

Key Thoughtz:

- Consumer demand for desktop PC make large panels appear unattractive to smaller AMLCD producers.
- Consumer demand for smart phones make small panels appear attractive to smaller AMLCD producers.
- The resulting reallocation of capacity from large panel to small panel markets drives small panel area prices down 16% a year.
- Falling prices for small AMLCD raise entry barriers against alternative technologies.

Small Makers: Small Panels

Analysis of recent capacity reallocation announcements by AMLCD producers

Smaller AMLCD producers in Taiwan are allocating more fab capacity to make small-medium displays (smaller than 10 diagonal inches). They are following the footsteps left by smaller Japanese producers earlier this decade that became uncompetitive in large panel market segments.

Like Fujitsu, NEC and other AMLCD pioneers in Japan, Chunghwa Picture Tubes (CPT) and HannStar Display (HSD) in Taiwan lack the capacity or capital to keep pace with leading producers. As their reinvestment rate slowed, their overhead and organization costs rose with inflation while large panel prices fell 20% a year or more on a display area basis. Unlike leading producers that sustained high rates of reinvestment, the laggards could not reduce costs through operating efficiency or purchasing scale. As explained in July (see <http://www.bizwitz.com/Downloads/Commentz-20090731.pdf>), leading producers are using larger glass substrates to make more TV panels per sheet, which reduces overhead costs. Increasing the number of panels per substrate also increases their consumption of post-fabrication parts such as driver IC or backlight components. That increases their purchasing scale and improves their buying power.

For such reasons, smaller producers benefit from shifting capacity allocation from panels for PC or TV to panels for mobile phones or

other portable products. Putting hundreds of smart-phone panels on a substrate shifts the cost structure from the fab to the assembly line where hundreds more components are purchased to support each sheet than would be required by four or six monitor panels.

Another dynamic has come into play recently. Positive (reinforcing) feedback loops are driving smaller AMLCD producers toward mobile display market segments more rapidly than in the past. As consumers reveal their preference for portable PC over desktop PC, demand for PC monitor displays has grown more slowly than in the past. As the large panel market with the lowest barrier to entry, a slower rate of growth for monitors stresses many panel makers. Demand for desktop products has been losing ground to portable products throughout this decade but recent events have accelerated this trend for AMLCD producers. The first of these was substitution of CRT monitors by LCD types. At this point, that substitution is nearly complete, so there is no added demand from CRT replacement: monitor panel producers depend on demand for new PC systems. Moreover, business buyers remain on the sidelines after the credit crisis of 2008. In prior years, business buyers would furnish trading desks with multiple monitors that increased demand for larger, higher-end panels. They may resume such purchases in 2010 as part of their transition to Win7. Until then, monitor panel makers must rely on consumer demand for desktops.

A second feedback loop reinforces the trend toward portable computing: smart phones and 3G/4G services. Innovations in wireless services and browser-based applications increase consumer acceptance of mobile platforms as alternatives to fixed installations. The surge of netbook (mini-note) purchases in 2008–2009 attest to this. Panel makers were quick to see the opportunity and were eager to serve such markets. That leads to even faster shifts in capacity allocation.

The shift from large panels to small ones may sustain capacity utilization for smaller panel producers but will it help their bottom line? The data suggests not, at least in the long run.

Mobile Display Trends

Recent reports concerning surging shipments of PC microprocessors signal a recovery in PC demand from consumers. Microsoft also reports positive response to its release of Windows 7 by consumers. Business buyers may defer converting to the new system until 2010 but the PC market seems unconstrained by the popularity of operating systems now.

A closer look at the chip numbers reveals that demand is not uniform, however. IDC says Mobile PC processor shipments rose 36% from Q2'09 to Q3'09 while Desktop chip units rose 11%. While such growth in chip demand for desktop PC is better than expected, it confirms that desktops will lose more ground to portables. For the year, IDC forecasts annual shipments of PC chips will rise 1.5% over 2008. That is modest growth indeed. The forecast indicates that the recent surge was a rebound from dismal conditions earlier this year, rather than a return to the double-digit annual growth of prior years.

Indeed, a look at October sales results from Taiwan's two leading producers shows a shift towards small panels, even for large firms. Earlier this decade, we would have seen a sequential increase in large panel shipments for year-end retail sales. This year, we see a sequential decrease. Apparently, retailers are reluctant to stock-up for late December sales. Forecasts by the National Retail Federation anticipate such behavior: sales promotion early in the holiday season followed by leaner inventories later in the season. As is, we see a sequential rise in small panel shipments. The combined shipments and sales indicate a 12% sequential reduction in average panel price.

