of certainty for each material aspect of an FMI's activities in all relevant jurisdictions.

- The material aspects of MEPS+ activities requiring legal certainty are:
 - settlement finality for the transfer of funds, settlement of payment obligations and the transfer and settlement of book-entry securities and instruments between or among participants; and
 - enforceability of sale and repurchase (“repo transactions”) transactions in the event of a default.

Settlement Finality

As MEPS+ is a designated system under the FNA, transactions settled in MEPS+ are protected from the application of the “zero-hour” rule in the event of a participant default¹⁷. Operating Rules in relation to the MEPS+ (the “MEPS+ Operating Rules”) in Appendix 1 of the MEPS+ Service Agreement set out the rules for funds transfer, settlement of payment obligations and transfer and settlement of scripless SGS and MAS Bills in MEPS+. Before access to MEPS+ is granted by MAS, participants are required to enter into the MEPS+ Service Agreement with MAS, which forms the contractual basis for the payment and settlement activities in MEPS+. The MEPS+ Operating Rules are read as part of the MEPS+ Service Agreement and shall be binding on the participant, and between the participant and MAS and all other participants in MEPS+. The participant shall comply strictly with the MEPS+ Operating Rules as long as the MEPS+ Service Agreement continues to be in force.

Enforceability of Repo Transactions

The MEPS+ Service Agreement also forms the contractual basis for enforceability of repo transactions in MEPS+. Rule 12 of the MEPS+ Operating Rules in Appendix 1 of the MEPS+ Service Agreement applies to repo transactions in MEPS+ and sets out the roles and responsibilities of the participants in the repo transactions.

- MEPS+ operates in Singapore only and does not have cross border presence or activity. Each MEPS+ participant is bound by the MEPS+ Service Agreement

¹⁷ No court in Singapore shall recognise or give effect to an order of the courts in a foreign jurisdiction to reverse or unwind transactions that have been settled in MEPS+.

which is governed by the laws of Singapore and has agreed to submit to the exclusive jurisdiction of the courts of Singapore.

Key consideration 1.2: An FMI should have rules, procedures, and contracts that are clear, understandable, and consistent with relevant laws and regulations.

- The relevant documents relating to MEPS+, which include the MEPS+ Service Agreement and the Operations and Contingency Manual for MEPS+ Participants and Non-Participants (“MEPS+ Documents”), are readily available and publicly disclosed on the MAS website¹⁸.
- MAS reviews the MEPS+ Service Agreement to ensure it is consistent with Singapore legislations. Where necessary, MAS will seek advice from the Attorney General’s Chambers of Singapore or external legal practitioners on specific issues concerning MEPS+.
- MAS seeks participants’ feedback when material amendments that may affect them are proposed to the MEPS+ Service Agreement. The consultation process provides a channel to receive feedback on the proposed changes and for participants to understand the revisions to the MEPS+ Service Agreement. The relevant MAS supervisory departments are also consulted so that supervisory concerns are addressed before the proposed changes to the MEPS+ Service Agreement are effected.

Key consideration 1.3: An FMI should be able to articulate the legal basis for its activities to relevant authorities, participants, and, where relevant, participants’ customers, in a clear and understandable way.

- The legal basis of MAS’ payment and settlement activities is articulated through legislation and contractual agreements. The details of the key legislation and main agreements entered into between MAS and the participants of MEPS+ are set out in the section titled “Legal and regulatory framework” of this document.
- Section 29A of the MAS Act provides MAS with the legal authority to establish and to operate MEPS+. The FNA provides settlement finality and protection from the application of the “zero-hour” rule in the event of a participant’s default. These and other relevant legislations (such as the ETA) are publicly available on the Singapore Statutes Online, which is the Singapore Government’s website for the online publication of Singapore legislations. The MEPS+ Documents are also readily available and publicly disclosed on the MAS website.

¹⁸ The MEPS+ Documents can be found at <https://www.mas.gov.sg/regulation/payments/meps>.

- Before access to MEPS+ is granted, participants are required to enter into the MEPS+ Service Agreement with MAS. The agreement forms the contractual basis for the payment and settlement activities in MEPS+.

Key consideration 1.4: An FMI should have rules, procedures, and contracts that are enforceable in all relevant jurisdictions. There should be a high degree of certainty that actions taken by the FMI under such rules and procedures will not be voided, reversed, or subject to stays.

Enforceability of rules, procedures and contracts

- Although participants of MEPS+ include entities which are incorporated in foreign countries, the rules applicable to MEPS+ are governed by Singapore law and require that all participants submit to the exclusive jurisdiction of the Singapore courts.

Degree of certainty for rules and procedures

- Section 7 of the FNA provides for the finality and irrevocability of transactions settled in MEPS+ and shall apply where the rules of a designated system provide that the transactions are final and irrevocable. However, as set out in section 12 of the FNA, the finality and irrevocability of transactions of a designated system does not extend to any transfer order given by a participant which is entered into a designated system after the expiry of one business day after the following events (“insolvency events”):
 - a court made an order for bankruptcy, judicial management or winding up in respect of the participant; or
 - a resolution for the voluntary winding up of the participant was passed.
- In this regard, Rule 17.1 of the MEPS+ Operating Rules lists the following transactions as being final and irrevocable:
 - the transfer of funds into and out of an account of a participant of MEPS+;
 - the settlement of any payment obligation in MEPS+; and
 - the settlement and transfer of book-entry SGS and MAS Bills.This means that notwithstanding anything to the contrary in any written law or rule of law, these transactions shall not be reversed, repaid or set aside and no order shall be made by any court for the rectification or stay of such transfer or settlement, as long as they are entered into MEPS+ before the expiry of one business day after the insolvency events.

Key consideration 1.5: An FMI conducting business in multiple jurisdictions should identify and mitigate the risks arising from any potential conflict of laws across jurisdictions.

- MEPS+ operates in Singapore only. To-date, the MEPS+ Documents have not been the subject of any conflict of laws across jurisdictions.

Principle 2: Governance

An FMI should have governance arrangements that are clear and transparent, promote the safety and efficiency of the FMI, and support the stability of the broader financial system, other relevant public interest considerations, and the objectives of relevant stakeholders.

Key consideration 2.1: An FMI should have objectives that place a high priority on the safety and efficiency of the FMI and explicitly support financial stability and other relevant public interest considerations.

- MEPS+ was implemented to provide the banking industry with a safe, efficient and robust payment system for effecting large value payments, thereby reducing systemic and operational risks and promoting stability in the financial system. Operational standards and targets are in place to achieve the outcome of a reliable, resilient and secure payment system infrastructure.
- The performance of MEPS+ against these operational standards and targets are reviewed monthly by CIIC.
- In addition, MAS holds MEPS+ to the standards set out in the *Standards For MAS-Operated Financial Market Infrastructures*¹⁹, as well as relevant MAS' notices and guidelines, such as Technology Risk Management Guidelines and Notice on Technology Risk Management. These are published on the MAS website.

Key consideration 2.2: An FMI should have documented governance arrangements that provide clear and direct lines of responsibility and accountability. These arrangements should be disclosed to owners, relevant authorities, participants, and, at a more general level, the public.

- There are clear lines of responsibilities for the operations, risk management and supervision of MEPS+.
- The MAS Board is the apex of the MEPS+ governance structure. CM, a MAS Board Committee chaired by the MAS Chairman, approves major policies and strategies relating to payment and settlement system(s) operated by MAS.
- The RC, also a Board Committee, provides oversight and guidance on the management of risks of MEPS+.

¹⁹ In January 2015, MAS released the *Standards for MAS-Operated Financial Market Infrastructures* that set out the minimum standards adopted from the PFMI that are applicable to MAS-operated FMIs. The standards can be found at <https://www.mas.gov.sg/publications/monographs-or-information-paper/2015/standards-for-mas-operated-financial-market-infrastructures>.

- The oversight of all MEPS+ operational matters is delegated to the MD.
- A cross-department committee, CIIC, chaired by the Deputy Managing Director (Corporate Development), aids the MD in overseeing the design, implementation, operations and risks associated with running MEPS+. CIIC makes recommendations to the MD and CM on strategic MEPS+ policies or initiatives, including any major revamp of systems.
- ITD and DTA, with the support of FD oversee and carry out the day-to-day operations of MEPS+. The primary responsibility for the risk ownership and management of MEPS+ rests with ITD and DTA, supported by FD.
- RiMD and the CCSO Office, as second line risk managers for operational risks and technology and cyber risks respectively, undertake independent risk review and challenge in respect of MEPS+. The Head of RiMD and the CCSO are members of CIIC.
- MEPS+ is subject to regular audits by the IAD and AGO. Their audit findings are reported to MD and the AC.
- PD is responsible for the supervision of MEPS+ to ensure its safety and efficiency through a combination of supervisory tools; and its adherence to the PFMI. To avoid possible or perceived conflicts of interest, PD is not involved in MEPS+ operations and is not a member of CIIC. PD carries out periodic inspections on MEPS+.
- The MEPS+ governance arrangement is set out in this disclosure, which is publicly available on MAS website.

Key consideration 2.3: The roles and responsibilities of an FMI's board of directors (or equivalent) should be clearly specified, and there should be documented procedures for its functioning, including procedures to identify, address, and manage member conflicts of interest. The board should review both its overall performance and the performance of its individual board members regularly.

- The MAS Board is appointed by the President of Singapore as required under section 7(3) and section 8(1) of the MAS Act. As set out in section 7(1) and section 7(2) of the MAS Act, the MAS Board is responsible for the policy and general administration of the affairs and business of MAS, and shall from time to time inform the Government of the regulatory, supervisory and monetary policies of MAS.
- Pursuant to section 13A of the MAS Act, MAS may appoint from among its directors or other persons who are not directors to such number of committees to assist MAS in the exercise of its powers and carrying out of its functions and duties. These committees have clear terms of reference which delineate and document the roles and responsibilities of each committee so as to prevent any

ambiguity or potential conflicts of interest. The terms of reference also set out the composition of each Board committee. Specific terms of reference for these committees have been developed and approved by the MAS Board. For instance, one of the roles of the CM is to approve major policies and strategies in relation to payment and settlement system(s) operated by MAS. The RC serves as an independent body to provide oversight and guidance on the management of risks faced by MAS in the course of its functions (including the operations of MEPS+).

- The MAS Act sets out provisions to address and manage conflicts of interest of the individual members of the MAS Board. Under section 8 of the MAS Act, directors should not act as delegates on the board from any commercial, financial, agricultural, industrial or other interests with which they may be connected. Under section 10(1) of the MAS Act, no person may be appointed as or remain a director of MAS who is a director or salaried official of any financial institution licensed or approved by MAS. Under section 13 of the MAS Act, a director who is, directly or indirectly, interested in a contract made, or proposed to be made, by MAS shall disclose the nature of his interest at the first meeting of the board at which he is present after the relevant facts have come to his knowledge. After the disclosure, the director shall not take part in any deliberation or decision of the board with respect to that contract and shall be disregarded for the purpose of constituting a quorum of the board for any such deliberation or decision. The MAS Board is also required to abide by a Code of Conduct, which sets out specific requirements and procedures relating to the management of conflicts of interest.

Key consideration 2.4: The board should contain suitable members with the appropriate skills and incentives to fulfil its multiple roles. This typically requires the inclusion of non-executive board member(s).

- The MAS Board comprises members from both the public and private sectors, with a variety of experience, expertise and skillsets. Currently, MAS has twelve MAS Board members, of which eleven are non-executive.
- MAS has several core functions – central banking, reserve management, integrated financial supervision, as well as development of Singapore as a financial centre. It is also responsible for operating the national real-time gross settlement system. The MAS Board comprises respected individuals who possess experience and expertise relevant to MAS' functions; and who do not hold appointments presenting potential conflicts of interest with MAS, i.e. holding key positions in MAS-regulated entities.

Key consideration 2.5: The roles and responsibilities of management should be clearly specified. An FMI's management should have the appropriate experience, a mix of skills, and the integrity necessary to discharge their responsibilities for the operation and risk management of the FMI.

- Pursuant to section 9(6) of the MAS Act, the MD formed the CIIC to exercise his powers and perform his duties in overseeing the critical information infrastructures ("CIIs") operated by MAS, including MEPS+.
- The CIIC:
 - oversees the overall design and functionality of the CIIs, performance standards of the CIIs, policies and operating rules of the CIIs, and compliance of the CIIs with legislative requirements, Government policies, industry standards, and MAS' risk management and operational guidelines, risk management of the CIIs, implementation of major system changes to the CIIs, and contingency plans for the CIIs;
 - makes recommendations to MAS management on list of CIIs, strategic policies of the CIIs and key risk parameters of the CIIs; and
 - provides regular assessments to RC on residual risks of the CIIs, including any deviations from relevant policies and industry standards.
- The CIIC has an appropriate mix and diversity of experience and skills. Its members comprise the Deputy Managing Director (Corporate Development Group) as the Chairman of the CIIC, the Assistant Managing Director (Technology) and the Assistant Managing Director (Finance, Risk and Currency) as the alternate chairmen, and the heads or senior representatives of various departments which are closely involved in the operation of the CIIs as members. Representatives from Banking Department and IAD attend the meetings as observers.

