Section 57 of the Competition Act (Cap. 50B)

Grounds of Decision issued by the Competition Commission of Singapore

In relation to the notification for decision of the proposed merger between Applied Materials, Inc. and Tokyo Electron Limited pursuant to section 57 of the Competition Act

23 September 2014

Case number: CCS 400/001/14

Confidential information in the original version of this Decision has been redacted from the published version on the public register. Redacted confidential information in the text of the published version of the Decision is denoted by [✂].

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I. Introduction

The Notification

1. On 17 January 2014, a joint notification under section 57 of the Competition Act (Cap. 50B)(the "Act") was made by Applied Materials, Inc. ("AMAT") and Tokyo Electron Limited ("TEL")(collectively "the Parties"), for a decision by the Competition Commission of Singapore ("CCS") as to whether the merger of AMAT and TEL in an all-stock transaction to create a new company (referred to in this decision as "Eteris"[1])(the "Transaction") will infringe the section 54 prohibition of the Act.[2]

2. In assessing the Transaction, CCS contacted ten competitors[3] and seven customers[4] in the market for the manufacture and supply of semiconductor equipment. Due to the range of products supplied by manufacturers, there is some overlap in the competitors and the customers of the products. Out of the 17 third-parties contacted, 12 replied[5] and provided substantive responses to CCS's questionnaires. One third-party[6] had no comments with regard to the Transaction.

3. The administrative timeline for CCS's consideration of the Transaction was stopped for two periods, from 24 January 2014 to 29 January 2014 and separately from 11 February 2014 to 27 August 2014. In the first instance, the Parties had not provided CCS with documents in Form M1 that complied with regulation 4 of the Competition (Notification) Regulations 2007. The timeline was subsequently stopped as the Parties were unable to provide information and documents which CCS had sought for in addition to the information requested in Form M1, within the deadline that CCS considered as appropriate. The timelines resumed on 30 January 2014 and 28 August 2014 respectively after the Parties submitted the outstanding requested information and documents.

4. At the end of the consultation process and after evaluating all the submissions, CCS has concluded that the Transaction will not infringe section 54 of the Act.

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[1] Refer to the Parties' email dated 15 September 2014
[2] Part 3 of Form M1
[3] [✂]
[4] [✂]
[5] [✂]
[6] [✂]

II. The Parties

AMAT

5. AMAT is the ultimate parent company of a multi-national group of companies comprised of 19 principal subsidiaries involved in the production and supply of equipment, services and software for the manufacture of semiconductor, flat panel display ("FPD") and photovoltaic ("PV") products. AMAT's business is organised into a wafer fabrication equipment ("WFE") segment (the Silicon Systems Group) and several other groups, namely the Display Group, Energy and Environmental Solutions Group and Applied Global Services Group.[7]

6. AMAT's registered office is at 3050 Bowers Ave, Santa Clara, CA 95054-3299, United States of America. Three of AMAT's subsidiaries are based in Singapore, Applied Materials South East Asia Pte. Ltd.; Applied Materials Singapore Technology Pte. Ltd.; and Varian Semiconductor Equipment Associates PacRim Pte. Ltd. AMAT has two principal locations in Singapore[8]:

   a. AMAT's subsidiary, Applied Materials South East Asia Pte. Ltd., has a main office and operations centre in Singapore with sales, marketing, technical support, general administration and other related services for AMAT's business units; and
   b. AMAT has a product development centre in Singapore, which is a manufacturing, and research and development facility.

7. The Singapore turnover of AMAT was [✂][9] and the worldwide turnover for AMAT's business was US$ 8,719 million (approximately S$10,968 million)[10] in the financial year ended 28 October 2013.

[7] Paragraph 7.1 of Form M1
[8] Paragraph 10.14 of Form M1
[9] See Parties' response dated 7 March 2014 to CCS's Request for Information ("RFI") question 3
[10] Paragraph 13.1 of Form M1

TEL

8. TEL is the ultimate parent company of a multi-national group of companies comprising of 25 principal subsidiaries involved in the supply of a wide range of WFE used to manufacture semiconductors. TEL also provides service and support to global semiconductor device manufacturers. Though the majority of its sales stem from its semiconductor equipment, TEL also has a FPD and PV production equipment business as well as electronic, computer and computer networks business. Similar to AMAT, TEL is organised into Semiconductor Production Equipment ("SPE") and Non-SPE (FPD, PV and electronic components) divisions.

9. TEL's registered office is at Akasaka Biz Tower, 3-1 Akasaka 5-chome, Minato-ku, Tokyo 107-6325, Japan.[11] Five of TEL's subsidiaries are based in Singapore, Tokyo Electron Device Singapore Pte. Ltd.; TEL NEXX Singapore Pte. Ltd.; TEL FSI Singapore Pte. Ltd.; TEL Solar Singapore Pte. Ltd.; and Tokyo Electron Singapore Ltd.[12] TEL operates a sales office in Singapore, but does not have any manufacturing facilities in Singapore.[13] TEL provides assistance with sales, marketing, technical support, general administration and engineering support to customers, and sells and markets post-warranty service and related services in Singapore.[14]

10. The Singapore turnover of TEL was [✂][15] and the worldwide turnover for TEL's business was US$ 5,288 million (approximately S$6,652 million)[16] in the financial year ended 31 March 2013.

III. The Transaction

11. The notified merger is an all-stock transaction and a merger of equals and involves all of the business of the Parties.[17] A new company, Eteris, valued at US$29 billion (approximately S$36.5 billion), will be created by AMAT and TEL.[18] Each TEL shareholder will receive 3.25 shares of Eteris for every TEL share held. Each AMAT shareholder will receive one share of Eteris for every AMAT share held. After completion, AMAT and TEL shareholders will hold approximately 68% and 32% of Eteris shares respectively.[19]

[11] Paragraph 1.2 of Form M1
[12] Paragraph 1.2 of Form M1
[13] Paragraph 10.21 of Form M1
[14] Paragraph 10 .17 of Form M1
[15] Paragraph 13.4 of Form M1
[16] Paragraph 13.2 of Form M1
[17] Paragraphs 11.1 and 11.4 of Form M1
[18] Paragraph 1 1.5 of Form M1
[19] Paragraph 11.3 of Form M1

12. Eteris will have dual headquarters in Tokyo, Japan and Santa Clara, California. Eteris will be incorporated in the Netherlands and is expected to be dual listed on the NASDAQ and the Tokyo Stock Exchange.[20]

13. Subsequent to the joint notification under section 57 of the Act on 17 January 2014, CCS was notified by the Parties on 7 March 2014 that the transaction structure of the merger had changed in order to ensure compliance with new regulations issued under the United States Internal Revenue Code ("Amended Transaction Structure"). The Parties confirmed that share exchange ratio and post-merger shareholding will continue to remain the same notwithstanding this change to the transaction structure. CCS noted Eteris' expressed continued intention to proceed for dual listing in Nasdaq and the Tokyo Stock Exchange after the completion of the merger.

14. The Parties are of the view that their combined capabilities will create a new global innovator in precision materials engineering and patterning that will better serve semiconductor, display and solar photovoltaic customers.[21]

15. Based on the Parties' submission (including the subsequent information relating to the Amended Transaction Structure) that the Transaction is a merger of the Parties, the Transaction constitutes a merger pursuant to section 54(2)(a) of the Act.

IV. Competition Issues

16. As set out in the *CCS Guidelines on the Substantive Assessment of Mergers*, CCS is generally of the view that competition concerns are unlikely to arise in a merger situation unless the merged entity will have a market share of 40% or more, or the merged entity will have a market share of between 20% to 40% and with a post-merger CR3[22] at 70% or more.[23]

17. The Parties submitted that the products and services provided by the Parties may generally be classified into (i) semiconductor manufacturing equipment; (ii) display manufacturing equipment; and (iii) solar panel manufacturing equipment. For this merger, the Parties have submitted that the Parties' businesses in display manufacturing equipment and solar panel

[20] Paragraph 8.4 of Form M1
[21] Paragraph 12.1 of Form M1
[22] Paragraph 5.14 of *CCS Guidelines on the Substantive Assessment of Mergers*. CR3 refers to the combined market shares of the three largest firms
[23] Paragraph 5.15 of *CCS Guidelines on the Substantive Assessment of Mergers*

manufacturing equipment are fully non-overlapping and accordingly, the Parties' supporting services are also fully non-overlapping.[24]

18. With regard to semiconductor manufacturing equipment, the Parties submitted that the Parties overlap in the following segments and in the provision of the following types of products:

Worldwide

(i) Sputtering[25] for bump processing;
(ii) Electrochemical Deposition ("ECD") (including Through-Silicon Via ("TSV")[26]);
(iii) ECD for bump processing;
(iv) Silicon etch (including TSV);
(v) Dielectric etch (including bump);
(vi) Clean tools; and
(vii) Plasma Nitridation

