DSCC

www.displaysupplychain.com

More Insight, Lower Cost.

REPORT CATALOG 2019

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Why DSCC?

DSCC's mission is provide worldwide end-to-end supply chain expertise for all display-based products. To accomplish this, we have established close relationships with the display supply chain from component and equipment suppliers to flat panel suppliers, OEMs, brands and even retailers. This has been achieved by the extensive experience of its founders and employees which have decades of experience covering every layer of the display supply chain.

DSCC analysts have worked throughout the supply chain at brands, panel suppliers, equipment suppliers and materials suppliers including:

- Brooks Automation
- Compaq
- Corning
- LG Philips Displays
- Magnachip
- Meko
- OWL Displays
- Panasonic
- Philips Display Components
- Samsung Display
- Samsung SDI
- Universal Scientific
- Ushio

In addition, DSCC analysts have extensive experience in market/technology analysis and consulting having worked in an analyst roles at:

- Corning
- DisplayBank
- DisplaySearch
- Forrester Research
- IHS Markit
- IMS Research
- NPD Group
- SNE Research
- TSR
- Young Market Research
- Panasonic
- Samsung Display

DSCC executives have also held Board positions at a number of different display related companies demonstrating its consulting value:

- Akhan Technologies
- Illumitex
- NanoPhotonica
- UniPixel
- Westar Display

DSCC employs methodologies which leverages its supply chain relationships as much as possible.

- On pricing, we survey buyers as well as sellers.
- On panel shipments, we survey panel suppliers, brands as well as component suppliers to ensure there is enough supply to meet demand. By knowing glass input as well as panel shipments, this also allows us to quantify yields.
- Our shipment forecasts are always based on both supply and demand.
- Our fab timing and equipment supplier market share data leverages official PO filings in Korea and equipment awards in China.
- For every display application, in addition to tracking supply and demand, we also quantify costs, prices and margins and factor into account regional differences.
- We also provide fab utilization data on a monthly basis for key segments and a quarterly basis for all segments by surveying suppliers of multiple components as well as the fabs themselves.

At DSCC, we pride ourselves on:

- Delivering more insight at a lower cost
- Providing timely, accurate and precise information in a timely way leveraging our relationships throughout the display supply chain.
- Quickly incorporating the outlook, supply/demand, costs and prices for emerging display technologies.
- The high quality and integrity of our analysts.
- Updating all our forecasts at least 1X per quarter.
- Excluding confidential information from our forecasts.
- Examining both supply and demand in every market we track.
- Offering customized reports and consulting.
- Providing superior customer support.
- Always being accessible to our customers.
- Being flexible to meet the needs of our customers.

Quarterly OLED Supply/Demand and Capital Spending Report

This quarterly report will prove to be critical for anyone tracking the implications of new OLED form factors on supply and demand. It also provides detailed fab schedules and the outlook for OLED manufacturers and OLED equipment producers.

This report includes the following deliverables:

- OLED demand by application, size and form factor.
- OLED fab schedules.
- OLED yield, capacity and form factor scenarios by fab.
- OLED glass input, yields and output by fab.
- An innovative model which will allow users to enter a given panel size and form factor such as rigid, flexible, rollable and foldable and determine the resulting impact on OLED supply/demand.
- Unit, revenue and design win results and forecasts for all equipment in OLED frontplane and backplane fabs on both a bookings and billings basis.
- Market share for all OLED frontplane equipment and most OLED backplane equipment.
- Powerpoint report covering:
  - OLED demand by application
  - OLED fab schedules and supply analysis
  - OLED supply/demand calculations and analysis
  - OLED equipment spending trends by equipment segment, panel manufacturer, country, fab generation, bookings basis vs. billings basis, etc.
  - OLED deposition market and technical trends and market share, FMM VTE, Open Mask VTE, IJP and others.
  - Thin film encapsulation market and technical trends, market share, etc. PECVD vs. ALD vs. IJP, etc.
  - Laser Lift Off market and technical trends and market share.
  - Excimer laser annealing (ELA) market and technology trends, market share, etc.

Sample Table of Contents

Subscription Options

- Quarterly OLED Supply / Demand Captial Spending Report - 4 Quarterly Releases
- Quarterly OLED Supply / Demand Capital Spending Report Includes Supply / Demand Model - 4 Quarterly Releases

OLED Eqpt. Spending by Manufacturer

- While SDC accounted for a majority of revenues in 2016 and 2017, BOE is expected to lead in 2018, 2019 and 2022. LGD is expected to lead in 2020, China Star is expected to lead in 2021 with SDC leading in 2023.
- From 2018-2023, BOE is expected to lead in spending with a 25% share followed by LGD at 21%, SDC at 18%, China Star at 12% and Visionox at 11%.

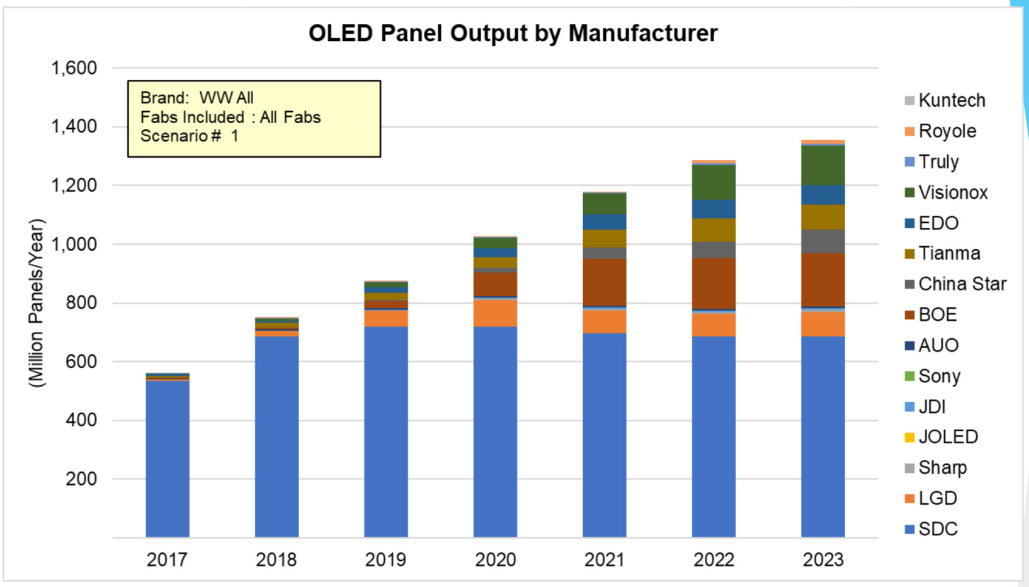
$US Millions

Mfr.	2016	2017	2018	2019	2020	2021	2022	2023
AUO								
BOE								
China Star								
EDO								
JDI								
JOLED								
LGD								
Royole								
SDC								
Sharp								
Tianma								
Visionox								
Total								

Mfr.	2016	2017	2018	2019	2020	2021	2022	2023
AUO								
BOE								
China Star								
EDO								
JDI								
JOLED								
LGD								
Royole								
SDC								
Sharp								
Tianma								
Visionox								
Total	100%	100%	100%	100%	100%	100%	100%	100%

OLED Panel Output by Manufacturer

- Samsung retains ~50% of output capacity in units, BOE to take #2 position by 2021, and Visionox takes #3 position by 2022.



Scenario 1: Rigid + Flat/Curved + Foldable

Mobile Applications

Quarterly OLED and Mobile LCD Fab Utilization Tracker

With a number of equipment and materials suppliers' financial results dictated by panel suppliers' fab utilization, we developed this service to help companies, industry analysts and financial analysts assess the impact of mobile OLED and LCD suppliers' fab utilization on company performance and the industry outlook.

For every OLED and LTPS LCD mobile fab, we reveal their capacity and glass input by month. This information is provided by month and forecasted forward one quarter. There are two deliverables per quarter.

The capacity and utilization data is provided through a series of pivot tables covering glass capacity and input in sheets and area.

Capacity – sheets and area
Input – sheets and area
Utilization – sheets and area

Utilization data can be segmented by:

- Supplier
- Country
- TFT Generation
- Backplane
- Frontplane
- Substrate type – rigid vs. flexible vs. foldable

Areas Covered:

Capacity, glass input and fab utilization by month for:
- Mobile OLEDs
- Mobile LCDs

Previous/current months results + 1 quarter forward forecast
Sortable by:
- Supplier
- Country
- TFT Generation
- Backplane
- Frontplane
- Form Factor
- Technology

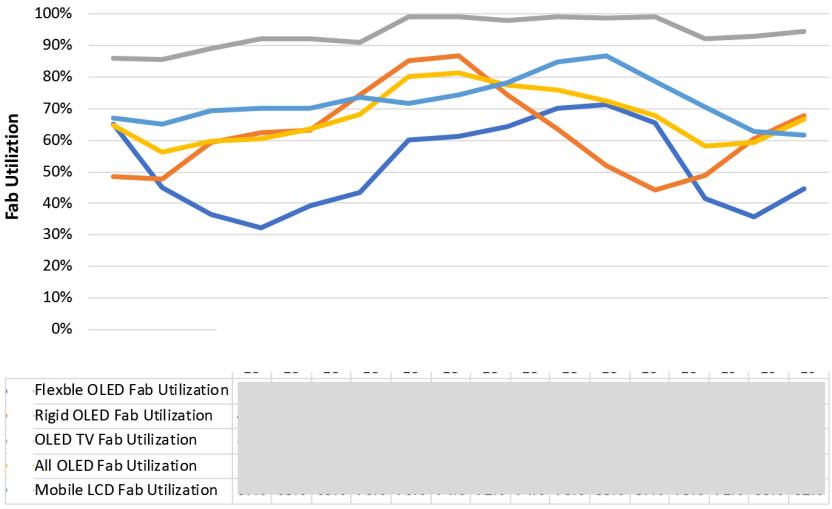
Fab Generations Covered:
- 3.5, 4.5, 5.5, 6 and 8.5

Subscription Options

• Quarterly OLED and Mobile LCD Fab Utilization Tracker - 4 Quarterly Releases

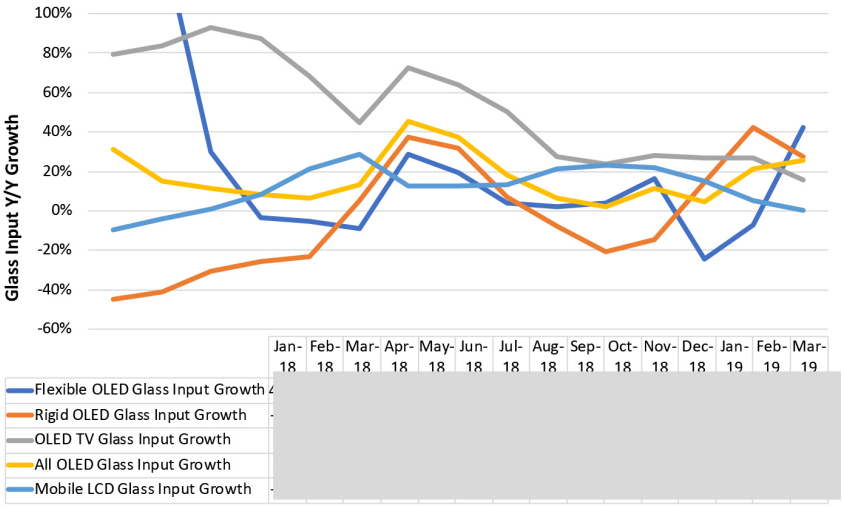
Executive Summary – Fab Utilization

- Flexible OLEDs – Upgraded January but downgraded February and March vs. the previous issue. This is largely a result of upgrading increasing BOE's B7 input and capacity.
- Rigid OLEDs – Improving faster than previously expected. Upgraded February & March w/, SDC EDO, Tianma, Truly & Visionox higher in February and March and SDC higher in March.
- OLED TVs – Remain at high levels as predicted.
- All OLEDs – January and February remained the same, but March increased from 66% to 67% on rigid OLED gains.
- Mobile LCDs revised higher in January and February, but lower in March.



Exec. Summary - Feb./March Y/Y Glass Input Growth

- Flexible OLEDs – February glass input was down 7% Y/Y after declining 25% Y/Y in January, but should be up 42% Y/Y on a significant decline in March of 2018.
- Rigid OLEDs – Up 42% Y/Y in February and should be up 27% Y/Y in March, healthy results on higher utilization and some capacity growth at EDO, Tianma and Visionox.
- OLED TVs – Up 27% Y/Y in February and expected to be up 16% in March. It will benefit from new capacity in Q3'19.
- All OLEDs were up 21% in February and are expected to be up 26% in March.
- Mobile LCD glass input was up 5% Y/Y and is expected to be flat in March with significant declines at AUO, JDI, LGD and Sharp with CSOT and Tianma enjoying sharp growth.



Quarterly OLED Shipment Report

This is the industry's most comprehensive OLED shipment report, covering smartphone, tablet, laptop and TV panel markets. This report looks at current and future OLED shipments and revenues by application, supplier and size, and forecasts the timing of OLED overtaking LCD in all major applications.

With this report, you can find out:

- How big the OLED market is projected to grow?
- How quickly will the smartphone market migrate to OLEDs?
- When will OLEDs overtake LCDs and when will flexible OLEDs overtake rigid OLEDs?
- When will foldable OLED shipments take significant share?
- What mobile applications after smartphones are likely to be dominated by OLEDs?
- Which brands are the largest buyers of OLEDs by application?
- Which Chinese suppliers are likely to emerge by application?

