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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
- Akhan Technologies
- Illumitex
- NanoPhotonica
- 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:

- 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.

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• What’s Changed This Quarter
• Executive Summary
• OLED Fab Schedules:
  - Methodology for OLED Display Production
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• Introduction to LLO Equipment
• LLO Results and Forecast 2016-2023
Subscription Options

- Quarterly OLED Supply / Demand Capital 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%.

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.
Quarterly OLED Shipment and Fab Utilization Report

The industry's most comprehensive OLED shipment and fab report covering both smartphone applications and TV panel markets. This report looks at current and future OLED shipments and revenues by application, supplier and size. It also examines when OLEDs will overtake LCDs in all major applications. This report also tracks OLED and LTPS LCD fab utilization.

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

This report will allow users to see:
- How big the OLED market is projected to grow.
- Historical shipment data for panel suppliers by model, size, resolution and aspect ratio.
- Historical Samsung OLED revenues matched to their real results.
- How quickly will the smartphone market migrate to OLED?
- 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?
- All major smartphone brands forecast quarterly for size, resolution, and aspect ratio through the current year.
- What is the forecast for utilization and yields?
- When will suppliers begin to take significant share from Samsung?
- Which Chinese suppliers are likely to emerge by application?

Subscription Options
- Mobile Panel Market - 4 Quarterly Releases
- TV Panel Market - 4 Quarterly Releases
- Report Package - Mobile & TV Panel Markets - 4 Quarterly Releases
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.

Annual OLED Units By Application

- On a unit basis, smartphones are expected to remain dominant with 86.3% share in 2023 to 931 Million.
- OLED TV share growth depends on new capacity and inkjet printing success in large gen fabs. We expect TV unit share of OLED panels to be 1.5% in 2023.
- Smart Watch is the #2 application with 6.9% unit share in 2023.
- VR, Tablet and Notebook together accounts for 3.9% unit share in 2023 but we expect tablet and Notebook share will grow quickly based on new foldable form factors.
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 OLED and mobile LCD suppliers’ fab utilization on company performance and the industry outlook.

For every OLED and LTPS LCD 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

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

Utilization data can be segmented by:

The utilization data can be segmented by:
- Supplier
- Country
- TFT Generation
- Backplane
- Frontplane
- Substrate type – rigid vs. flexible vs. foldable
- Technology – Mobile OLED, OLED TV, LTPS LCD, Total Mobile and Total OLED

Areas Covered:
Capacity, glass input and fab utilization by month for:
- Mobile OLEDs
- OLED TVs
- Mobile LCDs
- Total Mobile
- Total OLEDs
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
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.

Executive 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.
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
- 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
Quarterly Display Capex and Equipment Service

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 2022
- LCD equipment market size by segment and forecasted out to 2022
- Equipment revenues on a bookings or billings basis.
- Display equipment revenues for top 20 equipment suppliers.
- Quarterly and annual market share provided through as far as 2023 for all frontplane segments and major backplane segments.
- Design wins for all backplane and frontplane segments and certain color filter, cell and module segments.
- Includes our Equipment PO/Award Database revealing design wins by fab by tool type, updated weekly. See more here.
- All equipment and panel supplier financials (income statement, margins, balance sheet, cash flow) in pivot table format back to Q1'13. Also includes industry data such as shipments by application and area, ASPs, bookings, backlog, etc.
- Aggregated equipment and panel supplier financial results and comparisons. Establishes metrics and best of breed performers in each market.
- Consensus outlook for equipment and panel suppliers' financials.

Companies examined include:


- **Panels** - AUO, BOE, CEC, CPT, CSOT, HannStar, Innolux, JDI, LG Display, Samsung Display, Sharp, Tianma and Visionox. With fab activity for all panel suppliers.

**Subscription Options**

For samples, pricing & package pricing discount information, please contact [Gerry@DisplaySupplyChain.com](mailto:Gerry@DisplaySupplyChain.com)
Executive Summary...

▷ TVs Expected to Become Larger Share of Spending
  ▷ As mobile spending slows down, TVs are expected to dominate the next 5 years with a 58% - 78% share on OLED TV/QDOLED/10.5G LCD TV and other TV technology investments. Given the much higher share of TV capacity relative to mobile and the transformation to better performing TV technology, this makes sense. From 2018-2023, TVs are expected to lead with a 60% to 40% advantage after accounting for just a 39% share from 2016 – 2018.