(collectively, the "Overlapping Products")

Singapore

(i) Dielectric etch (including bump)(the "Singapore Overlapping Product")[27]

19. The market share estimates in 2013 submitted by the Parties in the markets for the manufacture and supply of the Overlapping Products worldwide, with the exception of ECD (including TSV) and clean tools, exceed the indicative thresholds set out in the *CCS Guidelines on the Substantive Assessment of Mergers*.[28]

20. With regard to the Singapore Overlapping Product, the Parties clarified that dielectric etch (including bump) is the only overlapping product for which both AMAT and TEL have sales to customer(s) in Singapore.[29] Third-parties consulted by CCS agreed with the Parties' submissions on the overlaps by

[24] Paragraph 15 of Form M1
[25] Sputtering is a physical vapour deposition ("PVD") process
[26] TSV refers to a method of 3D interconnect in which electrical connections pass completely through the wafer, allowing multiple chips to be stacked on top of one another and electrically connected
[27] Paragraph 15 of Form M1
[28] See Annex 1 of the Parties' response dated 30 May 2014 to CCS's RFI question 4
[29] See Parties' response dated 7 March 2014 to CCS's RFI question 11

the Parties in the manufacture and provision of semiconductor manufacturing equipment, including that in Singapore.[30]

21. In this regard, CCS notes that for the Overlapping Products except dielectric etch (including bump), there will be no or extremely minimal change to the merged entity's market shares in Singapore post-Transaction. The market share data (by value), as submitted by the Parties, for the Overlapping Products except dielectric etch (including bump) in the Other Asia Pacific region (including Singapore)[31] are as set out below:

Table 1: Existing competition between the Parties in the Other Asia Pacific region (including Singapore) for the Overlapping Products except dielectric etch (including bump)

Product	**Company**	
	AMAT	**TEL**
(i) Sputtering for bump processing[32]		
2010	0.0%	**0.0%**
2011	0.0%	**0.0%**
2012	0.0%	**0.0%**
2013	0.0%	**0.0%**
(ii) ECD (including TSV)[33]		
2010	[30-40]%	**0.0%**
2011	0.0%	**0.0%**
2012	0.0%	**0.0%**
2013	0.0%	**0.0%**
(iii) ECD for bump processing[34]		
2010	[40-50]%	**0.0%**
2011	[70-80]%	**0.0%**
2012	[70-80]%	**0.0%**
2013	[90-100]%	**0.0%**
(iv) Silicon etch (including TSV)[35]		
2010	[30-40]%	**0.0%**
2011	[40-50]%	**0.0%**
2012	[10-20]%	**0.0%**

[30] [✂]
[31] See paragraphs 57 and 59 for an explanation on the use of Other Asia Pacific region as proxy for market shares in Singapore
[32] Competitors present in at least Other Asia Pacific include Ulvac, Oerlikon, SPTS, Anelva and Lam. Competitors present worldwide include NEXX Systems
[33] Competitors present in at least Other Asia Pacific include Lam, Ebara and EEJA. Competitors present worldwide include Novellus Systems and NEXX Systems
[34] Competitors present in at least Other Asia Pacific include Lam, Ebara and EEJA. Competitors present worldwide include Novellus Systems and NEXX Systems
[35] Competitors present in at least Other Asia Pacific include Lam, HHT, Mattson, SEMES, Jusung and others.

2013[36]	[0-10]%	**0.0%**
(v) Clean Tools[37]		
2010	[0-10]%	[0-10]%
2011	**0.0%**	[0-10]%
2012	**0.0%**	[30-40]%
2013	**0.0%**	[10-20]%
(vi) Plasma Nitridation		
Not captured by Gartner		

22. CCS is of the view that there will be no, or at the least, limited competition concerns arising with regard to existing competition in these Overlapping Products given that the competition landscape in Singapore does not change as a result of the Transaction. Currently, there are a number of suppliers of semiconductor equipment in the Overlapping Products to customers in the Other Asia Pacific region who include Lam Research Corporation ("Lam"), Ulvac, Oerlikon, SPTS, Anelva, Ebara, EEJA, Hitachi High-Technologies Corporation ("HHT"), Mattson Technology ("Mattson"), SEMES Co., Ltd. ("SEMES"), Jusung Engineering Co Ltd ("Jusung"), Dainippon Screen Mfg. Co., Ltd. ("DNS"), TES Co. Ltd., PSK Inc., and other smaller players.38

23. However, CCS also notes that the Parties could be potential competitors in these Overlapping Products and that post-Transaction; there will be a loss of a potential supplier to the customers. In this regard, the Parties submitted that there exists a multitude of competing suppliers who will be able to provide substitutable products to customers and maintain strong competition post-Transaction.[39] Also, as highlighted in paragraphs 122 and 126 below, after taking into consideration third-parties' views, CCS agrees with the Parties' submission that that there is a multitude of semiconductor equipment suppliers worldwide that customers, whether in Singapore or elsewhere, would be able to switch to readily.

24. Therefore, in evaluating the potential impact of the Transaction, specifically in Singapore, given that customers in Singapore have procured only dielectric etch (including bump) equipment from both Parties i.e. the only overlapping product in Singapore, and that competition concerns in the other Overlapping Products are limited, CCS is of the view that the Transaction will only significantly impact customers in Singapore in this market. CCS

[36] Figures for Silicon etch (including TSV) has been combined with that of Metal etch for Wafer Fab into a single segment Conductor etch (including TSV) in the 2013 Gartner Report
[37] Competitors present in at least Other Asia Pacific include DNS, TES Co. Ltd., PSK Inc, Ulvac. Competitors present worldwide include SEMES, KC Tech, Rave and Suss MicroTech
[38] See footnotes 32 to 35 and 37 for the specific competitors in each Overlapping Product
[39] Paragraph 34.28 of Form M1

has accordingly considered whether the Transaction will lead to coordinated and non-coordinated effects that would substantially lessen competition in the market for the manufacture and supply of dielectric etch (including bump) equipment to Singapore.

V. Counterfactuals

25. As stated in paragraph 4.6 of the *CCS Guidelines on Substantive Assessment of Mergers*, CCS will, in assessing mergers and applying the substantial lessening of competition ("SLC") test, evaluate the prospects for competition in the future with and without the merger. In which case the competitive situation without the merger is referred to as the "counterfactual". The SLC test will be applied prospectively, that is, future competition will be assessed with and without the merger.

26. The *CCS Guidelines on Substantive Assessment of Mergers* also states that in most cases, the best guide to the appropriate counterfactual will be prevailing conditions of competition, as this may provide a reliable indicator of future competition without the merger. However, CCS may need to take into account likely and imminent changes in the structure of competition in order to reflect as accurately as possible the nature of rivalry without the merger.[40]

(i) The Parties' submissions

27. The Parties submitted that, in the absence of the Transaction, they will continue to operate separately and independently. However, there will be a loss in opportunity for the Parties to rationalise and achieve the efficiencies as described in Section IX below.[41] The Parties also submitted that competitors are likely to continue to compete for customers with, or without, the Transaction.[42]

(ii) CCS's assessment

28. CCS is of the view that prevailing conditions of competition would be the likely scenario without the merger and accordingly, would be the counterfactual with which the SLC test will be applied to.

[40] Paragraph 4.7 of the *CCS Guidelines* on *Substantive Assessment of Mergers*
[41] Paragraph 23.1 of Form M1
[42] Paragraph 23.2 of Form M1

VI. Relevant Markets

Description of the semiconductor manufacturing process

29. Semiconductor equipment (which includes dielectric etch equipment) is used to create the integrated circuits (silicon chips) that are present in everyday electrical and electronic devices.

30. The fabrication process for integrated circuits is a multiple-step sequence of photographic and chemical processing steps during which electronic circuits are gradually created on a wafer made of pure semiconducting material.[43] Transistors[44] are the basic element of semiconductor devices.[45] These differing processing steps require differing types of non-substitutable semiconductor equipment in the multiple-step sequence fabrication process.

31. The fabrication process can be divided into:[46]

    a. front-end manufacturing which refers to the process steps involved in actually creating or building the features of the integrated circuit chip from the bare silicon wafer; and

    b. back-end manufacturing which occurs after the integrated circuit chips have been created and refers to the testing[47] and assembly functions necessary to package[48] the completed chip. These processes are often performed by outsourced semiconductor assembly and test companies.