Key consideration 2.6: The board should establish a clear, documented risk-management framework that includes the FMI's risk-tolerance policy, assigns responsibilities and accountability for risk decisions, and addresses decision making in crises and emergencies. Governance arrangements should ensure that the risk-management and internal control functions have sufficient authority, independence, resources, and access to the board.

- A risk management framework sets out the responsibilities and accountability for key decisions relating to MEPS+, including processes and procedures for proactive operations, risk management and contingency preparedness in crises and emergencies. There are operational standards and targets to guide the line departments to measure, monitor and manage the operational risk in MEPS+.
 - Under this framework, the primary responsibility for the risk ownership and management of MEPS+ rests with ITD and DTA, supported by FD.
 - The framework includes an incident management protocol to guide staff in managing an incident, including reporting to and decision making by management. When an incident occurs, ITD will assess the nature and severity of the incident. Situation updates will be provided to the CIIC

Chairman and the relevant department heads. The CIIC Chairman (or in his or her absence, the alternate co-chairmen) will make the decision to activate appropriate contingency measures if there is a need to do so. If there is an assessed likelihood of a prolonged disruption (e.g. multiple days), MD's approval will be sought to activate the MAS Crisis Management Plan to manage the crisis response. In such instances, the decision-making authority will lie with MAS' Crisis Management Team²⁰.

- RiMD and CCSO Office, as second line risk managers for operational risks and technology and cyber risks respectively, undertake independent risk review and challenge in respect of MEPS+. They provide an additional layer of checks, including challenging assumptions, reviewing residual risk assessment and identifying longer-term implications of initiatives implemented by the operator. Where competing requirements or differences of views between departments arise in addressing the various risks, they will ensure that these issues and trade-offs are brought to CIIC's and MD's attention for deliberation. RiMD also has an independent reporting line to RC.
- IAD forms the third line of defence and provides an independent assessment of the internal controls for MEPS+. IAD also has a direct reporting line to AC.

Key consideration 2.7: The board should ensure that the FMI's design, rules, overall strategy, and major decisions reflect appropriately the legitimate interests of its direct and indirect participants and other relevant stakeholders. Major decisions should be clearly disclosed to relevant stakeholders and, where there is a broad market impact, the public.

- MAS actively consults MEPS+ participants on proposed changes to the MEPS+ Service Agreement, the MEPS+ Operating Rules and enhancements to MEPS+, unless the proposed changes have limited impact on the participants. Feedback from the participants will be presented to CIIC for information and discussion, before decisions are made on these changes. Once a decision is made on the changes, participants will be informed of the effective date of the proposed changes by way of circulars. Changes in MEPS+ Service Agreement and MEPS+ Operating Rules are published on the MAS website.

²⁰ This comprises MAS' Managing Director, Deputy Managing Directors and Assistant Managing Directors. This team, with the support of relevant line functions, is responsible for making decisions to manage the crisis over its duration.

Principle 3: Framework for the comprehensive management of risks

An FMI should have a sound risk management framework for comprehensively managing legal, credit, liquidity, operational, and other risks.

Key consideration 3.1: An FMI should have risk-management policies, procedures, and systems that enable it to identify, measure, monitor, and manage the range of risks that arise in or are borne by the FMI. Risk-management frameworks should be subject to periodic review.

- As the operator of MEPS+, MAS is exposed to operational and legal risks. MAS, as a central bank, faces other risks such as credit risk arising from the provision of ILF to participants. Liquidity risk to the MEPS+ participants can also arise when a participant's inability to pay triggers knock-on effects on other participants' ability to meet their payment obligations in a timely manner.
- Under the MEPS+ risk management framework, primary responsibility for the risk management of MEPS+ rests with ITD and DTA, supported by FD. These responsibilities include:
 - identifying, measuring and monitoring operational risks in MEPS+;
 - developing and implementing operational risk controls and other risk measures where appropriate; and
 - identifying, investigating, resolving and reporting operational risk incidents to RiMD.
- RiMD and CCSO Office, as second line risk managers for operational risks and technology and cyber risks respectively, undertake independent risk review and challenge in respect of MEPS+. They provide an additional layer of checks, including challenging assumptions, reviewing residual risk assessment and identifying longer-term risk implications of initiatives implemented by the operator. Where competing requirements or differences of views between departments arise in addressing the various risks, they will ensure that these issues and trade-offs are brought to CIIC's and MD's attention for deliberation. RiMD also has an independent reporting line to RC.
- IAD forms the third line of defence and provides an independent assessment of the internal controls for MEPS+. IAD also has a direct reporting line to AC.
- Annual risk assessment of MEPS+ is carried out. The results and risk mitigation measures are discussed at CIIC, and presented to RC for their endorsement and decision on whether additional risk mitigation measures need to be implemented.
- MAS uses several risk management tools to identify, measure, monitor and manage the range of risks that arises in MEPS+:

- A payments dashboard, which presents key payments parameters at the system and individual participant level (e.g. incoming and outgoing payments statistics, queued transaction volume);
- Customised reports generated by MEPS+ system (e.g. queue statistics, gridlock detection and resolution reports);
- Real-time system monitoring and alert, to ensure that system problems are detected promptly;
- Annual system performance tests to ensure MEPS+ can handle surges in transaction volume; and
- Penetration test, system vulnerability assessment and other risk assessments, conducted annually, to identify potential threats and weaknesses.

Key consideration 3.2: An FMI should provide incentives to participants and, where relevant, their customers to manage and contain the risks they pose to the FMI.

- The MEPS+ system design provides participants with the tools and incentives to manage the risks they pose to MEPS+:
 - The MEPS+ Browse service allows participants to access real-time online information on their account balances and securities holdings, and settlement status of their transactions. This service allows participants to monitor their own account positions and manage their liquidity more efficiently throughout the day using the MEPS+ queue management function. Participants are able to manage their liquidity requirements by setting bilateral limits, overall payment limits, or earmark funds for a specific counterparty or transaction. For the few participants who do not subscribe to the MEPS+ Browse service (contributing to less than 1% of the annual total volume of transactions processed through MEPS+), a statement of their financial position is available upon request.
 - At the end of day, MEPS+ provides participants with a report on their adherence to the Graduated Payment Schedule²¹. By adhering to the Graduated Payment Schedule, the likelihood of payment queues and gridlock in MEPS+ is reduced.
 - The fee structure of MEPS+ is time-based, which encourages early settlement of transactions by participants, thus reducing the operational risks which may result from concentration of payments towards the end of the MEPS+ operating hours.
 - MAS provides an interest-free ILF to participants with eligible collateral (i.e. SGS²² and MAS Bills) to help them fund their payment obligations. Automatic liquidity reversal takes place at 1730 hours. If participants are unable to return the funds borrowed under the ILF at the end of the day, the collateral will be held by MAS and participants may incur additional fees.

²¹ The Association of Banks in Singapore issued the Graduated Payment Schedule which recommends that banks make at least 30% of the transaction value by 10.30am, 60% by 2.30pm, and balance of all payments by 5.30pm.

²² All SGS, with the exception of SSBs, are eligible collateral.

- The MEPS+ system has an automatic gridlock detection and resolution mechanism, which runs every half hour to allow payments to be settled simultaneously on a multilateral basis, provided that the resulting positions of all accounts are positive. This feature reduces the liquidity needs and associated risks for participants.
- In addition, MAS keeps all participants notified of operational incidents encountered by another participant to assist them to mitigate the risks among themselves.

Key consideration 3.3: An FMI should regularly review the material risks it bears from and poses to other entities (such as other FMIs, settlement banks, liquidity providers, and service providers) as a result of interdependencies and develop appropriate risk-management tools to address these risks.

- MAS reviews the interdependencies and material risks that it bears from and poses to other entities during the annual risk assessment or when there are significant changes in the operating environment, system, procedures or findings from data analytics. More details are available under the disclosure for key consideration 17.7 of Principle 17 (Operational Risk).
- The key test when considering the impact that MEPS+ has on other entities or systems would be to review the impact should MEPS+ services be unavailable, partially or otherwise. This could occur when the MEPS+ system encounters an issue. Similarly, to assess impact on MEPS+ from other entities or systems, MAS would consider whether there is any disruption or impact to MEPS+ when these entities or systems encounter an issue or a disruption.
- MAS also conducts annual network analysis and stress tests that identify key participants and evaluate the potential settlement risks posed to the MEPS+ system due to these participants being unable to make payments as a result of a range of issues, including encountering liquidity or solvency issues. The results are discussed at CIIC and complement the MEPS+ operator's monitoring of participants as well as MAS' supervisory engagements with bank participants.

Key consideration 3.4: An FMI should identify scenarios that may potentially prevent it from being able to provide its critical operations and services as a going concern and assess the effectiveness of a full range of options for recovery or orderly wind-down. An FMI should prepare appropriate plans for its recovery or orderly wind-down based on the results of that assessment. Where applicable, an FMI should also provide relevant authorities with the information needed for purposes of resolution planning.

- According to CPMI-IOSCO note on *Application of the Principles for Financial Market Infrastructures to central bank FMIs*²³ and MAS' *Standards for MAS-Operated Financial Market Infrastructures*, the requirements to prepare recovery and orderly wind-down plans, and to support resolution planning or intervention by a resolution authority in the operation or ownership of the FMI do not apply to MEPS+.

²³ In August 2015, CPMI and IOSCO released the note on the *Application of the Principles for Financial Market Infrastructures to central bank FMIs* that provides guidance on how the PFMI applies to FMIs that are owned or operated by central banks, and further clarifies the interaction between the PFMI and central bank policies.

Principle 4: Credit risk

An FMI should effectively measure, monitor, and manage its credit exposure to participants and those arising from its payment, clearing, and settlement processes. An FMI should maintain sufficient financial resources to cover its credit exposure to each participant fully with a high degree of confidence. In addition, a CCP that is involved in activities with a more-complex risk profile or that is systemically important in multiple jurisdictions should maintain additional financial resources sufficient to cover a wide range of potential stress scenarios that should include, but not be limited to, the default of the two largest participants and their affiliates that would potentially cause the largest aggregate credit exposures to the CCP in extreme but plausible market conditions. All other CCPs should maintain, at a minimum, total financial resources sufficient to cover the default of the one participant and its affiliates that would potentially cause the largest aggregate credit exposures to the CCP in extreme but plausible market conditions.

Key consideration 4.1: An FMI should establish a robust framework to manage its credit exposures to its participants and the credit risks arising from its payment, clearing, and settlement processes. Credit exposure may arise from current exposures, potential future exposures, or both.

- MAS, as a central bank, offers the ILF which allows MEPS+ participants to borrow SGD on an intraday and collateralised basis to facilitate the settlement of SGD payments and helps prevent system gridlocks owing to timing mismatches. The ILF is available only to those participants who have executed the GMRA with MAS. Through the ILF, MAS is exposed to credit risk.
- Credit risk is mitigated by requiring participants to provide collateral against their borrowing. MAS accepts SGS and MAS Bills as collateral in exchange for SGD cash via the ILF, and will only extend the ILF to viable entities. The amount of liquidity extended to participants is the market value of the collateral provided subject to a haircut. The haircut applied is determined by a haircut framework and is suitably calibrated based on the time-to-maturity and risk characteristics of the collateral. The haircuts pertaining to the ILF are published on the MAS website and reviewed annually.

Key consideration 4.2: An FMI should identify sources of credit risk, routinely measure and monitor credit exposures, and use appropriate risk-management tools to control these risks.

- For credit risk to MAS arising from the extension of credit under the ILF, the credit exposure is collateralised with SGS²⁴ and MAS Bills received from the participant. There is an online platform that allows daily monitoring of participants who are tapping on this facility and the corresponding exposures.

²⁴ All SGS, with the exception of SSBs, are eligible collateral.

- Only participants who have signed the GMRA with MAS can access the ILF. MEPS+ automatically verifies that the participant has executed the GMRA with MAS before processing ILF requests by participants. In addition, DVP settlement mechanism is utilised for the exchange of collateral for intraday liquidity. Lastly, haircuts are incorporated to reduce MAS' credit risk exposure.

