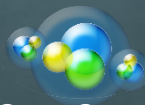




Electronics Materials Information



TECHCET Critical Materials: QUARTERLY UPDATE

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Market Segment (1)

- 🌐 The momentum started in 2H2016 has continued into 2017 with 1H17 up sequentially on 2H16 by 20.8% to \$190.5 B USD* putting this year on pace for a record year (\$397B USD)*, noting that 2Q17 is up sequentially 5.8% versus 1Q17 and growth continues
- 🌐 Although unit shipments declined YoY in 2016 to 868.6B**, they are projected to reach 950 B in 2017 showcased by strong sensor growth and essential components for consumer electronics (logic – special purpose & app. spec., analog and flash memory)
- 🌐 Silicon wafer unit shipments*** have posted their 6th consecutive sequential growing reaching another record at 2,978 MSI in 2Q17 (up 4.2% and 10.1% QoQ, YoY respectively)

Source: * SIA Aug 2017, ** IC Insights Mar 2017, *** SEMI SMG Jul 2017

Market Segment (2)

- 🌐 Semi revenue is being bolstered by strong DRAM price appreciation, having increased from Q316 by approximately 40% for key categories
- 🌐 After a slight aggregate decline in 2016, silicon wafer pricing has rebounded in 2017, up for some 300 mm customers / products by estimates in the range of 20 – 30% through 3Q17, contributing to strong earnings reports and financial performances by suppliers
- 🌐 Lagging 300 mm in price appreciation, 200 mm is now experiencing marked increases and in some instances, are exceeding the relative growth of the larger diameter wafer
- 🌐 Market fears concerning shortages in this critical material have led major silicon wafer customers to negotiate extended / multi-year contracts with suppliers in addition to pre-payment of capex to bolster certain product (leading-edge)

Financials (Apr 1– Jun 30)

Siltronic

- CY Q2 2017 - Net Sales 23.3% YoY, 9.7% QoQ
- CY Q2 2017 - EBITDA 107.1% YoY, 37.2% QoQ

As Reported
No Conversion

Shin Etsu Handotai (S E H)

- FY Q1 2018 - Net Sales 14.2% YoY, 7.5% QoQ
- FY Q1 2018 - EBIT 44.9% YoY, QoQ 20.1%

SUMCO

- CY Q2 2017 - Net Sales 23.9% YoY, 6.2% QoQ
- CY Q2 2017 – EBITDA 87.8% YoY, 10.8% QoQ