32. Some of the main steps involved in front-end manufacturing and the corresponding semiconductor equipment used is summarised in the table below:

Process Step	Purpose	Equipment Used
(a) Pattern Formation – - Starts with the addition of a photoresist layer whose	To print circuit patterns on the surface of the silicon	(i) Lithography Tools (ii) Etching Tools

[43] Paragraph 18.1 of Form M1
[44] A transistor is effectively an on/off switch made of semiconductor material that sits between a current input and a current output. A "gate" controls whether the transistor is in the on or off position, and thus whether current can flow
[45] Paragraph 18.2 of Form M1
[46] Presentation Slides provided by the Parties on 25 July 2014
[47] Individual chips are tested to ensure proper device function and performance
[48] Packaging is where the chips are fitted with electrical contacts and packaging materials so that they can be easily connected to external circuitry, and the wafer is cut by a dicing saw to separate the individual chips

characteristics change when exposed to ultraviolet ("UV") light (i.e. lithography). - The UV light is filtered through a mask containing the circuit patterns. - Etching subsequently removes excess film in accordance with the patterns - Ashing/cleaning removes the photoresist layer and cleans the wafer to remove particles and impurities.	wafer and create trenches in the wafer	(iii) Ashing/Cleaning Tools
(b) Shallow Trench Isolation Formation - oxide films are added to the trenches via deposition to form dielectric films. Chemical planarization is then performed to make the surface of the wafer even (i.e. planarization)	Creates trenches of insulator film that electrically isolate the different transistors from one another	(i) Lithography (ii) Etch (iii) Deposition Tools (iv) Chemical Mechanical Planarization ("CMP") Tools
(c) Gate Formation – application of oxide film and a polysilicon gate electrode film via deposition and annealing (i.e. rapid thermal processing) to remove impurities.	Creation of a gate electrode to modulate current flow across the circuit. This completes the formation of a single transistor.	(i) Lithography (ii) Etch (iii) Deposition Tools (iv) Rapid Thermal Processing Tools (v) Plasma Nitridation Tools
(d) Interconnect Formation – recapitulates the previous stages, using deposition, lithography and etching.	Connects multiple transistors together via metal layers	(i) Deposition Tools (ii) Lithography Tools (iii) Etching Tools

Source: Paragraph 18.3 of Form M1, Presentation Slides submitted by the Parties and information provided during meeting with Parties on 25 July 2014. See Annex A for a pictorial representation of the multiple processes involved in semiconductor manufacturing.

33. The formation of an integrated circuit chip involves the constant repetition of the above described process and a typical manufacturing process may involve more than 500 steps altogether. While many of the techniques used are similar across the different process steps, typically, unique equipment are used at each stage of the manufacturing process. For example, the etching tools used at the earlier stages of the formation of the integrated circuit chip would need greater accuracy (i.e. critical steps), whereas there would be

more room for error at a later stage of the manufacturing process (i.e. non-critical steps) and, hence, equipment that provide for less accuracy may be used.[49]

(a) Product markets

34. To reiterate, the Parties have submitted that the relevant product markets for the purposes of this notification worldwide are:

(i) Sputtering for bump processing;
(ii) ECD (including TSV);
(iii) ECD for bump processing;
(iv) Silicon etch (including TSV);
(v) Dielectric etch (including bump);
(vi) Clean tools; and
(vii) Plasma Nitridation.

35. However, as noted in paragraph 20 above, the Parties submitted that dielectric etch (including bump) equipment is the only Singapore Overlapping Product.

Description of product – etch and dielectric etch (including bump)

36. Etching is the process of chemically removing material, or layers of material, during the wafer fabrication process. Etching may be differentiated by dry and wet processes. "Dry" etching is a process that uses ion bombardment from reactive gases or plasmas to remove the target material. Ions from the gas or plasma are accelerated at high speeds and collide with the surface of the wafer, removing the exposed material. "Wet" etching is a process which uses liquid chemical solutions to react with and remove the targeted material.[50]

37. Dry etching tools are used to form patterned features of the integrated circuit chip. A masking material is placed on the surface of the wafer so that only certain areas of the wafer surface are exposed to the etching process. Only material from the exposed areas of the wafer is removed, and due to the nature of ion bombardment, the material is removed in a virtually perfect vertical direction. This is known as anisotropic etch. Wet etch tools cannot serve these applications because the chemical solutions remove the target material in all directions. As the chemical etchant begins to remove the

[49] Presentation Slides provided by the Parties on 25 July 2014
[50] Paragraph 19.15 of Form M1

exposed material in a vertical direction, it will also eat away at the target material in a horizontal direction, which cuts into the areas intended to be protected by the masking material.[51]

38. Of the Overlapping Products, silicon etch (including TSV)[52] and dielectric etch (including bump) are broadly considered etching tools.

39. Specifically, dielectric etch[53] tools are dry etch tools that are used to etch dielectric films, such as silicon dioxide, silicon nitride, and high-k and low-k dielectric films.

40. Besides dielectric etch and silicon etch (including TSV), there are also several other different etching tools such as:

    (i) Metal etch: Metal etch refers to the etching of metal films, such as tungsten or aluminum. Silicon and metal etch are sometimes grouped together and referred to as conductor etch; and

    (ii) Photomask etch: Photomask etch refers to etching performed in the photolithography process.[54]

41. From a demand perspective, the Parties submitted that a tool that is used for etch in any one of these etch sub-categories cannot be used in another etch sub-category. For example, a customer could not use a tool that conducts dielectric etch for etching silicon or metal.[55]

42. From a supply perspective, the Parties submitted that there is a wide spectrum of competing semiconductor manufacturing equipment suppliers, including manufacturers which, similarly, supply a range of the Overlapping Products, and manufacturers which supply products competing within specific applications. It is also not uncommon for suppliers to enter into specific segments of Overlapping Products. For example, Mattson is a US-based supplier of semiconductor manufacturing equipment specialising in

[51] Paragraph 19.16 of Form M1
[52] Silicon etch tools are dry etch tools that are used to etch silicon films, primarily for front-end-of-line ("FEOL") applications, such as the etching of silicon trenches for shallow trench isolation and etching of polysilicon used during creation of the transistor gate stack. The FEOL process refers to the first steps in fabrication process involving the creation of the transistors
[53] Dielectric etch tends to be back-end-of line ("BEOL") process, with critical applications, such as BEOL copper damascene, contact, capacitor and DRAM HAR, as well as semi-critical applications such as pad/passivation, etchbacks, and BARC Open/HMRM/Spacer. Dielectric etch and dielectric etch (including bump) are used interchangeably to refer to the general process of etching dielectric films in the semiconductor manufacturing process
[54] Paragraph 19.44 of Form M1
[55] Paragraph 19.45 of Form M1

three primary product sectors: etch, dry strip and thermal processing. The Parties submitted that Mattson is a relatively recent entrant into the etch market and has already demonstrated significant customer traction and growth.[56]

43. However, third-parties[57] commented that, generally, it would be quite difficult for a manufacturer of one specific semiconductor equipment to switch and enter into the manufacture and sale of another type of semiconductor equipment. This is due to the high expertise, different innovation and technology required to manufacture this equipment. One of the third-parties commented that there is also a need for sufficient lead time to establish and build a relationship with customers where a manufacturer may wish to sell a different type of semiconductor equipment.[58]

(b) Geographic Market

(i) Parties' submissions

44. The Parties submitted that there are many elements pointing to a worldwide market for the Overlapping Products. Semiconductor manufacturing equipment suppliers, including AMAT and TEL, have manufacturing facilities throughout the world and may import products into Singapore from a variety of locations, such as Korea and the US.[59] Specifically, in the case of AMAT, AMAT's manufacturing facilities are located in Germany, Italy, India, Israel, Singapore, Switzerland, Taiwan and the US whereas TEL's facilities are in China, Ireland, Japan, Korea, Switzerland and the US.[60]

45. With regard to the geographic market, third-parties[61] have commented that they view the market for the provision of semiconductor manufacturing equipment as global. That is, for customers of semiconductor manufacturing equipment, they are able to procure equipment required on a global basis and, similarly, competitors to the Parties supply semiconductor manufacturing equipment worldwide.

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[56] Paragraphs 19.76 and 19.77 of Form M1

[57] Response to CCS RFI by [✂] dated 14 February 2014. Response to CCS RFI by [✂] dated 19 February 2014. Response to CCS RFI by [✂] dated 18 February 2014. Response to CCS RFI by [✂] dated 4 March 2014

[58] Response to CCS RFI by [✂] dated 3 March 2014

[59] Paragraph 19.75 of Form M1

[60] Paragraph 19.79 of Form M1

[61] Response to CCS RFI by [✂] dated 14 February 2014. Response to CCS RFI by [✂] dated 14 February 2014. Response to CCS RFI by [✂] dated 21 February 2014. Response to CCS RFI by [✂] dated 14 February 2014. Response to CCS RFI by [✂] dated 19 February 2014. Response to CCS RFI by [✂] dated 18 February 2014. Response to CCS RFI by [✂] dated 4 March 2014

(ii) CCS's assessment

46. Based on the submissions by the Parties as set out in paragraphs 18 and 34 and above and feedback by third-parties, CCS is in agreement with the relevant product market definitions by the Parties.