TABLE 1: AUO + CMO RESULTS (MILLIONS, TWD)

Factor	Oct '08	Sep '09	Oct '09	YoY	MoM
Small	35.5	39.7	45.0	27%	13%
Large	11.3	16.7	15.7	39%	-6%
Total	46.8	56.4	60.7	30%	8%
Sales	48,095	71,139	67,104	40%	-6%
ASP	1,028	1,262	1,106	7%	-12%

Source: company press releases, BizWitz analysis

At first glance, the 7% increase in ASP over the prior year period seems positive, and it is. Nevertheless, it should be viewed in context. Combined sales for these two firms fell 47% from Oct '07 to Oct '08 as shipments rose 38%. That caused ASP to fall 62% YoY. The 7% YoY increase last month means ASP fell 59% over two years from Oct '07.

Results for the smaller producers in Taiwan look similar. Prime View International (PVI) was the only one of this group to record an increase from Oct '08. That resulted from demand for electrophoretic displays used in Kindle, nook and other electronic readers. Taken together, sales for this group declined 9% YoY and 11% MoM.

TABLE 2: SMALL PANEL SPECIALISTS (MILLIONS, TWD)

Factor	Oct '08	Sep '09	Oct '09	YoY	MoM
Giantplus	899	1,181	970	8%	-18%
PVI	570	1,470	1,301	128%	-11%
TPO	3,151	2,872	2,617	-17%	-9%
Wintek	3,473	2,802	2,504	-28%	-11%
Sum	8,093	8,325	7,392	-9%	-11%

Source: DigiTimes, BizWitz analysis

The rising average size of mobile phone displays suggests that the impact on area pricing is even greater than on unit pricing. As Apple, HTC and Motorola rush larger touch-panels to market, the average phone panel diagonal stretches from less than 2" towards more than 3". That implies that area prices are falling faster than unit prices. In addition, panel makers must contend with rising pixel counts that decrease yield and increase component costs.

Capacity Shifts

As mentioned in the introduction, AMLCD producers who fall behind in reinvestment soon fall behind in cost development, also. That creates motivation for reallocating capacity for small panel applications over time. The pace of reallocation has become more urgent in recent quarters as demand for monitor panels slows to single-digit annual growth rates.

As detailed in the following table, rivalry among panel makers in the monitor display market segment has been far greater than rivalry in notebook PC or TV segments has been for many years. Barriers to entry in the monitor market segment have been low compared to other segments. For example, it takes a team of experienced panel designers working closely with a team of notebook designers to create a winning package in a market with short product cycles. There is far less interaction between monitor panel designers and peripherals engineers and the product cycles can be longer. Three AMLCD firms (AU Optronics, LG Display and Samsung) command three-quarters or more of the notebook panel market. Attempts by smaller companies to drive new sizes or formats into the netbook market have failed. There are high barriers to entry for smaller producers of portable PC displays.

TABLE 3 RIVALRY INDICES FOR LARGE AMLCD

Segment	2005	2006	2007	2008
Monitors	6.8	7.5	7.6	7.3
Non-PC	6.6	5.1	5.5	6.3
LCD TV	5.2	5.2	5.4	5.3
Notebooks	6.4	5.8	4.4	4.3
All Large	7.1	6.7	6.3	6.0

Source: DisplaySearch data and BizWitz analysis of normalized, inverse Herfindahl indices of revenues

Adopting a strategy of making larger TV panels is also difficult for some. As shown in the table, rivalry (number of equivalent producers) in the TV panel market is low also because so many TV brands are integrated vertically. Intense rivalry in the monitor market adds to the problems smaller producers face when desktop PC demand levels out or declines.

Given the motivation to allocate more capacity in larger substrate fabs for mobile phone displays, we are not surprised by the following announcements.

- BOE Technology of China will commence production at its new 730×920 mm fab with panels for Nokia E75-sized phones.

- Tianma Microelectronics of China will increase its capacity for 730×920 mm substrates by 50%.
- CPT of Taiwan will re-start one of its idled 730×920 mm fabs to make mobile phone panels in Q1'10.
- HannStar Display of Taiwan will allocate capacity at its 1200×1300 mm fab for mobile phone and other small panels.
- Hitachi Displays will increase LTPS capacity for premium mobile displays at its 730×920 mm fab three-fold.
- LG Display of Korea will start making LTPS panels for mobile devices at a new 730×920 mm fab in 2010.
- Samsung Mobile Display of Korea may build a 1320×1500 mm LTPS fab for production in 2011.

Re-purposing older fabs adds to the capacity expansion caused by new investments. Such re-purposing is not without cost but it needs little capital and it leverages depreciated assets to serve expanding markets. It lends strength to our Legacy Transfer scenario (see <http://www.bizwiz.com/scenarios.html>).

The effect on variable costs and purchased parts can be substantial. Consider the HSD example. That producer can fabricate 19" monitor panels 12 up on 1200×1300 mm glass. With a change in allocation, HSD can make more than 300 iPhone size panels on the same substrate. That creates need for more module components, more assembly labor and more floor space for cutting and handling so many panels. Producer cost structure becomes more variable as a result. The following table estimates the number of mobile phone panels than producers can fabricate on various glass substrate sizes.

