



IHS Markit™

Smart phone display market outlook

2016 November - Korea Display Conference

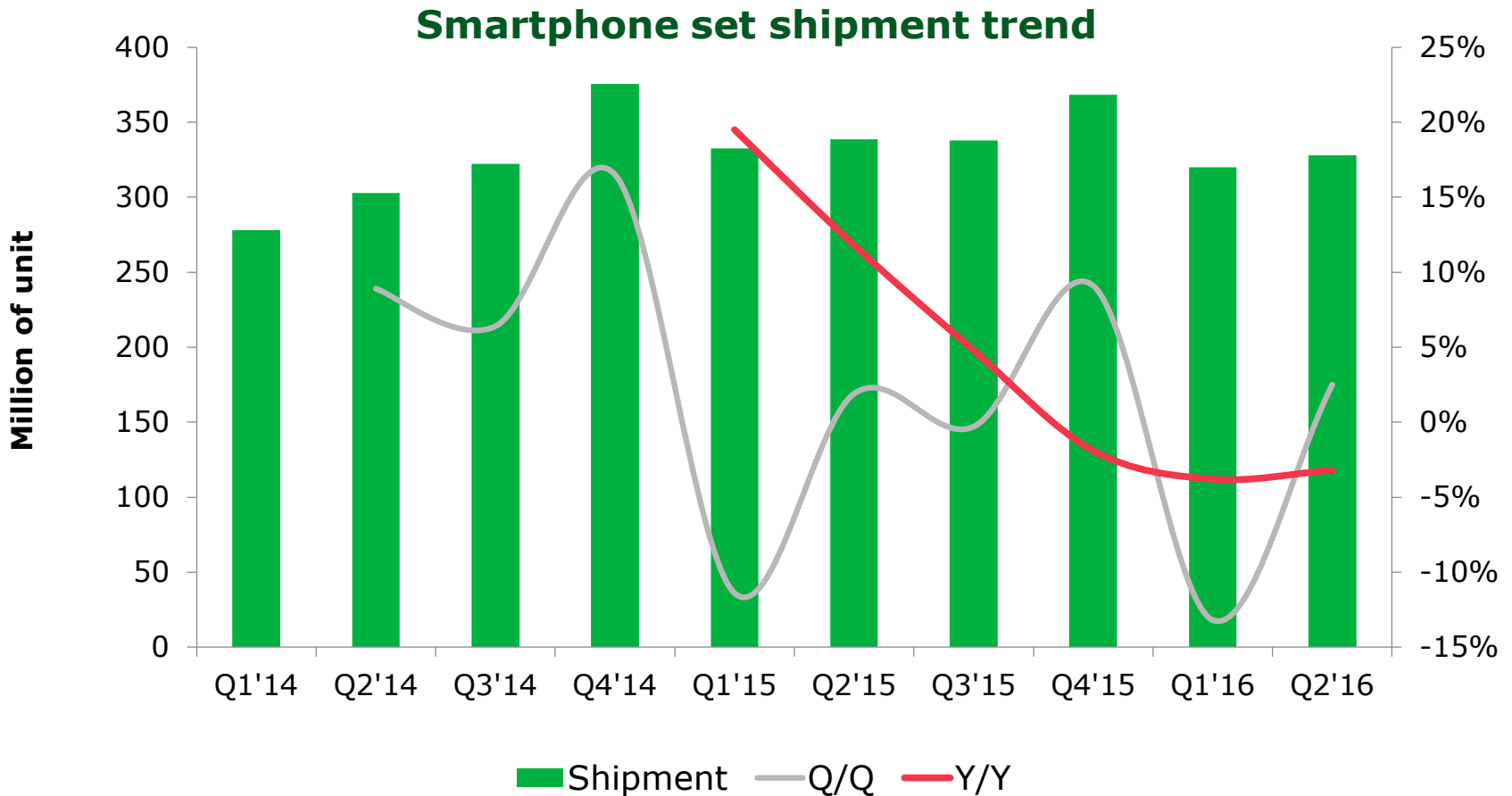
Brian Huh, Senior analyst of S&M display

Research, IHS Markit Technology

Smart phone SET outlook

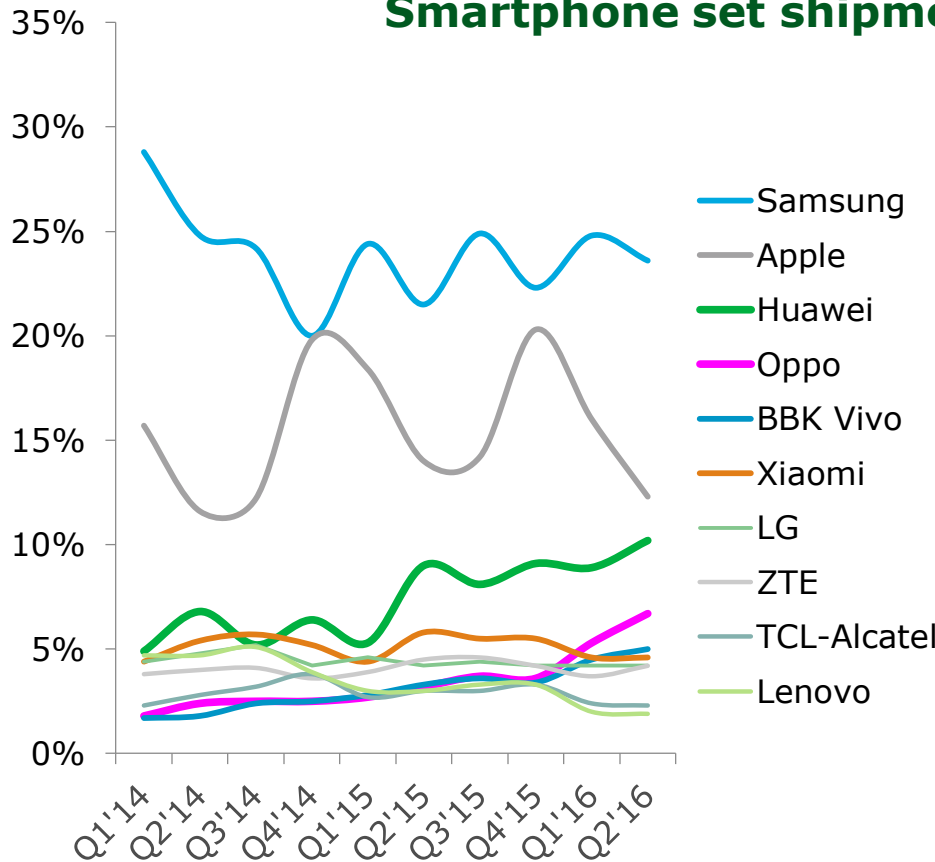
Entered phase of stagnation

Q2'16 Smartphone market recorded 328M, negative growth of Y/Y. Entered phase of stagnation



However, China OEMs continued to eat market share bit by bit.

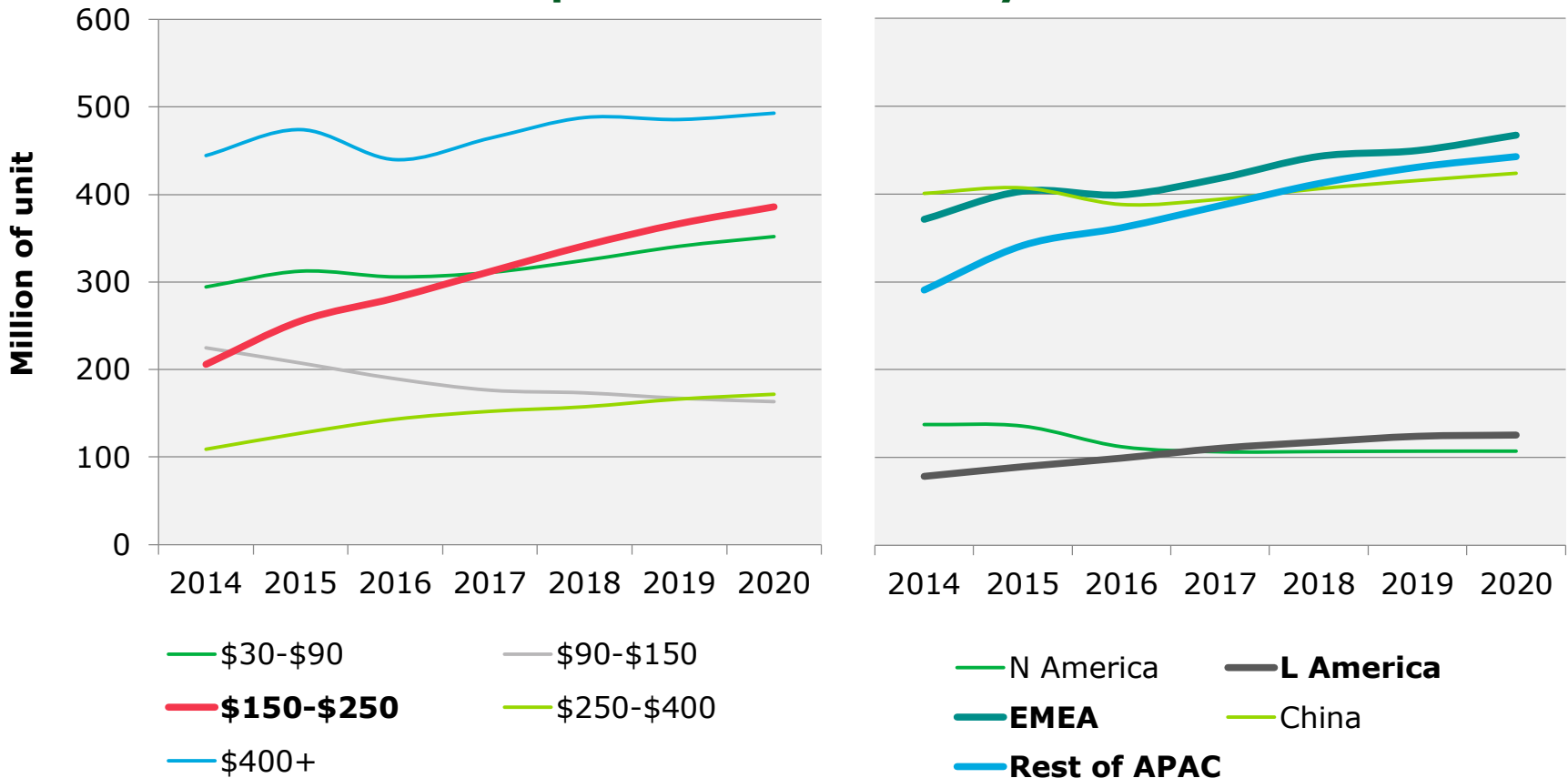
Smartphone set shipment trend by OEMs



No.	OEM	Q2'15	Q1'16	Q2'16	Q/Q	Y/Y	Rank
1	Samsung	73	79.4	77.5	-2%	6%	-
2	Apple	47.5	51.2	40.4	-21%	-15%	-
3	Huawei	30.6	28.4	33.3	17%	9%	-
4	Oppo	10.8	16.8	21.9	30%	103%	-
5	Vivo	11.2	14.4	16.4	14%	46%	1 up
6	Xiaomi	19.7	14.8	15.2	3%	-23%	1 down
7	LG	14.2	12.6	13.9	10%	-2%	-
8	ZTE	15.1	11.9	13.7	15%	-9%	-
9	TCL-Alcatel	10.1	7.8	7.4	-5%	-27%	-
10	Motorola	5.9	5.8	6.2	7%	5%	-