47. However, as highlighted in paragraphs 21 to 24, there are no or extremely minimal overlaps by the Parties in Singapore in the Overlapping Products with the exception of dielectric etch (including bump). Also, as highlighted in paragraph 23, while CCS notes that the Parties could be potential competitors in these Overlapping Products and that there will be a loss of a potential supplier to the customers post-Transaction, CCS is of the view that there is a multitude of semiconductor equipment suppliers worldwide and that customers, whether in Singapore or elsewhere, would be able to switch to without any undue impediments. This would mitigate the loss of potential competition between the Parties post-Transaction.

48. CCS is therefore of the view that the relevant market of concern for the purpose of this notification is the market for the worldwide manufacture and supply of dielectric etch (including bump) equipment(s) to Singapore.

VII. Market Structure

Background

49. At any one time, a semiconductor manufacturing equipment supplier will be selling products at a number of different process nodes[62] and seeking to develop products for future nodes. Semiconductor manufacturing equipment suppliers compete to expand their business with existing customers and/or to gain new business with each process node.[63] The Parties submit that beyond AMAT and TEL, there are numerous other suppliers of semiconductor manufacturing equipment, of which Lam, ASML Holding N.V. ("ASML") and KLA-Tencor Corporation ("KLA-Tencor") are the largest.[64]

50. The Parties submitted that semiconductor manufacturing equipment suppliers such as AMAT and TEL sell semiconductor equipment to semiconductor manufacturers, including integrated device manufacturers ("IDM"s), which handle both design and manufacturing, and foundries, which are

[62] Process nodes refer to the size of the features of a silicon chip. Thus, 20 nanometer (nm) process nodes refer to features that are 20nm in size. Process nodes have been shrinking as semiconductors get smaller.
[63] Paragraphs 19.30 and 19.31 of Form M1
[64] Paragraph 24.1 of Form M1

manufacturing-only customers. Intel Corporation ("Intel"), Taiwan Semiconductor Manufacturing Company Limited ("TSMC") and Samsung Electronics Co., Ltd. ("Samsung") are the "Big Three" semiconductor manufacturers, accounting for more than 50 per cent of total semiconductor manufacturing equipment sales globally.[65]

51. AMAT may enter into distributorship agreements for certain semiconductor manufacturing equipment, however, majority of products are sold by AMAT directly. TEL has a distributorship agreement with [✂][66]. Yet, it was submitted that the proportion of sales attributed to distributorship agreements is negligible.[67]

Procurement process

52. The Parties submitted that customers typically require a thorough review of new tools. The purchase process for next-generation tools can take several years.[68] The process includes initial discussions of tool requirements, design and development work at the semiconductor manufacturing equipment supplier , selection of a Development Tool of Record ("DTOR") by the semiconductor manufacturer, selection of a Process (Production) Tool of Record ("PTOR") by the semiconductor manufacturer, and ramping up of the new process to High Volume Manufacturing. Semiconductor manufacturers typically introduce a new process in one wafer fabrication plant and then use the same tool set in additional wafer fabrication plants. Intel's famous "copy exact" process of copying a successful process implementation at an initial wafer fabrication plant to subsequent wafer fabrication plants is an example.[69]

53. Typically, the purchase process is as follows.[70]

(i) a customer will either indicate to a supplier that it is interested in a certain area of technology or a supplier will try to market its unsolicited technology to customers;

(ii) customers typically evaluate new tools every two years as the process nodes become smaller. If a customer has recently purchased tools for a given process node, it may not be interested in new technology. As a

[65] Paragraph 18.5 of Form M1
[66] Paragraph 18.4 of Form M1
[67] See Parties' response dated 2 May 2014 to CCS's RFI question 31
[68] Paragraph 19.82 of Form M1
[69] Paragraph 24.3 of Form M1
[70] Paragraph 24.4 of Form M1 and information provided during meeting with Parties on 25 July 2014

result, suppliers will sometimes offer tools to customers free of charge to induce them to test their product, with no commitment for the customer to buy the tool;

(iii) when a customer actively seeks out a technology solution, either for an existing node or for a new process node, multiple suppliers are likely to try to bid for the business. Customers typically evaluate no more than two DTORs. Despite the fact that suppliers may be willing to provide their tool for free, testing more than two DTORs is costly to the customer. Customers subject new tools to rigorous testing because there is no established usage data explaining the wear and tear on the tool and the tool's useful life;

(iv) although equipment suppliers may provide cost estimates during the initial engagement steps, detailed pricing and other commercial terms of sales are generally not negotiated until after a tool has been selected as a DTOR or PTOR, which makes it more difficult for semiconductor equipment suppliers with broad portfolios to bundle products together; and

(v) whilst being selected as the DTOR is a significant step towards being selected as the PTOR, the semiconductor manufacturing equipment supplier is not guaranteed the PTOR. After the customer tests the DTORs, it then selects the PTOR. A PTOR is the tool that a customer decides to buy over the life of a process node, which is typically two years. Customers typically select only one PTOR, and rarely switch tools mid-node.

(a) Market shares and market concentration

(i) Parties' submissions

54. In line with the Parties' submission that the relevant geographic market is worldwide, the Parties submitted the Gartner[71] market share data from 2010 to 2013. While the Parties have recognised that there are limitations to the Gartner data, they submitted that it is the best and only reliable source of market share information available in the semiconductor manufacturing

[71] The following information is to be found on Gartner's website: "Gartner, Inc. (NYSE: IT) is the world's leading information technology research and advisory company which delivers the technology-related insight necessary for market players. Through the resources of Gartner Research, Gartner Executive Programs, Gartner Consulting and Gartner Events, they work with every of their client to research, analyze and interpret the business of IT within the context of their individual role. Founded in 1979, Gartner is headquartered in Stamford, Connecticut, USA, and has 6,400 associates, including more than 1,480 research analysts and consultants, and clients in 85 countries."

industry. Similarly, most of the third-party respondents have also relied on Gartner data when responding to CCS's information requests.

55. The Parties submitted the worldwide shares of competitors (by value) for the whole semiconductor manufacturing equipment industry, as extracted from the Gartner report for 2013.

Table 2: Market shares for the worldwide supply of semiconductor equipment (by value) to global customers

Company	**Worldwide Market Shares (%)**			
	2010	**2011**	**2012**	**2013**
TEL	[10-20]	[10-20]	[10-20]	[0-10]
AMAT	[10-20]	[10-20]	[10-20]	[10-20]
Merged entity	**[20-30]**	**[20-30]**	**[20-30]**	**[20-30]**
ASML	[10-20]	[10-20]	[10-20]	[10-20]
Lam	[0-10]	[0-10]	[0-10]	[0-10]
KLA-Tencor	[0-10]	[0-10]	[0-10]	[0-10]
DNS	[0-10]	[0-10]	[0-10]	[0-10]
Advantest	[0-10]	[0-10]	[0-10]	[0-10]
HHT	[0-10]	[0-10]	[0-10]	[0-10]
Nikon	[0-10]	[0-10]	[0-10]	[0-10]
ASM International N.V. ("ASM")	[0-10]	[0-10]	[0-10]	-
Others	[30-40]	[30-40]	[30-40]	[30-40]
Total market shares	**100.0**	**100.0**	**100.0**	**100.0**
Pre-merger CR3	**[30-40]**	**[30-40]**	**[30-40]**	**[40-50]**
Post-merger CR3	**[40-50]**	**[40-50]**	**[40-50]**	**[50-60]**

Source: Parties' Form M1 and RFI submissions, based on Gartner data 2012/2013

Table 3: Market shares for the worldwide supply of semiconductor equipment (by value) to customers in the "Other Asia Pacific" region

Company	**Market Shares in Other Asia Pacific Region (%)**		
	2011	**2012**	**2013**
TEL	[0-10]	[0-10]	[0-10]
AMAT	[0-10]	[0-10]	[10-20]
Merged entity	**[10-20]**	**[10-20]**	**[10-20]**
Lam	[0-10]	[10-20]	[10-20]
Teradyne	[10-20]	[10-20]	[10-20]
ASML	[10-20]	[0-10]	[0-10]
KLA-Tenor	[0-10]	[0-10]	[0-10]
ASM	-	-	[0-10]

Kulicke & Soffa	[0-10]	[0-10]	[0-10]
Besi	[0-10]	[0-10]	[0-10]
DNS	[0-10]	[0-10]	[0-10]
Others	[40-50]	[50-60]	[20-30]
Total market shares	**100.0**	**100.0**	**100.0**
Pre-merger CR3	**[30-40]**	**[20-30]**	**[30-40]**
Post-merger CR3	**[40-50]**	**[30-40]**	**[40-50]**

Source: Parties' Form M1 and RFI submissions, based on Gartner data 2012/2013

56. The market shares data for the provision of dielectric etch (including bump) specifically is set out in Tables 4 and 5 below.