▷ Oxide Backplanes Surging
  ▷ Oxide backplanes are expected to gain a significant share of annual spending rising each year from just 3% in 2016 to 67% in 2022 and 2023. Oxide is gaining acceptance in LCD TV fabs for high refresh rate, 8K TVs, as a backplane in WOLED and QDOLED TV fabs and as a lower cost alternative to LTPS in mobile LCD and mobile OLED fabs. From 2019 – 2023, oxide is expected to lead in backplane spending with a 37% share.
  ▷ LTPS is expected to be up and down, rising and falling with mobile spending. a-Si is expected to peak in 2019 on 10.5G and decline through the rest of the forecast as oxide gains.

LCD vs. OLED Mobile Capacity

▷ Comparing LTPS/oxide LCD vs. mobile OLED capacity presents a different story. Unyielded mobile OLED capacity is expected to overtake mobile LTPS/oxide LCD capacity in 2019 with LCDs growing at just a 3% CAGR with OLEDs growing at a 16% CAGR.
  ▷ By 2023, OLEDs are expected to have a 63% share of mobile capacity which will help OLEDs grab more smartphone share as LTPS capacity effectively shrinks from larger panel sizes and unrecognized shutdowns/conversions on lack of profitability.
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:

- **Panels** - AUO, BOE, CEC Panda, CPT, CSOT, HannStar, Innolux, JDI, LG Display, Samsung Display, Sharp, Tianma, and Visionox.

Subscription Options

- Quarterly 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 the 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%
Three unique databases which provide great visibility into who is being awarded display equipment business as far as a year in advance at Chinese LCD and OLED fabs. Over 100 different awards have been observed per fab. This data is a catalyst for pure play equipment stocks. Korean equipment suppliers POs by dollar amount and customer are also revealed.

This database features historical data from 2016 to present that includes:

- Over 500 POs
- Over 900 OLED Fab Awards
- Over 1300 LCD Fab Awards

**Deliverables Include:**

- Name of Customer
- Name of Fab
- Fab Location
- Gen Size
- Display Technology
- Equipment Company
- Award/PO Date
- Phase of the fab.
- Type of Equipment
- Date of delivery.
- Change in delivery date
- $US Amount
Database Descriptions:

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, customer, fab name, fab location, glass size, display technology, equipment description.

This database includes 500 different POs and includes the following companies – Alps, AMAT, ANI, AP Systems, ATS, Avaco, BF Tech, Canon Tokki, Charm Engineering, DE&T, ELP Corp., EO Technics, FNS, Hanwha, HB Technology, ICD, Invenia, Iruja, JSW, Jusung, Kateeva, KMAC, LIS, Meere Company, Narae Nanotech, Nikon, Nissin, Orbotech, Philoptics, Ronze Systems, SFA, Sineva, SNU Precision, Sunix Systems, Tera Semicon, TES, Tokyo Electron, Top Engineering, Toptec, Vessel, Viatron, Wonik IPS, YAS, YEST, Youngwoo DSP and more.

OLED Fab Equipment Award Database
This database includes equipment awards from Chinese OLED 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 and tool type.

This database includes awards from the following panel suppliers – BOE, CEC Panda, China Star and HKC. There are over 1300 entries which include the following equipment companies - ATI, AMAT, ATS, Avaco, Canon, Charm Engineering, DMS, DSK, Edwards, Hirose Optoco, Invenia, KC Tech, Koyo Thermo, Kubotek, Linde, Marketech, Nikon, Orbotech, SEMES, SFA, Shibaura, Shinko, Sineva, SNU, Takano, TEL, Top Engineering, Toray Engineering, ULVAC, USHIO, Vessel, V-Technology, YAC, Yodagawa Hu-Tech and many more...

Subscription Options
- Weekly Supply Chain Monitor Newsletter - 1 Year Subscription
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

---

### OLED Stack Cost - TV WOLED

![OLED Material Stack Cost for Open Mask VTE TV Panel](chart.png)
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 Report - 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

- 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:
Gerry@DisplaySupplyChain.com
770-503-6318
OLED Materials Market to Show Continued Growth

By Bob O'Brien

Sales for OLED stock materials for all applications are expected to grow at a 35% annual growth rate (CAGR) from $871 million in 2017 to $2.7 billion in 2023, according to the latest update of DisplaySearch. The report details all aspects of OLED materials, including multiple applications, supplier matrices, and cost comparisons.

The report incorporates all the latest updates to the OLED capacity and availability outlook for AMOLED, and to the OLED Association’s capacity outlook for PMOLED and OLED lighting. As we reported last week, global OLED sales for 2030 are expected to reach $178 billion from $82 billion for OLED lighting after Q4 of 2017, driven by the growth of AMOLED in TVs and phones, as well as other applications, which will continue to drive material sales.

Compared to the Q4 update, the current update includes revised output areas for AMOLED, with small decreases in the estimated utilised capacity for small medium OLED in 2018-2023. The current update also includes our view of 2017, based on our capacity database.