Global Handset market is slowing down and the growth comes from emerging regions

Smartphone set forecast by ASPs



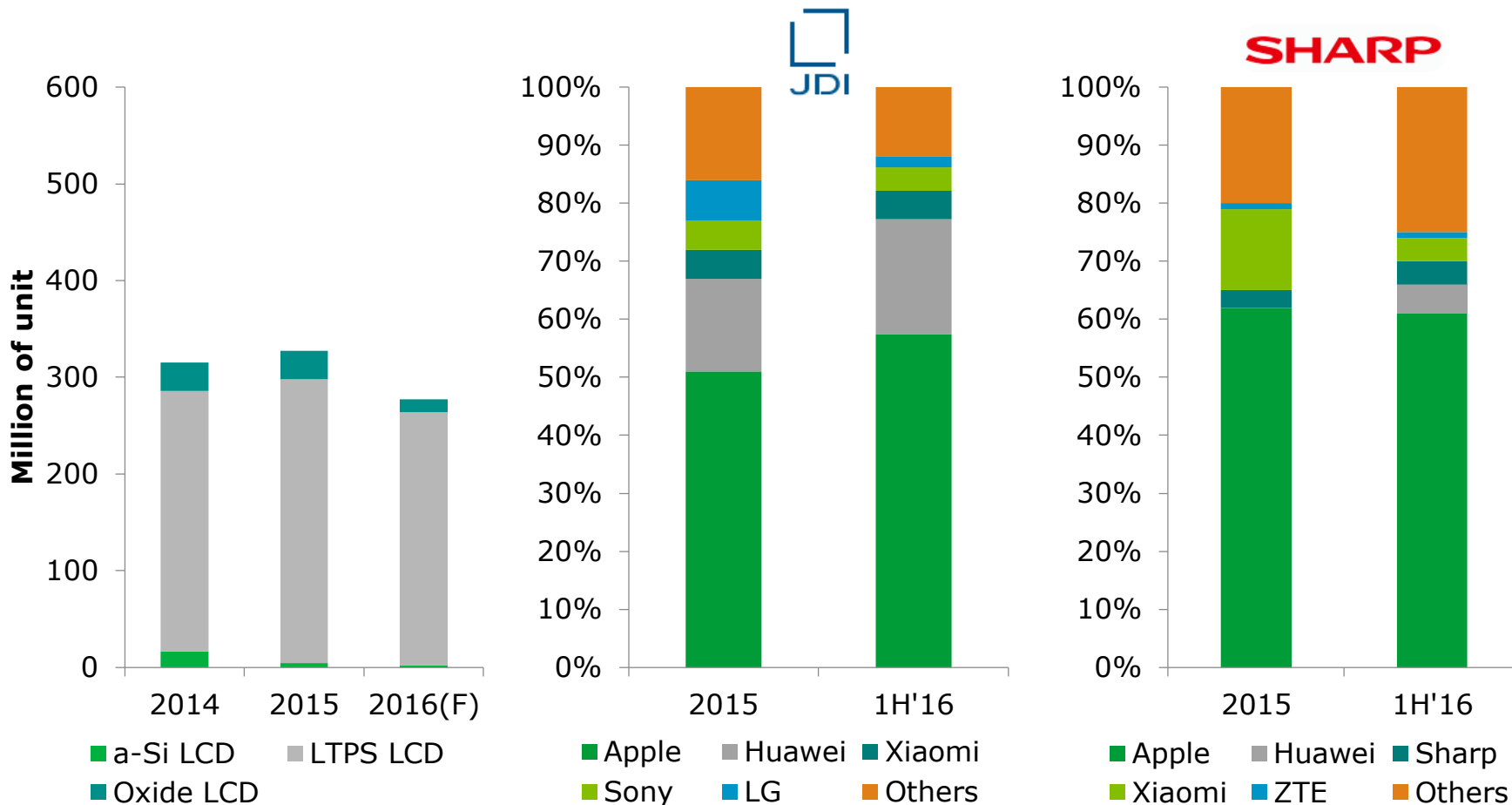
Smartphone DISPLAY outlook

AMOLED becoming the main stream !!

Smartphone panel shipment trend: Japan



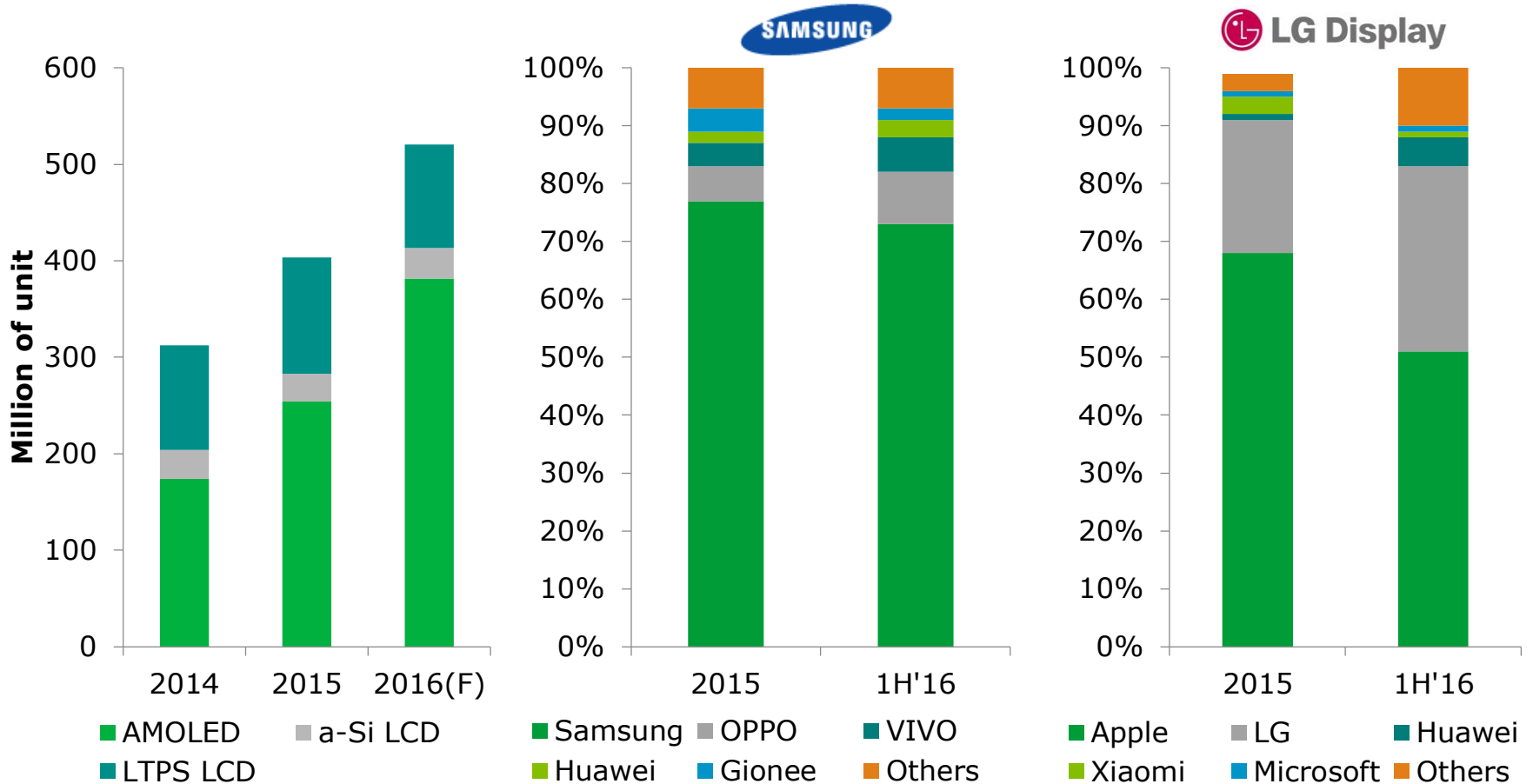
Market seems to be stagnant, but continued to lead the LTPS LCD market.