Table 4: Market shares for worldwide supply of dielectric etch (including bump) to global customers

Dielectric Etch (including bump)				
Company	**Worldwide Market Shares (%)**			
	2010	**2011**	**2012**	**2013**
TEL	[40-50]	[60-70]	[60-70]	[40-50]
AMAT	[10-20]	[0-10]	[0-10]	[0-10]
Merged entity	**[50-60]**	**[60-70]**	**[60-70]**	**[50-60]**
Lam	[30-40]	[20-30]	[20-30]	[30-40]
HHT	[0-10]	[0-10]	[0-10]	[0-10]
SEMES	[0-10]	[0-10]	[0-10]	[0-10]
Mattson	[0-10]	[0-10]	[0-10]	[0-10]
Other Companies	[0-10]	[0-10]	[0-10]	[0-10]
Total market shares	**100.0**	**100.0**	**100.0**	**100.0**
Pre-merger CR3	**[90-100]**	**[90-100]**	**[90-100]**	**[90-100]**
Post-merger CR3	**[90-100]**	**[90-100]**	**[90-100]**	**[90-100]**

Source: Parties' Form M1 and RFI submissions, based on Gartner data 2012/2013

57. The Parties submitted that they do not have information on Singapore market share estimates by value. The Parties provided the best available information, using "Other Asia Pacific" data by Gartner, which includes Singapore (and excludes China, Japan, South Korea and Taiwan), for the Overlapping Products.[72] Based on the Parties' observations, the Parties expect that the main countries included in the "Other Asia Pacific" classification would be Australia, Hong Kong, India, Indonesia, Malaysia, New Zealand, Philippines, Singapore and Thailand.[73]

[72] Paragraph 22.1 of Form M1
[73] See Parties' response dated 7 March 2014 to CCS's RFI question 4

Table 5: Market shares for worldwide supply of dielectric etch (including bump) to customers in the "Other Asia Pacific" region

Dielectric Etch (including bump)				
Company	**Market Shares in Other Asia Pacific Region (%)**			
	2010	**2011**	**2012**	**2013**
TEL	[40-50]	[30-40]	[10-20]	[0-10]
AMAT	[10-20]	[0-10]	[0-10]	[0-10]
Merged entity	**[50-60]**	**[40-50]**	**[20-30]**	**[0-10]**
Lam	[40-50]	[50-60]	[70-80]	[80-90]
Mattson	[0-10]	[0-10]	[0-10]	[0-10]
Other Companies	[0-10]	[0-10]	[0-10]	[0-10]
Total market shares	**100.0**	**100.0**	**100.0**	**100.0**
Pre-merger CR3	**[90-100]**	**[90-100]**	**[90-100]**	**[90-100]**
Post-merger CR3	**[90-100]**	**[90-100]**	**[90-100]**	**[90-100]**

Source: Parties' Form M1 and RFI submissions, based on Gartner data 2012/2013

58. As a proxy, the Parties also submitted the percentage of each Southeast Asia country's contribution of turnover to AMAT (excluding Australia) for the financial year 2012.[74]

[✂]

59. CCS notes that Singapore contributes a significant [✂] of AMAT's Southeast Asia total turnover. Accordingly, CCS is of the view that the Gartner "Other Asia/Pacific" market shares data would be the best available proxy of the Parties' market shares in Singapore. CCS is mindful that the use of this proxy may understate or overstate the actual market shares in Singapore.

60. The Parties further submitted that the semiconductor manufacturing equipment industry has also seen a trend of consolidation. For example, Lam, a major competitor and supplier of WFE and services, acquired Novellus, another WFE supplier, in 2011; and ASML, a major competitor and supplier of WFE, completed its acquisition of Cymer, Inc., a leading provider of lithography light sources used by chipmakers to manufacture advanced semiconductor devices, in 2013.[75]

[74] See Parties' response dated 7 March 2014 to CCS's RFI question 3
[75] Paragraphs 18.10 and 18.11 of Form M1

(ii) Feedback from third-parties

61. Third-party feedback[76] indicated that the merger would be between the first and third ranked SPE companies and the combined market share of the merged entity would be more than 25 percent. Further, the combined scale would be almost double that of the second largest supplier, ASML, post-merger. More specifically, [✂] stated that in the market for etch products, competition would definitely be reduced given that the merger would combine resources and operations of two big players in that market.[77]

62. [✂] also indicated that the SPE industry is characterised by high levels of market concentration – irrespective of how exactly the relevant markets are defined.[78]

(iii) CCS's assessment

63. As set out in paragraph 16 above, CCS is unlikely to intervene in a merger situation unless:

a. The merged entity will have a market share of 40% or more; or

b. The merged entity will have a market share between 20% to 40% and the post-merger CR3 is 70% or more.

64. CCS notes from Table 2 that for the worldwide semiconductor equipment manufacturing industry as a whole, the merger will combine the resources and operations of the joint-first and joint-fourth largest competitors, by value. This is reiterated by several of the third-parties surveyed. However, CCS also notes that neither of the indicative thresholds has been met, which may suggest that there might not be any significant competition concerns. The merged entity will have a combined worldwide market share of [20-30]% with a post-Transaction CR3 of [50-60]%.

65. Notwithstanding the above, given that the Singapore Overlapping Product is that of dielectric etch (including bump), CCS is of the view that the effects of the merger on Singapore should be considered in light of the specific market shares for said product as detailed in Tables 4 and 5.

[76] Response to CCS RFI by [✂] dated 12 February 2014, Response to CCS RFI by [✂] dated 14 February 2014, Response to CCS RFI by [✂] dated 18 February 2014 and Response to CCS RFI by [✂] dated 20 February 2014

[77] Response to CCS RFI by [✂] dated 18 February 2014

[78] Response to CCS RFI by [✂] dated 21 February 2014

66. For the Other Asia Pacific market shares data in Table 5, CCS notes that the merged entity will have a combined market share of [0-10]% with a post-Transaction CR3 of [90-100]%. While the merged entity's market share falls below the indicative thresholds as stated in the *CCS Guidelines on the Substantive Assessment of Mergers*, CCS notes that post-Transaction, there would only be three current existing players in the dielectric etch (including bump) equipment market in Other Asia Pacific with Lam the market leader with [80-90]% of the market in 2013.

67. However, as highlighted earlier, CCS is of the view that the geographic market for semiconductor equipment manufacturing is worldwide, and that would mean the other market players which are present worldwide i.e. market players listed in Table 4[79], would also be able to pose competitive constraints on the current market players i.e. the merged entity, Lam and Mattson as listed in Table 5.

68. CCS also notes that market shares fluctuate quite widely between years, especially in the dielectric etch (including bump) market. Specifically, CCS notes from Table 3 that TEL had an approximate [10-20]% drop in market share from 2012 to 2013 in the worldwide region which was almost completely captured by Lam. Similarly, Table 4 indicates that in the Other Asia Pacific region, TEL and AMAT both lost market share of about [10-20]% to Lam and Mattson collectively. This seems to suggest that the market can be quite competitive.

(b) Barriers to entry and expansion

69. Generally, entry by new competitors or expansion by existing competitors may be sufficient in likelihood, scope and time to deter or defeat any attempt by the merger parties or their competitors to exploit the reduction in rivalry flowing from the Transaction (whether through coordinated or non-coordinated strategies).[80]

(i) The Parties' submission

70. In general, the Parties have made submissions that there are relatively low barriers to entry.

Capital expenditure

[79] HHT, SEMES and other companies
[80] Paragraph 7.2 of *CCS Guidelines on Substantive Assessment of Mergers*

71. The Parties submitted that it is difficult to estimate with any precision the total cost of entry into the relevant markets, as the cost may vary based on the specific product, and product segment being targeted. Moreover, in addition to entirely new entries, there are also frequent expansions by existing players into new product segments. The Parties observe that the total cost of entry is unlikely to be prohibitively high or pose any barrier to entry, which is illustrated by the fact that there have been a number of new entrants into the semiconductor equipment industry, in particular multiple manufacturers in Asia such as Advanced Micro-Fabrication Equipment, Inc. ("AMEC"), Wonik IPS Co., Ltd., SEMES and TES Co., Ltd ("TES"). Moreover, customers drive and sponsor new innovation, and encourage suppliers to expand into other areas.[81]

72. Nonetheless, as a general point of reference, from TEL's perspective, the minimum capital required for entering the relevant markets may be approximately as follows, for a new entrant: [✂].[82]

73. More specifically, the capital investment required for dielectric etch (including bump) is broken down to be approximately [✂] for buildings and [✂] for machinery and equipment, which would take about [✂] to recoup.[83]

Expertise

74. The Parties submitted that the specific expertise and experience required to manage and run the necessary manufacturing facilities include:[84]

    a. prior site management experience and understanding of the basic functions of operations management;

    b. a basic understanding and experience with planning, procurement, logistics, manufacturing engineering (specifically, line set up as well as floor support or troubleshooting), quality management or process discipline; and

    c. a fundamental knowledge of assembly and test.