Areas Covered:

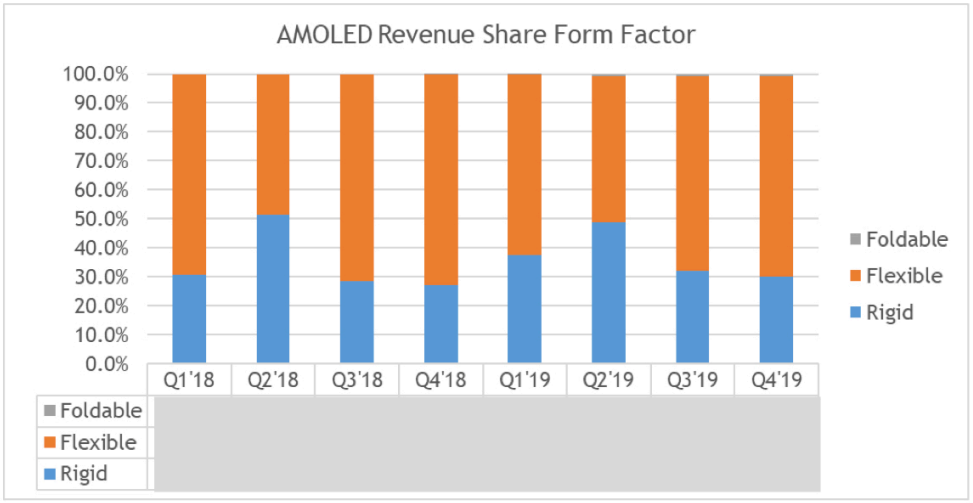
- Panel sizes ranging from 1" to 77"
- Quarterly OLED shipments and revenues by application, panel supplier and customer
- Supply chain for all OLED applications
- Mobile supply chain by model # in China
- OLED panel shipments to TV brands by size/resolution

Subscription Options

- Quarterly OLED Shipment Report- 4 Quarterly Releases

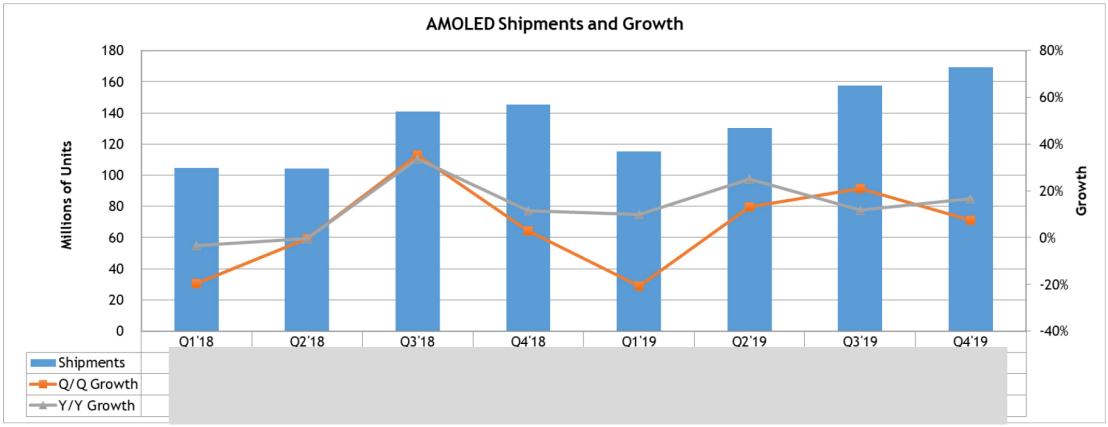
Quarterly OLED Revenue Share by Form Factor- Mobile

- Flexible revenue took 62.3% share in Q1'19, Q/Q revenue decreased 47.3% as the demand dropped dramatically.
- Rigid revenue share in Q1'19 was 37.6%, with Q/Q revenue decreasing by 15.4%.
- As foldable products have been delayed and shipment targets lowered, we expect foldable revenue share will not surpass 1% by end of 2019.



Quarterly OLED Unit Shipments and Growth

- Q4'18 AMOLED panel shipments grew 3% Q/Q and 11% Y/Y to 145.1 million. SDC had a 2% decrease Q/Q in Q4'18.
- Beyond SDC, other AMOLED panel suppliers such as BOE and Visionox showed growth.
- We expect Q1'19 WW AMOLED unit shipments will decrease by 21% Q/Q but grow by 10% Y/Y, as Q1 starts slow season with fewer shipments for Apple and others.



Foldable Display Technology and Market Report

This report explores the challenges and opportunities associated with manufacturing and selling foldable displays which have the opportunity to breathe new life into stagnant markets. It examines the obstacles that must be overcome, explores potential solutions, timing of foldable display production and which markets and companies are likely to benefit. This report relies directly on interviews with panel, equipment and materials suppliers, includes supplier roadmaps and presents a detailed foldable market forecast. It also examines how foldable demand will impact OLED supply/demand and impact demand for equipment and materials.

This report is critical for any company participating in the flexible OLED supply chain, looking to enter the flexible OLED supply chain or investing in these companies.

The report reveals:

- Why foldable displays must succeed;
- What the key challenges are and industry solutions to overcome those challenges;
- What changes are required to the backplane and frontplane processes to maximize yields and foldability;
- What are the requirements, new materials and manufacturing processes for foldable touch sensors, optically clear adhesive (OCA) materials, circular polarizers, cover films, hard coats and foldable glass covers;
- What kind of mechanical solutions are required;
- Cost and price forecasts for multiple sizes and resolutions;
- Capacity and yield forecasts with yield scenarios by tier;
- Segmentation of the foldable market into 6 distinct segments;
- Shipment forecasts by application, size, area, units, revenues, ASPs, etc.;
- Foldable supply vs. demand;

This report includes:

- Technology Analysis
- Manufacturing Process Flows
- Display Materials Market Analysis
- Cost Forecasts
- Price Forecasts
- Capacity Forecasts
- Market Forecasts
- Smartphones
- Tablets
- Notebooks
- Supply/Demand Forecasts

Markets and Technologies Covered:

- Foldable OLEDs
- Flexible OLEDs
- Rigid OLEDs
- LTPS LCDs
- Tablets
- Notebook PCs
- Polyimide
- OCA
- Touch Sensors
- Polarizers
- Cover film
- CPI
- Hardcoats
- Foldable Cover Glass

Companies Covered:

- 3M
- Apple
- Applied Materials
- AP Systems
- Ares Materials
- Asahi Glass
- BOE Technology
- C3 Nano
- DuPont
- Fuji Film
- Huawei
- Kaneka
- Kateeva
- Konica Minolta
- LG Display
- Light Polymers
- Microsoft
- Nippon Zeon
- Nissha
- Nitto Denko
- Samsung Display
- Samsung Electronics
- Schott
- SKC Kolon
- Solip Tech
- Sumitomo Chemical
- Tosoh
- TPK
- Ube Industries
- Unitika
- VIsionox
- and more

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Subscription Options

Foldable Display Technology and Market Report - Single Release

2019 Foldable Display Market Update and Outlook Report

The 80-page 2019 Foldable Display Market Update and Outlook Report provides deep insight into the status and outlook of foldable smartphones, tablets and notebooks and their displays at leading brands and panel suppliers. It provides the::

The provides the:

- Status of current foldable products including detailed cross sections showing film thickness and suppliers for the different layers above and below the foldable panels.
- Product roadmaps for 11 different brands covering Samsung, Huawei, Lenovo/Motorola, Xiaomi, Oppo, Vivo, TCL, Google, Sony, Apple and PC brands.
- 19 different foldable devices to be launched within 2020.
- Cover material by product - CPI vs. UTG.
- Panel suppliers foldable roadmaps and unyielded capacity, yielded capacity and yields.
- Costs in bill of material format for 6.7" clamshell, 7.3" in-folding and 8.03" out- folding displays.
- Cost comparison between China and Korea.
- Unit and revenue forecasts by:
  - Application
  - Brand
  - Panel Supplier
  - Form Factor
  - Size

With this report, you can find out:

- What foldable products are coming?
- Which products will use cover film vs. ultra-thin glass?
- What volumes are likely by brand, by panel supplier, by size, by resolution, by form factor?
- Which form factors are likely to dominate?
- Which brands are expected to lead?
- What will foldable penetration be into the smartphone market?
- Where are foldable display costs and prices going?

Subscription Options

2019 Foldable Display Market Update and Outlook Report - Single Release

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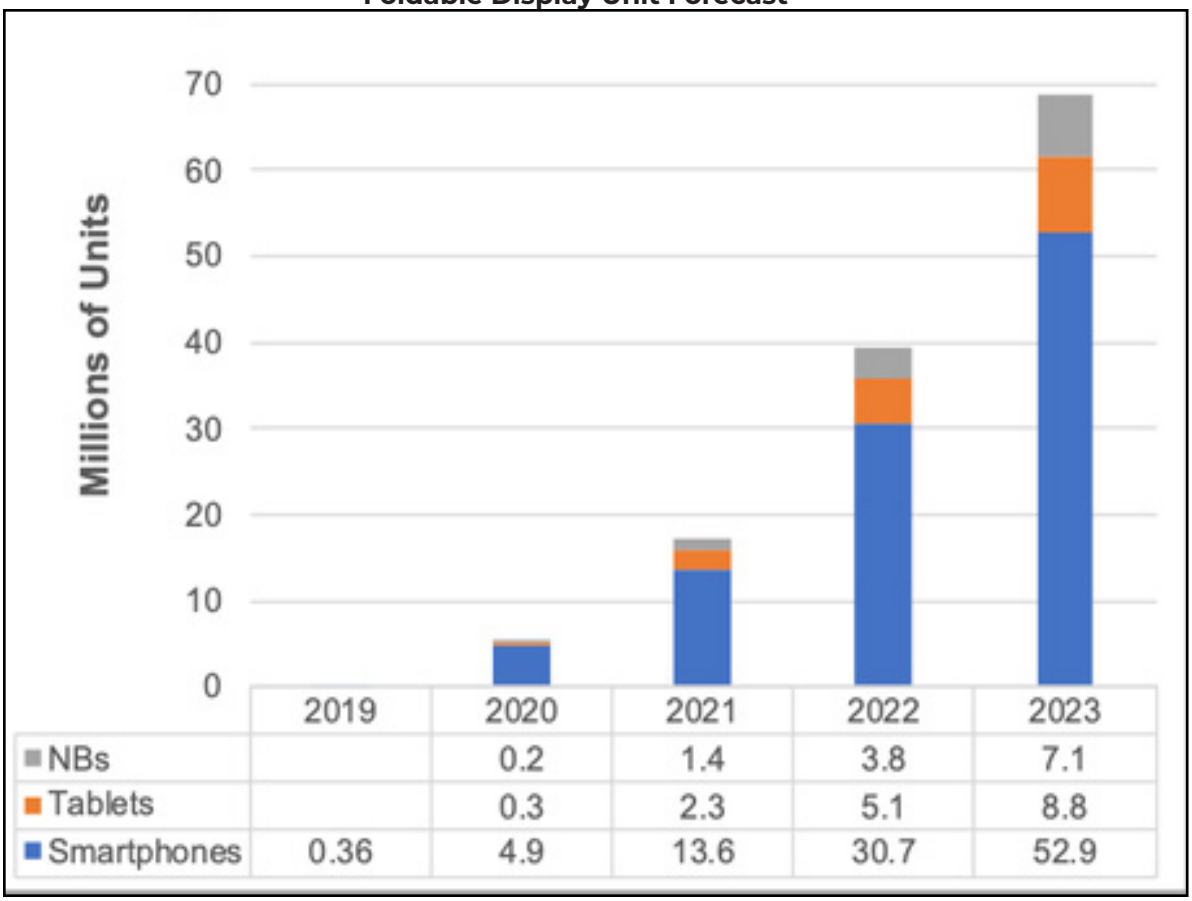
Foldable Display Unit Forecast



Quarterly Display Capex and Equipment Report

This report provides all of the market intelligence that a display equipment manufacturer, supplier to display equipment manufacturer or analysts covering display equipment suppliers would want. It is also ideal for panel suppliers tracking the health, outlook and performance of their equipment suppliers.