Key consideration 4.3: A payment system or SSS should cover its current and, where they exist, potential future exposures to each participant fully with a high degree of confidence using collateral and other equivalent financial resources (see Principle 5 on collateral). In the case of a DNS payment system or DNS SSS in which there is no settlement guarantee but where its participants face credit exposures arising from its payment, clearing, and settlement processes, such an FMI should maintain, at a minimum, sufficient resources to cover the exposures of the two participants and their affiliates that would create the largest aggregate credit exposure in the system.

- To manage exposures that arise due to extension of intraday credit to participants, the lending is collateralised with SGS²⁵ and MAS Bills. The amount of liquidity extended to a participant is the market value of the collateral provided subject to an appropriate haircut. This ensures the exposure to the participant is fully covered at the 99% confidence level for Value-At-Risk. The lending is automatically reversed at 1730 hours in MEPS+. MAS is entitled to reverse the repo transaction at the end of the day and to secure funds covering the repurchase price either directly from the affected participant's MEPS+ account or by selling the SGS or MAS Bills that MAS had obtained in the opening leg of the repo transaction. In the unlikely scenario where there is still a shortfall, MAS is entitled to seek the return of liquidated damages as per the Terms and Conditions Governing the MAS Intraday Liquidity Facility²⁶.

Key consideration 4.4: A CCP should cover its current and potential future exposures to each participant fully with a high degree of confidence using margin and other prefunded financial resources (see Principle 5 on collateral and Principle 6 on margin). In addition, a CCP that is involved in activities with a more-complex risk profile or that is systemically important in multiple jurisdictions should maintain additional financial resources to cover a wide range of potential stress scenarios that should include, but not be limited to, the default of the two participants and their affiliates that would potentially cause the largest aggregate credit exposure for the CCP in extreme but plausible market conditions. All other CCPs should maintain additional financial resources sufficient to cover a wide range of potential stress scenarios that should include, but not be limited to, the default of the participant and its affiliates that would potentially cause the largest aggregate credit exposure for the CCP in extreme but plausible market conditions. In all cases, a CCP should

²⁵ All SGS, with the exception of SSBs, are eligible collateral.

²⁶ This is available on MAS website at <https://www.mas.gov.sg/monetary-policy/liquidity-facilities/mas-intraday-liquidity-facility>.

document its supporting rationale for, and should have appropriate governance arrangements relating to, the amount of total financial resources it maintains.

- Not applicable as MEPS+ does not act as a central counterparty.

Key consideration 4.5: A CCP should determine the amount and regularly test the sufficiency of its total financial resources available in the event of a default or multiple defaults in extreme but plausible market conditions through rigorous stress testing. A CCP should have clear procedures to report the results of its stress tests to appropriate decision makers at the CCP and to use these results to evaluate the adequacy of and adjust its total financial resources. Stress tests should be performed daily using standard and predetermined parameters and assumptions. On at least a monthly basis, a CCP should perform a comprehensive and thorough analysis of stress testing scenarios, models, and underlying parameters and assumptions used to ensure they are appropriate for determining the CCP's required level of default protection in light of current and evolving market conditions. A CCP should perform this analysis of stress testing more frequently when the products cleared or markets served display high volatility, become less liquid, or when the size or concentration of positions held by a CCP's participants increases significantly. A full validation of a CCP's risk-management model should be performed at least annually.

- Not applicable as MEPS+ does not act as a central counterparty.

Key consideration 4.6: In conducting stress testing, a CCP should consider the effect of a wide range of relevant stress scenarios in terms of both defaulters' positions and possible price changes in liquidation periods. Scenarios should include relevant peak historic price volatilities, shifts in other market factors such as price determinants and yield curves, multiple defaults over various time horizons, simultaneous pressures in funding and asset markets, and a spectrum of forward-looking stress scenarios in a variety of extreme but plausible market conditions.

- Not applicable as MEPS+ does not act as a central counterparty.

Key consideration 4.7: An FMI should establish explicit rules and procedures that address fully any credit losses it may face as a result of any individual or combined default among its participants with respect to any of their obligations to the FMI. These rules and procedures should address how potentially uncovered credit losses would be allocated, including the repayment of any funds an FMI may borrow from liquidity providers. These rules and procedures should also indicate the FMI's process to replenish any financial resources that the FMI may employ during a stress event, so that the FMI can continue to operate in a safe and sound manner.

- Losses from participant-default are not applicable as MEPS+ is a real-time gross settlement system and transactions are settled using available funds and

securities in the participants' MEPS+ accounts. Participants who encounter liquidity strains may tap the ILF, as provided in the MEPS+ Service Agreement. If a defaulting participant taps the ILF, MAS' credit risk is fully mitigated as it has obtained collateral and the liquidity granted is based on the amount of collateral received after factoring in appropriate haircuts. In the unlikely scenario that the collateral provided is insufficient, the GMRA allows MAS to make claims against the participant for the shortfall.

Principle 5: Collateral

An FMI that requires collateral to manage its or its participants' credit exposure should accept collateral with low credit, liquidity, and market risks. An FMI should also set and enforce appropriately conservative haircuts and concentration limits.

Key consideration 5.1: An FMI should generally limit the assets it (routinely) accepts as collateral to those with low credit, liquidity, and market risks.

- MAS offers the ILF to participants using MEPS+ to facilitate the settlement of their SGD transactions. The ILF is available only to participants that have signed the GMRA with MAS. Through this ILF, MAS provides SGD liquidity to the participant in exchange for collateral from the participant.
- Eligible collateral under the ILF is limited to SGD-denominated debt of the highest credit quality. MAS therefore only accepts SGS²⁷ and MAS Bills as collateral under the ILF. These constitute the highest quality liquid assets available domestically.
- MEPS+ automatically checks that the collateral is eligible to be used for ILF before the DVP settlement of the ILF request is effected.

Key consideration 5.2: An FMI should establish prudent valuation practices and develop haircuts that are regularly tested and take into account stressed market conditions.

- Collateral is marked to market daily, and collateral valuation is performed based on an established framework. Management approval is sought for any exceptions.
- The amount of haircut to the collateral is determined by a haircut framework, which analyses the historical Value-At-Risk of daily changes in the price movement of debt securities in each class at the 99% confidence level, with a long lookback period which will include the stressed periods of the Global Financial Crisis. The ILF haircuts are reviewed annually.

²⁷ All SGS, with the exception of SSBs, are eligible collateral.

Key consideration 5.3: In order to reduce the need for procyclical adjustments, an FMI should establish stable and conservative haircuts that are calibrated to include periods of stressed market conditions, to the extent practicable and prudent.

- As explained in key consideration 5.2 above, periods of stressed market conditions are incorporated in the calibration of the haircuts.

Key consideration 5.4: An FMI should avoid concentrated holdings of certain assets where this would significantly impair the ability to liquidate such assets quickly without significant adverse price effects.

- Collateral is limited to SGS²⁸ and MAS Bills, which constitutes the highest quality liquid assets available in SGD.

Key consideration 5.5: An FMI that accepts cross-border collateral should mitigate the risks associated with its use and ensure that the collateral can be used in a timely manner.

- MAS does not accept cross-border collateral under the ILF.

Key consideration 5.6: An FMI should use a collateral management system that is well-designed and operationally flexible.

- MEPS+ also functions as the collateral management system for the ILF. It uses DVP Model 1 settlement for ILF transactions, i.e. the securities in the MEPS+ account of the participant are automatically earmarked and instantaneously transferred to the MEPS+ account of MAS in exchange for the liquidity provided to the participant. MAS is able to monitor the collateral pledged under the ILF on a real-time basis.

²⁸ All SGS, with the exception of SSBs, are eligible collateral.

Principle 6: Margin

A CCP should cover its credit exposures to its participants for all products through an effective margin system that is risk-based and regularly reviewed.

Key consideration 6.1: A CCP should have a margin system that establishes margin levels commensurate with the risks and particular attributes of each product, portfolio, and market it serves.

- Not applicable as MEPS+ does not act as a central counterparty.

Key consideration 6.2: A CCP should have a reliable source of timely price data for its margin system. A CCP should also have procedures and sound valuation models for addressing circumstances in which pricing data are not readily available or reliable.

- Not applicable as MEPS+ does not act as a central counterparty.

Key consideration 6.3: A CCP should adopt initial margin models and parameters that are risk-based and generate margin requirements sufficient to cover its potential future exposure to participants in the interval between the last margin collection and the close out of positions following a participant default. Initial margin should meet an established single-tailed confidence level of at least 99 percent with respect to the estimated distribution of future exposure. For a CCP that calculates margin at the portfolio level, this requirement applies to each portfolio's distribution of future exposure. For a CCP that calculates margin at more-granular levels, such as at the subportfolio level or by product, the requirement must be met for the corresponding distributions of future exposure. The model should (a) use a conservative estimate of the time horizons for the effective hedging or close out of the particular types of products cleared by the CCP (including in stressed market conditions), (b) have an appropriate method for measuring credit exposure that accounts for relevant product risk factors and portfolio effects across products, and (c) to the extent practicable and prudent, limit the need for destabilising, procyclical changes.

- Not applicable as MEPS+ does not act as a central counterparty.

Key consideration 6.4: A CCP should mark participant positions to market and collect variation margin at least daily to limit the build-up of current exposures. A CCP should have the authority and operational capacity to make intraday margin calls and payments, both scheduled and unscheduled, to participants.

Key consideration 6.5: In calculating margin requirements, a CCP may allow offsets or reductions in required margin across products that it clears or between products that it and another CCP clear, if the risk of one product is significantly and reliably correlated with the risk of the other product. Where two or more CCPs are authorised to offer cross-margining, they must have appropriate safeguards and harmonised overall risk-management systems.

- Not applicable as MEPS+ does not act as a central counterparty.

Key consideration 6.6: A CCP should analyse and monitor its model performance and overall margin coverage by conducting rigorous daily backtesting and at least monthly, and more-frequent where appropriate, sensitivity analysis. A CCP should regularly conduct an assessment of the theoretical and empirical properties of its margin model for all products it clears. In conducting sensitivity analysis of the model's coverage, a CCP should take into account a wide range of parameters and assumptions that reflect possible market conditions, including the most-volatile periods that have been experienced by the markets it serves and extreme changes in the correlations between prices.

- Not applicable as MEPS+ does not act as a central counterparty.

Key consideration 6.7: A CCP should regularly review and validate its margin system.

- Not applicable as MEPS+ does not act as a central counterparty.

Principle 7: Liquidity risk

An FMI should effectively measure, monitor, and manage its liquidity risk. An FMI should maintain sufficient liquid resources in all relevant currencies to effect same-day and, where appropriate, intraday and multiday settlement of payment obligations with a high degree of confidence under a wide range of potential stress scenarios that should include, but not be limited to, the default of the participant and its affiliates that would generate the largest aggregate liquidity obligation for the FMI in extreme but plausible market conditions.

Key consideration 7.1: An FMI should have a robust framework to manage its liquidity risks from its participants, settlement banks, nostro agents, custodian banks, liquidity providers, and other entities.

- MAS, as the operator of MEPS+, does not face liquidity risk because the operator does not act as the central counterparty or guarantee the settlement of transactions entered into MEPS+.
- All transactions in MEPS+ are settled gross, in real-time and on DVP basis (for securities transfers). If a participant does not have sufficient balances or securities, its payments or securities transfers will be queued accordingly. Participants have real-time access to MEPS+ to enquire on the status of their transactions. They are also able to set fund allocations, bilateral and overall payment limits, but these limits will be automatically lifted by the system after 1530 hours. Participants are also able to perform queue prioritisation and cancellation on their outstanding transactions. An automatic gridlock detection and resolution mechanism runs every half hour to allow payments to be settled simultaneously on a multilateral gross basis, provided that the resulting positions of all MEPS+ RTGS accounts are positive. All these features aid participants in managing their liquidity needs. If the participants' accounts do not have sufficient balances by the end of day, the queued transactions will be cancelled automatically by MEPS+. MEPS+ provides participants with a report on their adherence to the Graduated Payment Schedule at the end of day. By adhering to the Graduated Payment Schedule, the likelihood of payment queues and gridlock in MEPS+ is reduced.
- To support the liquidity needs of the MEPS+ participants and assist them in managing their liquidity risks, MAS, as the central bank in Singapore, offers the ILF which allows participants to borrow SGD, interest-free, on an intraday and collateralised basis, to settle their SGD payments. Participants need to enter into the GMRA with MAS and ensure that they have eligible collateral (i.e. SGS²⁹ or MAS Bills) before they can tap on the ILF. The amount of liquidity that MEPS+ participants can borrow via the ILF depends on the amount of eligible collateral they have. Aside from the ILF, MEPS+ participants can turn to the interbank market to obtain SGD to settle their payments.

²⁹ All SGS, with the exception of SSBs, are eligible collateral.

Key consideration 7.2: An FMI should have effective operational and analytical tools to identify, measure, and monitor its settlement and funding flows on an ongoing and timely basis, including its use of intraday liquidity.