75. It was further submitted that the time required and ease or difficulty of obtaining the required experience and capabilities would depend upon the

[81] Paragraph 26.1 of Form M1
[82] Paragraph 26.3 of Form M1
[83] See Parties' response dated 22 July 2014 to CCS's RFI question 28
[84] See Parties' response dated 17 June 2014 to CCS's RFI question 26

scope and scale of the manufacturing operations.[85] As an indication, the AMAT greenfield factory in Singapore took approximately [✂] to be fully operational; whereas the TEL manufacturing facility in Taiwa, Japan took approximately [✂] to become fully operational.[86]

Regulation

76. The Parties submitted that they are unaware of regulations or requirements in Singapore for setting up semiconductor equipment manufacturing facilities which would be different from any other type of manufacturing operations. Some requirements are verification testing and environmental control and abatement requirements, which are not unique.[87]

77. The Parties also submitted that they are unaware of any restrictions on the importation of any semiconductor manufacturing equipment for semiconductor manufacturing in Singapore. Outside of Singapore, etch systems (such as the *Tactras*, *Telius*, and *UNITY* platforms) are subject to export controls (catch-all controls) in the United States. Export controls also apply in Japan to certain semiconductor manufacturing equipment. Export licenses for such semiconductor manufacturing equipment are required to export such equipment, in both the United States and Japan.[88]

(ii) Feedback from third-parties

78. Some industry feedback[89] indicated that it is difficult to enter into the sale of products that they were not originally producing, due to the difficulty in obtaining the expertise required within a short period of time. [✂] indicated that the sale and/or manufacture of the Overlapping Products mentioned require high expertise which would be difficult to acquire[90]; and [✂] stated that companies would, generally, only have a chance to enter when the device technology for that particular function dramatically changes[91].

79. [✂] stated that at least 10% of sales revenue would need to be invested in research and development to prepare for entry into a new market. Further, it could take 10 years or more to complete the required research and

[85] See Parties' response dated 17 June 2014 to CCS's RFI question 26
[86] See Parties' response dated 17 June 2014 to CCS's RFI question 25
[87] See Parties' response dated 17 June 2014 to CCS's RFI question 29
[88] Paragraph 18.7 of Form M1
[89] Response to CCS RFI by [✂] dated 14 February 2014, Response to CCS RFI by [✂] dated 20 February 2014 and Response to CCS RFI by [✂] dated 26 February 2014
[90] Response to CCS RFI by [✂] dated 14 February 2014
[91] Response to CCS RFI by [✂] dated 20 February 2014

development of the equipment and build a relationship with customers in the market.[92]

80. Overall, it was indicated by the respondents that potential new entrants into the production of the Overlapping Products would be unlikely. However, CCS also notes that there is a multitude of existing global suppliers that could readily supply to Singapore.

(iii) CCS's assessment

81. Firstly, CCS notes that there does not appear to be any regulations in place in Singapore that makes entry into the relevant market particularly cumbersome. Further, an entrant need not be present in Singapore physically for them to enter into the Singapore market, given that the supply of semiconductor manufacturing equipment is worldwide. While costs of entry are fairly significant, it is indicated that these can be recouped within the first [✂] of entry.

82. Yet, it appears that the expertise required for entry into the relevant markets can pose difficulty to potential entrants.

83. On balance, CCS is of the view that the barriers to entry are not insurmountable but significant resources and time would have to be invested by any new potential entrant before they can be considered a significant competitive constraint.

(c) Countervailing buyer power

(i) Parties' submission

84. As indicated above, the Parties submitted that semiconductor manufacturing equipment suppliers such as AMAT and TEL sell semiconductor equipment to semiconductor manufacturers, including IDM, which handle both design and manufacturing, and foundries, which are manufacturing-only customers. Intel, TSMC and Samsung semiconductor manufacturers, accounting for more than 50 per cent of total WFE sales globally.[93]

85. It was further submitted that, [✂] indicating that the vast majority of TEL's and AMAT's semiconductor equipment sales are made to relatively few

[92] Response to CCS RFI by [✂] dated 26 February 2014
[93] Paragraph 18.5 of Form M1

customers.[94] In Singapore, the Parties submitted that their customers in the market for dielectric etch (including bump) are [✂] and [✂].[95]

86. There has also been an observed trend of consolidation by customers. For example, Micron acquired Elphida Memory, Inc. ("Elphida") in 2012.[96]

Ease of switching

87. The Parties submitted that there are no long-term contracts [✂].[97] The long-term contracts that exist only set out general terms and conditions, specifically:[98]

a. AMAT [✂]

b. For TEL, [✂]

88. The Parties submitted that customers frequently switch to, or threaten to switch to, other suppliers. Some examples of switching behavior by customers include:[99]

a. [✂]; and

b. [✂]

89. The Parties submitted that, often, customers will qualify at least two tools for high volume manufacturing (i.e. post-testing of DTORs) so that they can threaten to switch suppliers, should the suppliers not provide the lowest possible price.[100]

Setting of industry standards

90. Semiconductor Equipment and Materials International, the global industry association serving the manufacturing chain for semiconductors and other industries, has defined a standard hardware interface for SPE tools that, as a practical matter, is and must be followed within the industry. Through this, the buyers' market has effectively excluded semiconductor manufacturing

[94] Paragraph 32.2 of Form M1
[95] See Annexes 3 and 4 of Parties' response dated 7 March 2014 to CCS's RFI
[96] See Parties' response dated 17 June 2014 to CCS's RFI question 32
[97] See Parties' response dated 2 May 2014 to CCS's question 17
[98] See Parties' response dated 7 March 2014 to CCS's RFI question 18
[99] See Parties' response dated 2 May 2014 to CCS's RFI question 17
[100] See Parties' response dated 17 June 2014 to CCS's RFI question 22

equipment suppliers' ability to entrench themselves by designing tools incompatible with tools of other suppliers.[101]

Customer-sponsored new entry

91. Customers can sponsor and/or facilitate new entrants through strategic investments, joint development, or modifications in the fabrication process in order to qualify alternative suppliers for high volume manufacturing to exert pricing influence on existing suppliers.[102]

92. Some instances of customer sponsorship include:

    a. ASML, the leading player in lithography, entered into risk sharing agreements for its 450 mm and EUV development projects with three of its largest customers: Intel, TSMC, and Samsung. These three customers collectively committed to contribute €1.38 billion (approximately S$2.37 billion) toward ASML's 250 mm and next-generation EUV development projects[103];

    b. Intel has been a major sponsor for ASM International N.V. in atomic layer deposition technology and HHT in etch technology;[104] and

    c. Samsung has been a major supporter and sponsor for local entrants in Korea such as SEMES, Jusung, PSK Inc. and Wonik IPS. Other Korean suppliers such as TES and AMEC have also received support from local customers like SK Hynix and TSMC respectively.[105]

(ii) Feedback from third-parties

93. [✂] confirmed that there are only three main customers for semiconductor equipment manufacturing, being Intel, Samsung and TSM, thus, market concentration on the buyer-side is high.[106] Several competitors[107] also concurred that customers have strong bargaining power due to their scale, and the trend of consolidation of customers.