This report includes the following deliverables:

- OLED Fab Schedules and Capacity Forecast
- LCD Fab Schedules and Capacity Forecast
- OLED equipment market size by segment and forecasted out to 2024
- LCD equipment market size by segment and forecasted out to 2024
- Equipment revenues on a bookings or billings basis.
- Quarterly and annual market share provided through as far as 2024 for all frontplane segments and major backplane segments.
- Design wins for all backplane and frontplane segments and all color filter, cell and module segments.
- Added 21 new equipment segments in the Q2'19 issue. As a result, >67 segments are now provided in total with more to be added soon.
- Equipment prices for 60 different tool segments

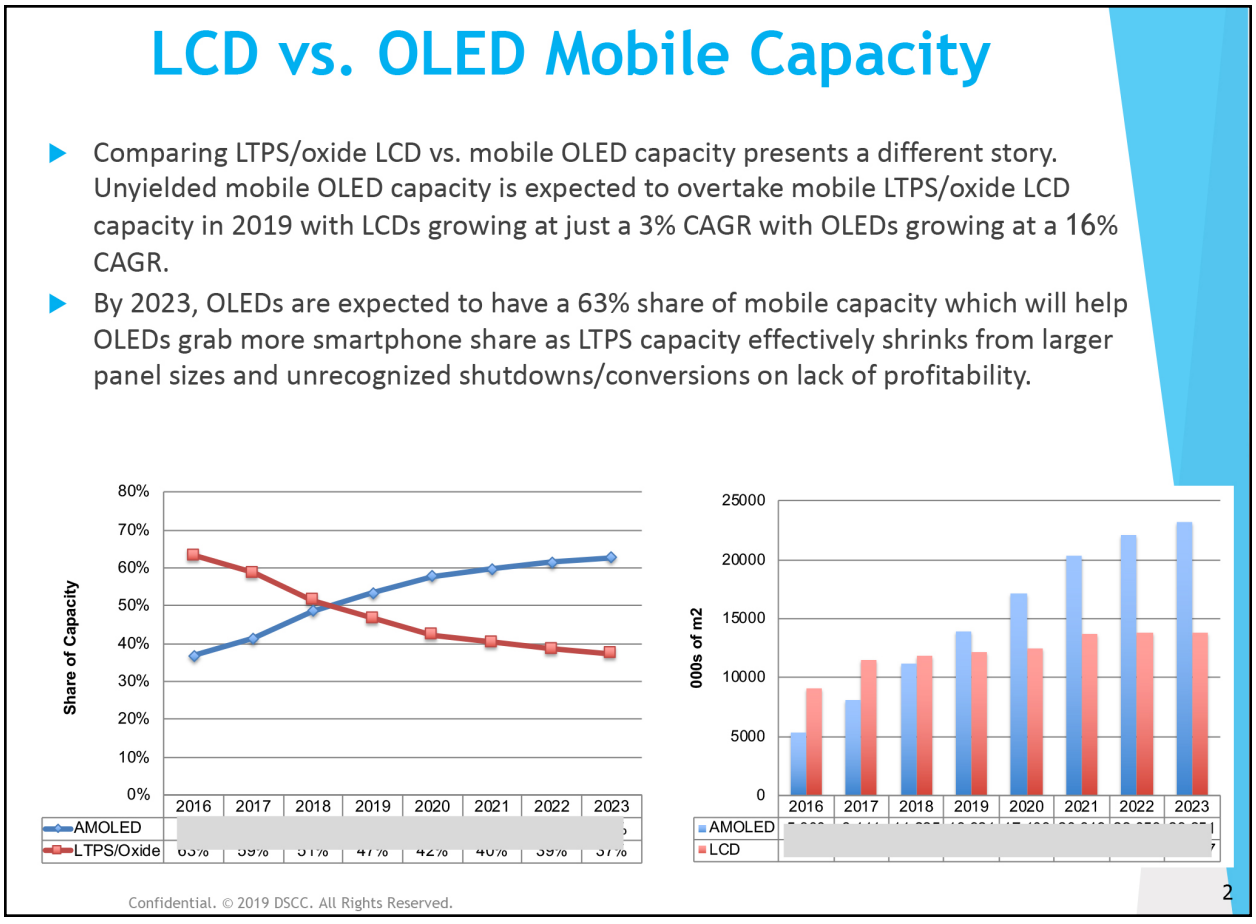
Segments Covered include:

- **Backplane**
  - AOI Inline
  - AOI Stand-Alone
  - Array Test
  - Automation
  - Bubble/PI Other Repair
  - CD/Overlay
  - Coater/Developer
  - CVD - Buffer/a-Si Precursor
  - CVD - ILD/Gate Dielectric
  - CVD Island
  - CVD Passivation, E/S
  - Dry Etch
  - Dry Strip
  - ELA
  - Exposure
  - Film Thickness Measurement
  - Film thickness (stand-alone)
  - Furnace (Activation/Annealing)
  - Ion Implant
  - Initial Clean
  - ITO Furnace
  - Laser CVD Repair
  - O/S Tester
  - Other Backplane
  - PI Coater
  - PI Curing
  - PVD - ITO/IGZO
  - PVD - S/D, Gate, L/S
  - Repair
  - SEM
  - Total Pitch
  - Wet Clean
  - Wet Etch - Gate, S/D
  - Wet Etch - ITO/IGZO
- **Frontplane**
  - AOI
  - CD/Overlay
  - Evaporation (R&D)
  - Film Thickness
  - Film thickness (stand-alone)
  - FMM VTE
  - FMM VTE Source
  - Frontplane Automation
  - Glass/Metal Encapsulation
  - Half cut glass cut
  - IJP
  - Inorganic TFE
  - LLO
  - Open Mask VTE
  - Open Mask VTE Source
  - Organic TFE
  - Other Frontplane
  - Total Pitch
  - Film Thickness Measurement

- **For Cell**
  - PI IJP
  - PI Cure
  - Photo-alignment
  - Rubbing
  - LC Dispense
  - One drop fill
  - Seal dispense
  - Cell repair
  - Scribe
- **Color Filter**
  - CF Automation
  - CF CD/Overlay
  - CF Coater
  - CF Developer
  - CF Exposure
  - CF Other
  - CF Repair
  - CF Sputtering
  - CF Total Pitch
- **Module**
  - Laser Cell Cutting
  - Laser Shape Cutting
  - Visual Inspection
  - Automated Module Test
  - Automated Final Test
  - Automated Cell Aging Test
  - Multi Time Program Test

Subscription Options

For samples, pricing & package pricing discount information, please contact **Gerry@DisplaySupplyChain.com**



Quarterly Display Supply Chain Financial Health Report

This report provides a deep dive into the health of 31 publicly traded companies in the display supply chain which enables companies to benchmark themselves against their competition as well as track the health of their suppliers and customers. It provides critical data and unbiased analysis on panel suppliers and equipment manufacturers which financial analysts can use to benchmark the companies they are tracking and monitor those they haven't been tracking. It also enables companies and bankers to perform financial due diligence on companies they are interested in acquiring or investing in as well as establish industry specific benchmarks and baselines.

This report provides its clients with all of the critical data (income statements, balance sheet, cash flow and industry metrics), insights, market commentary and guidance released by publicly traded display supply chain companies in their quarterly earnings reports, stock exchange filings, press releases and conference calls along with unbiased analysis from DSCC analysts within 24-48 hours of their earnings calls.

The financial and industry data is incorporated into pivot tables which go back to Q1'13 and makes comparisons by company, layer of the supply chain, country, etc. extremely easy. The results are also aggregated to determine which layer of the supply chain (equipment or panels) is performing best and has the best outlook and which companies within each layer of the supply chain are performing best. Aggregated financial and industry metrics are also provided. Analysis is provided in a PPT file which can easily be incorporated into internal presentations.

This report includes the following deliverables:

- Powerpoint summaries from every publicly traded display equipment and panel supplier within 48 hours of their earnings calls.
- Pivot tables with all company financial (income statement, balance sheet, cash flow) and industry data which go back to Q1'13.
- Comparison chapter which compares company financial and industry performance by company and layer of the supply chain, determining which companies are performing best. Also includes financial and industry metrics aggregated by layer of the supply chain.

Companies Covered:

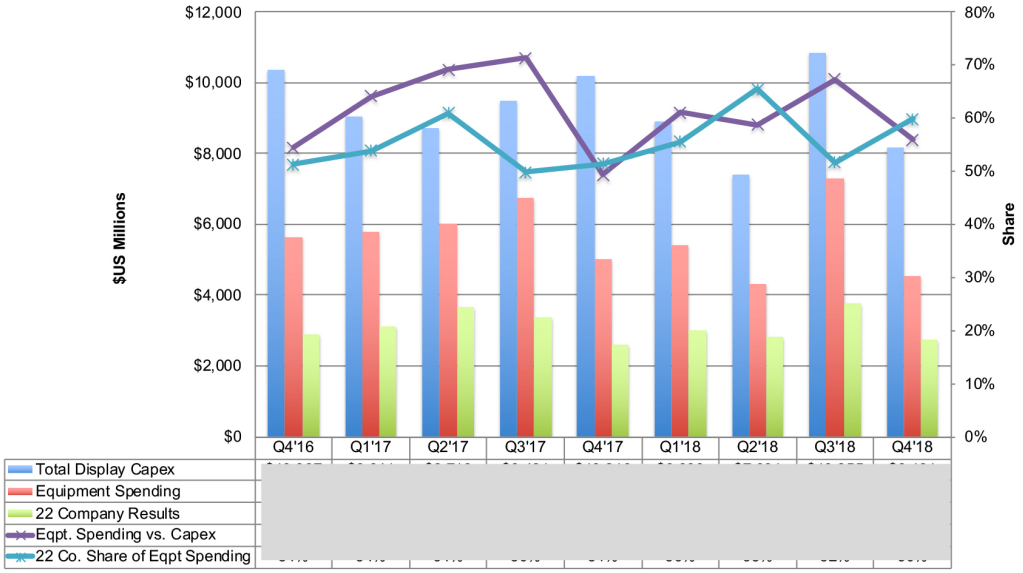
- **Equipment** - Applied Materials, AP Systems, Avaco, Canon (Tokki), Coherent, Contrel, Han's Laser, ICD, Jusung, KC Tech, LIG Invenia, Nikon, Nissin Electric, Philoptics, SCREEN Holdings, SFA Engineering, SNU Precision, Tera Semicon, TES, ULVAC, Viatron Technologies, V-Technology, Wonik, Wuhan Jingce, IPS and Y.A.C.
- **Panels** - AUO, BOE, CEC Panda, CPT, CSOT, HannStar, Innolux, JDI, LG Display, Samsung Display, Sharp,

Subscription Options

- Quartery Subscription - Includes Pivot Table with Weekly Updates - 4 Quarterly Releases / Weekly Updates
- Single Issue (Excludes Pivot Table)
- Report Package - Mobile & TV Panel Markets - 4 Quarterly Releases

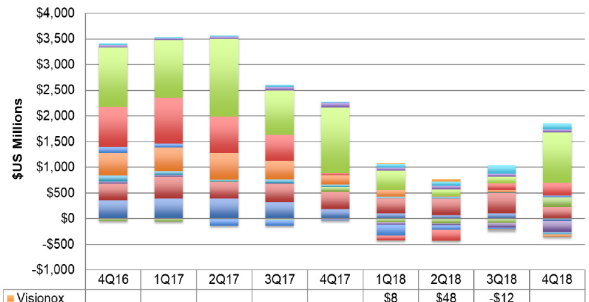
Display Capex vs. Eqpt Spending by Quarter

- Q4'18 was a down quarter for display capex and equipment spending and equipment supplier revenues. It was he lowest quarter for the 22 companies we now follow since Q4'17.
- From Q1'16 – Q4'18, equipment spending amounted to 63% of total capex and the 22 companies we follow accounted for 53% of equipment spending on average.

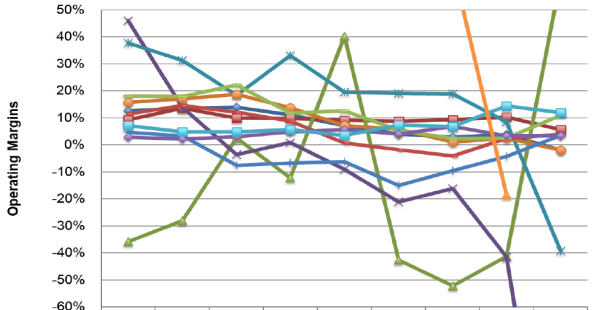


Operating Profits and Margins by Supplier

- CEC Panda bounced from lowest to highest as Q4 government subsidies came in
- CPT operating margins reached unprecedented depths
- Samsung profit margin recovered strongly
- Tianma sustained high OPM%



	4Q16	1Q17	2Q17	3Q17	4Q17	1Q18	2Q18	3Q18	4Q18
Visionox						$8	$48	-$12	
Tianma	$31	$20	$23	$34	$21	$75	$79	$164	$124
Sharp	$48	$31	$45	$77	$92	$51	$80	$58	$55
SDC	$1,156	$1,128	$1,513	$856	$1,275	$381	$125	$130	$981
LG Display	$780	$891	$711	$517	$41	-$91	-$211	$125	$247
JDI	$116	$71	-$130	-$111	-$12	-$211	-$90	-$42	$34
Innolux	$440	$471	$523	$360	$188	$131	$22	$58	-$46
HannStar	$111	$63	$29	$73	$40	$29	$33	$11	-$41
CPT	$52	$40	-$9	$2	-$27	-$49	-$38	-$87	-$221
CEC Panda	-$48	-$51	$6	-$27	$96	-$70	-$92	-$84	$191
BOE	$314	$429	$332	$363	$334	$298	$317	$394	$224
AUO	$364	$387	$386	$322	$189	$101	$71	$100	-$47



	4Q16	1Q17	2Q17	3Q17	4Q17	1Q18	2Q18	3Q18	4Q18
AUO	13%	14%	14%	11%	7%	4%	3%	4%	-2%
BOE	9%	14%	10%	10%	9%	9%	9%	10%	6%
CEC Panda	-36%	-28%	3%	-12%	40%	-43%	-52%	-41%	61%
CPT	46%	14%	-4%	1%	-9%	-21%	-16%	-41%	-164%
HannStar	38%	31%	18%	33%	20%	19%	19%	9%	-39%
Innolux	16%	17%	19%	14%	7%	6%	1%	2%	-2%
JDI	5%	3%	-8%	-7%	-6%	-15%	-9%	-4%	3%
LG Display	11%	15%	12%	9%	1%	-2%	-4%	2%	4%
SDC	18%	18%	22%	12%	13%	5%	2%	2%	11%
Sharp	3%	2%	3%	5%	6%	4%	7%	3%	3%
Tianma	7%	5%	5%	6%	4%	7%	7%	14%	12%
Visionox						473%	66%	-18%	

Quarterly Display Fab Utilization Report

With a number of equipment and materials suppliers' financial results dictated by panel suppliers' fab utilization, we developed this service to help companies, industry analysts and financial analysts assess the impact of OLED and LCD suppliers' fab utilization on company performance and the industry outlook.

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The capacity and utilization data is provided through a series of pivot tables covering glass capacity and input in sheets and area.

Capacity – sheets and area
Input – sheets and area
Utilization – sheets and area

In addition to the pivot tables, analysis is provided through PPT slides.