- MAS monitors MEPS+ payment patterns through the MEPS+ reports that cover daily statistics relating to the payment and queue status, monthly summaries of peak and average transaction volume, annual reports of transaction volume and other important metrics. In addition, MEPS+ is monitored on a near real-time basis using an automated utility which alerts MAS on payment anomalies e.g. when a participant has outstanding transactions that have been queued for a length of time exceeding the specified threshold.

Key consideration 7.3: A payment system or SSS, including one employing a DNS mechanism, should maintain sufficient liquid resources in all relevant currencies to effect same-day settlement, and where appropriate intraday or multiday settlement, of payment obligations with a high degree of confidence under a wide range of potential stress scenarios that should include, but not be limited to, the default of the participant and its affiliates that would generate the largest aggregate payment obligation in extreme but plausible market conditions.

- MAS, as the operator of MEPS+, does not face liquidity risk because the operator does not act as the central counterparty or guarantee the settlement of transactions entered into MEPS+. As such, the requirement to maintain sufficient liquid resources to effect settlement of payment obligations in stressed scenarios does not apply.

Key consideration 7.4: A CCP should maintain sufficient liquid resources in all relevant currencies to settle securities-related payments, make required variation margin payments, and meet other payment obligations on time with a high degree of confidence under a wide range of potential stress scenarios that should include, but not be limited to, the default of the participant and its affiliates that would generate the largest aggregate payment obligation to the CCP in extreme but plausible market conditions. In addition, a CCP that is involved in activities with a more-complex risk profile or that is systemically important in multiple jurisdictions should consider maintaining additional liquidity resources sufficient to cover a wider range of potential stress scenarios that should include, but not be limited to, the default of the two participants and their affiliates that would generate the largest aggregate payment obligation to the CCP in extreme but plausible market conditions.

- Not applicable as MEPS+ does not act as a central counterparty.

Key consideration 7.5: For the purpose of meeting its minimum liquid resource requirement, an FMI's qualifying liquid resources in each currency include cash

at the central bank of issue and at creditworthy commercial banks, committed lines of credit, committed foreign exchange swaps, and committed repos, as well as highly marketable collateral held in custody and investments that are readily available and convertible into cash with prearranged and highly reliable funding arrangements, even in extreme but plausible market conditions. If an FMI has access to routine credit at the central bank of issue, the FMI may count such access as part of the minimum requirement to the extent it has collateral that is eligible for pledging to (or for conducting other appropriate forms of transactions with) the relevant central bank. All such resources should be available when needed.

- MAS, as the operator of MEPS+, does not face liquidity risk because the operator does not act as the central counterparty or guarantee the settlement of transactions entered into MEPS+. As such, the requirement to meet minimum liquid resources to cover payment obligations in extreme market conditions does not apply.

Key consideration 7.6: An FMI may supplement its qualifying liquid resources with other forms of liquid resources. If the FMI does so, then these liquid resources should be in the form of assets that are likely to be saleable or acceptable as collateral for lines of credit, swaps, or repos on an ad hoc basis following a default, even if this cannot be reliably prearranged or guaranteed in extreme market conditions. Even if an FMI does not have access to routine central bank credit, it should still take account of what collateral is typically accepted by the relevant central bank, as such assets may be more likely to be liquid in stressed circumstances. An FMI should not assume the availability of emergency central bank credit as a part of its liquidity plan.

- MAS, as the operator of MEPS+, does not face liquidity risk because the operator does not act as the central counterparty or guarantee the settlement of transactions entered into MEPS+. As such, the requirement to maintain liquid resources does not apply.

Key consideration 7.7: An FMI should obtain a high degree of confidence, through rigorous due diligence, that each provider of its minimum required qualifying liquid resources, whether a participant of the FMI or an external party, has sufficient information to understand and to manage its associated liquidity risks, and that it has the capacity to perform as required under its commitment. Where relevant to assessing a liquidity provider's performance reliability with respect to a particular currency, a liquidity provider's potential access to credit from the central bank of issue may be taken into account. An FMI should regularly test its procedures for accessing its liquid resources at a liquidity provider.

- MAS, as the operator of MEPS+, does not face liquidity risk because the operator does not act as the central counterparty or guarantee the settlement of transactions entered into MEPS+. As such, the requirement to maintain liquid resources to cover payment obligations in stressed scenarios does not apply.

Key consideration 7.8: An FMI with access to central bank accounts, payment services, or securities services should use these services, where practical, to enhance its management of liquidity risk.

- Not applicable as MEPS+ is owned and operated by the central bank.

Key consideration 7.9: An FMI should determine the amount and regularly test the sufficiency of its liquid resources through rigorous stress testing. An FMI should have clear procedures to report the results of its stress tests to appropriate decision makers at the FMI and to use these results to evaluate the adequacy of and adjust its liquidity risk-management framework. In conducting stress testing, an FMI should consider a wide range of relevant scenarios. Scenarios should include relevant peak historic price volatilities, shifts in other market factors such as price determinants and yield curves, multiple defaults over various time horizons, simultaneous pressures in funding and asset markets, and a spectrum of forward-looking stress scenarios in a variety of extreme but plausible market conditions. Scenarios should also take into account the design and operation of the FMI, include all entities that might pose material liquidity risks to the FMI (such as settlement banks, nostro agents, custodian banks, liquidity providers, and linked FMIs), and where appropriate, cover a multiday period. In all cases, an FMI should document its supporting rationale for, and should have appropriate governance arrangements relating to, the amount and form of total liquid resources it maintains.

- MAS, as the operator of MEPS+, does not face liquidity risk because the operator does not act as the central counterparty or guarantee the settlement of transactions entered into MEPS+. As such, the requirement to conduct stress testing of the sufficiency of liquid resources of the system operator is not applicable.

Key consideration 7.10: An FMI should establish explicit rules and procedures that enable the FMI to effect same-day and, where appropriate, intraday and multiday settlement of payment obligations on time following any individual or combined default among its participants. These rules and procedures should address unforeseen and potentially uncovered liquidity shortfalls and should aim to avoid unwinding, revoking, or delaying the same-day settlement of payment obligations. These rules and procedures should also indicate the FMI's process to replenish any liquidity resources it may employ during a stress event, so that it can continue to operate in a safe and sound manner.

- MEPS+ is a designated system under the FNA. The FNA provides settlement finality and protection from the application of the "zero-hour" rule in the event of

a participant's default³⁰. However, under section 12 of the FNA, such protection does not extend to any transfer order given by a participant which is entered into a designated system after the expiry of one business day after: (i) a court made an order for bankruptcy, judicial management or winding up in respect of the participant; or (ii) a resolution for the voluntary winding up of the participant was passed.

- Pursuant to section 14 of the FNA, no court in Singapore shall recognise or give effect to an order of a court exercising jurisdiction under the law of insolvency in a place outside Singapore, or an act of a person appointed in a foreign jurisdiction to perform a function under the law of insolvency there, in so far as the making of the order or doing of the act would be prohibited under the FNA for a court in Singapore. As such, should a participant default during the day, any transfer order relating to payments or securities transfers that have been entered into MEPS+ will be effected accordingly as long as there is sufficient liquidity or securities in the participant's MEPS+ accounts, and provided the transfer order made by the participant is entered into MEPS+ on or before the expiry of one business day after: (i) a court made an order for bankruptcy, judicial management or winding up in respect of the participant; or (ii) a resolution for the voluntary winding up of the participant was passed.
- MAS, as the central bank in Singapore, also offers the ILF which allows participants to borrow SGD, interest-free, on an intraday and collateralised basis, to settle their SGD payments. Participants need to enter into the GMRA with MAS and ensure that they have eligible collateral (i.e. SGS³¹ or MAS Bills) before they can tap on the ILF. The amount of liquidity that MEPS+ participants can borrow via the ILF depends on the amount of eligible collateral they have. Aside from the ILF, MEPS+ participants can turn to the interbank market to obtain SGD to settle their payments.

³⁰ No court in Singapore shall recognise or give effect to an order of the courts in a foreign jurisdiction to reverse or unwind transactions that have been settled in MEPS+.

³¹ All SGS, with the exception of SSBs, are eligible collateral.

Principle 8: Settlement finality

An FMI should provide clear and certain final settlement, at a minimum by the end of the value date. Where necessary or preferable, an FMI should provide final settlement intraday or in real-time.

Key consideration 8.1: An FMI's rules and procedures should clearly define the point at which settlement is final.

- Section 7 of the FNA provides for the finality and irrevocability of transactions carried out on MEPS+ and shall apply where the rules of a designated system provide that the transactions are final and irrevocable. In this regard, Rule 17.1 of the MEPS+ Operating Rules lists the following transactions as being final and irrevocable:
 - the transfer of funds into and out of an account of a participant of MEPS+;
 - the settlement of any payment obligation in MEPS+; and
 - the settlement and transfer of book-entry SGS and MAS Bills.This means that notwithstanding anything to the contrary in any written law or rule of law, these transactions shall not be reversed, repaid or set aside and no order shall be made by any court for the rectification or stay of such transfer or settlement.
- Section 12 of the FNA makes it clear that section 7 of the FNA shall not apply to any transfer order given by a participant which is entered into a designated system after the expiry of one business day after: (i) a court made an order for bankruptcy, judicial management or winding up in respect of the participant; or (ii) a resolution for the voluntary winding up of the participant was passed.
- Rule 17.1 of the MEPS+ Operating Rules provides that a payment or transaction is deemed entered into MEPS+ from the moment they are validated by MEPS+.

Key consideration 8.2: An FMI should complete final settlement no later than the end of the value date, and preferably intraday or in real-time, to reduce settlement risk. An LVPS or SSS should consider adopting RTGS or multiple-batch processing during the settlement day.

- Settlement in MEPS+ takes place continuously throughout the day whenever a payment is accepted by the system and participants have sufficient funds and/or SGS and MAS Bills in their MEPS+ accounts. Participants who originate the payments or securities transfers will receive notifications once their transactions are settled in MEPS+. They can also perform online enquiries on the transaction statuses. Unsettled payments and securities transfers at the end of day are automatically cancelled.

Key consideration 8.3: An FMI should clearly define the point after which unsettled payments, transfer instructions, or other obligations may not be revoked by a participant.

- Section 7 of the FNA provides for the finality and irrevocability of transactions in MEPS+ and shall apply where the rules of a designated system provide that the transactions are final and irrevocable. Pursuant to section 7, Rule 17.1 of the MEPS+ Operating Rules has listed the transactions to be deemed as final and irrevocable.
- As set out in Rule 4.3 of the MEPS+ Operating Rules, transactions pending settlement or execution may still be cancelled by participants who initiated the transactions.
- For any transaction involving SGS and MAS Bills that is not matched, the participant that sent the instruction may unilaterally initiate its cancellation. For any transaction involving SGS and MAS Bills that is matched, both participants that are parties to the transaction are required to initiate and confirm the cancellation.

Principle 9: Money settlements

An FMI should conduct its money settlements in central bank money where practical and available. If central bank money is not used, an FMI should minimise and strictly control the credit and liquidity risk arising from the use of commercial bank money.

Key consideration 9.1: An FMI should conduct its money settlements in central bank money, where practical and available, to avoid credit and liquidity risks.

- Payments in MEPS+ settle in SGD only, on a real-time gross settlement basis in central bank money.

Key consideration 9.2: If central bank money is not used, an FMI should conduct its money settlements using a settlement asset with little or no credit or liquidity risk.

- MEPS+ settles in central bank money.

Key consideration 9.3: If an FMI settles in commercial bank money, it should monitor, manage, and limit its credit and liquidity risks arising from the commercial settlement banks. In particular, an FMI should establish and monitor adherence to strict criteria for its settlement banks that take account of, among other things, their regulation and supervision, creditworthiness, capitalisation, access to liquidity, and operational reliability. An FMI should also monitor and manage the concentration of credit and liquidity exposures to its commercial settlement banks.

- MEPS+ settles in central bank money.

Key consideration 9.4: If an FMI conducts money settlements on its own books, it should minimise and strictly control its credit and liquidity risks.

Credit Risks

- MAS does not act as the central counterparty or guarantee the settlement of transactions by MEPS+ participants. As the operator of MEPS+, MAS is hence not exposed to credit risk.
- In providing the ILF to participants, MAS, as the central bank, has the potential to incur credit exposures to the participants. MAS will only extend the ILF to viable entities. Even if the ILF is granted, the residual credit risk is managed by requiring participants to enter into repo transactions with MAS using their own

SGS or MAS Bills as collateral in exchange for the intraday liquidity. For more details, please refer to Principle 4 on Credit Risk.