[101] See Parties' response dated 2 May 2014 to CCS's RFI question 17
[102] See Parties' response dated 17 June 2014 to CCS's RFI question 22
[103] Paragraph 19.80 of Form M1
[104] See Parties' response dated 17 June 2014 to CCS's RFI question 34
[105] See Parties' response dated 17 June 2014 to CCS's RFI question 34
[106] Response to CCS RFI by [✂] dated 14 February 2014
[107] [✂]; Response to CCS RFI by [✂] dated 4 March 2014, Response to CCS RFI by [✂] dated 14 February 2014 and Notes of Teleconference between CCS and [✂], 21 February 2014

94. In terms of ease of switching, most of the market feedback collated stated that there were no long-term contracts. [✂] alluded to the existence of long-term contracts but said that these were for non-pricing terms and conditions, and exact prices would be negotiated over time, corroborating the information received from the merging parties.[108]

95. [✂] stated that customers can easily switch to other manufacturers for processes where multiple vendors have been qualified.[109] However, it has also been acknowledged that, generally, there is a long lead time and huge costs incurred to qualify a new supplier.[110] [✂] indicated that substantial resources would have to be invested to collaborate with new suppliers and the process could take several years due to the lengthy development and qualification processes. Further, there are certain products for which there is only one credible supplier, for example, photoresist processing (track) for which TEL has 89 percent worldwide market share; and epitaxy for which AMAT has 89 percent worldwide market share.[111]

96. [✂] has also raised concern that industry standards are influenced by particular industry groups within which the merged entity has a presence. Following the Transaction, the combined company could be able to wield the additional market power obtained to unduly influence the industry standards/specifications for products to favour its own technology.[112]

97. None of the customers surveyed indicated that sponsoring new entry is a part of their business plan and indicated that they were unlikely to undertake such sponsorship given that they either had no technological know-how or it is not part of their core competencies.[113]

(iii) CCS's assessment

98. From the Parties' submissions and third-party feedback, there is indication that the customers of semiconductor equipment companies are large and there is little evidence to suggest that there are any long-term contracts that prevent customers from switching to the use of the equipment of other competitors as there are multiple suppliers. Large customers or industry

[108] Response to CCS RFI by [✂] dated 14 February 2014
[109] Response to CCS RFI by [✂] dated 12 February 2014, Response to CCS RFI by [✂] dated 14 February 2014 and Response to CCS RFI by [✂] dated 14 February 2014
[110] Response to CCS RFI by [✂] dated 12 February 2014, Response to CCS RFI by [✂] dated 21 February 2014 and Response to CCS RFI by [✂] dated 21 February 2014
[111] Response to CCS RFI by [✂] dated 21 February 2014
[112] Response to CCS RFI by [✂] dated 14 February 2014
[113] Views from [✂]

groups also appear to be in position to set industry standards that the SPE manufacturers have to follow. This suggests that customers would have significant bargaining power.

99. However, many industry players made reference to the long qualification process for SPE and indicated that customer's bargaining power is only strengthened if they have multiple vendors qualified for a single process. In addition, there are some specific processes other than the Overlapping Products where they are no viable alternatives to the merging parties' products.

100. On balance, CCS is of the view that there is relatively strong countervailing buyer power which would pose a competitive constraint on the merger parties.

VIII. Competition Assessment

(a) Non-coordinated effects

101. Non-coordinated effects may arise where, as a result of the Transaction, the merged entity finds it profitable to raise prices (or reduce output or quality) because of the loss of competition between the merged entities.[114] Other firms in the market may also find it profitable to raise their prices because the higher prices of the merged entity's product will cause some customers to switch to rival products, thereby increasing demand for the rivals' products.[115]

(i) Parties' submission

102. The Parties submitted that the Transaction is unlikely to result in non-coordinated effects due to the following factors:

(i) limited product overlaps between the Parties;
(ii) limited competition between the Parties for overlaps;
(iii) multitude of existing and potential competing suppliers;
(iv) structure of demand;
(v) low barriers to entry; and
(vi) strong countervailing buyer power.

[114] Paragraph 6.3 of *CCS Guidelines on the Substantive Assessment of Mergers*
[115] Paragraph 6.3 of *CCS Guidelines on the Substantive Assessment of Mergers*

Limited product overlaps between the Parties[116]

103. The Parties submitted that although they currently offer several overlapping products, the vast majority of the products affected by the Transaction are non-overlapping products. The Parties also submitted that there is limited competition between the Parties for the Overlapping Products.

104. The Parties further submitted that there are no potential portfolio or conglomerate effects as:

a. the Parties' customers are concentrated, large and powerful, and who are capable of exercising countervailing buyer power. Such customers would be capable of instituting procurement policies to protect their interests and to constrain the ability of the merged entity to engage in anticompetitive conduct;

b. customers choose the "best of breed" solutions for each step in the manufacturing process. Semiconductor manufacturers make independent and unrelated purchasing decisions for each of the separate steps of the manufacturing process based on their technical requirements. They make purchases based on the individual merit of each tool through a competitive process to build a complete manufacturing line. This is especially so, given the unrelenting pace of technology advancements that characterise the industry. The notion that customers would purchase a sub-optimal solution for a particular application simply because it is part of a mixed bundle is extremely unlikely, not only on the merits but also practically, given the steps involved in the equipment purchasing process, and when pricing discussions occur during that process;

c. numerous other large semiconductor equipment suppliers will continue to exert competitive pressure on the merged entity post-Transaction. These include Lam, ASML, KLA-Tencor, DNS, ASM, and HHT, among others; and

d. the Parties observe that semiconductor manufacturing equipment suppliers with broader product lines have not "dominated" individual product categories. In addition to the larger semiconductor equipment suppliers, there are numerous competitors with more discrete product lines in several product areas. The success of these specialty firms demonstrates that they can, and do, successfully

[116] Paragraph 34.1 of Form M1

compete against larger suppliers offering a wider portfolio of products. This is direct evidence that a portfolio of products is not necessary to compete effectively. Some examples of products with significant market share for smaller vendors include sputtering (PVD) for bump processing (specifically, Ulvac and Oerlikon have a [40-50]% and [20-30]% market share respectively) and CMP (specifically, Ebara has a market share of [30-40]%. The Parties are not aware of any evidence that the larger companies that currently possess significant portfolios—whether on a standalone basis or following consolidations—have "foreclosed" smaller companies from the market.

Limited competition between the Parties for product overlaps[117]

105. Specifically for the Singapore Overlapping Product, the Parties submitted that that they compete to a limited extent for dielectric etch tools. In particular, AMAT has low market share, and the Parties focus on different application customers.

106. TEL has three etch platforms: *Tactras*, *Telius*, and *UNITY*. *Tactras* and *Telius* are designed for 300 mm wafers, and UNITY is designed for 200 mm wafers. Of these, *Telius* and *UNITY* are old technologies, whereas TEL is only developing (and most fabrication customers are only just purchasing) new chambers for the *Tactras* platform. TEL offers a number of capacitively coupled plasma ("CCP") chambers on the *Tactras* that serve dielectric etch applications, including *Vigus*, *Vesta*, *DRM*, and *SCCM*. TEL's dielectric etch chambers [✂].

107. AMAT offers various inductively coupled plasma ("ICP") and CCP etch tools that serve dielectric etch applications, including its *Producer*, *Enabler*, *Avatar*, and *eMax* etch tools. In contrast to TEL, AMAT [✂].

108. The Parties submitted that AMAT has, generally, been a weak competitor in dielectric etch, and has failed to gain any significant customer traction. As a result, AMAT views dielectric etch [✂]. Currently, [✂] dielectric etch applications that AMAT targets [✂], which account for a small portion of the overall dielectric etch area. AMAT's tools in this space are older and thus may be of even less ongoing competitive significance. AMAT views its closest competitors for these applications to be [✂]. TEL is not a significant competitor for supplying equipment for these applications.

[117] Paragraph 34.3 of Form M1 and information provided during meeting with Parties on 25 July 2014

109. TEL is a leader in dielectric etch, and consequently, [✂]. TEL views its closest competitor [✂].

Multitude of existing and potential competing suppliers[118]

110. The Parties submitted that for the dielectric etch (including bump) market, it is served by numerous competitors, including Lam, HHT, Mattson, SEMES, Jusung, SPTS Technologies Limited ("SPTS") and AMEC.

111. Lam, the overall leader in etch, and the number two competitor in dielectric etch according to Gartner, has tool placement at virtually every major customer for dielectric etch applications.

112. HHT has placed tools at Intel for dielectric etch applications, as well as at TSMC, SK Hynix, and Elpida for other etch applications.

113. AMEC is a Chinese-based supplier of advanced micro-fabrication equipment to the global semiconductor industry. AMEC's business focuses exclusively on etch and provides multiple tools that serve various etch applications. AMEC has placed tools at TSMC, SK Hynix, Winbond, Huali, SMIC, and potential other customers for dielectric etch applications.

114. Mattson is a US-based supplier that offers two primary etch tools that use ICP technology, including its Alpine system, which targets dielectric etch applications. Mattson is a relatively recent entrant into the etch market, and has already demonstrated significant customer traction and growth. According to Mattson, its etch tools are used by DRAM, NAND, and Foundry/Logic customers with placements with at least six leading semiconductor manufacturers across multiple regions.

115. SEMES is a Korean-based supplier of semiconductor equipment with a global presence.

116. SPTS is a supplier specialising in etch, deposition, and thermal products. SPTS's etch business is based in the U.S. with a global network of sales and service offices. SPTS has been a consistent and strong supplier of quality etch products. According to SPTS, it has an installed base of over 1000 etch modules.

117. Jusung is a Korean-based manufacturer that serves the solar, semiconductor, and display segments. Jusung's dry etcher, Genaon, uses ICP technology and

[118] Paragraphs 34.42 to 34.50 of Form M1

can be used for any etch process, including polysilicon and metal etch applications.