Smartphone panel shipment trend: Korea

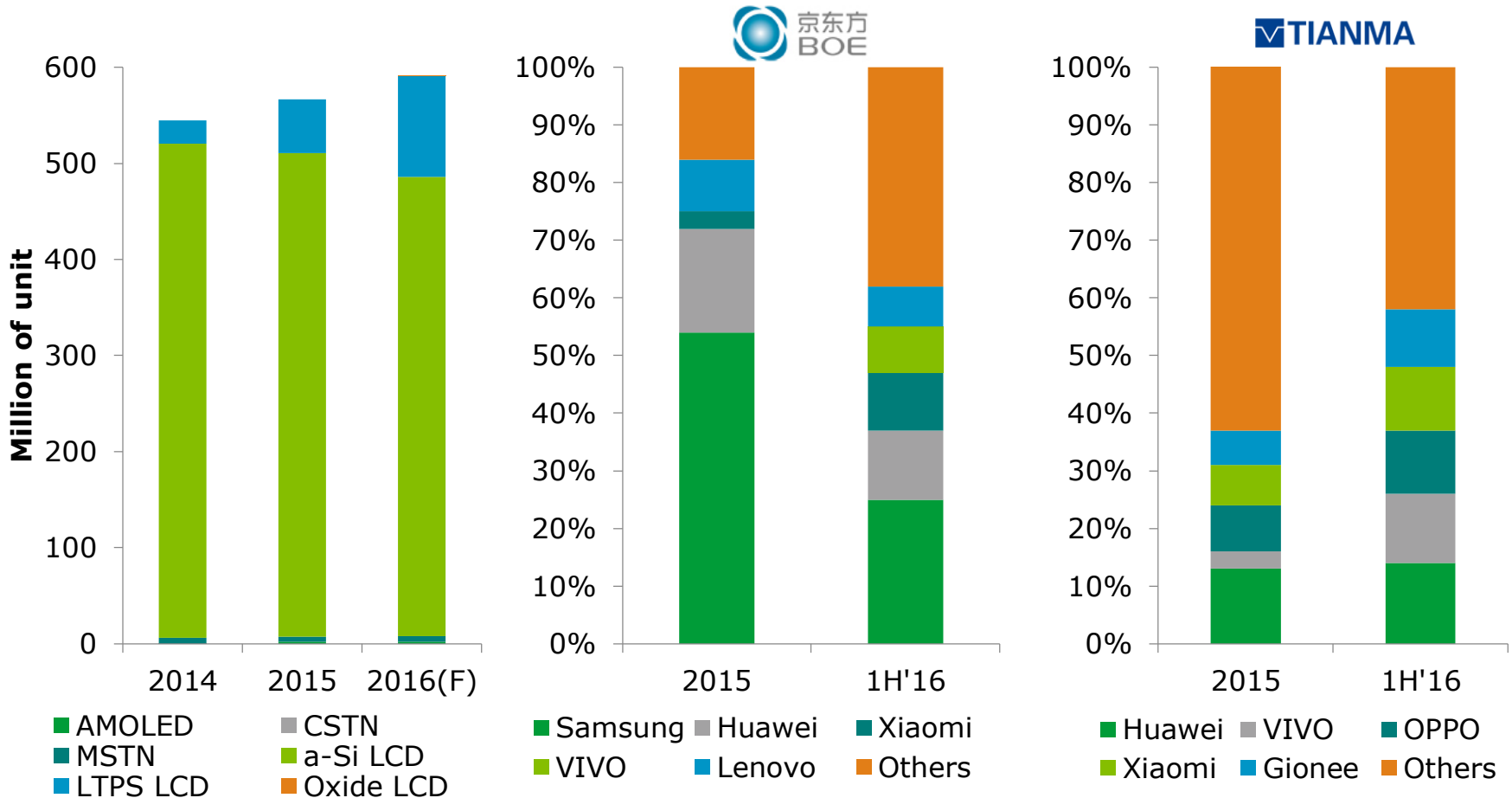


Shipments continued to increased due to AMOLED.



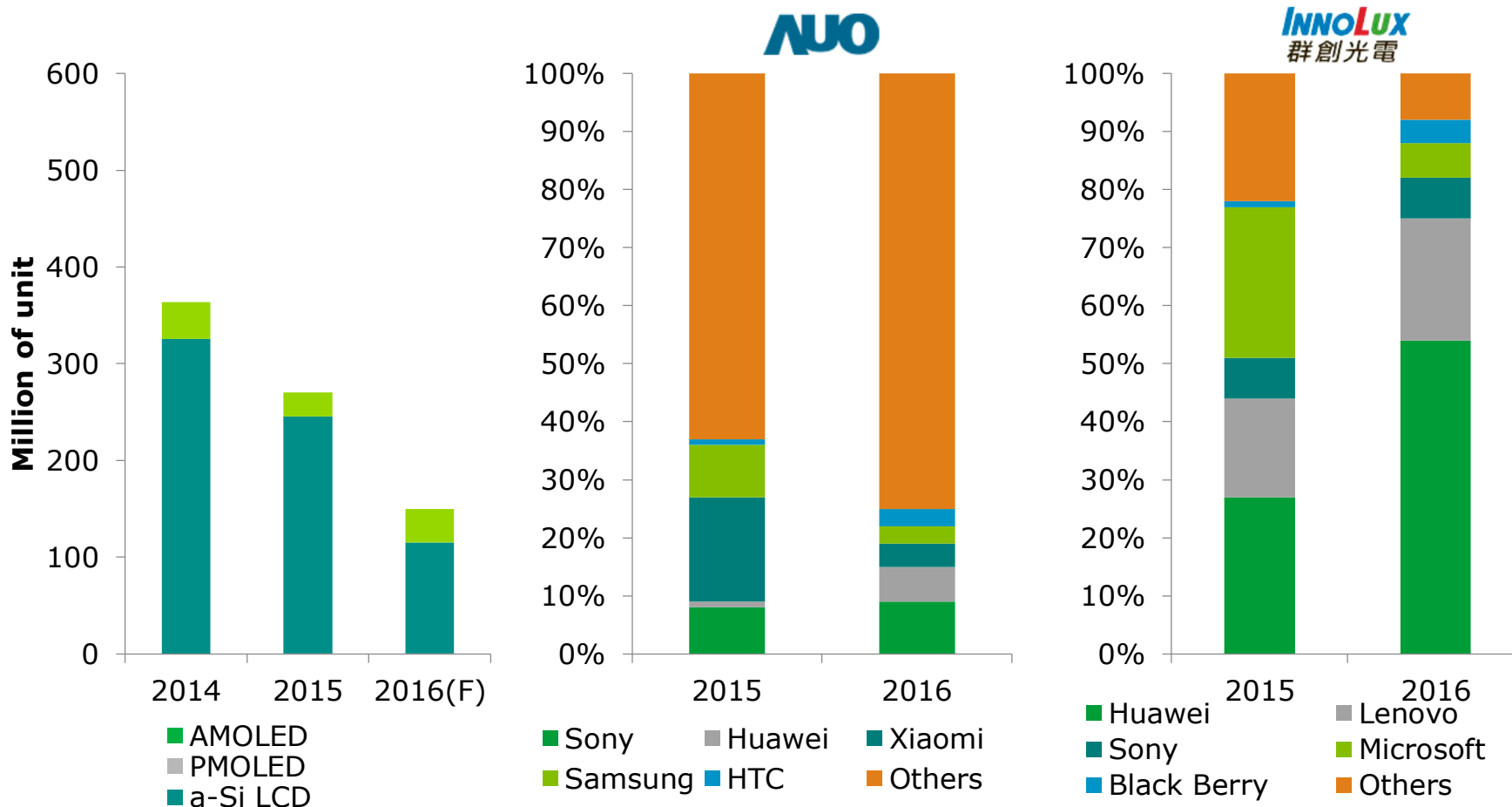
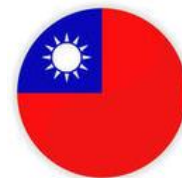
Smartphone panel shipment trend: China

Leading the market based on shipments, catch up high-end product rapidly



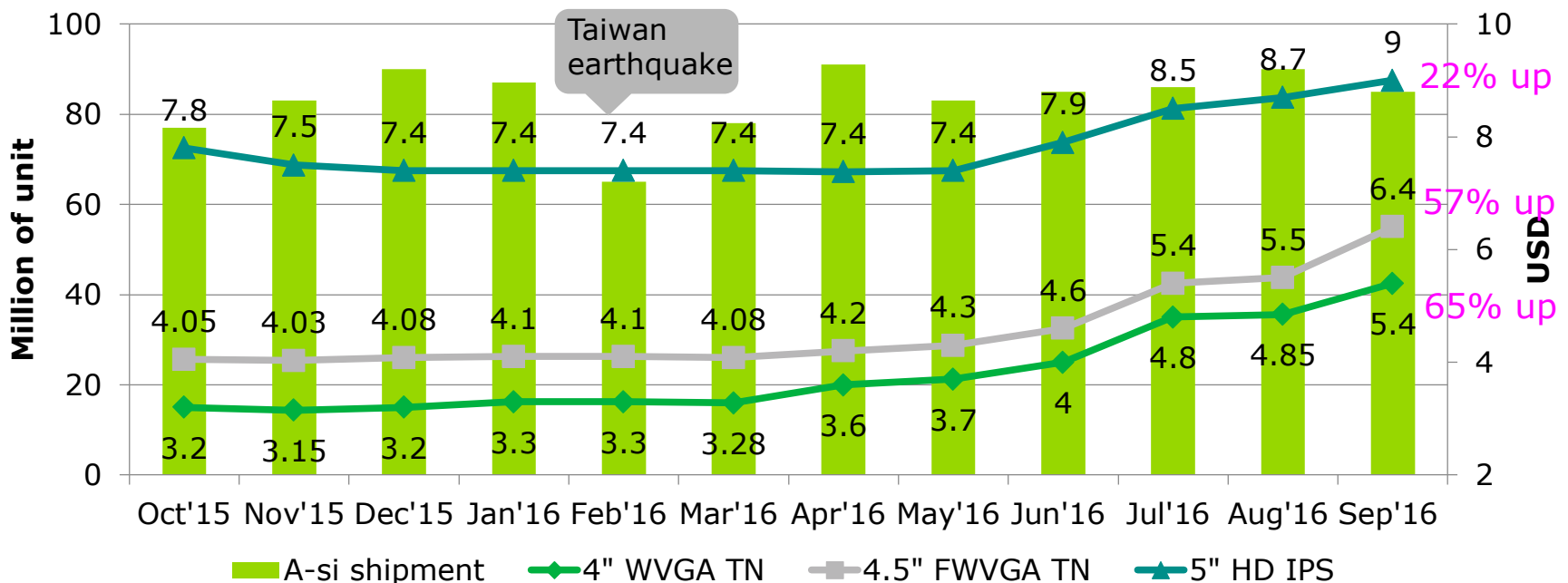
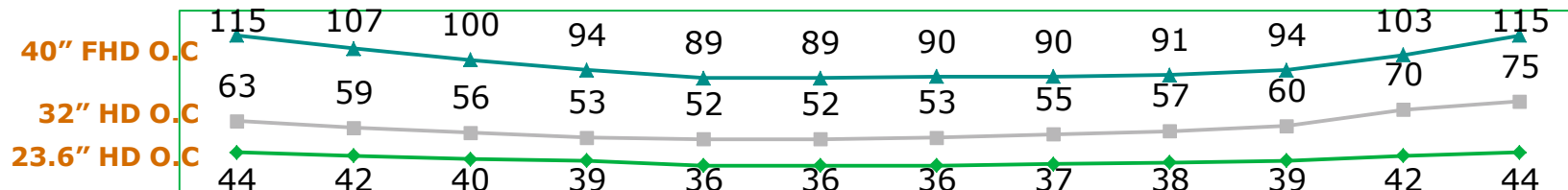
Smartphone panel shipment trend: Taiwan