GlobalWafers

- CY Q2 2017 - Net Sales 187% YoY*, 5.9% QoQ

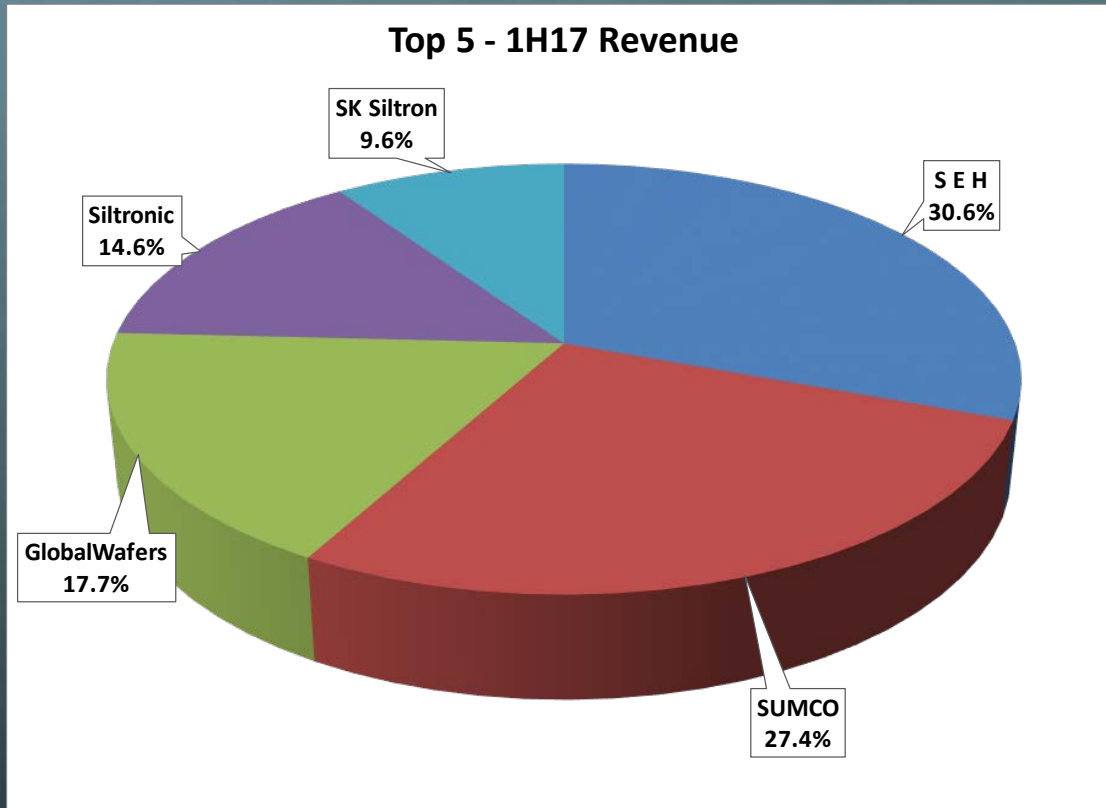
LG Siltron

- CY H1 2017 – Net Sales 6.4% YoY, 1.2% HoH**

**Dramatic
improvements in
sales and profits are
driven across the
board by strong
demand and rising
prices**

* Includes SunEdison gains ** TECHCET estimate

Top 5 Market Leaders (1)



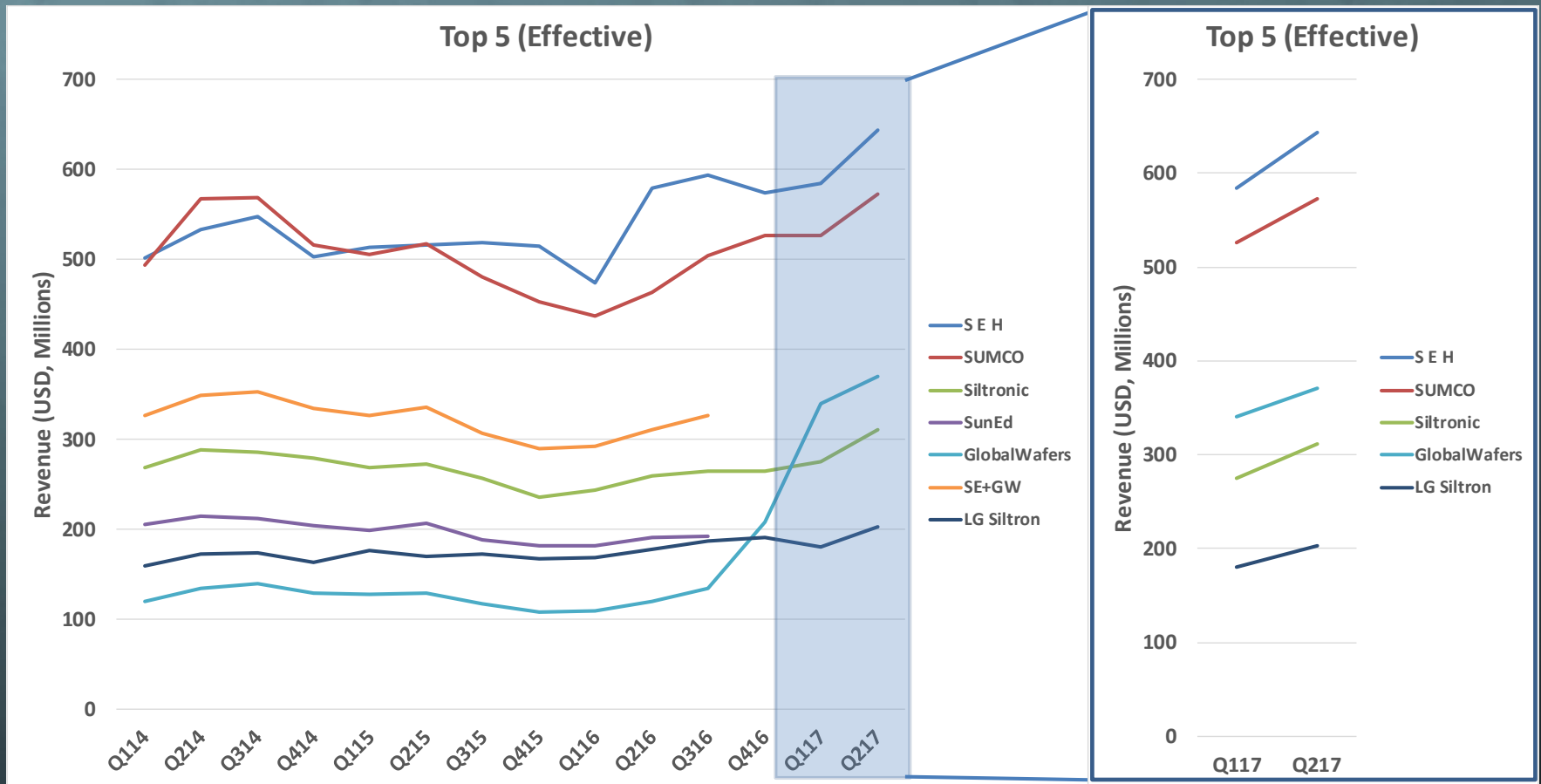
SEH continues to lead the top 5 who account for more than 93% of total wafer revenue