STOCKS STEADY DESPITE RISING EU TRADE TENSIONS

The US is looking to engage the World Trade Organization (WTO) with China over the WTO’s decision to impose tariffs on $34 billion of Chinese goods in response to US tariffs on $50 billion of Chinese goods. The US has been seeking to avoid a trade war with China, but the WTO’s decision to impose tariffs on Chinese goods will likely make it more difficult for the US to reach a resolution.

CATEGORIES 

Display Industry Analysis 3 

DSCC Analysis and Content 1 

OLED Materials Market to Show Continued Growth 2 

Display Industry Analysis 3 

DSCC Analysis and Content 1 

STOCKS STEADY DESPITE RISING EU TRADE TENSIONS 2 

DSCC Analysis and Content 1 

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 had the DSCC annual report, which includes some exciting new ideas, and the OLED report, which highlights the growth of AMOLED in TVs and phones, as well as other applications, which will continue to drive material sales.

In addition, this week we heard from the World Trade Organization (WTO) with China over the WTO’s decision to impose tariffs on $34 billion of Chinese goods in response to US tariffs on $50 billion of Chinese goods. The US has been seeking to avoid a trade war with China, but the WTO’s decision to impose tariffs on Chinese goods will likely make it more difficult for the US to reach a resolution.

Some of those stories might be of interest to you, so you might want to check out 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, OLED continues to expand as a competitive technology with OLED technology, but that is not our intent. OLED continues to be a focus of investment, but in this week’s announcement, we have seen that it is intended that the other four companies named will provide $20 billion in the OLED space, and it will be critical to keep OLED at the forefront of innovation.

We also heard that subsidies to Airbus have been used to support the European aerospace industry, but that is not our intent. The US is looking to avoid a trade war with China, but the WTO’s decision to impose tariffs on Chinese goods will likely make it more difficult for the US to reach a resolution.

We also heard that subsidies to Airbus have an adverse impact on the US, but that is not our intent. The US is looking to avoid a trade war with China, but the WTO’s decision to impose tariffs on Chinese goods will likely make it more difficult for the US to reach a resolution.

As always, we welcome feedback; drop me a note at bob.obrien@displaysupplychain.com.
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
  - Introduction
  - The World in 2020
- 2020 Olympics as a Driver for Tech Development and Commercialization
- Evaluation of the 8K Production Equipment
  - Overview
  - Cameras
  - Camera Lenses
  - Color Grading
  - Encoders
  - Players
  - Recorders/Players
  - Converters
  - Other Gear
- Evaluation of the 8K Distribution Systems
  - Satellite
  - Over the Air
  - Cable and Telco
  - Other Options
  - Tuners/Demodulators
  - Summary of Expectations
- 8K Connectivity
  - HDMI
  - DisplayPort
  - SuperMHL
  - Thunderbolt
  - USB Type-C
  - U-SDI
  - Panasonic Hybrid Cable
  - V-by-One
- 8K Flat Panel Manufacturing
  - LCD Challenges
  - OLED Challenges
  - WOLED Challenges
  - IJP Challenges
- 8K Panel Cost Forecasts
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  - QD LCDs
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  - IJP OLEDs
- 8K Flat Panel Roadmaps/Production
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- 8K TV and Monitor Brand Strategies
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  - Dell
  - Eizo
  - Hisense
  - Konka
  - LG Electronics
  - Loewe
  - Panasonic
  - Philips
  - Samsung
  - Sharp
  - Skyworth
  - Sony
  - TCL
  - ViewSonic
  - Vizio
- 8K TV and Monitor Forecasts
  - Units and Revenues
  - Size Segmentation
  - Regional Segmentation
- 8K Video Wall Outlook
- 8K Projector Outlook

Subscription Options
Outlook on 8K Report - Single Report Release
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 designed to take advantage of these features.

Gamut (WCG) and High Dynamic Range. In order to maximize the impact, displays are expected to have acceptable levels. There is no reason to think that 8K will be an exception to this pattern, and by making at first, but with time, experience, and volume panel makers increased yield up to make 4K, 8K or 2K.

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.

Fab Yield

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.

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.

Screen Resolution vs Screen Size

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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.

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.

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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, CCA, 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 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.

Harry Kim  
Director of Japan Sales and APAC Business Development

Harry has been involved in display market research since 2004 as an analyst and in business development. He started out covering LCDs, OLEDs, flexible electronics and semiconductor materials. He then joined DisplayBank in 2007 as a senior analyst and was promoted to Japan representative director in 2009 where he accelerated their report business in Japan. When DisplayBank was acquired by IHS in 2012, he became Director, Japan Business Leader, where he had responsibility for Technology, Media and Telecommunication industry sales in Japan. His role then expanded to Director of APAC Business Development at IHS Markit.
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