Shipments continued to decreased, furthermore weak local set OEMs



a-Si LCD ASPs rebounded to upward in Q2'16

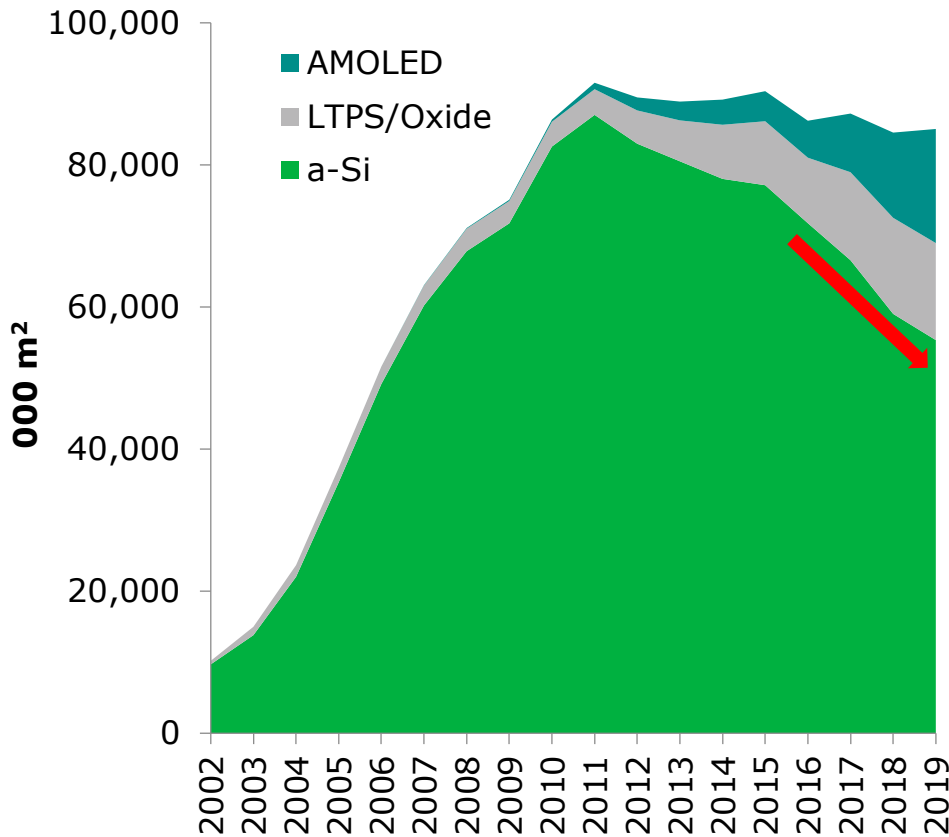
Remained panel supply tightness, trigger effect from TV, & IT, low profitability



Smartphone display shifted from a-Si to LTPS

Requirement for multimedia push to increase demand for over FHD resolution, and small & old fab losing the competitiveness.

Supply capacity forecast (≤Gen6)

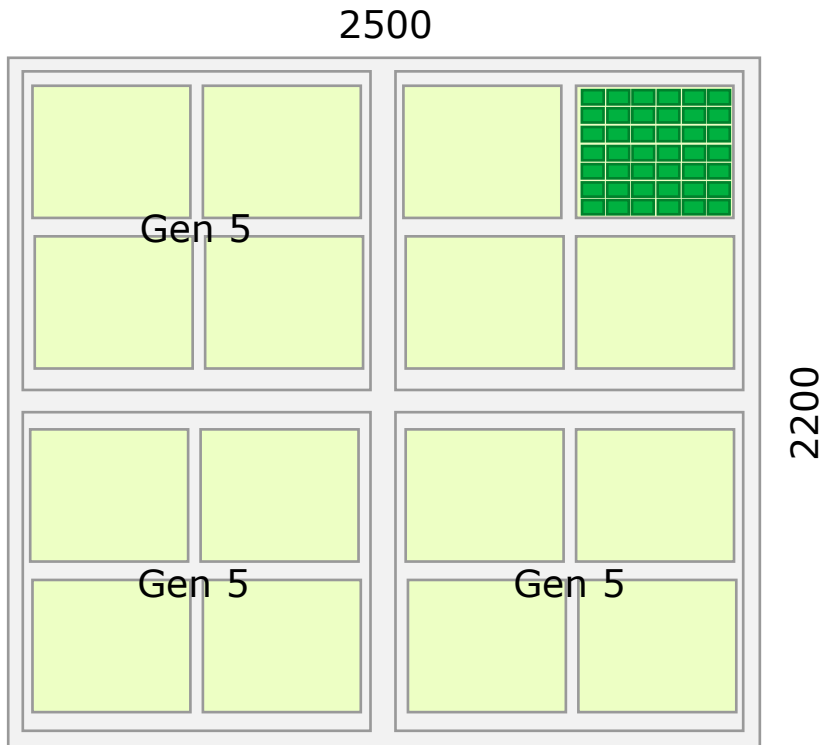


Fab closing plan (2016 ~ 18)

No	Maker	Location	Tech	Gen	Capacity (K/M)	End
1	AUO	Hsinchu L3C	a-Si	3.25	45	Q2'17
2	AUO	Lungtan L4A	a-Si	3.5	60	Q3'17
3	AUO	Linkou L5D	a-Si	5	75	Q1'18
4	BOE	Beijing B1	a-Si	5	45	Q4'17
5	CPT	Taoyuan T2	a-Si	3.5	73	Q4'18
6	Innolux	Tainan Fab1	a-Si	3.25	60	Q2'17
7	Innolux	Tainan Fab2	a-Si	3.5	85	Q2'18
8	Innolux	Tainan Fab3	a-Si	5	65	Q2'18
9	Innolux	Jhunan T0	a-Si	4	20	Q1'18
10	Innolux	Jhunan T1	a-Si	5	33	Q4'18
11	JDI	Mobara V3	a-Si	4	58	Q4'16
12	LGD	Kumi P2	a-Si	3.25	17	Q1'17
13	LGD	Kumi P3	a-Si	3.5	92	Q1'17
14	LGD	Kumi P4	a-Si	5	130	Q3'17
15	LGD	Kumi P6	a-Si	6	60	Q4'17
16	SDC	Chonan L6	a-Si	5	125	Q1'17
17	Sharp	Taki No2C	a-Si	3.5	45	Q3'18
18	Sharp	Taki No2D	a-Si	3.5	53	Q3'18
19	Truly	Shanwei 1	a-Si	2	30	Q3'18

A-Si LCDs in Gen 8

Panel makers considering a-Si LCDs in Gen 8 to compete LTPS LCD and AMOLED, and will be ready for MP in 2017

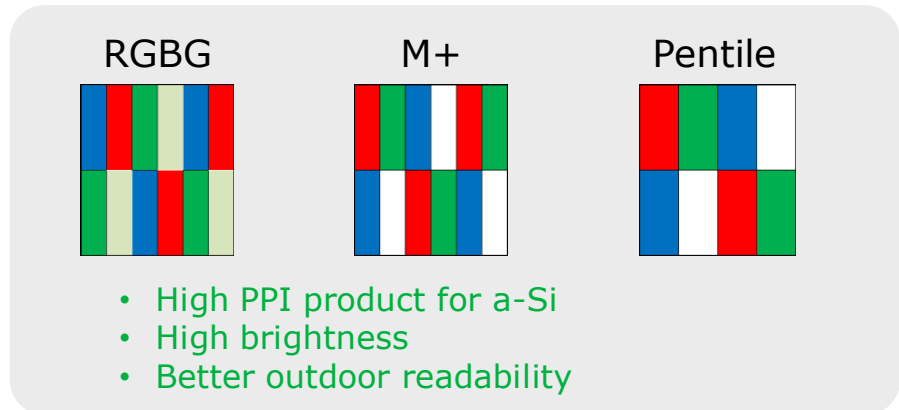


Cuts/glass	Gen 6	Gen 8
5" HD	330up	650~680up
5.5" HD	264up	550~580up

TDDI



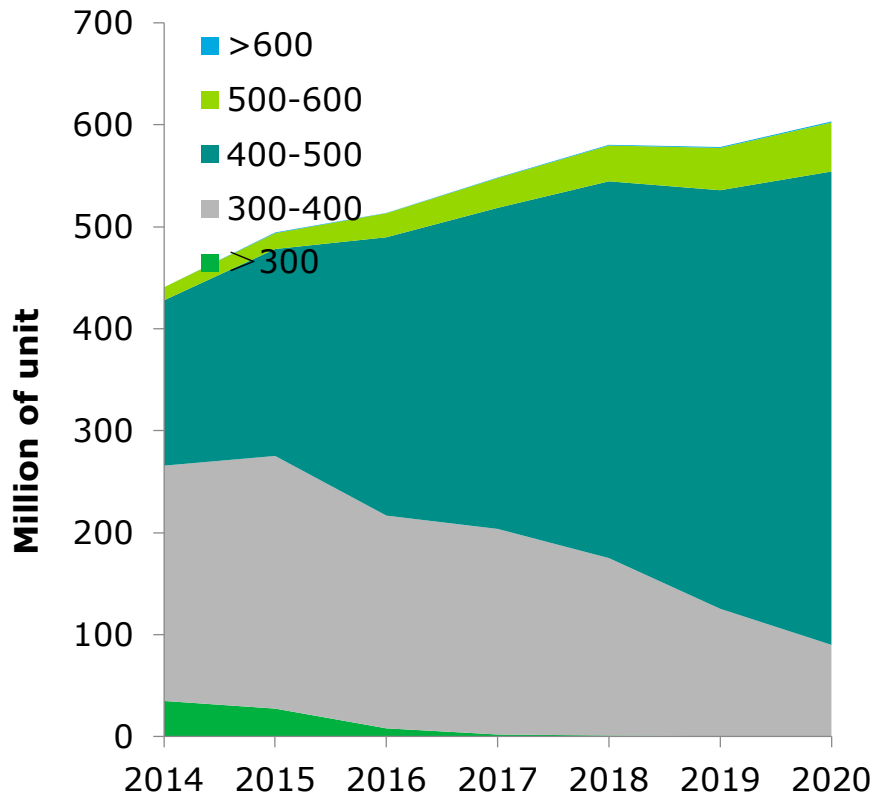
SPR (Sub Pixel Rendering)