The top 2, who had for a protracted time, accounted for more than 60% of the total, have now fallen to 58%

As expected, the GlobalWafers acquisition of SunEdison SEMI has strengthened and now landed the entity in 3rd place, behind SUMCO

Source: Company reports, TECHCET

Top 5 Market Leaders (2)



The evolution of the top 5 – 2 still clearly lead the pack but their lead is shrinking

Source: Company reports, TECHCET

Mergers & Acquisitions

- The SK Group and conglomerate chief Chey Tae-won finalized their 100% acquisition of LG Siltron on August 30, bringing the total takeover to a cost of nearly 1T KWN and the company was renamed SK Siltron
- The acquisition occurred in three blocks
 - 51 % from LG – Jan 2017
 - 19.6 % from KTB Private Equity – May 2017
 - 29.4 % from Woori Bank and other creditors – August 2017

Expansions (1)

- As forecasted demand continues to climb, there are increasing concerns regarding the availability of silicon with some allocations already being made public
- Initially a 300 mm issue, this has now spread to 200 mm, bolstered by automotive, industrial and IoT growth, and is even beginning to trickle down to 150 mm
- SUMCO has become the latest to publicly disclose expansion (300 mm) sighting that previous reticence has been overcome largely due to substantially appreciating prices

Expansions (2)

- Slated for Imari to be available in 1H19, SUMCO's brownfield expansion is scheduled to add 110 k wpm which accounts only for approximately 2% of the current installed base
- Ferrotec is pursuing addressable markets for semiconductor wafers (primarily in China) and has brought 200 mm crystal growth to Yinchuan China earlier this year, coupled with expanded wafering at the Shanghai facility, targeting 100 K wpm overall (in addition to the installed capacity of 350 k wpm of 150 mm and smaller)
- GlobalWafers and Ferrotec Shanghai (FTS) formed a joint venture sales company to market the 200 mm wafer output identified above (Shanghai GROWFAST Semiconductor Technology Co., LTD.)