118. Mattson, SEMES, and Jusung are significant competitors with tool placement at TSMC, Samsung, SK Hynix, and potentially other competitors for dielectric etch applications. Lam, HHT, SPTS and AMEC also serve the silicon etch market.

Structure of demand[119]

119. The Parties submitted that semiconductor manufacturers i.e. customers are constantly seeking to improve their device performance, yield, and cost, resulting in dynamic competition to provide the best solutions to meet these needs. Therefore, semiconductor equipment manufacturing is subject to rapid technological change as there is a constant need for improvements in these products. The market for semiconductor equipment manufacturing, as a result, is very dynamic with respect to innovations in products. As such, the market share of a supplier can evolve quickly with a new generation of technology arriving on the market.

Low barriers to entry[120]

120. The Parties submitted that apart from earning new business within process nodes, the transition from a 300 mm wafer to a 450 mm wafer represents a potential greenfield entry and expansion opportunity to suppliers across segments, as the entire industry will need to purchase new tools to handle the larger wafer size. Accordingly, as the industry approaches, and ultimately adopts, 450 mm wafers (anticipated to begin in 2015, and complete by 2019 or 2020), there will be significant competition to maintain and earn customer DTORs and PTORs.

Strong countervailing buyer power[121]

121. As highlighted in paragraphs 84 to 92 above, the Parties submitted that there is strong countervailing buyer power.

(ii) CCS's assessment and conclusion on non-coordinated effects

122. CCS is of the view that given the indicative merger thresholds in the dielectric etch (including bump) for the Other Asia Pacific region (which

[119] Paragraphs 34.56 and 34.57 of Form M1
[120] Paragraphs 34.58 and 34.59 of Form M1
[121] Paragraphs 34.58 and 34.59 of Form M1

includes Singapore) have not been crossed, taking into consideration third-parties' feedback that customers of semiconductor equipment are large and have significant buyer power, and that there are no long term contracts and customers are able to switch to other alternative suppliers, the Parties post-Transaction would likely face sufficient competition constraints in the market for dielectric etch (including bump).

123. Therefore, it can be concluded that the Transaction would unlikely lead to non-coordinated effects that would lead to competition concerns in Singapore.

(b) Coordinated effects

124. A merger may also lessen competition substantially by increasing the possibility that, post-merger, firms in the same market may coordinate their behaviour to raise prices, or reduce quality or output. Given certain market conditions, and without any express agreement, tacit collusion may arise merely from an understanding that it will be in the firms' mutual interests to coordinate their decisions. Coordinated effects may also arise where a merger reduces competitive constraints in a market, thus increasing the probability that competitors will collude or strengthen a tendency to do so.[122]

(i) Parties' submission

125. The Parties submitted that the Transaction will not give rise to coordinated effects in the markets for the Overlapping Products, in view of:

a. the multitude of competing suppliers globally who can provide similar products to semiconductor manufacturers, and who will thereby be able to disrupt any coordinated behaviour; and
b. the strong countervailing buyer power of large semiconductor manufacturers, who will be able to disrupt any coordinated behaviour.

(ii) CCS's assessment and conclusion on coordinated effects

126. On the available evidence, given that customers of semiconductor equipment are large and that there is a multitude of semiconductor equipment suppliers worldwide, in particular in the market for dielectric etch (including bump) which are corroborated by third-parties, CCS concludes that the Transaction does not raise concerns in terms of coordinated effects on competition.

[122] Paragraph 6.7 of *CCS Guidelines on Substantive Assessment of Mergers*

IX. Efficiencies

(i) Parties' submission[123]

127. The Parties have submitted and CCS notes that the merged entity is expected to realise significant operating synergies. In particular, the Parties expect to achieve US$250 million (approximately S$314 million) in annualised run-rate operating synergies by the end of the first year following closing and US$500 million (approximately S$629 million) in run-rate operating synergies by the end of the third year following closing. In addition, they expect to realise meaningful savings as a result of the new corporate structure.

128. Further, with the Parties' combined presence, Eteris will be a global company with access to global talent that can respond to customers' needs anywhere in the world. Eteris will bring together an expansive knowledge-base that can be combined in new ways to provide customers with innovative solutions to improve their device performance, yield, and cost. In addition, Eteris will create a powerful network of field resources that will be able to facilitate a better understanding of customers' needs, in order that Eteris would be able to offer solutions to customers that have valuable and sustainable differentiation.

129. With regard to innovation, the Parties submitted that by bringing together non-overlapping technologies and products, Eteris will create an expanded set of capabilities in precision materials engineering and patterning to solve customers' high-value problems better, faster and at lower costs. In particular, the Parties submitted that there are extensive opportunities to utilise their non-overlapping technologies in etch, deposition, and clean to accelerate the technological development of customers' roadmaps in both semiconductor and display.

130. The Parties also submitted that Eteris will be able to reduce costs in infrastructure areas and increase investment in R&D capacity to develop superior products and meet customer demand for increasingly complex innovations in shorter timeframes.

(ii) CCS's assessment

[123] Paragraphs 12.2 to 12.8 of Form M1

131. CCS notes that claimed efficiencies may be taken into account at two separate points in the analytical framework: first, where they increase rivalry in the market so that no SLC will result from the merger and second, efficiencies can be taken into account where they do not avert a SLC, but will nevertheless bring about lower costs, greater innovation, greater choice or higher quality and be sufficient to outweigh the detriments to competition caused by the merger in Singapore.

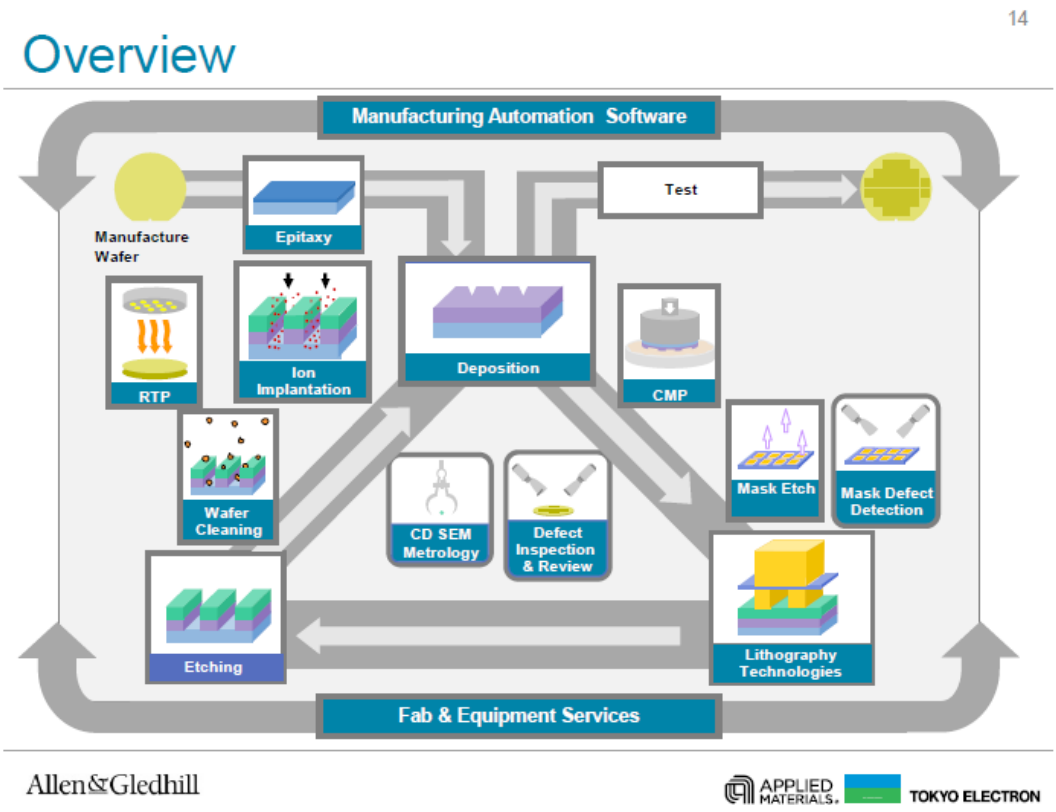
132. Given that the above competition assessment did not point to a SLC, CCS is of the view that it is not necessary to make an assessment on the claimed efficiencies by the Parties.

X. Conclusion

133. For the reasons above and based on the information available, CCS assesses that the Transaction will not lead to SLC concerns and accordingly will not infringe the section 54 prohibition.

Toh Han Li
Chief Executive
Competition Commission of Singapore

Annex A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Overview
Manufacturing Automation Software
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Epitaxy
Test
RTP
Ion Implantation
Deposition
CMP
Wafer Cleaning
CD SEM Metrology
Defect Inspection & Review
Mask Etch
Mask Defect Detection
Etching
Lithography Technologies
Fab & Equipment Services
Allen&Gledhill
APPLIED MATERIALS
TOKYO ELECTRON