New LTPS LCD fabs will be released in 2017

Strong demand for FHD+, LCD panel makers invested LTPS fab, but decreasing demand for apple will impact the LTPS fab operation in 2017

LTPS LCD shipment forecast



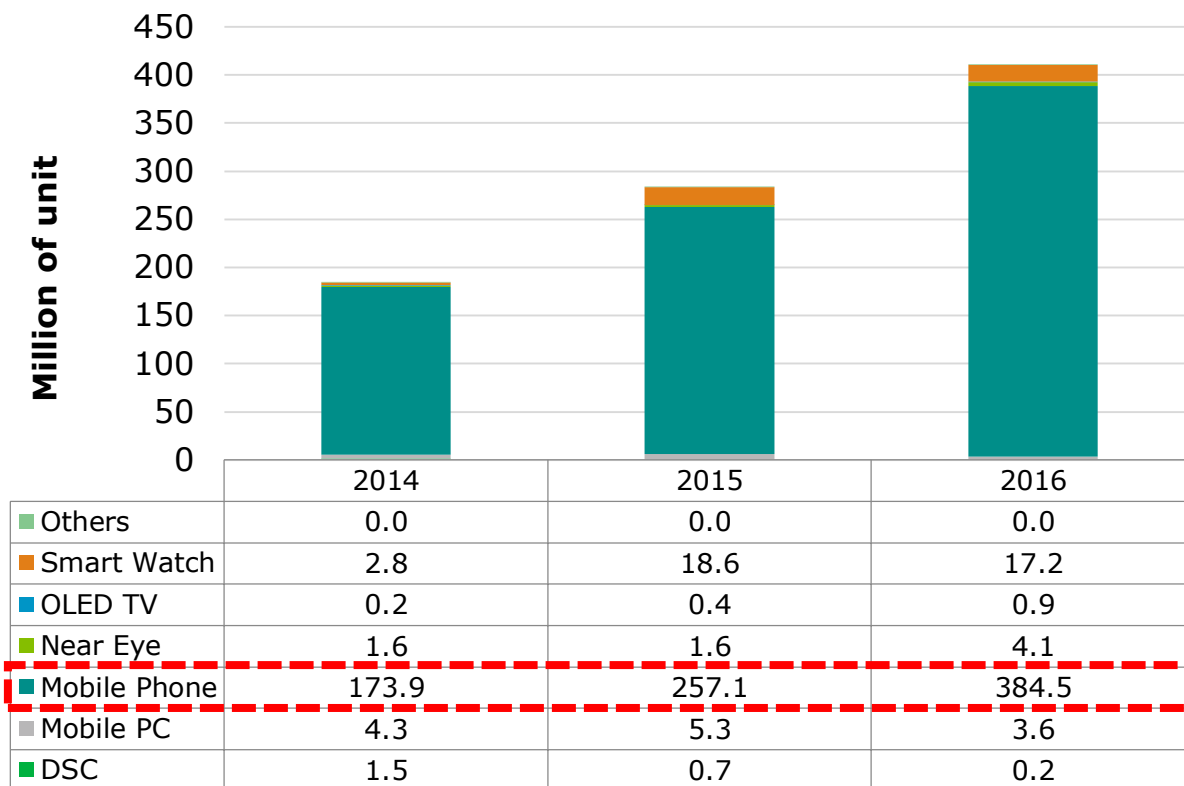
New LTPS LCD Fab

Maker	Factory	Gen	panel	Capacity (K/M)	MP Ramp
AUO	Kunshan	6	LCD	25	Q4'16
BOE	Ordos B6	5.5	LCD/AMOLED	30	Q1'17
CSOT	Wuhan T3	6	LCD/AMOLED	15	Q2'17
Tianma	Xiamen 2	6	LCD	15	Q4'16
JDI	Hakusan D3	6	LCD	25	Q4'16
LGD	Kumi AP3	6	LCD/AMOLED	8	Q2'16

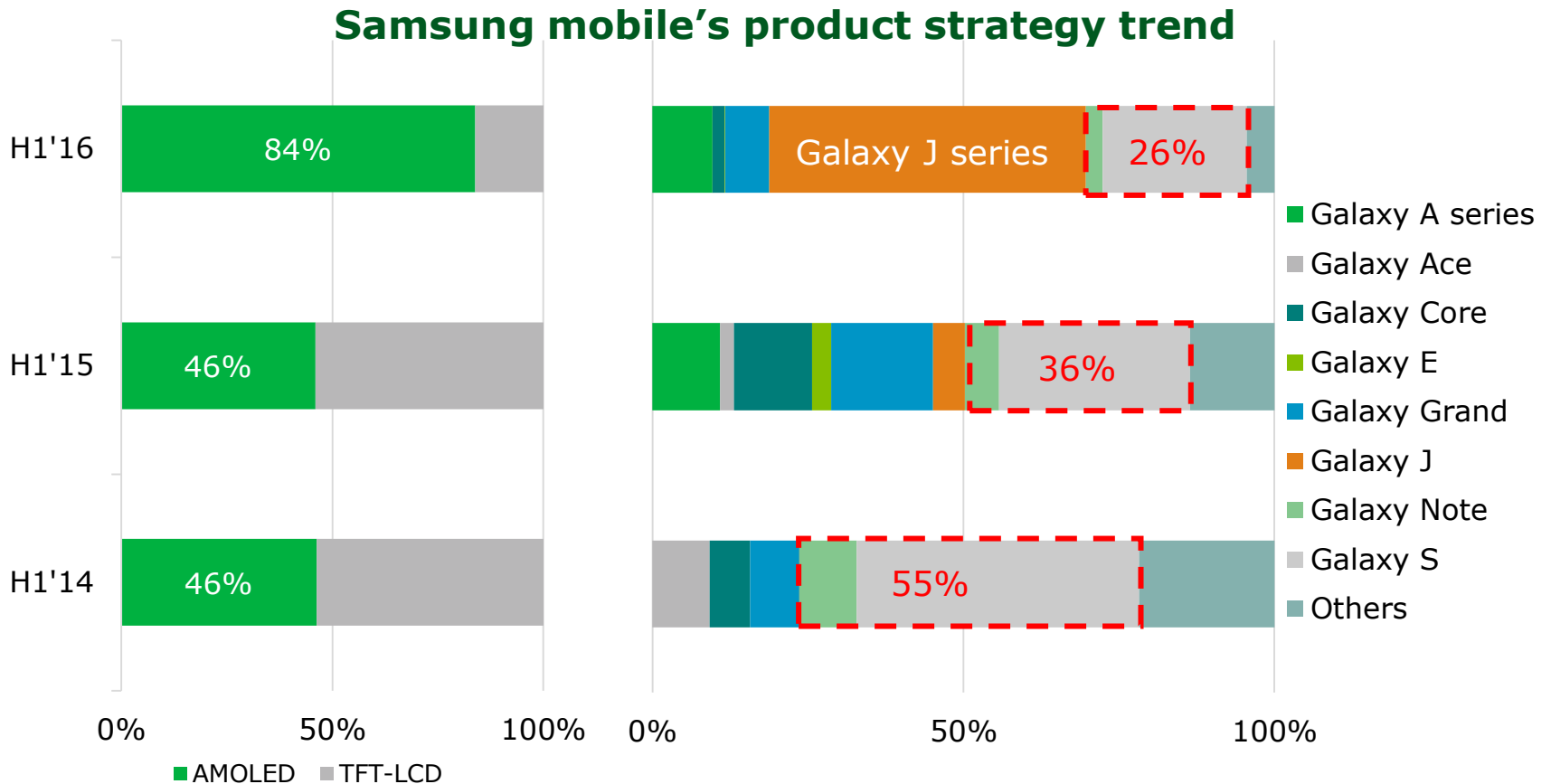
Area (KM ²)	2016 vs 2018
Supply	38% up at least
demand	18% up at best

AMOLED shipment continued to increased, especially strong demand for mobile phone