Utilization data can be segmented by:

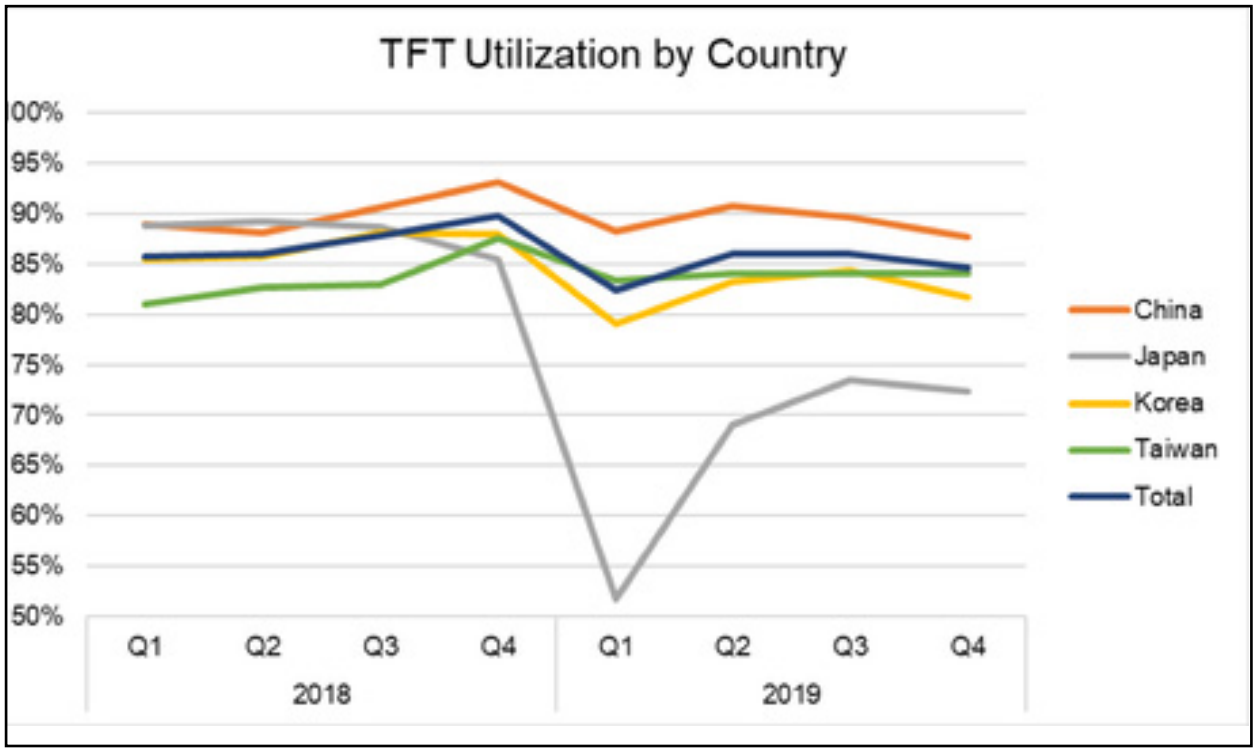
- Supplier
- Country
- TFT Generation
- Backplane (a-Si, oxide, LTPS)
- Frontplane (LCD, OLED)
- Substrate type – rigid vs. flexible vs. foldable

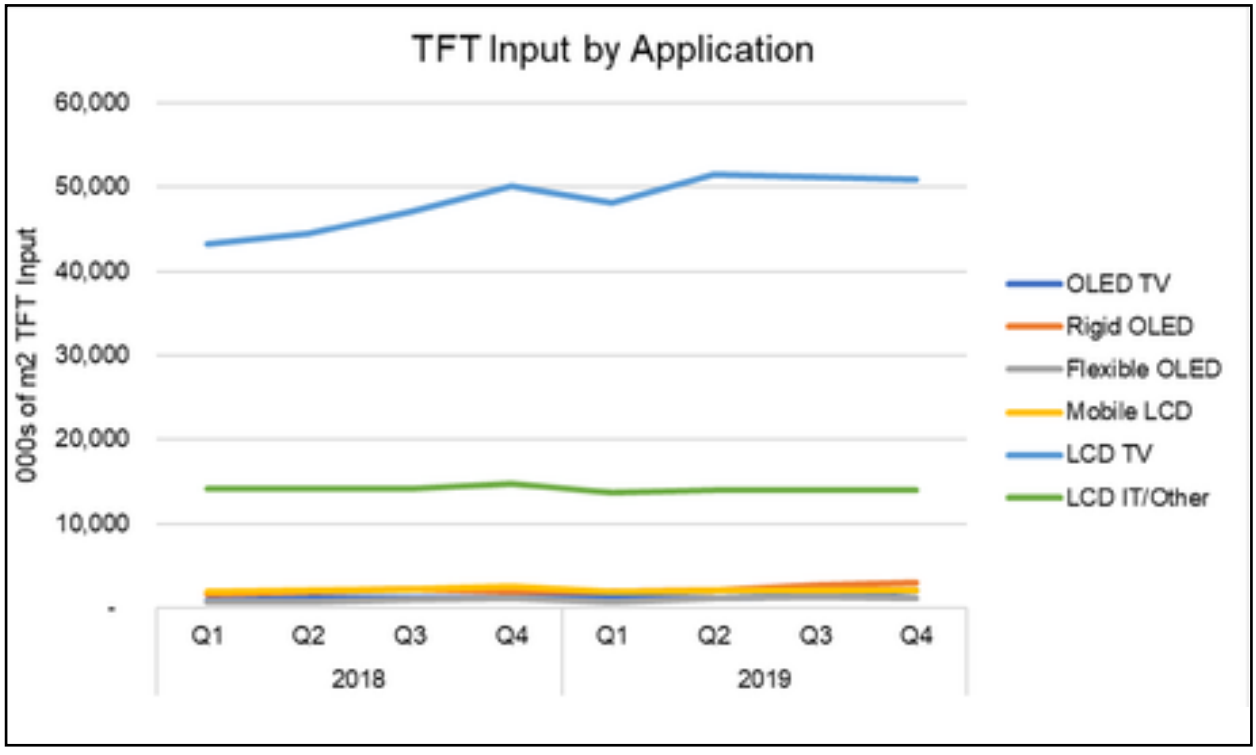
Areas Covered:

- Capacity, glass input and fab utilization by quarter for all OLED and LCD fabs
- History by quarter from Q1 2018 + forward forecast by quarter to Q4 2019
- Regions Covered:
  - China
  - Japan
  - Korea
  - Singapore
  - Taiwan
- Sortable by:
  - Supplier
  - Country
  - TFT Generation
  - Backplane
  - Frontplane
  - Form Factor
- Fab Generations Covered:
  - Gen 1 through Gen 10.5

Subscription Options

• Quarterly Display Fab Utilization Report - 4 Quarterly Releases





Advanced Weekly PO and Award Database

A first of its kind database which provides the complete toolset and components used in all display fabs in China, from 2015-2020 and beyond. The Advanced Weekly PO and Award Database reveals all the different tools and components for nearly every display fab in China along with the supplier of those tools and components and the number of units being delivered. These awards are typically issued before purchase orders are released, allowing analysts to not only track, but also predict company bookings. In addition, since display equipment can be delivered more than a year after the awards are issued, it allows users to accurately forecast market share out as much as 18-months in advance for more than >150 different equipment categories, ranging from <$5000 to over $100M per tool/component. With the fabs in this database representing over 75% of 2018-2020 equipment spending, it represents a cost effective and highly accurate way for companies to predict the size of the display market in units and revenues as well as track their competition. It also gives component suppliers a way to track their end-markets and market share of their customers. In addition, it allows panel manufacturers to examine the tool choices of their competitors and gain insight into their competitor's processes. Furthermore, it allows equipment suppliers to track the growth of segments they are not participating in, providing an immediate way to size the market for every category and shorten the time it takes to assess new markets.

China Fab List:

AUO
- Kunshan

BOE
- B3
- B6
- B7
- B9
- B10
- B11
- B17

CEC
- CHOT Xianyang

CEC Panda
- CCPD Chengdu
- Fab1 Nanjing
- Fab2 Nanjing

CSOT
- Huizhou Module
- T2
- T2 R&D
- T3
- T4
- T6
- T7

EDO
- Shanghai

HKC
- H1
- H2
- H4
- Royole
- R1

Royole
- R1

Tianma
- Wuhan
- Xiamen
- Shanghai
- Chengdu

Truly
- SDC L5

Visionox
- V1
- V2
- V3

Customer	Fab Name	Fab Location	Gen size	Display Type	Equipment Company	PO	1st Schedule	Amount (USD) million	Expected Tool Type	Tool maker HQ
SDC	T8	Ta	G	O	Intekplus (Private company)	4/	9	$2	In	Korea
EDO	Sh	Sh	G	O	DMS	4/	1 9	$9	Et	Korea
SDC	L8	Ta	G	O	Youngwoo DSP	4/	7	$4	ba	Korea
SDC	Dc	Dc	m	O	Youngwoo DSP	4/	6	$1	ba	Korea
BOE	B1	M	G	O	YAS	4/	5	$1	Ev	Korea
SDC	Vi	Vi	m	O	HIMS	4/	5	$9	Pa	Korea
SDC	L8	Ta	G	O	DIT	3/	6	$7	In	Korea
BOE	B1	M	G	O	Viatron Technologies	3/	6	$1	PL	Korea
Neolux	R8	R8		O	Sunic System	3/	9	$4	R8	Korea
BOE	B1	W	G	LC	Meere Company	3/	7	$7	Gu	Korea
LGE		Kc	G	O	Hansong Neotech	3/	6	$1	M	Korea
BOE	B1	W	G	LC	STI	3/	6	$1	CF	ea Korea
LGD	Ha	Vi	M	M	DE&T	3/	5	$9	M	Korea
LGD	Gu	Gl	G	O	DE&T	3/	1 9	$0		Korea
BOE	B1	W	G	LC	DMS	3/	3	$2	W	s Korea
BOE	B1	W	G	LC	Meere Company	3/	5	$2	Ec	Korea
BOE	B1	W	G	LC	Vessel	3/	5	$3		Korea
LGD	Gu	Gl	G	O	YAS	3/	7	$1		Korea
SDC	Dc	Dc		O	Finetek	3/	4	$1		Korea
Visionox	Gu	Gu	G	O	HIMS	3/	3	$1	M	Korea
BOE	B1	M	G	O	FNS (083500)	2/	9	$8	LL	le Korea
SDC	L8	Ta	G	O	HIMS	2/	9	$3		Korea
BOE	B1	W	G	LC	DSK	2/	7	$9	PC	is Korea
BOE	B1	M	G	O	Intekplus (Private company)	2/	6	$2	In	Korea
SDC	L8	Ta	G	O	Youngwoo DSP	2/	5	$1	In	Korea
BOE	B1	Ch	G	LC	DMS	2/	8	$5	W	s Korea
BOE	B5	He	G	O	LIS	2/	4	$4	La	Korea

Database Desriptions:

PO Database

This database includes all the Purchase Order (PO) announcements made by equipment companies. In particular, we are showing all the PO announcements filed by publicly traded Korean equipment suppliers, which we update on a weekly basis. Going back 3 years, we show PO dates, delivery dates, changes to delivery dates, PO amount in $US, customer, fab name, fab location, glass size, display technology, equipment description. This database includes >500 different POs

LCD Fab Equipment Award Database

This database includes equipment awards from Chinese LCD panel makers to equipment makers. These awards are issued prior to the purchase orders (POs). This database includes the equipment company, customer, award date, fab location, fab name, glass size, phase, display technology, tool type and number of tools..

This database includes the equipment supplier and number of tools per equipment type by fab from the following panel suppliers – AUO, BOE, CEC Panda, China Star, HKC, Tianma and Truly. There are over 5000 entries.

OLED Fab Equipment Award Database

This database includes equipment awards from Chinese OLED panel makers to equipment makers by tool type including the number of tools by tool type by fab. These awards are issued prior to the purchase orders (POs). This database includes the equipment company, customer, award date, fab location, fab name, glass size, phase, display technology, tool type and # of tools. There are over 2300 entries..