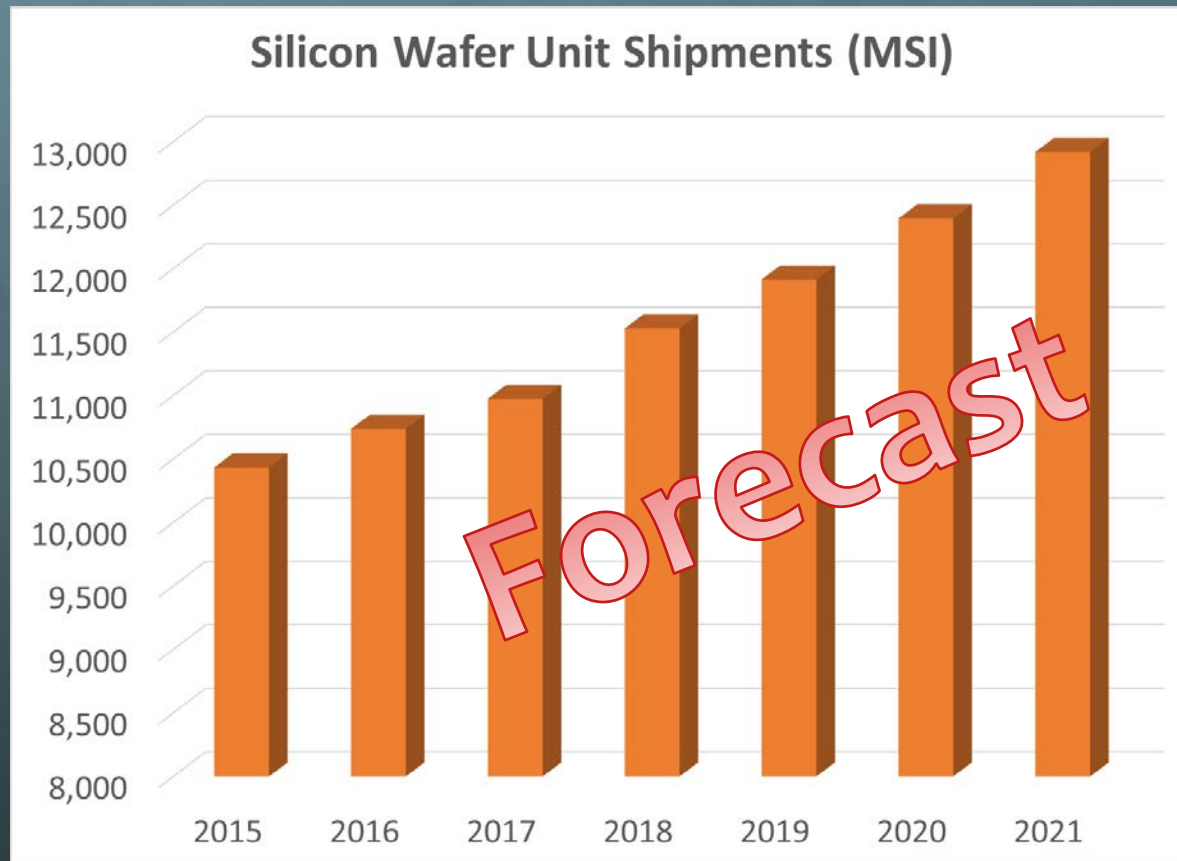
Expansions (3)

- 🌐 In addition to 200 mm expansion, Ferrotec has also reportedly been considering a 300 mm silicon production operation in China
- 🌐 WaferWorks is also expected to bring their new 200 mm facility on line in Zhengzhou, China during 1Q18, a plant which will ultimately reach 200 k wpm, and additionally have announced expansion of their Longtan, Taiwan from 200 k to 250 k wpm in 2H17

Plant Closures / Discontinued Operations

- 🌐 Wacker Chemie AG discontinued operations at its Charleston, Tennessee plant as the result of an explosion caused by a localized leak of chlorosilane
- 🌐 The \$2.5 B plant, which produces PV polysilicon, will be closed for months, with no definitive restart date released
- 🌐 Capacity at its two German facilities should be sufficient to fulfill existing contracts, according to Chief Executive Rudolf Staudigl

Forecasts – No update



- TECHCET forecasts a record production of 10,976 MSI in 2017
- Steady growth is expected through 2021
- Current installed capacity (which is heavily product mix dependent) will struggle to meet anticipated demand beyond 2017, even with stated expansions

Source: 2015 - 2016 SEMI SMG; 2017 – 2021 TECHCET

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Runaway Pricing – Not So Yet

Top 5* Key Factors

	MSI	Rev (\$M)	\$ / sq. in.
2Q16	2,706	1,792	0.66
2Q17	2,978	2,099	0.70
YoY	10.1%	17.1%	6.4%

* 2Q16 combined SunEdison SEMI and GlobalWafers

- To consider the impact of pricing increases, the table at the left compares 2Q16 and 2Q17
- Prices were known to stabilize during the former and were reported to increase during the latter
- The aggregate pricing is up 6.4% on 10.1% unit increase and 17.1% revenue growth
- Prices are expected to show further increases – this will be revisited once results are published

Source: SEMI SMG; TECHCET

Thank You!
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