AMOLED panels shipment trend by application



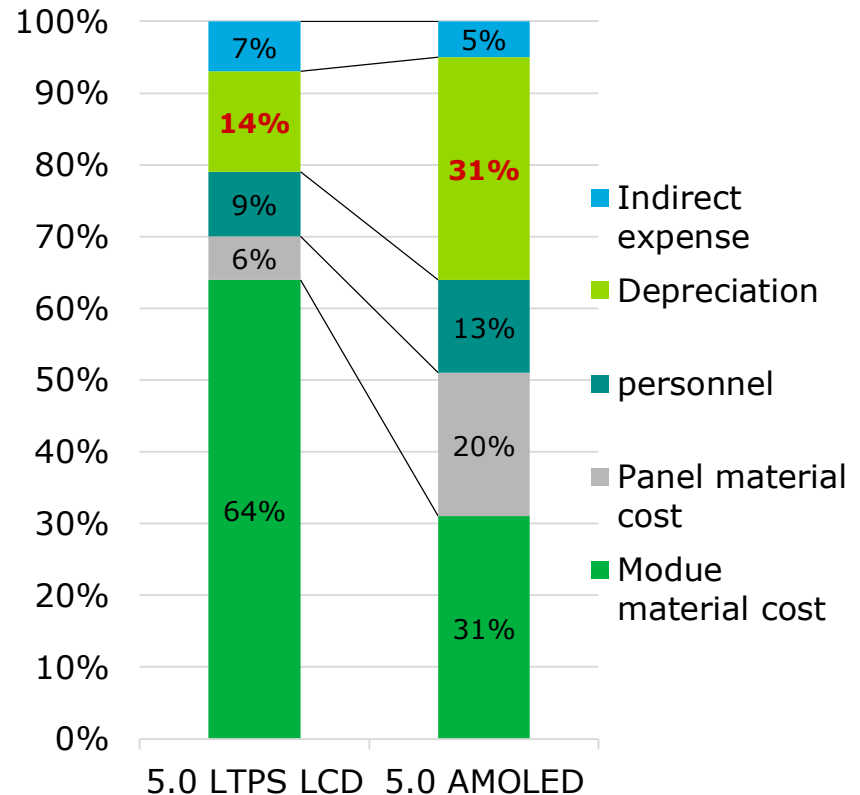
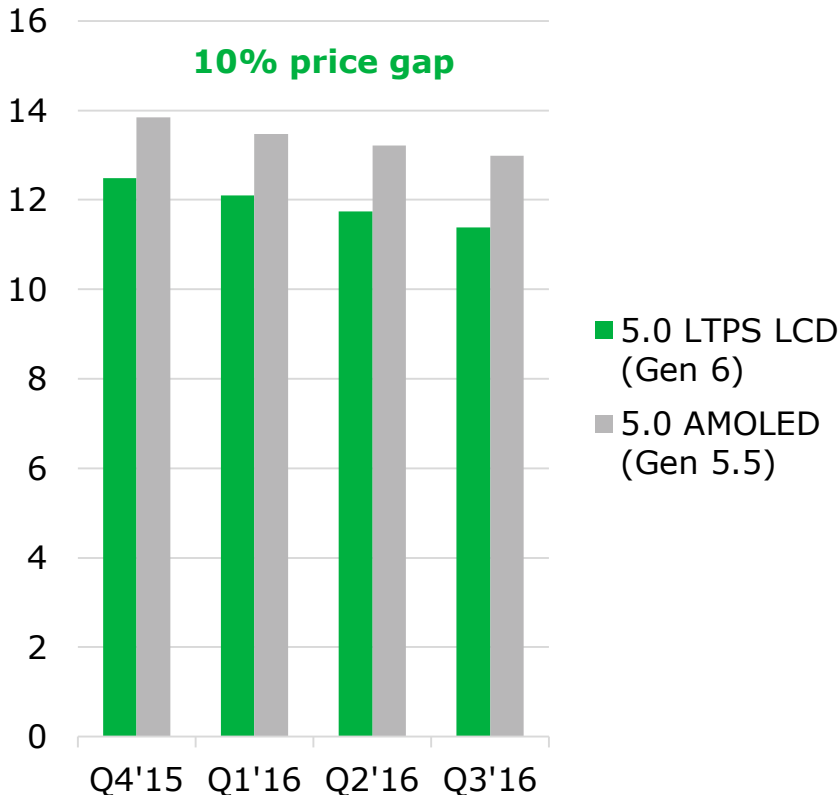
Samsung increased AMOLED smartphone ratio remarkably to mid-end lineups



Cost simulation for LTPS LCD vs rigid AMOLED

Cost of mobile AMOLEDs have recently reached parity with LCDs. Furthermore, AMOLED have more room to enhance cost reduction than LCDs.

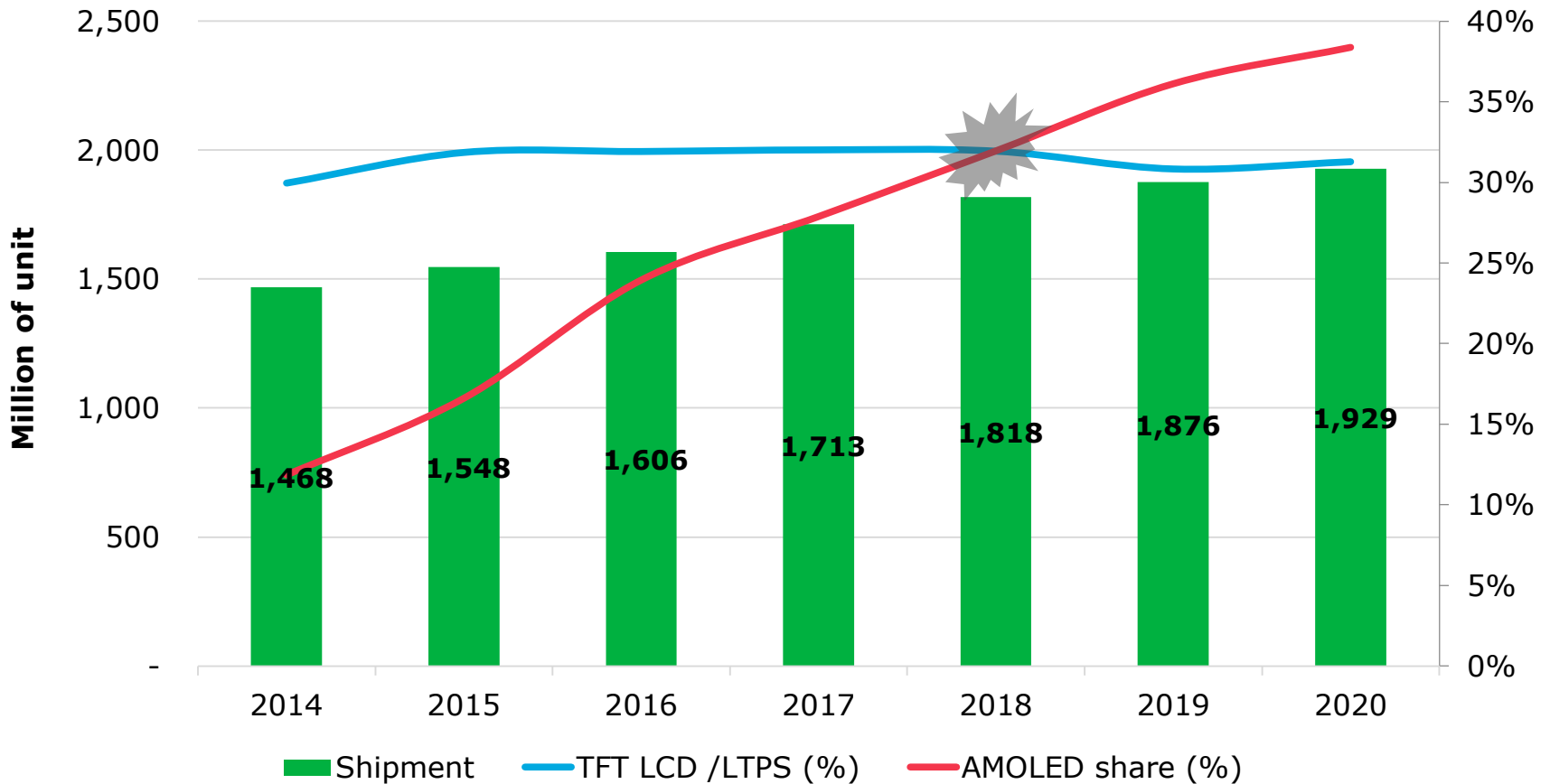
Cost comparison between LTPS LCD vs AMOLED



Note: Utilization: 90% / Cuts: 330up@G6, 220@G5.5 / 5% cum yield gap

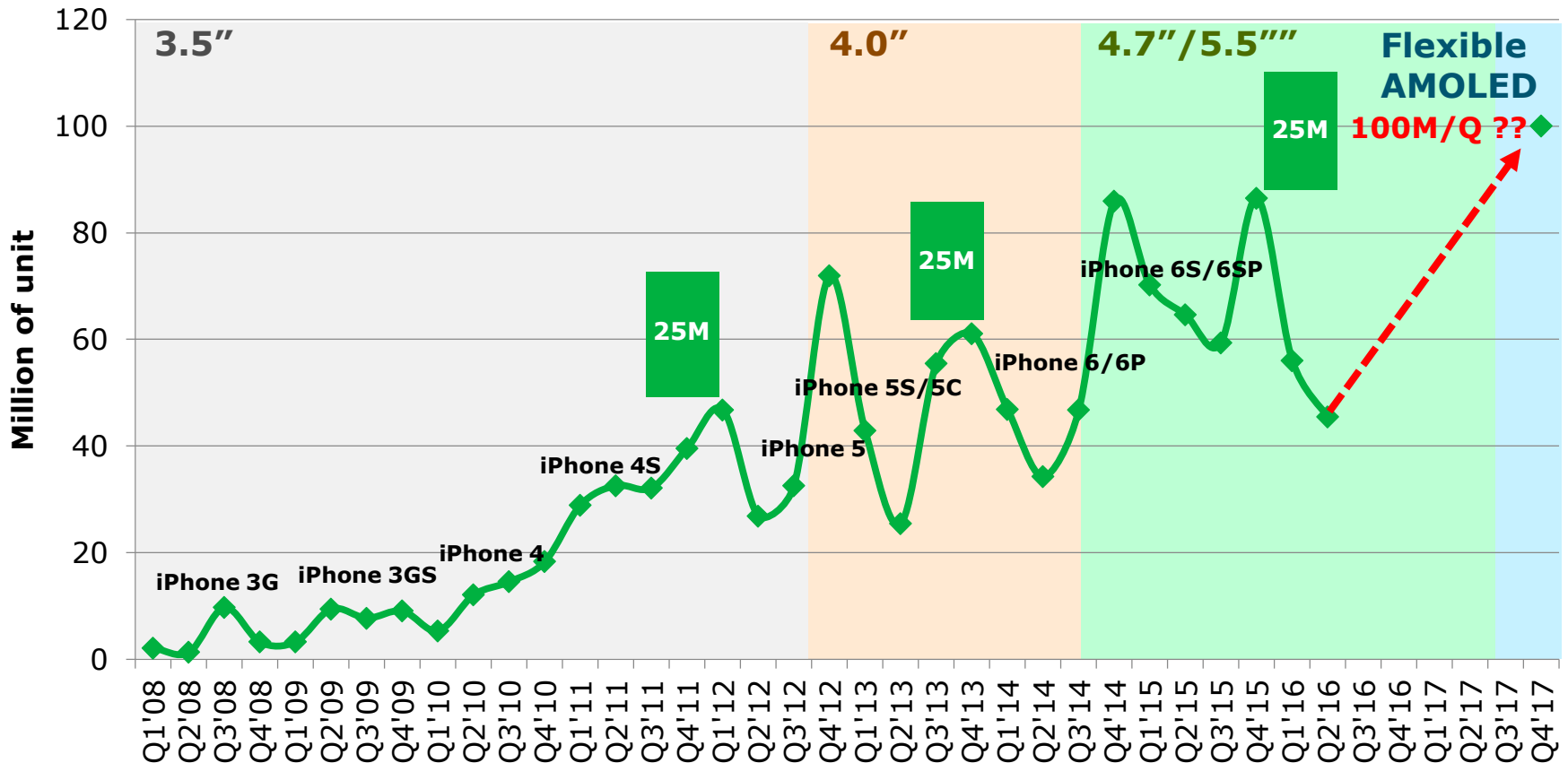
Smartphone display market forecast by technology