- The SGS³² and MAS Bills held as collateral constitute the highest quality collateral available domestically, and the liquidity granted are subjected to a lending haircut to cater for market movements. Other safeguards include:
 - MAS, as the central bank, is entitled to instruct the MEPS+ operator, to reverse the repo transaction at the end of the day if there are sufficient funds in the participant's RTGS account; or to do so on the next earliest business day on which there are sufficient funds in the participant's RTGS account;
 - MAS, the central bank, can return the collaterals to the participant only after the repurchase price and liquidated damages (if any) have been duly returned to MAS; and
 - MAS shall have the right to sell or dispose of the eligible collaterals pledged to MAS for the transaction, and to apply the proceeds from the disposal of the eligible collaterals to offset the outstanding amounts that may be due to MAS, including any liquidated damages that may have accrued.

Liquidity Risks

- MAS, as the operator of MEPS+, does not face liquidity risk because the operator does not act as the central counterparty or guarantee the settlement of transactions entered into MEPS+. All transactions in MEPS+ are settled in real-time and DVP basis (for securities transfers) only if the participants have sufficient balances and securities. If a participant does not have sufficient liquidity or securities, its payments or securities transfers will be queued accordingly.
- MAS, as the central bank in Singapore, provides the ILF to participants of MEPS+ to enable them to settle their payments and securities transfers on a timely basis. Participants have to enter into the GMRA with MAS before it can tap on the facility. In addition, participants need to ensure that they have eligible collateral before they can tap on the facility. MAS, the central bank, is not exposed to liquidity risk as it has unlimited amount of SGD liquidity.

Key consideration 9.5: An FMI's legal agreements with any settlement banks should state clearly when transfers on the books of individual settlement banks are expected to occur, that transfers are to be final when effected, and that funds received should be transferable as soon as possible, at a minimum by the end of the day and ideally intraday, in order to enable the FMI and its participants to manage credit and liquidity risks.

- MEPS+ settles in central bank money.

³² All SGS, with the exception of SSBs, are eligible collateral.

Principle 10: Physical deliveries

An FMI should clearly state its obligations with respect to the delivery of physical instruments or commodities and should identify, monitor, and manage the risks associated with such physical deliveries.

Key consideration 10.1: An FMI's rules should clearly state its obligations with respect to the delivery of physical instruments or commodities.

- MEPS+ does not handle physical delivery of SGS and MAS Bills.

Key consideration 10.2: An FMI should identify, monitor, and manage the risks and costs associated with the storage and delivery of physical instruments or commodities.

- MEPS+ does not handle physical delivery of SGS and MAS Bills.

Principle 11: Central securities depositories

A CSD should have appropriate rules and procedures to help ensure the integrity of securities issues and minimise and manage the risks associated with the safekeeping and transfer of securities. A CSD should maintain securities in an immobilised or dematerialised form for their transfer by book entry.

Key consideration 11.1: A CSD should have appropriate rules, procedures, and controls, including robust accounting practices, to safeguard the rights of securities issuers and holders, prevent the unauthorised creation or deletion of securities, and conduct periodic and at least daily reconciliation of securities issues it maintains.

Securities Issuance

- As the fiscal agent of the Singapore Government, MAS is empowered by the the Government Securities (Debt Market and Investment) Act 1992 and the Significant Infrastructure Government Loan Act 2021 to undertake the issuance and management of securities on behalf of the Government, comprising SGS (Market Development) bonds, SGS (Infrastructure) bonds, Treasury Bills (T-Bills), and Singapore Savings Bonds (SSBs). MAS is also the issuer of short-term MAS Bills and MAS Floating Rate Notes as part of its money market operations. The amount of SGS issued is authorised by a resolution of Parliament and with the President's concurrence. Each year, MAS seeks approval from the Minister for Finance for the total SGS issuance amount for the new financial year. MAS then decides, in consultation with the SGS primary dealers, the timing and amount of each individual SGS issue and publishes the issuance calendar on the website at the end of each year for the following year. Announcements on auction details, such as size, are put up on the MAS website³³. SGS primary dealers would then submit their bids via the SGS Electronic Applications Service available on the MAS website. SGS bonds may also be issued via syndication, which involves the appointment of a group of banks, known as bookrunners, to jointly market and distribute a bond. The results of the SGS auctions and syndications are announced on the MAS website. On the issuance date, settlement of successful auction bids takes place in MEPS+ on a DVP basis without any manual intervention and MEPS+ system will automatically allot the securities to the participants' securities accounts in MEPS+.
- Issuance of MAS Bills adopts the similar process of auction (except that the announcement is only published on the MAS website), bid submission, tender processing and results announcement for SGS described above.

³³ The web-link is available at <https://www.mas.gov.sg/bonds-and-bills/auctions-and-issuance-calendar>.

Securities Holdings

- All securities deposited by participants in their securities accounts in MEPS+ are dematerialised and transfers of securities take place by book-entry only. Rule 12 of the MEPS+ Operating Rules sets out the operating rules relating to transfers of SGS and MAS Bills custodised in MEPS+. Securities confirmation messages are generated automatically by MEPS+ upon matching and settlement of securities transfer transactions. MEPS+ also generates daily statements of accounts for participants, listing their SGS and MAS Bills holdings and securities transfer transactions. Participants are required under Rule 18 of the MEPS+ Operating Rules to notify MAS of any incorrect figures in the statements of accounts. As an additional layer of check, MEPS+ automatically conducts regular reconciliation of participants' holding positions against the settled transactions throughout its operating hours.
- MAS does not provide other services which involve the use of securities from an omnibus account or using the securities from participants without any authorisation from the participant. Daily statements of accounts are sent to all participants listing their securities holdings and all debits and credits to the holdings. In addition, MEPS+ generates yearly audit confirmation statements to participants for reconciliation and review.
- Regular audits of MEPS+ have thus far not surfaced any issues with the controls in SGS and MAS Bills processes or discrepancies in participants' securities holdings.

Securities Redemption

- Redemption of SGS and MAS Bills from the participants is automatically carried out based on the maturity date set up in the MEPS+ system. This mitigates the risk of unauthorised deletion of securities. SSBs may be redeemed prior to maturity, SGS primary dealers will submit requests on behalf of investors via the SGS Electronic Applications service, which will collate the requests and send them to MEPS+.

Securities Reconciliation

- The securities holdings in MEPS+ are reconciled daily and monthly. Daily statements of accounts are sent to all participants listing their securities holdings and all debits and credits to their holdings. In addition, MEPS+ generates yearly audit confirmation statements to participants and their auditors for reconciliation and review.

Key consideration 11.2: A CSD should prohibit overdrafts and debit balances in securities accounts.

- Securities transfers in MEPS+ take place only when there is mutual agreement between the buyer and seller on the transaction, and when there are sufficient

funds (for buyer) and securities (for seller) in their MEPS+ accounts. Overdrafts and debit balances are not permitted in the participants' securities accounts in MEPS+.

Key consideration 11.3: A CSD should maintain securities in an immobilised or dematerialised form for their transfer by book entry. Where appropriate, a CSD should provide incentives to immobilise or dematerialise securities.

- All the SGS and MAS Bills in MEPS+ are in dematerialised form.

Key consideration 11.4: A CSD should protect assets against custody risk through appropriate rules and procedures consistent with its legal framework.

- MEPS+ only effects securities transfers based on authenticated instructions from the respective owner of the securities account. All activities in MEPS+ are recorded in audit trails. As an additional layer of check, MEPS+ automatically conducts regular reconciliation of participants' holding positions against the settled transactions throughout its operating hours. In addition, daily statement of accounts are generated by MEPS+ for participants for their reconciliation.
- Operational controls are in place in FD, who supports the issuance and settlement operations for SGS and MAS Bills. Access to MEPS+ is restricted and issued on a need-to basis. Users are issued with their individual user accounts and passwords to log into the system. Audit trails are available for all log-ons to MEPS+ and security administrators can review these audit logs and follow up on unusual activities.
- MAS reviews the MEPS+ Operating Rules to ensure consistency with the legal framework of MEPS+.

Key consideration 11.5: A CSD should employ a robust system that ensures segregation between the CSD's own assets and the securities of its participants and segregation among the securities of participants. Where supported by the legal framework, the CSD should also support operationally the segregation of securities belonging to a participant's customers on the participant's books and facilitate the transfer of customer holdings.

Segregation between CSD and participants' securities

- MAS, as operator of MEPS+, does not hold any SGS and MAS Bills. As the central bank, MAS holds SGS to facilitate its conduct of money market operations. These securities are maintained in a securities account maintained by MAS, who is a participant of MEPS+.

Segregation of securities belonging to participants' customers

- Clause 3 of the Terms & Conditions Governing the Operation of the Accounts for SGS and MAS Bills requires participants that offer custodial services to ensure that all SGS and MAS Bills received on behalf of their customers are segregated from the participants' own holdings and are held in trust in the participants' customer accounts. These participants shall also ensure proper documentation and identification of customers to whom they are providing custodial services.
- MEPS+ provides each participant with accounts for its own holdings and customer accounts for segregation of its customers' securities:
 - The SGS Trade Account is for participants' SGS and MAS Bills which the participants may use for its own trade.
 - The SGS Reserve Account is for maintaining SGS and MAS Bills used to meet Minimum Liquid Assets³⁴ ("MLA") requirements.
 - The SGS Customer Accounts are for holding SGS and MAS Bills owned by the participants' customers.
- MEPS+ has validation and matching processes in place to validate the securities transfer instructions sent by participants prior to transferring the securities out from one participant's account into another participant's account.

Key consideration 11.6: A CSD should identify, measure, monitor, and manage its risks from other activities that it may perform; additional tools may be necessary in order to address these risks.

- Risks from all MEPS+ activities are identified and managed as part of the risk management framework.

³⁴ Please refer to MAS Notice 649 <https://www.mas.gov.sg/regulation/notices/notice-649> .

Principle 12: Exchange-of-value settlement systems

If an FMI settles transactions that involve the settlement of two linked obligations (for example, securities or foreign exchange transactions), it should eliminate principal risk by conditioning the final settlement of one obligation upon the final settlement of the other.

Key consideration 12.1: An FMI that is an exchange-of-value settlement system should eliminate principal risk by ensuring that the final settlement of one obligation occurs if and only if the final settlement of the linked obligation also occurs, regardless of whether the FMI settles on a gross or net basis and when finality occurs.

- MEPS+ has implemented DVP (Model 1) for processing of securities transfer instructions from participants, and payment of SGD corporate bonds traded by participants in CDP.
- For securities transfer instructions from participants, MEPS+ will earmark the securities in the MEPS+ account of the seller after the trade has been matched, and then generate a payment order on behalf of the buyer based on the details in the matched trade. The payment order will be stored in MEPS+ until the settlement day. On settlement day, MEPS+ will automatically execute the payment order by debiting the MEPS+ account of the buyer (as long as there are sufficient funds in its MEPS+ account) and instantaneously transfer the earmarked securities to the MEPS+ account of the buyer. Rule 12 of the MEPS+ Operating Rules sets out the provisions for DVP processing. Each leg of the DVP trade is also accorded finality under the FNA upon settlement.
- For payments of SGD corporate bonds, MEPS+ will debit the MEPS+ account of the buyer as long as there are sufficient funds in its MEPS+ account, and instantaneously transmit a SWIFT message to CDP who will simultaneously transfer the earmarked SGD corporate bonds to the buyer's account within CDP's Debt Securities Clearing and Settlement System.

Principle 13: Participant-default rules and procedures

An FMI should have effective and clearly defined rules and procedures to manage a participant default. These rules and procedures should be designed to ensure that the FMI can take timely action to contain losses and liquidity pressures and continue to meet its obligations.

Key consideration 13.1: An FMI should have default rules and procedures that enable the FMI to continue to meet its obligations in the event of a participant default and that address the replenishment of resources following a default.

- The MEPS+ Service Agreement sets out the definition of default, and the procedures for handling a default of a participant. A participant must notify MAS if it is being or has been wound up or has a receiver or manager appointed. With or without notification from the participant, under such events, MAS may immediately suspend the provision of MEPS+ services to the affected participant, or terminate the MEPS+ Service Agreement. Based on the Operations and Contingency Manual for MEPS+ Participants and Non-Participants, MAS will notify all participants of the suspension or termination via SWIFT and email, and all pending, queued and forward-dated transactions of the suspended or terminated participant at the point of suspension or termination will be cancelled or rejected, except for certain transactions³⁵ as specified in the MEPS+ Service Agreement. All new transactions submitted by the suspended or terminated participant will be rejected by MEPS+, except for the aforementioned transactions.
- MAS, as a central bank, is not affected by liquidity pressures arising from the default of a participant. Furthermore, there are no losses from participant-default as MEPS+ is a real-time gross settlement system and loss sharing arrangements are not applicable. Participants who encounter liquidity strains arising from failed payments due from the defaulting participant may tap on the ILF, as provided in the MEPS+ Service Agreement and Terms and Conditions Governing the MAS Intraday Liquidity Facility. Collateral provided to borrow SGD cash through the ILF is subject to haircuts to manage possible losses or exposures to MAS in the event that the defaulting participant is unable to return the SGD cash by the cut-off time for liquidity reversal. MAS will only extend the ILF to viable entities. In the unlikely scenario of a default by a participant and that the collateral provided is insufficient, the GMRA allows MAS to make claims against the participant for the shortfall.