Subscription Options

- Advanced Weekly Supply Chain Monitor Newsletter - 1 Year Subscription

Display Maker	Fab Name	Fab Location	Gen Size	Frontplane	Backplane	Rigid/Flex	Equipment Supplier	Awarded	Equipment	Units	Bidding Codes
BOE		Kumming	8"	MicroOLED			Impressive Edge SDN		ule Lay		0714-184BOEBMOT01/90
CSOT		Wuhan	G6	OLED			FormFactor		ual Pr		0714-1740CSOT0009/191
CSOT		Wuhan	G6	OLED			Daewon F&C		PDRS		0714-1740CSOT0009/162
CSOT		Wuhan	G6	OLED			Nissin		Ion In		0714-1740CSOT0009/203
Visionox		Gu'an	G6	OLED			LIS		ser Ho		0714-174YUNGU0002/75
BOE		Mianyang	G6	OLED			Beijing Sunrise Technology		So		0714-174BOEMY0001/301
BOE		Mianyang	G6	OLED			Jiangsu Tunhsuyitai Intelligent Eqpt		nated		0714-174BOEMY0001/302
Tianma		Wuhan	G6	OLED		R	Semilab Sysco, Verity Instrument		t Dete		0730-194011020019/101
Tianma		Wuhan	G6	OLED		R	Wuhu Tunghsu Photoelectric Eqpt & Tech		JPK &		0730-194011020019/96
Visionox		Gu'an	G6	OLED			SFA Engineering		to Sof		0714-174YUNGU0002/76
Visionox		Gu'an	G6	OLED			Wuhan Jingce Electronic Technology		Mura T		0714-164YUNGU0001/269
Tianma		Wuhan	G6	OLED		R	Wonik IPS		Dry		0730-194011020019/102
Visionox		Hefei	G6	OLED			ANAC		ical su		0714-194VISIONOX3/66
Visionox		Hefei	G6	OLED			ANAC		ical su		0714-194VISIONOX3/65
Visionox		Hefei	G6	OLED			CKFST		T		0714-194VISIONOX3/63
Visionox		Hefei	G6	OLED			FAE		ical su		0714-194VISIONOX3/67
Visionox		Hefei	G6	OLED			Semilab Semiconductor Physics Laboratory		Ellipso		0714-194VISIONOX3/56
Visionox		Hefei	G6	OLED			Tyne Systems		EDA		0714-194VISIONOX3/68
Visionox		Hefei	G6	OLED			Toho Technology		Cass		0714-194VISIONOX3/43
Visionox		Hefei	G6	OLED			CEC Jiutian Intelligent Tech		lock Co		0714-194VISIONOX3/57
Visionox		Hefei	G6	OLED			DIT		M		0714-194VISIONOX3/61
BOE		Chengdu	G6	OLED			Nanotech		Monit		0714-184BOECDCK01/42
CSOT		Wuhan	G6	OLED			FormFactor		ual Pr		0714-1740CSOT0009/191
Visionox		Gu'an	G6	OLED			SYO Technology		ptical		0714-164YUNGU0001/268
Visionox		Hefei	G6	OLED			Edwards		Dry I		0714-194VISIONOX3/58
Visionox		Hefei	G6	OLED			Kashiyama Industries		Dry I		0714-194VISIONOX3/59
Visionox		Hefei	G6	OLED			Korea Conveyor		O		0714-194VISIONOX3/47
Visionox		Hefei	G6	OLED			Philoptics		Laser		0714-194VISIONOX3/53
Visionox		Hefei	G6	OLED			Shimadzu		olecul		0714-194VISIONOX3/60
Visionox		Hefei	G6	OLED			Shinsung FA		AM		0714-194VISIONOX3/45
Visionox		Hefei	G6	OLED			Shinsung FA		O		0714-194VISIONOX3/46
Visionox		Hefei	G6	OLED			Wuhu Tunghsu Photoelectric Eqpt & Tech.		AM		0714-194VISIONOX3/44
Tianma		Wuhan	G6	OLED		R	ANI		F		0730-194011020019/80
Tianma		Wuhan	G6	OLED		R	SCREEN		pater-I		0730-194011020019/104
Tianma		Wuhan	G6	OLED		R	Toray Engineering		cle Nu		0730-194011020019/91
Tianma		Wuhan	G6	OLED		R	Unisem		ion Ch		0730-194011020019/112
BOE		Mianyang	G6	OLED			CETC Fenghua Information Eqpt		uto-Cla		0714-174BOEMY0001/286
BOE		Mianyang	G6	OLED			CETC Fenghua Information Eqpt		uto-cla		0714-174BOEMY0001/286
BOE		Mianyang	G6	OLED			Finetek		Visua		0714-174BOEMY0001/291
BOE		Mianyang	G6	OLED			G.N. Tech		nding		0714-174BOEMY0001/292
BOE		Mianyang	G6	OLED			Han's Laser Technology Industry		Shap		0714-174BOEMY0001/293
BOE		Mianyang	G6	OLED			Han's Laser Technology Industry		Pac		0714-174BOEMY0001/293
BOE		Mianyang	G6	OLED			Jiangsu Tunhsuyitai Intelligent Eqpt		So		0714-174BOEMY0001/297

Quarterly OLED Materials Report

This report tracks all the major materials used to produce flexible OLEDs, rigid OLEDs and OLED TVs. It combines DSCC's deep knowledge on OLED capacity and panel shipments with insight on OLED device structures and OLED material prices providing the industry's most accurate market size and market share results and forecasts.

Organic materials covered include small molecule and polymer emitter materials and all common materials including hole injection, hole transport, electron transport and more.
Also available is coverage on other materials found in OLED displays including circular polarizers and polyimide.
These markets are expected to grow rapidly as the smartphone market transitions from LCD to OLED on OLED's superior performance and desirable form factor. OLED material suppliers and market and financial analysts now have a way to track these exciting markets.

This report includes the following deliverables:

Overview

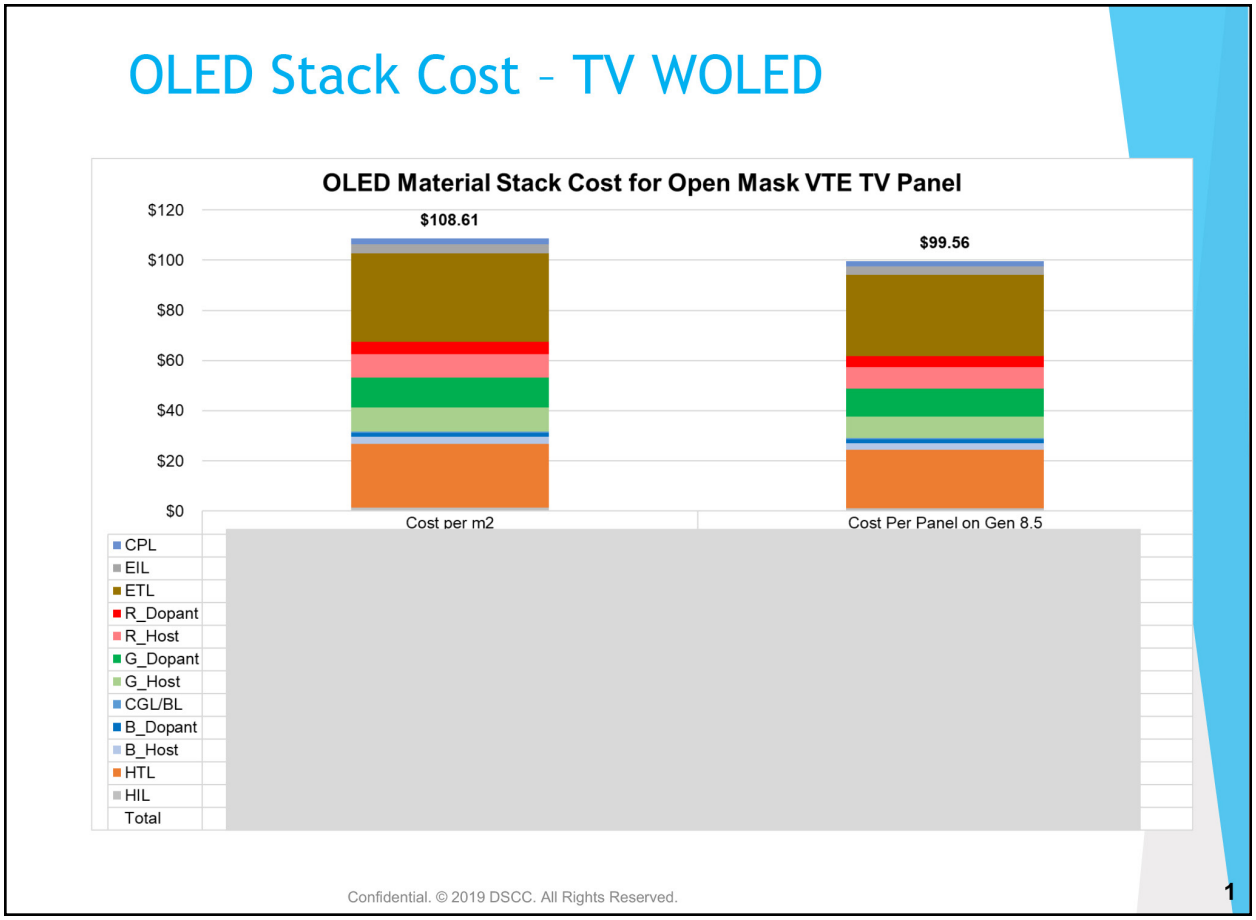
- OLED device structures
- Material classifications
- Material development trends

Intro

- OLED material descriptions
- Industry value chain descriptions
- Supplier profiles
- Material pricing

OLED Material Forecasts (2017-2023)

- Shipment volumes and revenue projections
- Material revenues and quantities segmented by:
  - Panel supplier
  - Application - Mobile, TV, Other
  - Form factor - Rigid vs. Flexible



Materials Covered Include:

Organic Layers

- Small molecule emissive material (EML)
- Polymer emissive material (EML)
- Hole injection material (HIL)
- Hole transport material (HTL)
- Electron transport material (ETL)

Organic materials covered include:

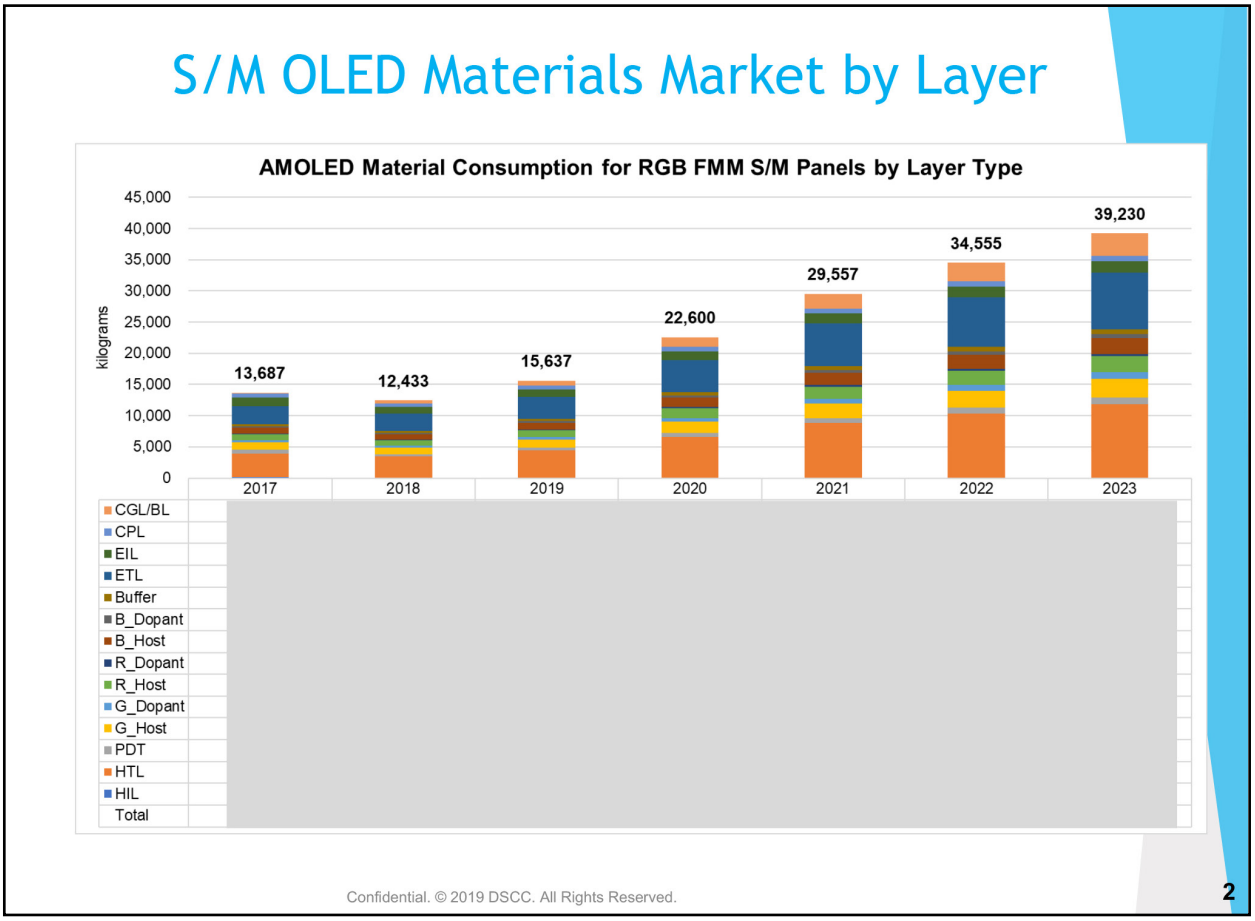
- Phosphorescent and fluorescent emitter dopants
- Host materials for the emitting layer
- All common materials including hole injection, hole transport, electron transport, and more.

Optional chapters cover other materials found in OLED displays including

- Circular polarizers
- Polyimide

Subscription Options

- OLED Materials Report4 Quarterly Releases
- OLED Materials Report - Including Circular Polarizer Module - 4 Quarterly Releases
- OLED Materials Report Including Polyimide for Flexible OLED Module - 4 Quarterly Releases



Quarterly Display Glass Report

Glass substrates form the starting point for production of all flat-panel displays, and glass supply is critical to the display industry. Even for flexible and foldable OLED displays, glass substrates are used as carriers for a polyimide layer for the display, because of the superior thermal stability characteristics of this versatile material.

This report tracks glass capacity and shipments for all major glass makers across all LCD and OLED display fabs. The report combines DSCC's comprehensive insight into industry capacity and utilization with in-depth understanding of display glass and the supply chain.

Areas Covered:

- Display Glass Capacity Regions: Japan, China, Korea, Taiwan
- Display Glass Shipment Regions: Japan, China, Korea, Taiwan, Singapore
- Gen Sizes from Gen 1 to Gen 10.5
- Glassmakers: AGC, Corning, NEG, Others
- Supply Matrix to 26 panel makers

Report Deliverables Include:

- Mother Glass Capacity by Region
- Display Glass Market by Quarter, segmented by:
    - Panel supplier
    - Gen Size
    - Region of destination shipment
    - Backplane Type (a-Si, LTPS, oxide)
    - Display Technology (LCD, OLED)
- Display Glass Market Supply Chain
- Display Glass Prices by backplane type and Gen Size
- Profile of Glass Manufacturers

Subscribers will receive a Powerpoint presentation with the elements above with history from Q1 2018 and a forecast of the current year. Subscribers will also receive an Excel file with pivot tables of the display glass market supply chain allowing additional detailed analysis.

Optional Capacity and Utilization Module

An optional add-on to the glass report will cover DSCC's capacity and utilization database. Delivered in an Excel worksheet with pivot tables, the Capacity and Utilization Module will cover all the segmentations described above with TFT input capacity and utilization by quarter with history starting from 1Q 2018 and a forecast including the current year.