AMOLED demand is soaring and will surpass LTPS TFT LCD in 2018



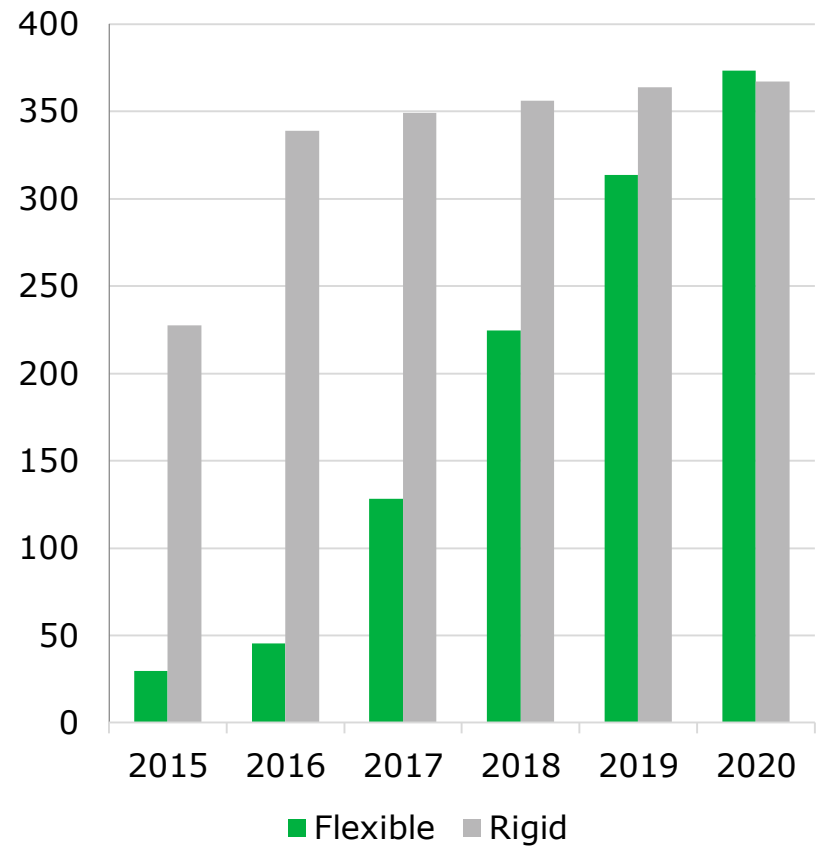
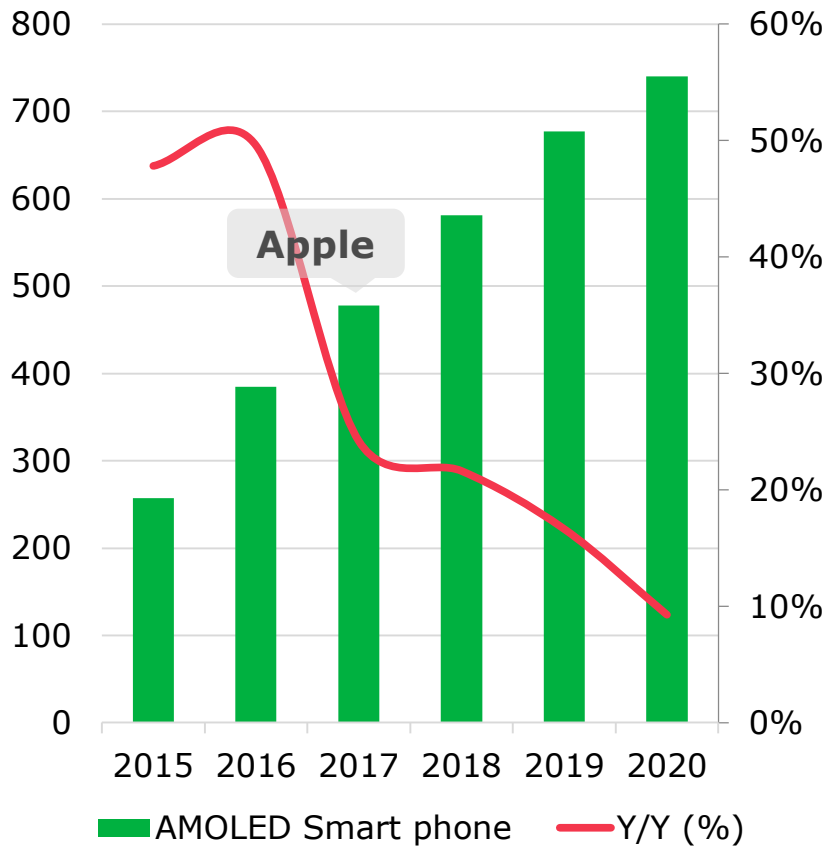
APPLE's new challenge, AMOLED iPhone in 2017.

Flexible AMOLED fab will be ready for MP from Q2'17, and one model is expected to adopt flexible AMOLED.



Demand for AMOLED smartphone keep growing

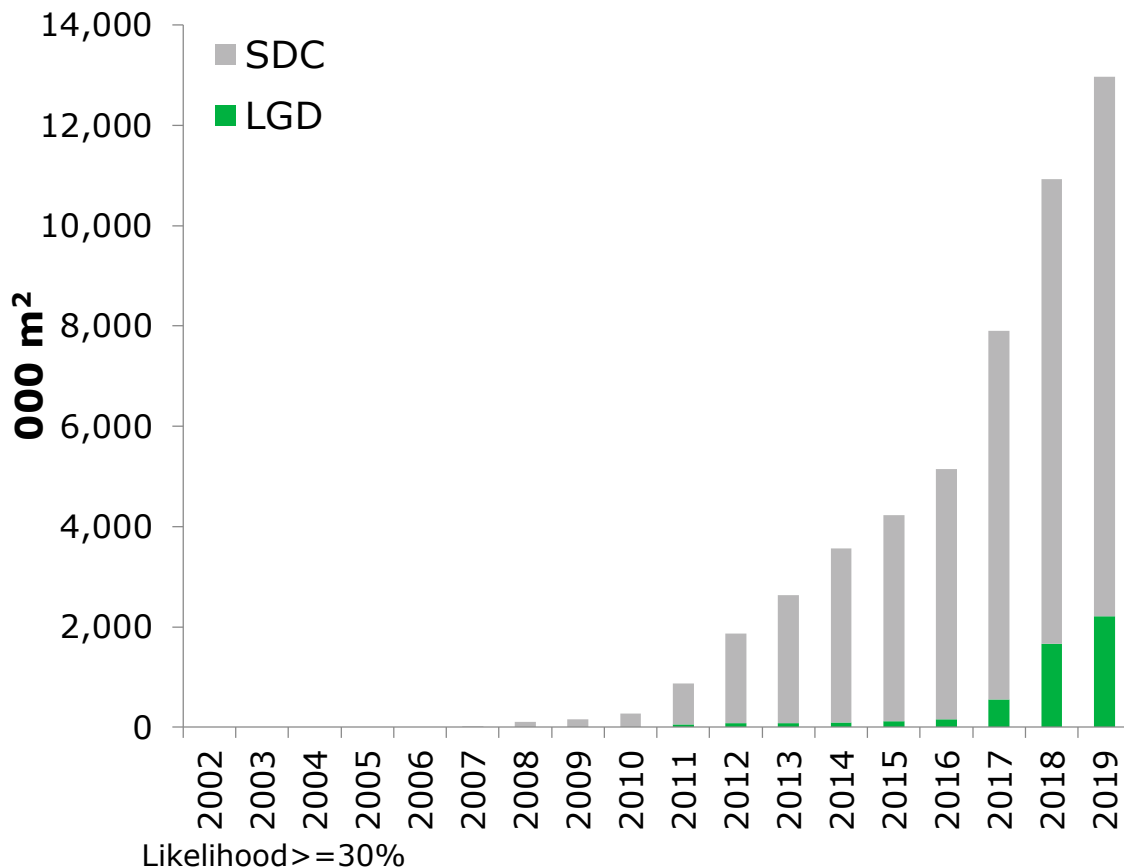
In 2020, AMOLED displays will reach 700M, flexible AMOLEDs market will surpass rigid AMOLED market.



OLED fab forecast: Korea



Huge and fastest investment than others. Strong customer base, leading technology.



Maker	Factory	Gen	Capacity (K/M)
LGD	AP2-E2	G4	26
	AP3-E5	G6	15
	P10	G6	45
	P9-E6	G6	45
SDC	A3	G6	120
	A4	G6	45
	A1	G4	55
	A2	G5.5	180

OLED fab forecast: China

Fast following Korea panel makers, but need more time.