Key consideration 13.2: An FMI should be well prepared to implement its default rules and procedures, including any appropriate discretionary procedures provided for in its rules.

³⁵ These transactions include the settlement of FAST clearing obligations, interbank funds transfers between the affected participant and MAS, and the redemption of matured SGS and MAS Bills held in the affected participant's accounts for SGS and MAS Bills.

- Relevant MAS departments and when activated, MAS' Crisis Management Team, will manage the default of a participant.

Key consideration 13.3: An FMI should publicly disclose key aspects of its default rules and procedures.

- Key aspects of the rules and procedures on participant-default are set out in the MEPS+ Service Agreement and the Operations and Contingency Manual for MEPS+ Participants and Non-Participants, which are available on the MAS website.

Key consideration 13.4: An FMI should involve its participants and other stakeholders in the testing and review of the FMI's default procedures, including any close-out procedures. Such testing and review should be conducted at least annually or following material changes to the rules and procedures to ensure that they are practical and effective.

- MAS conducts an annual contingency drill on key aspects of the participant-default procedures. The drill and associated tests cover, among others, the failure of the largest net debit bank or a group of banks in meeting their cheque/Inter-Bank GIRO obligations.

Principle 14: Segregation and portability

A CCP should have rules and procedures that enable the segregation and portability of positions of a participant's customers and the collateral provided to the CCP with respect to those positions.

Key consideration 14.1: A CCP should, at a minimum, have segregation and portability arrangements that effectively protect a participant's customers' positions and related collateral from the default or insolvency of that participant. If the CCP additionally offers protection of such customer positions and collateral against the concurrent default of the participant and a fellow customer, the CCP should take steps to ensure that such protection is effective.

- Not applicable as MEPS+ does not act as a central counterparty.

Key consideration 14.2: A CCP should employ an account structure that enables it readily to identify positions of a participant's customers and to segregate related collateral. A CCP should maintain customer positions and collateral in individual customer accounts or in omnibus customer accounts.

- Not applicable as MEPS+ does not act as a central counterparty.

Key consideration 14.3: A CCP should structure its portability arrangements in a way that makes it highly likely that the positions and collateral of a defaulting participant's customers will be transferred to one or more other participants.

- Not applicable as MEPS+ does not act as a central counterparty.

Key consideration 14.4: A CCP should disclose its rules, policies, and procedures relating to the segregation and portability of a participant's customers' positions and related collateral. In particular, the CCP should disclose whether customer collateral is protected on an individual or omnibus basis. In addition, a CCP should disclose any constraints, such as legal or operational constraints, that may impair its ability to segregate or port a participant's customers' positions and related collateral.

- Not applicable as MEPS+ does not act as a central counterparty.

Principle 15: General business risk

An FMI should identify, monitor, and manage its general business risk and hold sufficient liquid net assets funded by equity to cover potential general business losses so that it can continue operations and services as a going concern if those losses materialise. Further, liquid net assets should at all times be sufficient to ensure a recovery or orderly wind-down of critical operations and services.

Key consideration 15.1: An FMI should have robust management and control systems to identify, monitor, and manage general business risks, including losses from poor execution of business strategy, negative cash flows, or unexpected and excessively large operating expenses.

- MAS manages the general business risks of operating MEPS+ based on the enterprise-wide budgeting and accounting processes, which allow it to monitor, manage and control its operating expenses, including those arising from MEPS+ operations. MAS' accounting processes are subject to audit by both internal and external auditors.
- MAS recovers the MEPS+ operating costs, including those related to enhancements and upgrade of MEPS+ from participants through fees and charges. Major MEPS+ upgrades that require substantial expenses to be incurred are approved by CIIC. CIIC reviews MEPS+ costs and income regularly.

Key consideration 15.2: An FMI should hold liquid net assets funded by equity (such as common stock, disclosed reserves, or other retained earnings) so that it can continue operations and services as a going concern if it incurs general business losses. The amount of liquid net assets funded by equity an FMI should hold should be determined by its general business risk profile and the length of time required to achieve a recovery or orderly wind-down, as appropriate, of its critical operations and services if such action is taken.

- According to CPMI-IOSCO note on *Application of the Principles for Financial Market Infrastructures to central bank FMIs* and MAS' *Standards for MAS-Operated Financial Market Infrastructures*, the requirement to hold ring-fenced liquid net assets funded by equity to cover business risk and support a recovery or wind-down plan does not apply to MEPS+ as an FMI operated by the central bank.

Key consideration 15.3: An FMI should maintain a viable recovery or orderly wind-down plan and should hold sufficient liquid net assets funded by equity to implement this plan. At a minimum, an FMI should hold liquid net assets funded by equity equal to at least six months of current operating expenses. These assets are in addition to resources held to cover participant defaults or other

risks covered under the financial resources principles. However, equity held under international risk-based capital standards can be included where relevant and appropriate to avoid duplicate capital requirements.

- According to CPMI-IOSCO note on *Application of the Principles for Financial Market Infrastructures to central bank FMIs* and MAS' *Standards for MAS-Operated Financial Market Infrastructures*, the requirement to hold ring-fenced liquid net assets funded by equity to cover business risk and support a recovery or wind-down plan does not apply to MEPS+ as an FMI operated by the central bank.

Key consideration 15.4: Assets held to cover general business risk should be of high quality and sufficiently liquid in order to allow the FMI to meet its current and projected operating expenses under a range of scenarios, including in adverse market conditions.

- The issue of wind-down is not relevant to MEPS+ as it is owned and operated by MAS, Singapore's central bank, which has sufficient liquid assets to ensure continuity of MEPS+. Accordingly, the requirements to hold high quality and sufficient liquid assets to meet its current and projected operating expenses in adverse market conditions do not apply.

Key consideration 15.5: An FMI should maintain a viable plan for raising additional equity should its equity fall close to or below the amount needed. This plan should be approved by the board of directors and updated regularly.

- According to CPMI-IOSCO note on *Application of the Principles for Financial Market Infrastructures to central bank FMIs* and MAS' *Standards for MAS-Operated Financial Market Infrastructures*, the requirement to maintain a plan to raise additional equity does not apply to MEPS+ as it is an FMI operated by the central bank.

Principle 16: Custody and investment risks

An FMI should safeguard its own and its participants' assets and minimise the risk of loss on and delay in access to these assets. An FMI's investments should be in instruments with minimal credit, market, and liquidity risks.

Key consideration 16.1: An FMI should hold its own and its participants' assets at supervised and regulated entities that have robust accounting practices, safekeeping procedures, and internal controls that fully protect these assets.

- MAS (as the operator of MEPS+) does not use commercial custodian services for its own or participants' assets (cash, SGS and MAS Bills).
- There are procedures and internal controls to protect participants' assets in MEPS+. These include segregation of duties, controls on accesses to MEPS+ (such as monthly review of access rights) and the conduct of internal and external audits. In addition, participants who subscribe to MEPS+ Browse service have access to online records of their MEPS+ account positions and holdings of SGS and MAS Bills. Participants can also request for electronic statements of accounts at any time for their reconciliation.

Key consideration 16.2: An FMI should have prompt access to its assets and the assets provided by participants, when required.

- MAS (as the operator of MEPS+) does not use commercial custodian services for its own or participants' assets in MEPS+, and has immediate access to these assets, when required.

Key consideration 16.3. An FMI should evaluate and understand its exposures to its custodian banks, taking into account the full scope of its relationships with each.

- MAS (as the operator of MEPS+) does not use commercial custodian services for its own or participants' assets.

Key consideration 16.4: An FMI's investment strategy should be consistent with its overall risk-management strategy and fully disclosed to its participants, and investments should be secured by, or be claims on, high-quality obligors. These investments should allow for quick liquidation with little, if any, adverse price effect.

- MAS (as operator of MEPS+) does not invest in any assets.

Principle 17: Operational risk

An FMI should identify the plausible sources of operational risk, both internal and external, and mitigate their impact through the use of appropriate systems, policies, procedures, and controls. Systems should be designed to ensure a high degree of security and operational reliability and should have adequate, scalable capacity. Business continuity management should aim for timely recovery of operations and fulfilment of the FMI's obligations, including in the event of a wide-scale or major disruption.

Key consideration 17.1: An FMI should establish a robust operational risk-management framework with appropriate systems, policies, procedures, and controls to identify, monitor, and manage operational risks.

- MAS manages its risks, including those from operating MEPS+, based on an organisation-wide risk management framework. Key risk events which impair the achievement of MAS' vision, mission, objectives and business outcomes are identified by MAS departments and the measures to address these risks are submitted to RC for concurrence.
- Under the MEPS+ risk management framework, ITD and DTA, supported by FD, oversee and carry out the day-to-day operations of MEPS+. The primary responsibility for the risk ownership and management of MEPS+ rests with ITD and DTA, supported by FD. They are required to perform an annual risk analysis and assessment of MEPS+ and report the results to RC and management for their endorsement and decision on whether additional risk mitigating measures are needed.
- The risk management framework also identifies internal procedures and key controls to monitor and manage the operational risks, as described in subsequent paragraphs.
- RiMD and CCSO Office, as second line risk managers for operational risks and technology and cyber risks respectively, undertake independent risk review and challenge in respect of MEPS+. They complement the day-to-day risk management of MEPS+ carried out by the operator (i.e. ITD and DTA with the support of FD), by providing an additional layer of checks. They review the adequacy and effectiveness of risk controls on a regular basis. Their role includes challenging assumptions, reviewing residual risk assessment and identifying longer-term risk implications of initiatives implemented by the operator.
- MEPS+ is subjected to annual audits by the AGO, in addition to that conducted by IAD. Audit findings are reported to MAS' MD and the AC.
- Personnel involved in MEPS+ operations are subject to the requisite security screening. They also attend in-house training as well as training courses provided by SWIFT. To mitigate staff turnover and key-person risk for MEPS+

operations, MEPS+ operational processes are documented in respective departments' standard operating procedures. To prevent fraudulent payments effected on behalf of participants (during technical disruption encountered by individual participants), these payments are required to be authorised by at least one senior officer before they can be effected. Access rights to MEPS+ are reviewed on a monthly basis by the relevant MAS departments to ensure that they are granted on a need-to basis.

- Changes to the MEPS+ system are carried out in a controlled manner so as to minimise operational disruptions after implementation. Each change, such as enhancements to the functions in the system, security patches and adoption of the annual changes to the SWIFT standards, goes through the following processes before they can be deployed:
 - Application change process where the requirements for the changes to MEPS+ system are gathered, prioritised and approved by CIIC. Once the changes have been developed, testing will be performed by independent test consultants, MAS departments and all MEPS+ participants. The types of tests conducted include functional and non-functional tests, as well as regression tests. Sign-offs are obtained from all testers upon completion of testing. The MEPS+ source codes will also be reviewed by independent security consultants for viruses, malicious codes and code quality before the new codes can be deployed to production. MAS also appoints independent security consultants to review and advise MAS on MEPS+ application vulnerabilities and threats. Penetration testing and system vulnerability assessment on MEPS+ are conducted annually.
 - System change process where risk assessment will be conducted for the changes to be deployed. A cutover checklist which identifies critical checkpoints and contingency plans will be prepared. The project team will further ensure that MEPS+ operational guides are updated and ready before the implementation date.
 - Evaluation and approval process where all changes to MEPS+ will be submitted to Head, ITD for approval. For changes that are assessed to be of high risk (e.g. urgent code fix), these will be submitted to the Chairman of CIIC for approval.
 - Post-implementation process where relevant MAS departments will verify the changes on the first business day after the deployment in production.
- MAS maintains oversight of the MEPS+ vendor's practices and conducts regular reviews of the MEPS+ vendor's code testing, review, compilation and deployment controls and processes. To further tighten oversight, the MEPS+ vendor is required to indicate the level of compliance in their annual self-attestations against requirements on financial strength, operational controls and processes and information security, as well as to ensure that their external audit is conducted using acceptable national or international standards.
- MAS conducts near real-time monitoring of MEPS+ system's condition and the transaction flows during MEPS+ operating hours. MEPS+ automatically conducts regular reconciliation of participants' account balances and holding positions against the settled transactions. MAS has also enhanced monitoring

of user and application logins. System health checks are conducted on a quarterly basis.