TABLE 4: PHONE PANELS PER SUBSTRATE

Glass	370 x	600 x	730 x	1200 x
	470	720	920	1300
feet ²	270	670	1,041	2,418
E75	60	156	240	572
HTC	32	91	144	360
iPhone	30	84	120	308
Droid	30	72	130	299

Source: BizWitz estimates

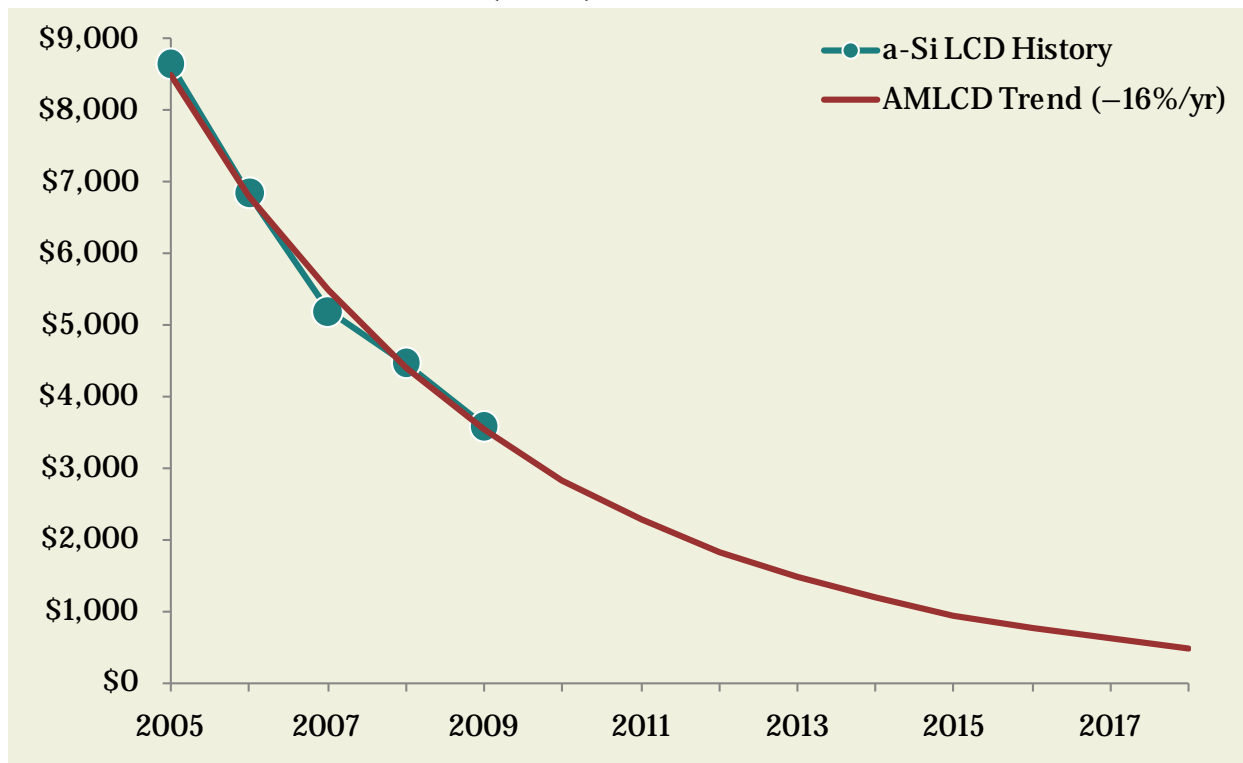
Falling Prices—Rising Barriers

Shifting capacity to serve small panel markets in general and serve smart phone markets in particular is good for consumers. Is it good for producers?

It might be good for panel makers on the basis of sunk cost and employment if we set aside considerations of profit. As seen in Japan throughout this decade, repurposing older fabs to make specialty products for smaller but less contested market segments can sustain factory utilization and preserve jobs. This rationale is most apparent in the recent announcement by Hitachi Displays. The conversion of more amorphous silicon (a-Si) process capacity to polysilicon (LTPS) will give the producer more ability to serve customers demanding high pixel-counts in small, mobile displays. That will give Hitachi engineers a worthy mission and give their factories a new lease on life.

It may be less good for panel makers on the basis of profit, however. As plotted in the following chart, prices are falling 16% a year.

FIGURE 1 SMALL PANEL PRICE DEVELOPMENT (USD/M²)



Source: DisplaySearch, BizWitz analysis

The chart considers only a-Si AMLCD smaller than ten diagonal inches in order to avoid the effect of LTPS pricing. The area price of LTPS panels has fallen faster in recent years as producers failed to replace a-Si displays in notebooks or other large panel applications. It became more difficult to obtain premiums as the price of a-Si panels declined and the performance of a-Si panels improved.

As panel makers shift more capacity to serve mobile product markets, they sustain market dynamics that drive prices down. At the historical rate, the areal price in 2012 will be 40% less than in 2009. That will make it harder to justify investments in new display technologies, especially for venture funds with mid-term objectives.

—by David Barnes for BizWitz LLC, a consultancy specializing in electronic display and imaging business decisions throughout the supply chain from raw materials through retail, worldwide