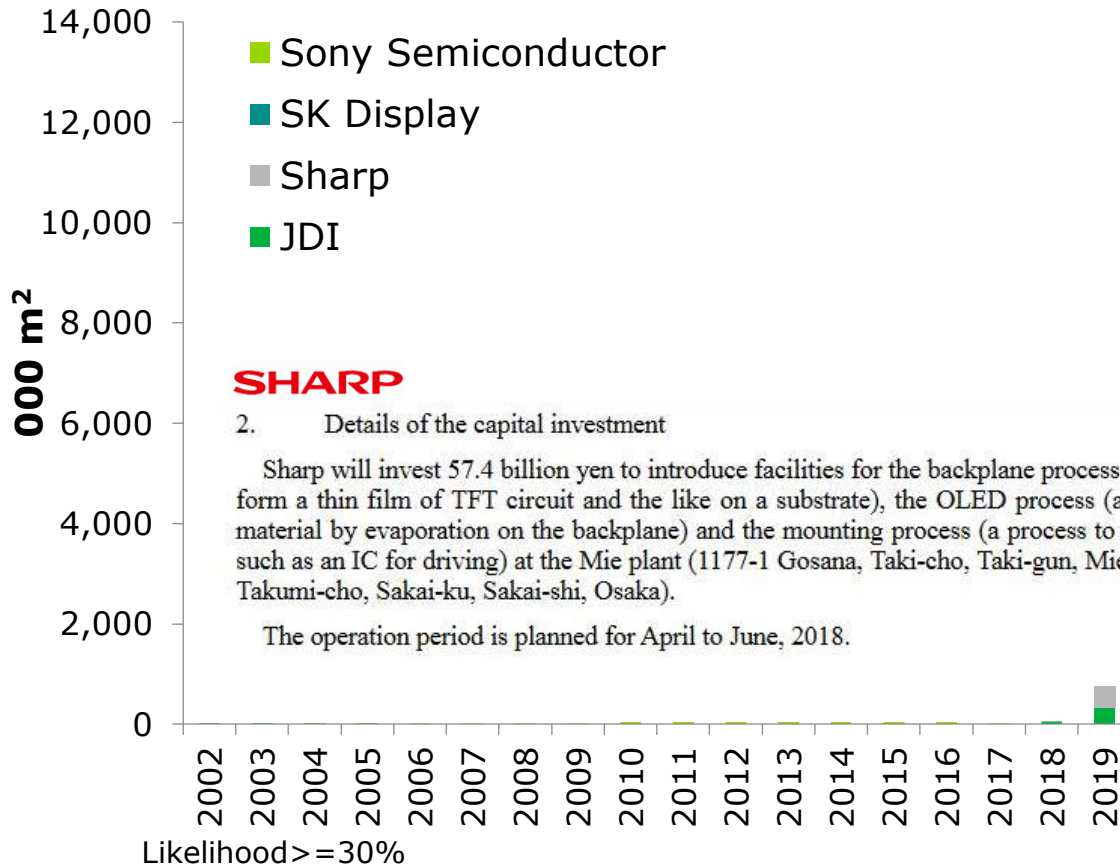


Maker	Factory	Gen	Capacity (K/M)
BOE	B7	G6	45
	B11	G6	45
China Star	T4	G6	60
EDO	Shanghai	G4	22
	Shanghai	G6	30
Tianma	Shanghai	G5.5	6
	Wuhan	G6	30
Truly	Huizhoi	G4	15
Visionox	Kunshan	G5.5	15
	Guan	G6	30



OLED fab forecast: Japan

More conservative, different stance of JDI and Sharp-Foxconn.

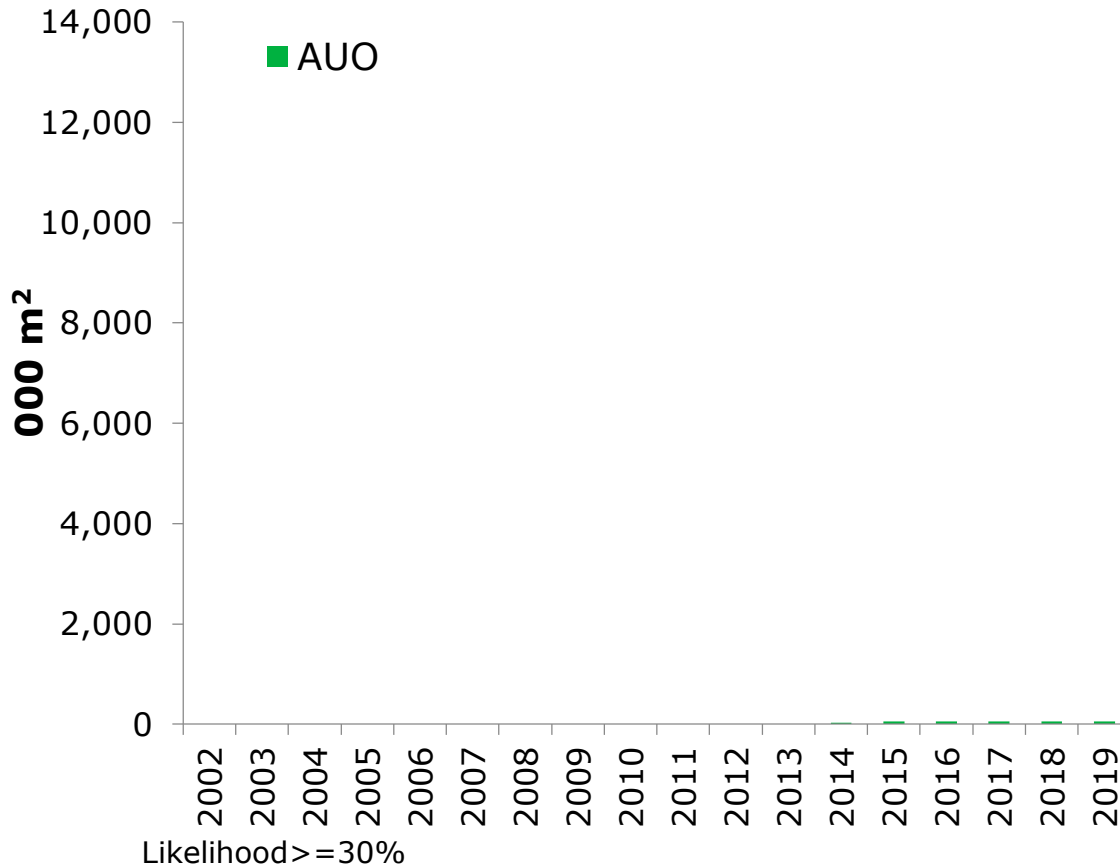


Maker	Factory	Gen	Capacity (K/M)
JDI	Mobara	G6	30 (??)
Sharp	Sakai	G6	30

OLED fab forecast: Taiwan



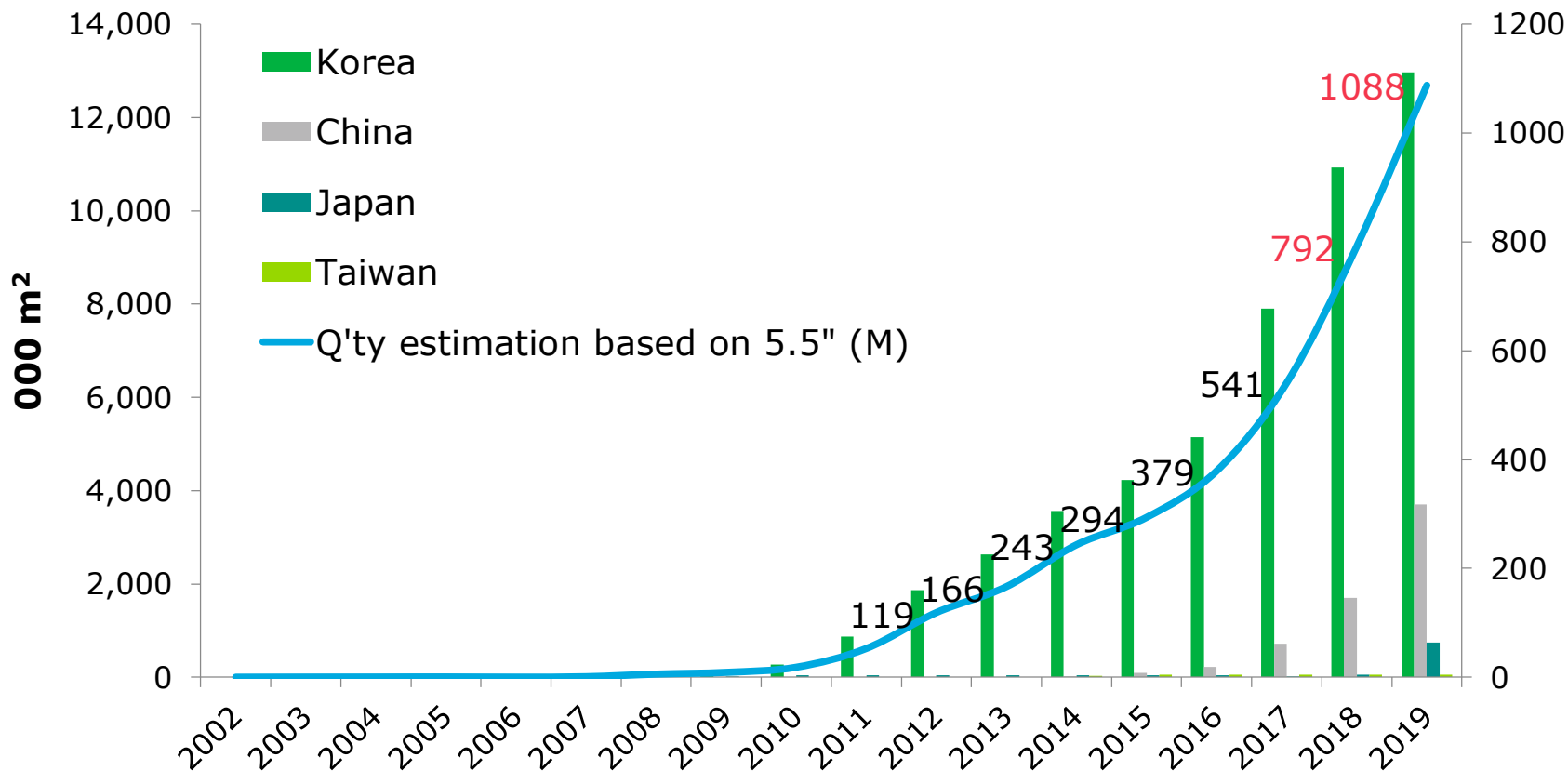
No new OLED fab investment yet. Focusing on a-Si LCD ??



Maker	Factory	Gen	Capacity (K/M)
AUO	L4B	G4	15

OLED fab forecast: over all

Korea will keep leading market dominance, but have to consider over supply!!



Estimation: Likelihood >= 30%, cum yield 75%, utilization 95%, glass efficiency 96%

Galaxy note 7 effect

Samsung Display trying to minimize the impact on Note 7, but it will be a challenge to recover.

Aug. 2nd introduced

Aug. 24th
1st battery explosion

Sep. 2nd
announced Recall

Sep. 19th
started to replace to new note 7

Oct. 10th Stop !

- ✓ Reduce inventory to others
- ✓ Replace order to Galaxy S7 edge
- ✓ Advance Galaxy S8 production
- ✓ Develop new model