- Annual contingency drills with participants, MEPS+ vendors and other service providers are conducted to maintain a high state of contingency preparedness across system, processes and people. MAS also participates in the annual contingency drills of linked FMIs, such as SACH and CLS.
- MAS adopts the CPMI-IOSCO's *PFMI*, the CPMI-IOSCO's *Guidelines on Cyber Resilience for Financial Market Infrastructures*³⁶, CPMI's *Strategy for Reducing the Risk of Wholesale Payments Fraud Related to Endpoint Security*³⁷ and SWIFT's CSP and benchmarks its operational risk management standards with other central banks that operate similar real-time gross settlement systems. MAS also subjects MEPS+ to the same standards as prescribed in Singapore Government policies, and for technology risk management, outsourcing and business continuity management that are applicable to financial institutions operating in Singapore.

Key consideration 17.2: An FMI's board of directors should clearly define the roles and responsibilities for addressing operational risk and should endorse the FMI's operational risk-management framework. Systems, operational policies, procedures, and controls should be reviewed, audited, and tested periodically and after significant changes.

- The relevant MAS departments (mainly ITD and DTA with the support of FD) responsible for managing the various sources of risk faced by MEPS+ have been identified in the risk management framework.
- RiMD and CCSO Office, as second line risk managers for operational risks and technology and cyber risks respectively, undertake independent review and challenge in respect of MEPS+ risks and the risk controls designed to address them. ITD, DTA and FD report MEPS+ operational risk incidents (including near misses) to RiMD and CCSO Office for independent review on the impact assessment and the proposed remediation measures to mitigate recurrence of similar incidents. Periodic meetings with operational units are also held to discuss operation and risk issues.
- MEPS+ is subject to annual audits by the AGO, in addition to that conducted by IAD. Audit findings are reported to MAS' MD and the AC.

³⁶ In June 2016, CPMI and IOSCO released guidance in the area of cyber resilience to support relevant requirements in the PFMI. The *Guidance on Cyber Resilience for Financial Market Infrastructures* is intended to help FMIs enhance their cyber resilience and recognises that measures to mitigate cyber threats would need to continuously evolve given the dynamic nature of the threats. More details are available from <https://www.bis.org/cpmi/publ/d146.htm>.

³⁷ In May 2018, the CPMI published a strategy to encourage and help focus industry efforts to reduce the risk of wholesale payments fraud related to endpoint security. More details are available from <https://www.bis.org/cpmi/publ/d178.htm>.

- In addition, contingency exercises are conducted with participants annually to test the operational robustness and resiliency of MEPS+.

Key consideration 17.3: An FMI should have clearly defined operational reliability objectives and should have policies in place that are designed to achieve those objectives.

- MEPS+ operational standards, such as service availability, have been established to ensure that MEPS+ has a high degree of operational reliability. The performance of MEPS+ against these operational standards is reported on a monthly basis to CIIC.
- MEPS+ system architecture and infrastructure are designed to eliminate single point of failure by having redundancy for critical components. In addition, penetration test and system vulnerability assessment are conducted annually to identify potential threats and weaknesses.
- Contingency plans are drawn up and tested regularly to ensure that when a disruption occurs, these standards can be met. MAS has also established an incident and problem management framework to manage operational incidents to ensure that MEPS+ operations are restored as quickly as possible and post-incident reviews are conducted to identify root causes, resolutions and preventive measures. In addition, MAS executes service level agreements with the MEPS+ service providers to ensure that the services underpinning MEPS+ operations meet the same reliability and contingency requirements. The service levels are closely monitored through monthly meetings.

Key consideration 17.4: An FMI should ensure that it has scalable capacity adequate to handle increasing stress volumes and to achieve its service-level objectives.

- MEPS+ has sufficient capacity to meet the needs of its participants. This capacity is tested by independent consultants as part of each major upgrade of MEPS+ to ensure that the system can cope with the projected volumes. The test results are reviewed by CIIC.
- MEPS+ capacity is also monitored closely by ITD. This is reviewed at least quarterly with the MEPS+ vendors as part of their maintenance and support of MEPS+, so that preventive measures can be taken to increase the capacity. Should the operational capacity of MEPS+ be neared or exceeded, there will be a system alert and the ITD will take remediation steps to increase the capacity.

Key consideration 17.5: An FMI should have comprehensive physical and information security policies that address all potential vulnerabilities and threats.

Physical security

- MAS employs a multi-layered physical security protection from all entry points into and within the MAS building comprising preventive and detective measures such as security searches, biometric or card-controlled accesses and explicit approvals and CCTV security systems.

Information security

- As set out in the MEPS+ application change process, for each major MEPS+ upgrade, MAS appoints independent security consultants to review and advise MAS on MEPS+ application vulnerabilities and threats. Penetration testing and system vulnerability assessment on MEPS+ are conducted annually. The security consultants' assessment results and recommendations are reported and discussed at the CIIC.
- MAS has established a Cyber Resiliency Framework for MAS-operated critical information systems. The framework covers the various cyber resiliency domains such as identification, protection, detection, response and recovery.
- Annual cybersecurity risk assessments are conducted to identify areas of strengthening in cyber risk mitigation. Key measures identified and implemented since the last disclosure include:
 - the use of cyber threat intelligence platform for threat surveillance and to integrate the platform with Enterprise Security Information and Event Management for better threat detection;
 - enhanced database activity monitoring, network monitoring, endpoint detection and response capabilities as well as user behavioural analytics to enhance threat detection and response; and
 - near real-time alerts for execution of privileged activities to strengthen detection of unauthorized activities.

Key consideration 17.6: An FMI should have a business continuity plan that addresses events posing a significant risk of disrupting operations, including events that could cause a wide-scale or major disruption. The plan should incorporate the use of a secondary site and should be designed to ensure that critical information technology (IT) systems can resume operations within two hours following disruptive events. The plan should be designed to enable the FMI to complete settlement by the end of the day of the disruption, even in case of extreme circumstances. The FMI should regularly test these arrangements.

- MEPS+ has high availability infrastructure with redundancy for critical components and proactive operations management at the main and alternate data centres. To mitigate risk of data loss when MAS activates the alternate site, data in the main site is mirrored live to the alternate site during MEPS+

operating hours. Critical MEPS+ data is also stored at a third site and can be used to continue processing and settling interbank funds and securities transfers. A full backup of data is performed daily and stored offsite after the MEPS+ system closes.

- MEPS+ business continuity plan covers the scenarios of major disruptions caused by the failure of critical MEPS+ components, wide-scale disruption affecting both MEPS+ data centres and failure in MEPS+ application software. In such scenarios, the Offline Contingency Modules (“OCMs”) can be activated to allow MAS to continue processing and settling interbank funds and securities transfers.
- Comprehensive checklists are in place to guide the execution of the business continuity plan and to ensure that MEPS+ is able to resume its services to meet its Recovery Time Objective of two hours. MAS has also conducted live MEPS+ operations at the alternate data centre to verify the operational readiness of the MAS staff, vendors and participants as well as the operating systems at the alternate data centre.
- Various contingency drills are conducted annually with participants, MEPS+ vendors and service providers to maintain a high state of preparedness across system, processes and people to cope with various disruptions in MEPS+ operations. The scope of each drill is reviewed as part of the planning and scheduling of the drills and approved by CIIC. The results of the contingency exercises are reviewed and discussed at the CIIC. Participants’ feedback are collated and reviewed after each contingency drill. These are taken into consideration in the planning for subsequent MEPS+ contingency drills.
- MAS also participates in contingency drills conducted by linked FMIs, such as SACH and CLS.

Key consideration 17.7: An FMI should identify, monitor, and manage the risks that key participants, other FMIs, and service and utility providers might pose to its operations. In addition, an FMI should identify, monitor, and manage the risks its operations might pose to other FMIs.

Risks from participant

- Robustness of MEPS+ operations is dependent on the security of its participants. MAS has established security guidelines and contingency requirements for participants relating to:
 - regular reviews of access rights to MEPS+ Browse (to access MEPS+ online enquiries and liquidity management functions);
 - notification to MAS of any security-related incidents that disrupt the flow of payments in MEPS+;
 - implementation of backup and disaster recovery facilities to resume the processing of payments and securities settlements within two hours of any

- event that hinders its ability to send or receive payments or securities settlement instructions to or from MEPS+; and
 - monitoring of messages and instructions submitted to MEPS+ for settlement.
- Participants are required to perform annual self-assessment against these guidelines and requirements. Participants are also required to conduct an independent review of their self-assessment against the MEPS+ security guidelines biennially.
- MAS also monitors participants' adoption of the SWIFT's CSP to review any risks posed by any participant's non-adherence.
- In addition, MAS provides participants with a manual contingency module to continue to submit their messages and instructions to MEPS+ in the event of an outage in SWIFT's messaging services or SWIFT network. MEPS+ participants are required to take part in the annual contingency drill with MAS to rehearse the use of this module.
- MAS, in supervising banks, also seeks to ensure that MEPS+ participants have sound processes in place.

Risks from other FMIs

- CLS' and CDP's participation in MEPS+ as well as SACH's linkage with MEPS+ are of critical importance to MEPS+ operations. Any failure or disruption event in CLS, CDP or SACH may impact MEPS+ service operations as MEPS+ operating hours may need to be extended to allow for settlement of these FMIs' transactions in MEPS+. There are agreed upon contingency procedures with CLS, CDP and SACH. MAS conducts regular contingency drills with these FMIs to ensure that these contingency procedures are well understood.

Risks from service and utility providers (i.e. telecommunication/network partners)

- MAS maintains redundancy in the telecommunications and network partners used for MEPS+ connection to SWIFT, so as to manage the operational risks arising from a disruption in the telecommunications or networks. In addition, MAS subscribes to the PremiumPlus service support from SWIFT, where SWIFT pro-actively monitors the connection of MEPS+ to SWIFT and alerts MAS should there be any anomaly. In the event of an outage in SWIFT's services, MEPS+ can operate in an offline mode. The participants will use the afore-mentioned manual contingency module to send transactions to MAS using alternative electronic channel, upon which, MAS will upload these transactions to MEPS+ for processing.

Risks posed to other FMIs

- Disruption in MEPS+ services may affect the settlement of the following transactions:
 - SGD leg of CLS members' foreign exchange transactions;
 - cheque, Inter-Bank GIRO and FAST clearing obligations; and
 - securities market trades by CDP's members.These risks are taken into consideration in the design of MEPS+ contingency measures. Feedback from these FMIs would be obtained before the MEPS+ contingency arrangements are operationalised.
- Contingency drills are conducted regularly with the FMIs. The respective manuals which document these arrangements are reviewed and updated regularly with inputs from the FMIs.

Principle 18: Access and participation requirements

An FMI should have objective, risk-based, and publicly disclosed criteria for participation, which permit fair and open access.

Key consideration 18.1: An FMI should allow for fair and open access to its services, including by direct and, where relevant, indirect participants and other FMIs, based on reasonable risk-related participation requirements.

- The criteria for access to MEPS+ is documented in the MEPS+ Service Agreement and applies consistently to all applicants. In assessing an entity's application, MAS will review the applicant's creditworthiness, and risks posed to system and other participants amongst other strict admission criteria.
- Existing participants must continue to exhibit a good track record with respect to fulfilment of financial obligations such as the payment of fees and charges.
- Participants also have to demonstrate their operational readiness to participate in MEPS+, such as having a SWIFT membership as well as the necessary hardware, software, systems and capability to send and receive messages from others in the SWIFT network. Participants are required to have adequate and appropriate level of fault tolerance in the form of disaster recovery facilities.

Key consideration 18.2: An FMI's participation requirements should be justified in terms of the safety and efficiency of the FMI and the markets it serves, be tailored to and commensurate with the FMI's specific risks, and be publicly disclosed. Subject to maintaining acceptable risk control standards, an FMI should endeavour to set requirements that have the least-restrictive impact on access that circumstances permit.

- The MEPS+ access criteria is set out in the MEPS+ Service Agreement, which is available on the MAS website and is reviewed every two years or as and when required.
- In addition to the criteria set out in key consideration 18.1 that are based on the potential risks a participant could pose to the FMI, the requirements for participation in MEPS+ also take into consideration that the applicant is appropriately licensed and approved by MAS or adequately supervised by a competent authority in the country where the applicant is established or licensed. In this respect, the MEPS+ participation requirements are risk focused and not restrictive.

Key consideration 18.3: An FMI should monitor compliance with its participation requirements on an ongoing basis and have clearly defined and publicly disclosed procedures for facilitating the suspension and orderly exit of a participant that breaches, or no longer meets, the participation requirements.

- MAS monitors participants' compliance with the participation requirements on an on-going basis. The MEPS+ Service Agreement sets out the conditions under which MAS can suspend or terminate a participant's access to MEPS+.
- Key aspects of the procedures for suspending or terminating a participant's access to MEPS+ are reflected in the Operations & Contingency Manual for MEPS+ Participants and Non-Participants used by all participants.