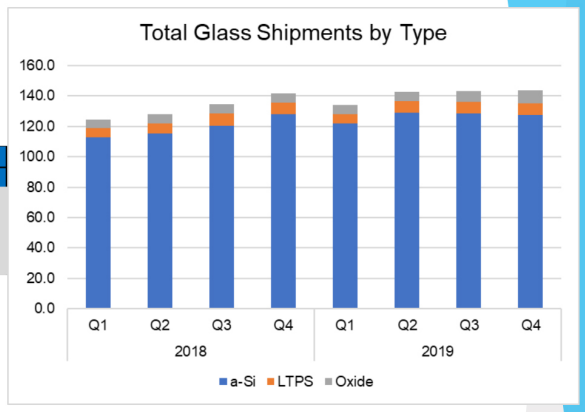
Subscription Options

- Quarterly Display Glass Report - 4 Quarterly Releases
- Quarterly Display Glass Report with Capacity and Utilization Database - 4 Quarterly Releases

Display Glass Market by Backplane Type

Millions of m^2

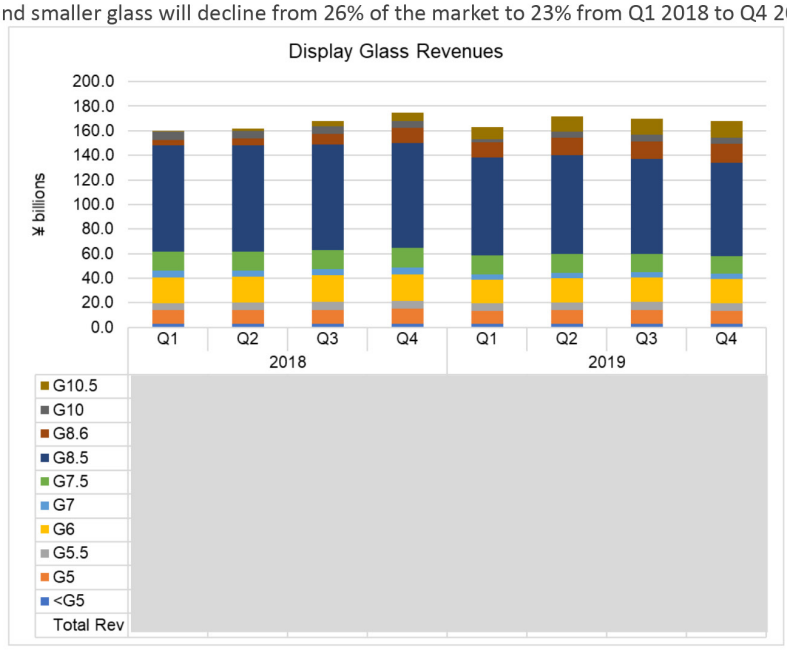
	2018				2019			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
a-Si								
LTPS								
Oxide								
Total								



- A-Si makes up >90% of display glass demand, but LTPS and oxide TFT are a growing portion
- OLED displays require LTPS (for small gen) or oxide (for large gen), but most OLEDs consume only 1x glass per display

Display Glass Revenues by Gen Size

- Gen 8.5 will fall from 54% of the glass market in Q1 2018 to 45% by Q4 2019, as Gen 10.5 increases from 0% to 8%
- Gen 6 and smaller glass will decline from 26% of the market to 23% from Q1 2018 to Q4 2019



Quarterly Smartphone Display Cost and Forecast Report

Due to the growing penetration of OLEDs into smartphones, DSCC has developed a cost model that compares and forecasts OLED smartphone display costs. The cost model also examines all of the different form factors currently or coming into the smartphone market. Panels covered include the most common smartphone sizes in the ranges:

- Rigid panels from 5.5" to 7.21"
- Flexible panels from 4.58" to 6.85"
- Foldable 7.3"

More displays will be added as these categories continue to emerge. Includes detailed BOM results and forecasts, panel prices and panel margins.

Reporting on notebook and tablet panel markets are also available for an additional fee.

Deliverables Include:

- Analysis of OLED smartphone panel cost by region.
- Analysis of OLED smartphone panel cost by size and resolution.
- Analysis of Apple and Samsung Galaxy models including Apple 5.8”/6.5” FHD+, Samsung Galaxy 5.8”/6.2”/6.3” QHD+, as well as, 5.5”/6”/6.4” FHD to FHD+, etc.
- Comparison of OLED smartphone panel cost by Fab generation - G6 vs G5.5
- Costs provided on a line item basis.
- Tier 1 based model cost and profit history in addition to forecasting by fab utilization, investment, and depreciation timing and more.
- Forecasted by substrate size on a rolling 16-quarter basis.
- Flexible, foldable and rollable form factors included as they emerge.
- Touchscreen and cover glass costs also provided.
- Panel prices and margins also provided and forecasted.

Additional optional OLED NB and Tablet Panel Report includes the following sizes:

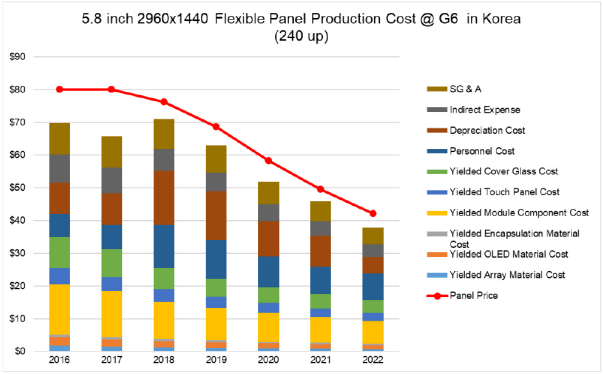
- Rigid Tablet Panels - 9.7"/10.5"/12.9
- Rigid NB Panels sized - 13.3"/15.6" QHD/UHD
- Rollable and foldable displays added as they emerge.

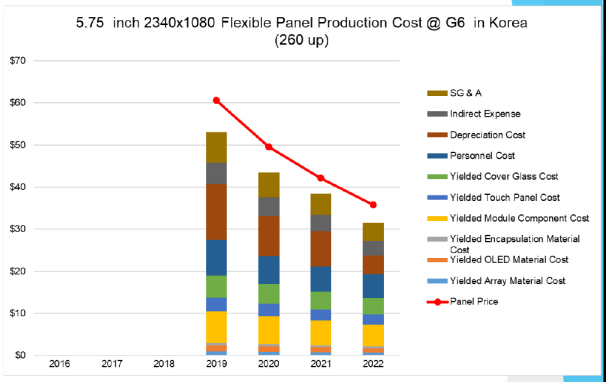
Subscription Options

- Smart Phone Display Cost and Forecast Report - 4 Quarterly Releases
- Smart Phone Display Cost and Forecast Report With Notebook and Tablet Module - 4 Quarterly Releases

Comparison – Galaxy S8/9 and S10 Light

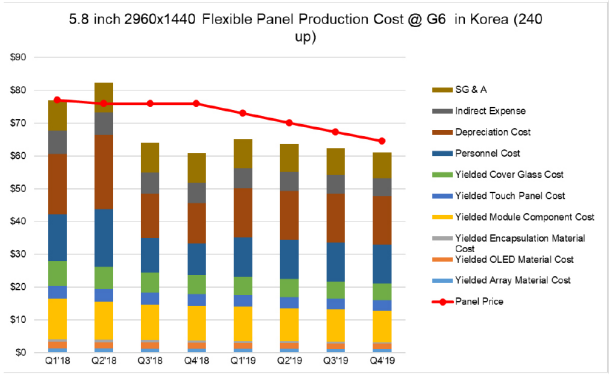
- Longer term, Galaxy S8/S9 stays profitable with margins >10%
- Galaxy S10 Light panels start in 2019 with 5.77" 2340x1080. Higher number of cuts on Gen 6 and lower resolution allow sustained profitability even with prices 20% lower than S8/S9. Lower resolution reduces costs by ~15%

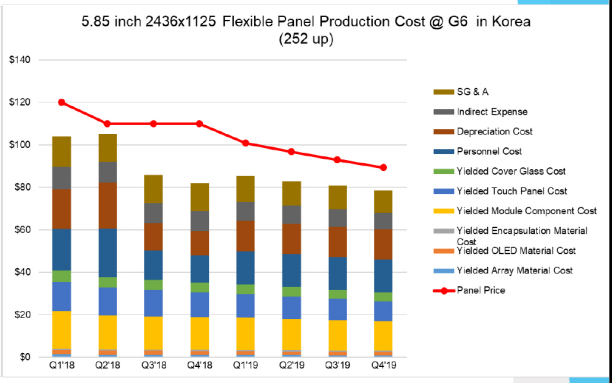




Comparison – Galaxy S8/9 vs. iPhone X/XS

- iPhone X total cost is higher, driven mostly by touch panel with force touch feature
- COP reduces module component costs for Galaxy to be lower than iPhone X
- iPhone X has lower cost cover glass, 2.5D vs. 3D, but Samsung In-House 3D minimizes cost adder





Quarterly Advanced TV Display Cost Report

Given the price sensitivity of the TV market, costs play a big factor in determining which TV technologies are likely to dominate. This report quantifies and forecasts costs, prices and margins for panel suppliers at the high end of the TV market, covering sizes from 48" to 82" . It covers costs from various regions of production for OLEDs, Quantum Dot (QLED) and LCD. It also examines new approaches to manufacturing OLED TVs including ink jet printing and their impact on costs.

This report covers and compares the following topics:

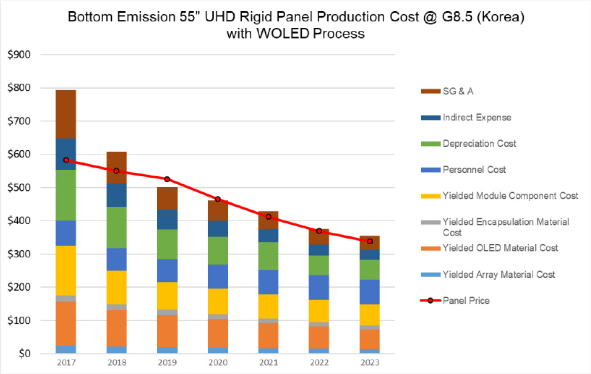
- **OLED 55"/65"/77" FHD/UHD/8K Panels**
- WOLED / Inkjet
- Bottom and Top Emission
- Costs by Region
- Cost Breakdown by Fab Generation G8.5/G10.5
- MMG by 65" 3up & 55" 2up
- **LCD 55"/65"/75"/82" Panels**
- 4K and 8K LCD
- QD LCD
- Cost Breakdown by Fab generation, G8.5/G10.
- Costs provided on a line item basis.
- Forecasted on a rolling 16-quarter basis.
- TV Panel prices provided and forecasted.
- TV Panel margins provided and forecasted.

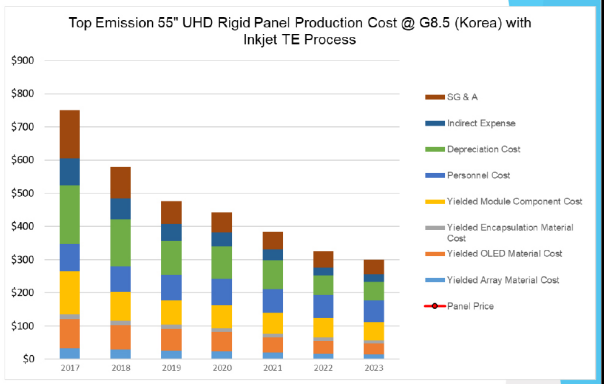
Subscription Options

- Advanced TV Display Cost Report - 4 Quarterly Releases

55” UHD Cost WOLED vs. IJP

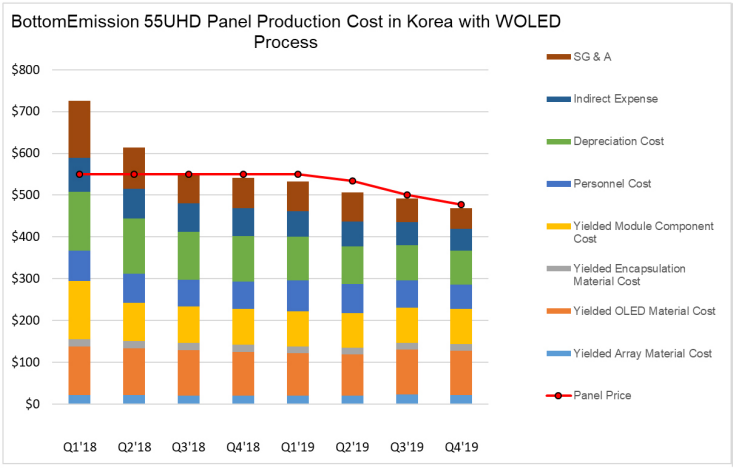
- LGD existing Gen 8.5 capacity in Korea is WOLED, this comparison models a shift to Inkjet Printing (IJP) on the same Gen size
- IJP gives reduction in material costs through better utilization and less waste
- IJP assumes a RGB structure vs. WOLED RGBW

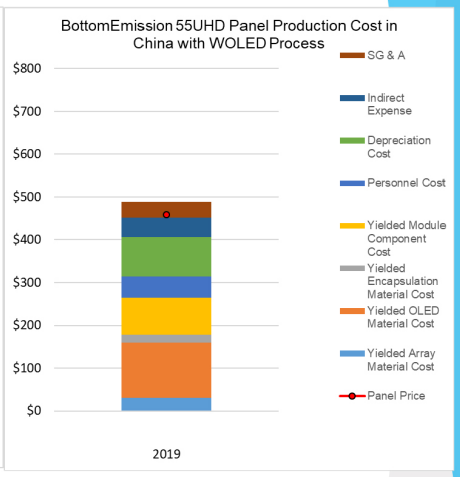




55” UHD Cost/Price

- Cost reductions in Q2-Q3 2018 and flat prices have improved profitability for 55” UHD WOLED
- Profit for this product in Korea will peak in Q2 2019; starting in Q3 2019 price declines resume to generate more volume to absorb new China capacity





DSCC Weekly Review

The DSCC Weekly Review provides subscribers with critical market intelligence and technical trends in the display industry. Delivered every Monday, this newsletter includes analysis of panel pricing, supply/demand, new fab developments, flexible display trends, OLED developments and much more. It also covers the display stock price outlook, company financial analysis and outlook, news and other data from primary and secondary sources across the globe. As of 2019, DSCC has partnered with UK-based display research firm Meko, to provide an even more robust weekly newsletter featuring additional authors, articles and areas of coverage.

The Weekly Display Supply Chain Monitor includes:

- Panel supplier stock index, consisting of 8 panel suppliers, and analysis of weekly changes by supplier and of the overall index, updated daily for customers who upgrade to the daily option.
- Analysis of financial analysts' research and ratings changes.
- Display supply chain companies stock price outlook.
- Analysis of weekly news based on 60+ years of industry experience.
- Editorials on key issues facing the display industry.
- Panel pricing and analysis.
- Monthly panel suppliers' revenues and shipments.
- New fab activity.
- Equipment supplier design wins.
- Panel suppliers financial results and analysis along with new product analysis.
- FPD equipment suppliers' financial results and analysis along with new product analysis.
- FPD material suppliers financial results and analysis along with new product analysis.
- TV brands financial results and analysis along with new product analysis.
- Retailers financial results and analysis.
- Excerpts from DSCC's valuable monthly, quarterly and annual reports.
- Analysis and industry insight from Display Daily contributors.
- Analysis of news items that affect the display industry, including applications outside of the traditional flat panel space, such as large-format LEDs and AR/VR devices.
- Extensive new product launch coverage.

Subscription Options

Weekly Supply Chain Monitor Newsletter - 1 Year Subscription

Please Email or Call For a Free Sample Issue:

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DSCC WEEKLY REVIEW

Weekly Review

Volume 2 No 15
April 15th 2019

Contents

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OLED Materials Market to Show Continued Growth

By Bob O'Brien

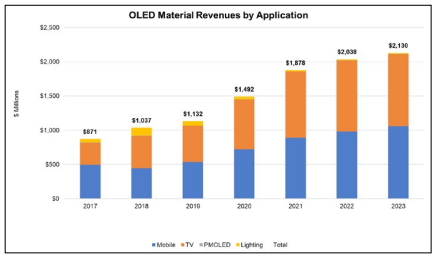
Sales for OLED stack materials for all applications are expected to grow at a 16% annual CAGR from $871 million in 2017 to $2.13 billion in 2023, according to the latest update of DSCC's Quarterly OLED Material Report, written in cooperation with the OLED Association. The report details all aspects of OLED materials, including multiple applications, supplier matrices, and cost comparisons.

The report incorporates the latest update to DSCC's capacity and utilization outlook for AMOLED, and to the OLED Association's capacity outlook for PMOLED and OLED Lighting. As we reported last week, LG Display's exit from the OLED Lighting business has dramatically reduced the prospects for that application, but nevertheless the growth of AMOLED in TV and phones, as well as other applications, will continue to drive material sales.

Compared to the Q4 update, the current update includes revised input area for AMOLED, with small decreases in the anticipated utilized capacity for small/medium OLED in 2018-2022. The current update also includes our view out to 2023, based on our capacity database.

[Continued on page 3]

OLED Material Revenues by Application, 2017-2023



Source: DSCC/OLED-A Quarterly OLED Material Report

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Editor's notes

By Bob O'Brien

This week we've got an unusually wide range of stories in the DSCC Weekly Review, it was a big week for announcements in the display industry. We lead off with some DSCC-only content in my article on the latest update to our Quarterly OLED Materials Report. This includes revised perspectives on QD OLED from an updated stack profile and on OLED Lighting after news of LGD's expected exit from that business. OLED materials remains one of the most promising opportunities for double-digit revenue growth in the display industry.

Sometimes when reading the DSCC Weekly Review one might think that we overemphasize OLED at the expense of LCD and other technologies, but that is not our intent. OLED continues to be a focus of investment in new capacity, as shown this week by announcements from JOLED about expansion in soluble OLED and from JDI about expansion of evaporative OLED. Further, the new product category of foldables depends on OLED technology, and Ross gives an excellent overview of developments from several companies.

Nevertheless, OLED is not the whole industry, and may never dominate the display space the way that LCD has done in this decade, and especially for larger venues we don't expect OLED to compete any time soon. Sony's development of a massive 65-foot MicroLED with 16K resolution is another signal that MicroLED can stretch the boundaries of flat panel displays, opening up new opportunities. Some of those might be in high-end cinemas, where you might see the Iconic Engine Holometric 4D Cinema reviewed by Matt B in this issue.

In the display space that is high-volume but still a premium segment, BOE is working to extend the dominance of LCD with its Dual Cell technology. Dual Cell may allow LCD to compete effectively with OLED for premium TV by achieving the black levels and contrast ratios that up to now only OLED could achieve. Over the last few decades, many companies have tried and failed to beat LCD in the display space, and it would be reckless to bet against LCD now.

We include the regular features as well this week: smartphone and other product announcements, the stock market developments, and other news. As always, we welcome feedback; drop me a note at bob.obrien@displaysupplychain.com.

Thanks,

Bob

DSCC Analysis and Content

JDI Reveals Investment Terms

By Bob O'Brien

As we reported last week, JDI was in discussions about securing a major investment to reorganize the company and prepare it for growth in OLED. This week JDI announced the investment and described the terms, which will significantly dilute existing investors. JDI's stock price dropped at the news that the new investors will hold 49.8% of the company.

JDI described the investors as the Suwa Consortium, with three major entities including Taiwan-based TPK Holding, Taiwan private equity firms Cosgrove and Topnotch, and China-based private equity Harvest Tech. Earlier reports had described China's Silk Road Investment Capital as an investor; JDI explained that in order to speed up the transaction, the Suwa Consortium is established with China Silk Road as its only shareholder, but that it is intended that the other four companies named will take over Suwa by the time the deal is implemented.

Along with the financing, the deal includes tie-ups with both TPK and Harvest Tech to enhance JDI's business. With TPK, JDI expects to expand its LCD business in China through leveraging TPK's touch panel customer base, and expects that TPK will be able to expand its LCD business with JDI's customer base. With Harvest Tech, JDI expects to build an OLED panel business based on evaporative technology (in contrast to JOLED's inkjet/soluble technology), with JDI supplying the technology and Harvest to "secure OLED mass production line with limited financial burden for JDI to achieve stable profitable growth." We interpret this to mean that Harvest will work to secure substantial China government financing for a JDI OLED line in China.

JDI describes that the Suwa investment will come in three stages, the first stage with payment from June 20th to December 30th, 2019 of ¥42 billion ($375 million) for 840 million shares of JDI common stock at ¥50 per share, which will represent 49.8% ownership of the company after it is completed, and is a substantial discount to the market price of ¥79 as of April 12. A second round would be convertible bonds worth ¥18 billion ($160 million); these bonds would be convertible to stock at ¥50 per share if not paid off within five years. A third round, which JDI says may depend on funding needs, would provide ¥20 billion ($178 million), also convertible at the issue price of ¥50 per share.

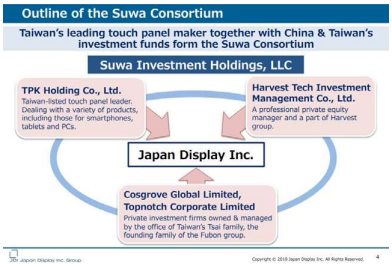
JDI intends to use the investment for working capital, R&D expenses, and capital expenditures. JDI said that ¥38 billion ($338 million) of the investment would be used for working capital, and while this will allow JDI to function smoothly without risk of default, this large amount just gets JDI a normal operation. An additional ¥9.2 billion ($82 million) would be used for research and development on OLEDs, virtual reality, and sensors. The final ¥32 billion would be used for expansion, with ¥10 billion for OLED, ¥12 billion for automotive displays, and ¥10 billion for a ramp-up of new business. JDI described that the OLED investment would allow mass production at JDI's evaporative OLED line in Mobara.

Along with the investment from Suwa, JDI will refinance its obligations with the Innovation Network Corporation of Japan (INCJ). JDI will convert an existing line of credit of ¥107 billion, plus short-term loans of ¥20 billion and convertible bonds of ¥25 billion into a long-term loan of ¥77 billion and preferred shares of ¥75 billion. Thus the refinancing will bring another ¥25 billion ($220 million) from INCJ. INCJ will see its share of JDI's common stock fall from 25.3% to 12.7%.

An article from Reuters expressed the concern that this deal could "potentially be subject to a U.S. national security review at a time when Washington is stepping up its scrutiny on Chinese investment in the United States", since JDI has a subsidiary in San Jose. In response to a question about this, JDI CFO Minoru Kikuoka told reporters that a US filing would not be needed.

JDI was a major supplier to Apple for iPhone panels until Apple shifted to OLED with the iPhone X in 2017, and Kikuoka mentioned at the briefing that JDI still owes "its client" (Apple, unnamed) about ¥100 billion ($892 million) from pre-purchases Apple made several years ago to fund JDI's LCD plant. JDI supplies LCD panels for the iPhone XR, but those sales have been disappointing, and recently we have learned that JDI will also supply OLED panels for the Apple Watch.

JDI has been at the forefront of LCD display technology since it was formed from the LCD businesses of Sony, Toshiba, and Hitachi in 2011, but has struggled to make a profit (and usually failed to do so). With the new investment, JDI will get itself out of the short-term financial hole, but their ability to compete in the long term may depend on their ability to build OLED capacity.



DSCC Analysis and Content

Stocks Steady Despite Rising EU Trade Tensions

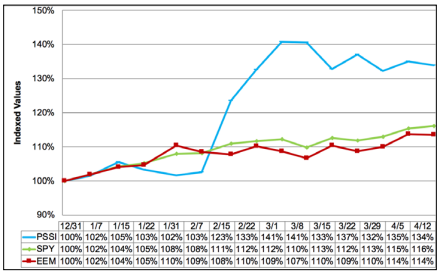
[Continued from page 8]

- The Consumer Price Index rose 0.4% in March with core prices up 0.1%. Total and core prices were up 2.0%.
- President Trump threatened to impose $11B worth of tariffs on products from the European Union (EU). This outcome is a result of a nearly 15-year dispute over subsidies from the EU to Airbus and US subsidies to Boeing. The US claims that the World Trade Organization (WTO) found that subsidies to Airbus have adversely impacted the US. There were two types of offenders called out for more tariffs. The US is looking to punish just France, Germany, Spain and the UK for imports of
  - Helicopters
  - Aircrafts
  - Aircraft parts

The US is also calling for tariffs on the following product categories made from any of the 28 EU countries which include:

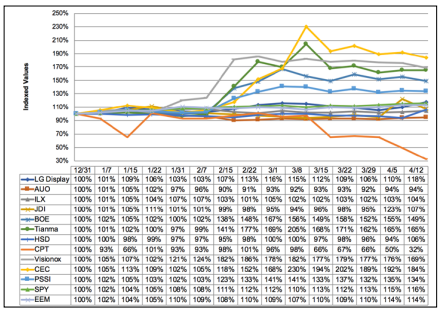
- Seafood
- Yogurt
- Butter
- Cheese
- Fruit
- Olive oil
- Sweet biscuits
- Olives
- James
- Juices
- Wine
- Vegetable and fruit oil
- Paper
- Books
- Cotton
- Yarn
- Wooden tools
- Handbags over $20
- Carpets
- Sweaters
- Suit
- Ceramics
- Dresses
- Pajamas
- Bed linens
- Glassware
- Iron, steel, copper alloys, zinc,
- Pliers, screwdrivers, metal blades, magnets
- Telescopes and sights
- Wall clocks
- Artists brushes

PSSI vs. SPY vs. EEM Indexed to 12/31/18



	12/31	1/7	1/15	1/22	1/31	2/7	2/15	2/22	3/1	3/8	3/15	3/22	3/29	4/5	4/12
PSSI	100%	102%	105%	103%	102%	103%	123%	133%	141%	141%	133%	137%	132%	135%	134%
SPY	100%	102%	104%	105%	108%	108%	111%	112%	112%	110%	113%	112%	113%	115%	116%
EEM	100%	102%	104%	105%	110%	109%	108%	110%	109%	107%	110%	109%	110%	114%	114%

Stock Price Results by Index and Panel Supplier Indexed to 12/31/18



	12/31	1/7	1/15	1/22	1/31	2/7	2/15	2/22	3/1	3/8	3/15	3/22	3/29	4/5	4/12
LG Display	100%	101%	100%	106%	103%	103%	107%	113%	116%	115%	112%	109%	106%	110%	116%
AUO	100%	101%	105%	102%	97%	96%	90%	91%	93%	92%	93%	93%	92%	94%	94%
ILX	100%	101%	105%	104%	107%	107%	103%	101%	105%	102%	102%	103%	102%	103%	104%
JDI	100%	101%	105%	111%	101%	101%	99%	98%	95%	94%	96%	98%	95%	123%	107%
BOE	100%	102%	105%	102%	100%	102%	138%	148%	167%	156%	149%	158%	152%	155%	149%
Tianma	100%	101%	102%	100%	97%	99%	141%	177%	185%	205%	168%	171%	162%	165%	165%
HSD	100%	100%	98%	99%	97%	97%	95%	98%	100%	100%	97%	98%	96%	94%	106%
CPT	100%	93%	68%	101%	93%	93%	98%	101%	98%	98%	66%	67%	68%	50%	32%
Visionox	100%	105%	107%	102%	121%	124%	182%	186%	178%	182%	177%	179%	177%	176%	169%
CEC	100%	105%	113%	109%	102%	105%	118%	152%	168%	230%	194%	202%	189%	192%	184%
PSSI	100%	102%	105%	103%	102%	103%	123%	133%	141%	141%	133%	137%	132%	135%	134%
SPY	100%	102%	104%	105%	108%	108%	111%	112%	112%	110%	113%	112%	113%	115%	116%
EEM	100%	102%	104%	105%	110%	109%	108%	110%	109%	107%	110%	109%	110%	114%	114%

You will note that cars and car parts were excluded. The US is looking to engage the EU in trade negotiations without having to bring in cars and car parts. The final list of products and the associated tariff amount will

[Continued on page 10]

Outlook on 8K Report

This report, published in partnership with Insight Media, goes beyond just examining 8K TVs to cover the entire emerging 8K ecosystem. We take an in-depth look at the accelerating development of 8K display panels, 8K display production technologies, 8K vs. 4K display costs and prices, 8K broadcast receivers, 8K cameras, and other forthcoming 8K technologies. In addition to evaluating how the display suppliers and TV brands are approaching 8K, we look into many non-display factors in the areas of content acquisition, production and post-production, distribution, and connectivity as well as comment on value propositions and business models. The purpose of this report is to understand the products that make up the current 8K landscape, what factors will drive development and adoption and what factors may hinder or slow adoption. In addition, this report presents the views, plans, roadmaps and motivations of the panel makers, TV and monitor makers.