Principle 19: Tiered participation arrangements

An FMI should identify, monitor, and manage the material risks to the FMI arising from tiered participation arrangements.

Key consideration 19.1: An FMI should ensure that its rules, procedures, and agreements allow it to gather basic information about indirect participation in order to identify, monitor, and manage any material risks to the FMI arising from such tiered participation arrangements.

- Direct participants are those that have executed the MEPS+ Service Agreement and are able to settle payments, SGS and MAS Bills transactions directly on their MEPS+ accounts. Indirect participants are the financial institutions in Singapore who submit their MEPS+ payments, SGS and MAS Bills transactions through the direct participants.
- Basic information about indirect participation is obtained from the information furnished by the indirect participant when they open a current account with MAS. The information (such as name of indirect participant, and its SWIFT BIC) is published on the MAS website and updated as and when there are changes.
- Direct participants are required to submit an annual return to MAS on the total volume and value of the MEPS+ transactions which they perform on behalf of indirect participants. MAS will analyse these annual statistics to identify, monitor and manage the risks arising from any material dependencies between direct and indirect participants.

Key consideration 19.2: An FMI should identify material dependencies between direct and indirect participants that might affect the FMI.

- As described in key consideration 19.1, MAS identifies and monitors material dependencies between direct and indirect participants that might affect MEPS+ on an annual basis.

Key consideration 19.3: An FMI should identify indirect participants responsible for a significant proportion of transactions processed by the FMI and indirect participants whose transaction volumes or values are large relative to the capacity of the direct participants through which they access the FMI in order to manage the risks arising from these transactions.

- The methodology described in key consideration 19.1 will enable MAS to identify the indirect participants responsible for a significant proportion of transactions processed in MEPS+ and indirect participants whose transaction values are large relative to the capacity of their direct participants.

Key consideration 19.4: An FMI should regularly review risks arising from tiered participation arrangements and should take mitigating action when appropriate.

- MAS performs an annual review of the risks arising from tiered participation arrangements and the materiality of such risks. The results of the analysis are reviewed and discussed at CIIC for its decision on whether mitigating actions are required, such as:
 - encouraging indirect participants with large MEPS+ transaction values or whose transaction values are large relative to the capacity of their direct participants to participate directly in MEPS+; and
 - requiring key direct participants to put in place robust contingency arrangements so as to minimise disruptions to indirect participants in the event of an operational disruption affecting the key direct participants.

Principle 20: FMI links

An FMI that establishes a link with one or more FMIs should identify, monitor, and manage link-related risks.

Key consideration 20.1: Before entering into a link arrangement and on an ongoing basis once the link is established, an FMI should identify, monitor, and manage all potential sources of risk arising from the link arrangement. Link arrangements should be designed such that each FMI is able to observe the other principles in this report.

- Risk assessment will be performed on the prospective link, taking into consideration the key risk areas (i.e. operational, credit, liquidity and legal) arising from the link arrangement. The risk assessment, including mitigating measures if any, will be presented to CIIC, whose approval will be sought for the link arrangement.
- A link arrangement has been established between MEPS+ and CDP whereby CDP holds MEPS+ SGS account for the purpose of custodising SGS for retail investors who invest in these debt instruments. This arrangement was initiated by MAS to develop retail interest in SGS.
- Potential risks arising from MEPS+ interdependencies with CDP have been identified and mitigated, and are reviewed annually.

Key consideration 20.2: A link should have a well-founded legal basis, in all relevant jurisdictions, that supports its design and provides adequate protection to the FMIs involved in the link.

- CDP has executed the MEPS+ Service Agreement which is part of the legal framework for MEPS+ SGS and MAS Bills as described in Principle 1.

Key consideration 20.3: Linked CSDs should measure, monitor, and manage the credit and liquidity risks arising from each other. Any credit extensions between CSDs should be covered fully with high-quality collateral and be subject to limits.

- The link arrangement between MEPS+ SGS and CDP does not involve credit extension or liquidity provision, and hence does not give rise to credit or liquidity risks.

Key consideration 20.4: Provisional transfers of securities between linked CSDs should be prohibited or, at a minimum, the retransfer of provisionally transferred securities should be prohibited prior to the transfer becoming final.

- The link arrangement between MEPS+ SGS and CDP is used to facilitate cash settlement of the SGS trading in CDP and does not involve provisional transfers of securities.

Key consideration 20.5: An investor CSD should only establish a link with an issuer CSD if the arrangement provides a high level of protection for the rights of the investor CSD's participants.

- Not applicable as MEPS+ SGS is not the investor CSD in the link arrangement with CDP.

Key consideration 20.6: An investor CSD that uses an intermediary to operate a link with an issuer CSD should measure, monitor, and manage the additional risks (including custody, credit, legal, and operational risks) arising from the use of the intermediary.

- There is no intermediary in the link arrangement between MEPS+ SGS and CDP.

Principle 21: Efficiency and effectiveness

An FMI should be efficient and effective in meeting the requirements of its participants and the markets it serves.

Key consideration 21.1: An FMI should be designed to meet the needs of its participants and the markets it serves, in particular, with regard to choice of a clearing and settlement arrangement; operating structure; scope of products cleared, settled, or recorded; and use of technology and procedures.

- The design, rules and procedures for MEPS+ are customised to meet the needs of its participants. A MEPS+ User Group, comprising key MEPS+ participants, meets regularly to provide feedback to MAS on MEPS+ and share industry best practices. Major changes to the MEPS+ system, operational procedures and rules are made after consultation with the participants. Efficiency-enhancing features of MEPS+ include the liquidity management tools, multilateral settlement and gridlock resolution mechanisms. In addition, MEPS+ uses the SWIFT network and MT message standards for all funds settlement and securities transfer instructions, which are also used by the participants. Use of common network and message standards help to facilitate straight-through-processing, resulting in higher efficiency and smoother flow of payments.

Key consideration 21.2: An FMI should have clearly defined goals and objectives that are measurable and achievable, such as in the areas of minimum service levels, risk-management expectations, and business priorities.

- As described in Principle 2 (key consideration 2.1), MEPS+ was implemented to provide the banking industry with a safe, efficient and robust real-time gross settlement system. Operational standards and targets to assess these objectives have been established as described in key consideration 17.3 under Principle 17 (Operational Risk). Performance against these operational standards and targets are tracked and reported to CIIC monthly.

Key consideration 21.3: An FMI should have established mechanisms for the regular review of its efficiency and effectiveness.

- MEPS+ efficiency and effectiveness are measured by the extent to which the operational standards and targets are met. These operational standards and targets are tracked and reported to CIIC monthly.

Principle 22: Communication procedures and standards

An FMI should use, or at a minimum accommodate, relevant internationally accepted communication procedures and standards in order to facilitate efficient payment, clearing, settlement, and recording.

Key consideration 22.1: An FMI should use, or at a minimum accommodate, internationally accepted communication procedures and standards.

- MEPS+ uses internationally accepted communication procedures and standards provided by SWIFT to communicate with its participants.

Principle 23: Disclosure of rules, key procedures, and market data

An FMI should have clear and comprehensive rules and procedures and should provide sufficient information to enable participants to have an accurate understanding of the risks, fees, and other material costs they incur by participating in the FMI. All relevant rules and key procedures should be publicly disclosed.

Key consideration 23.1: An FMI should adopt clear and comprehensive rules and procedures that are fully disclosed to participants. Relevant rules and key procedures should also be publicly disclosed.

- The MEPS+ operating rules and procedures are documented in the MEPS+ Service Agreement and the Operations and Contingency Manual for MEPS+ Participants and Non-Participants. These documents are published on the MAS website.
- To ensure that the MEPS+ rules and procedures are clear and comprehensive, MAS actively consults key MEPS+ participants when there are major changes to the MEPS+ procedures, processes and rules.

Key consideration 23.2: An FMI should disclose clear descriptions of the system's design and operations, as well as the FMI's and participants' rights and obligations, so that participants can assess the risks they would incur by participating in the FMI.

- MEPS+ system design and operations are documented in the MEPS+ user manuals which are updated and provided to all participants after each MEPS+ upgrade and made available on the MAS website.
- All MEPS+ participants are required to enter into the MEPS+ Service Agreement with MAS, which includes the MEPS+ Operating Rules that set out the duties and obligations of the participants. As the MEPS+ Service Agreement is available on the MAS website, participants are able to assess the risks they may incur by participating in MEPS+.

Key consideration 23.3: An FMI should provide all necessary and appropriate documentation and training to facilitate participants' understanding of the FMI's rules and procedures and the risks they face from participating in the FMI.

- MEPS+ rules and operational procedures are available on the MAS website. Participants that require assistance or clarifications on MEPS+ operational procedures can contact the MEPS+ Helpdesk.
- MAS conducts annual contingency exercises and industry tests to facilitate participants' understanding of the MEPS+ rules and operational procedures.

Participants are required to submit self-assessments on their tests during these contingency exercises and industry tests to MAS. Participants who did not demonstrate familiarity or understanding of the MEPS+ rules and processes will be required to undergo additional tests.

- The assessment of MEPS+'s adherence to PFMI in this document also aids participants in understanding the risks of participation in MEPS+.

Key consideration 23.4: An FMI should publicly disclose its fees at the level of individual services it offers as well as its policies on any available discounts. The FMI should provide clear descriptions of priced services for comparability purposes.

- MEPS+ pricing and the incentive structure for early settlement of messages are documented in the MEPS+ Service Agreement that is posted on the MAS website.

Key consideration 23.5: An FMI should complete regularly and disclose publicly responses to the CPSS-IOSCO Disclosure framework for financial market infrastructures. An FMI also should, at a minimum, disclose basic data on transaction volumes and values.

- This disclosure forms the public responses to the CPSS-IOSCO Disclosure framework for financial market infrastructures. It will be updated every two years. MEPS+ statistics (transaction volume and value) is disclosed to the public and updated annually. The list of MEPS+ participants is also disclosed on the MAS website and updated as and when there are changes.

Principle 24: Disclosure of market data by trade repositories

A TR should provide timely and accurate data to relevant authorities and the public in line with their respective needs.

Key consideration 24.1: A TR should provide data in line with regulatory and industry expectations to relevant authorities and the public, respectively, that is comprehensive and at a level of detail sufficient to enhance market transparency and support other public policy objectives.

- Not applicable as MEPS+ is not a trade repository.

Key consideration 24.2: A TR should have effective processes and procedures to provide data to relevant authorities in a timely and appropriate manner to enable them to meet their respective regulatory mandates and legal responsibilities.

- Not applicable as MEPS+ is not a trade repository.

Key consideration 24.3: A TR should have robust information systems that provide accurate current and historical data. Data should be provided in a timely manner and in a format that permits it to be easily analysed.

- Not applicable as MEPS+ is not a trade repository.

V. List of Publicly Available Resources

1. Available on Bank of International Settlement website (<https://www.bis.org/>):
 - Principles for Financial Market Infrastructures
 - PFMI: Disclosure Framework and Assessment Methodology
 - Payment, clearing and settlement systems in the CPMI countries – Volume 1
 - Guidance on Cyber Resiliency for Financial Market Infrastructures
 - Reducing the Risk of Wholesale Payments Fraud Related to Endpoint Security
2. Available on MAS website (<https://www.mas.gov.sg/>):
 - Industry Engagement Report for MEPS+ Technical Architecture Design Phase
 - Supervision of Financial Market Infrastructures In Singapore
 - Standards For MAS-Operated Financial Market Infrastructures
 - MEPS+ Service Agreement
 - Terms and Conditions governing the Operation of the Current Account of the Specified Institution
 - Terms and Conditions Governing the Operation of the Accounts for SGS and MAS Bills
 - Terms and Conditions governing the MAS Intraday Liquidity Facility
 - Operations and Contingency Manual for MEPS+ Participants and Non-Participants
 - MEPS+ User Manuals
 - MEPS+ Annual Statistics
 - MEPS+ Monthly Statistics
 - List of MEPS+ Participants
 - List of MEPS+ Non-Participants
3. Available on Attorney-General's Chambers website (<https://sso.agc.gov.sg/Browse/>):
 - MAS Act 1970
 - Payment Services Act 2019
 - Payments and Settlement Systems (Finality and Netting) Act 2002
 - Electronic Transactions Act 2010
 - Government Securities (Debt Market and Investment) Act 1992
 - Significant Infrastructure Government Loan Act 2021
4. Available on International Capital Market Association website (<https://www.icmagroup.org/>):
 - PSA/ISMA Global Master Repurchase Agreement
5. Available on SWIFT website (<https://www.swift.com/>):
 - Customer Security Programme