- Executive Summary
- Analyzing the 8K TV Opportunity
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  - Regional Segmentation
- 8K Video Wall Outlook
- 8K Projector Outlook

Subscription Options

Outlook on 8K Report - Single Report Release

Figure 5: AstroDesign 8K Camera

Like Hitachi, there is a separate camera control unit (CCU) that houses the power supplies and does all the debayering and processing to support output to other equipment. An optional fiber optic attachment can facilitate transfer of data and signals to/from the camera to the CCU.

Astrodesign told us that a basic 8K camera set up, including a lens, is in the $600K to $700K range – a significant investment.

In the **Ikegami** booth at NAB 2017 we saw the SHK-810 Super High Vision Digital Portable Camera. This features an 8K Super 35 mm CMOS sensor, PL lens mounting, lens aberration correction and a 40 Gbps fiber SMPTE interface (U-SDI). Outputs can be at 8K, 4K or 2K. Images were displayed on an 8K monitor with an Ikegami label.

Figure 6: Ikegami 8K Camera

Sharp's recently announced 8C-B60A 8K professional camera features a single 35mm equivalent CMOS image sensor with 33m pixels. It can capture about 40 minutes of 8K 10-bit

At least four different players are planning Gen 10.5 capacity expansions during the years 2018-2022, as shown in Table 4.

In addition to these expansions, relative industry newcomer HKC announced in January 2018 a plan for a RMB 40 billion (US$6.4 billion) investment in Gen 11 capacity (expected to be Gen 10.5; industry players vary in their naming for the 2940mm x 3370mm substrate) in Henan, China, with the exact timing of mass production uncertain. Such an investment would add another million or more Gen 10.5 substrates per year to industry capacity.

From just the numbers in Table 4, the industry capacity in 2022 could theoretically make more than 60 million 60" and larger panels, if it were all making 8-cut panels at 100% yield. Although the actual output of these fabs will be considerably less, considering a product mix of 65" and 75" and yield lost, the industry capacity exceeds all reasonable estimates of demand under the current set of market conditions. Therefore, suppliers are developing technologies that increase the attractiveness of very large screen sizes, and 8K is foremost among these.

Display Panel Factors to Enable 8K

In order to bring four times the number of pixels to the display, a number of changes are required in the display architecture, driving higher costs.

Resolution

In the display industry, the term resolution is used both in describing the number of pixels in a display and in describing the spatial resolution on the display in pixels per inch (PPI). An 8K display has 7680 x 4320 pixels independent of screen size, but the pixels per inch vary inversely with screen size, as shown in Figure 18.

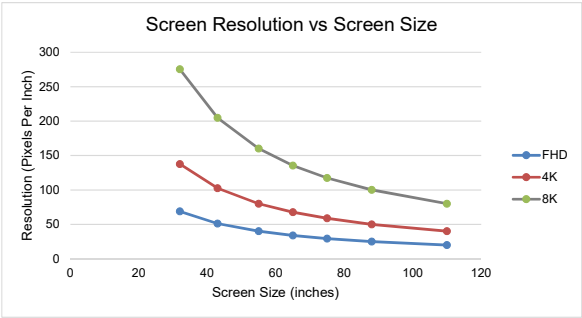

Figure 18: Screen Resolution vs. Screen Size for TV

fabs are likely to be even lower at first, as low as 10-20% according to one panel maker. At such low yields, 8K products can hardly be economically viable, but in the early stages, these products are mostly demonstration models in very small volumes.

The history of the LCD industry provides many examples of products which were difficult to make at first, but with time, experience, and volume panel makers increased yield up to acceptable levels. There is no reason to think that 8K will be an exception to this pattern, and by the time that 8K panels reach the millions of units for the leading panel makers, yields will likely be in the range of 80% or higher.

Achieving UHD Features Beyond Resolution

Along with 8K, two important features of Ultra-High Definition (UHD) sets are Wide Color Gamut (WCG) and High Dynamic Range. In order to maximize the impact, displays are designed to take advantage of these features.

In the production process of making video content, the producer must choose a color standard to create a master copy. The color standard defines the available color gamut and is intended to match the available display and camera technology – it does no good to try to capture a color point that the camera cannot see and the display cannot show.

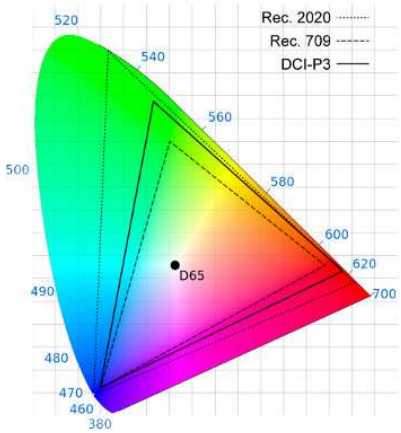

Figure 21: Color Standards

8K by Size

The 8K penetration over the Worldwide TV sales volume results in the following forecast for 8K TV sales by screen size (Figure 31). The largest volume of 8K will be in 65" from 2019 onwards, as this size gets the big supply push from Gen 10.5 capacity.

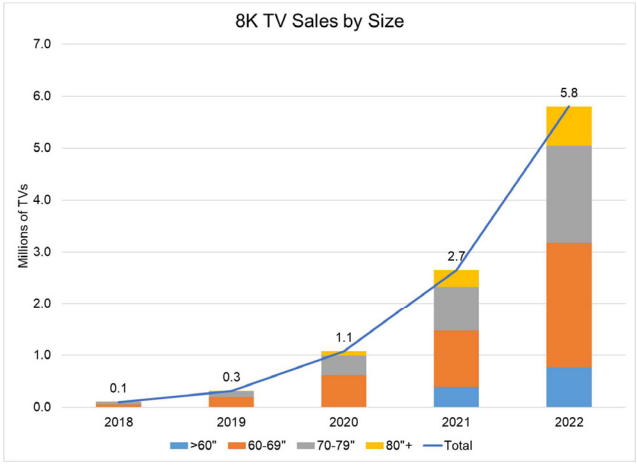

Figure 31: Forecast of Worldwide 8K TV Sales by Screen Size

8K by Region

With respect to regional output, we expect that 8K will grow first in China, followed by North America and Japan. Several unique aspects of the China market make it fertile ground for 8K, as it was for 4K:

- The China market is fiercely competitive, with all major international brands competing, plus the six major local brands (Changhong, Konka, Haier, Hisense, TCL, Skyworth), plus a number of additional local brands such as CEC, all competing for consumer attention.

OUR TEAM

Ross Young
Founder and CEO

Ross Young is the Founder and CEO of DSCC. Prior to DSCC, Ross founded DisplaySearch, the leading flat panel display market research, consulting and events firm, in 1996 and ran it for 12 years before selling it to The NPD Group and joining Samsung LCD as VP of New Market Creation. Unlike other DisplaySearch analysts, Ross pioneered coverage in each layer of the display supply chain and was the only analyst to cover the entire display supply chain at DisplaySearch. Ross has also worked at Brooks Automation, Fusion Semiconductor, GCA, IMS Research, OWL Displays and Young Market Research in the semiconductor equipment, display equipment, driver IC, LED and PV markets. He has also served as a member of the Board of Directors at Akhan Technologies, UniPixel and Westar Display Technologies, the Advisory Board of Illumitex and currently serves on the Advisory Board of NanoPhotonica. He has received awards for outstanding performance from The NPD Group, SID and VLSI Research.

Robert J (Bob) O'Brien
Co-Founder and President

Robert J (Bob) O'Brien has decades of experience turning market and business analysis into strategic insights in the display and electronics industries. As a former Corning, Philips and LG Display executive he essentially built a smaller, in-house version of DSCC as Director of Marketing Intelligence at Corning. With analysts in the US and Asia, they performed channel checks throughout the display supply chain and delivered critical intelligence to Corning management and investors.

Mr. Yoshio Tamura
Co-Founder and President of Asian Operations

Yoshio Tamura has covered the flat panel display market since 1990 and is one of the foremost authorities on the LCD industry and its supply chain. He has developed deep and extensive contracts throughout the display market and has developed numerous innovative methodologies for forecasting various aspects of the display market. He launched LCD market coverage at Techno Systems Research in Tokyo and grew it rapidly over a 10-year period. He then joined DisplaySearch in 2000 as SVP and Founder of DisplaySearch Asia. He became a Fellow at NPD DisplaySearch. After DisplaySearch was sold to IHS Corp. in 2014, he held the title of Senior Director and Advisor to the Display Technology Group.

Mr. Satoshi (Sam) Matsuno
Co-Founder and VP of Japan Sales, Events and Operations

Satoshi (Sam) Matsuno is Co-Founder and VP of Japan Sales, Events and Operations at DSCC. He has spent over 30 years in the display industry at Panasonic, Compaq, DisplaySearch, NPD DisplaySearch and IHS working with CRT, plasma, TFT LCD and projection display technology. . Sam is a leader in understanding and predicting trends in the display industry, developing and publishing the industry's first LCD monitor price/penetration curve and coining numerous industry terms such as "mega-note" to describe larger notebooks.

Sung Eun Kim
Senior Analyst and Marketing Manager

Sung Eun Kim entered the flat panel display industry in 1999 as a senior analyst at DisplaySearch, the leader in flat panel display market research, consulting and events. After working at DisplaySearch for 7 years, she joined MagnaChip as Strategic Marketing Leader in their Flat Panel Display Driver IC Division. She concurrently works at the OLED Association as an Associate Director. Sung will be utilizing her strong language skills - English, Japanese and Korean - and market research experience as well as her digital marketing experience at DSCC.

Rita Li
Director of China Operations

Rita Li has over 10 years of experience working in in the flat panel industry. She joined Universal Scientific Industrial (USI) in 2007 as a Business Development Manager, covering all of supply chain management internally and maintaining key client relationships with AUO, Innolux and others. She then joined NPD DisplaySearch in 2010 in a sales and marketing role and worked at DisplaySearch for 5 years. She played a key role in developing China business for the company in terms of report sales, consulting and events. She also developed new business for the company in the solar/PV market. She is deeply familiar with the China flat panel industry from materials to brands and OEMs.

Calvin Lee
Director of Korean Operations

Calvin Lee has more than 20 years experience in display market research and consulting. He started display market research in 1996, the same year DisplaySearch was formed, while employed at Samsung SDI where he covered the entire display industry covering CRT, LCD and PDP markets and technologies. After 10 years at Samsung SDI, he joined DisplaySearch in 2006 as research director where he played a key role in gathering display market data in Korea. He later joined DisplayBank as VP of Marketing, also covering the display market. After DisplayBank was acquired by IHS and merged with other display groups, he joined SNE Research where he covered IT, electric vehicle and battery markets.

Gerry McGinley
Director of US Sales

Gerry McGinley joined DSCC as Director of Sales in July 2018. He has had a 30+ year career in display hardware and research. Gerry had sales, marketing and product management roles at Panasonic Industrial Company and Richardson Electronics. He began his display research career with NPD DisplaySearch in 2007 as a Director, Business Development. Gerry joined IHS via the DisplaySearch acquisition. After leaving IHS, Gerry spent two-years as a Director of Client Development at Forrester Research. Gerry has extensive knowledge of the global display supply chain, manufacturers, brands and numerous vertical markets. He is focused on managing an ever-growing client base for DSCC and is committed to providing clients with a great customer experience.

Jayden Lee
Director of Display Equipment and Materials

Jayden has around 15 years of experience working in the flat panel display and semiconductor industries. Since 2005, he was employed at Ushio Korea, a leading light source and equipment company which plays an important role in the lithography supply chain. While at Ushio, Jayden had responsibility for light sources and related equipment used in photo and deposition processes as well as FPD substrate cleaning. In addition, he was active in various fields including LED, laser diode and digital cinema light sources.

Dustin Gaedtke
Director of Events and Digital Marketing

Dustin Gaedtke has several years of event experience with the PGA, Capsule, and numerous other companies. He entered the display industry in 2008 as owner and lead project coordinator of Hifi Install, a technology integration firm specializing in residential and commercial audio / visual solutions and home automation. After successfully growing Hifi Install to be a leader in the Austin, TX market he sold the company to pursue a position as head of sales for a high end lighting startup, Biotech Lighting. From there he transitioned to director of event planning and digital marketing for DSCC.

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