

# STATE OF DISPLAY

Putting display innovation at  
the heart of product design

## THE DISPLAY COMFORT ZONE

From smartphones and wearables to digital signage and industrial terminals, display technology of all shapes and sizes features heavily in our everyday lives.

But isn't it surprising — given how much time we as users spend engaging with 'screens' at home, at work or on the move — that so many applications and product categories all feature a very similar looking set of 'me-too' products? Why, in so many cases, is product design, and in particular the choice of display, always being approached through the same very limited 'glass' ceiling?

Product displays can be a creative canvas for innovation which unlocks new streams of competitive advantage and product differentiation. Why aren't more designers looking to step outside their comfort zones and innovate with different display technologies (such as e-paper) as a potential way to stand out

from the crowd, make products more enticing to customers and ultimately disrupt the status quo? These are the questions that Plastic Logic set out to explore in its latest research project.

We surveyed 115 professional electronics engineers\* involved in the outline specification or physical design of electronic products featuring integrated displays. We asked them – what are the pressures they face? How are they approaching their designs? What influences display choices in the design process?

**Plastic Logic's State of Display report is our litmus test to the world of product design and display innovation.**



**1 in 5 aren't satisfied** with the display in their most recent design

**24%**

**believe their organisation** lacks in-house display expertise



**Two thirds agree** that the choice of display has a major impact on the end design/product

## WHAT'S THE PRIORITY?

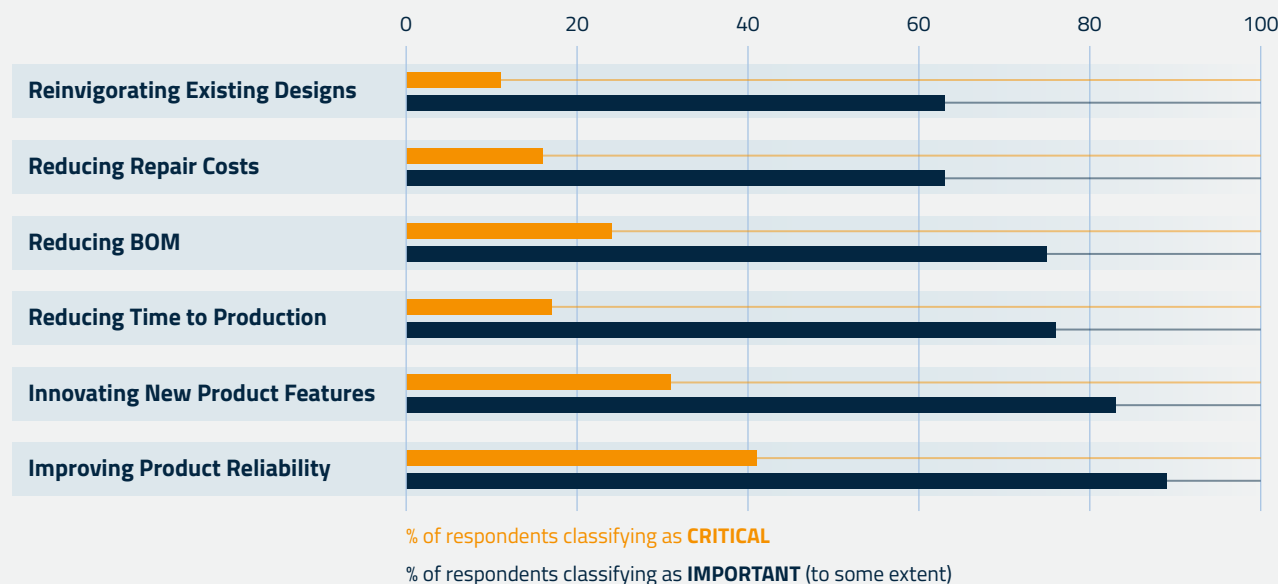
### What are the key priorities for electronics designers today?

Despite the obvious commercial pressures placed on engineers, only a quarter (24%) consider reducing the BOM to be a top priority and only 17% see reducing time to production as their primary focus.

Improving product reliability (41%) is the number one priority and in second place with 31% is the need to produce innovative new product features.

When asked what drives the design process in their organisation, the majority (44%) say they are regularly required to suggest and innovate new features. Almost a quarter (23%) are working collaboratively with marketing to define product specs. Only 9% work on products that are marketing driven and where they're told what to produce.

Reinvigorating existing designs, on the other hand, appears to be the least important, with only 11% of respondents considering it as critical.



**83%** of engineers say innovating new product features is important  
**31%** say it is critical

**44%** are regularly required to suggest and innovate new features

## EXPERIENCE AND EXPERIMENTATION (OR LACK OF)

### What experience do people have with different display technologies? What are the technologies most commonly being used?

Perhaps unsurprisingly LCD Graphical (35%) and OLED (27%) are the most popular technologies — i.e. they have been used by designers on their latest design or within the last year. But over a third (36%) have never worked with OLED.

Respondents experience of working with e-paper is low. Only 5% are using it in their current designs and two thirds (67% for e-paper segment and 65% e-paper active matrix) have never worked with the technology.

However, there does appear to be a real appetite to use the technology in the future – 60% say they are likely or very likely to do so. Just 5% think they never will.

Given the general pressure to innovate identified in the previous section, it's surprising that so many engineers have been slow to experiment with e-paper as an antidote to the challenge of finding differentiation and competitive advantage.

Respondents cited: a lack of familiarity and understanding of the benefits; perceived cost and challenges justifying new technology as common reasons why they haven't or are unlikely to use e-paper.

Given that highly versatile e-paper technology is truly lightweight, flexible, rugged, low power and readable in absolutely any condition, clearly more work needs to be done to educate the market and stimulate experimentation.

### TECHNOLOGIES USED BY RESPONDENTS ON THEIR LATEST DESIGN OR IN THE LAST YEAR



LCD GRAPHICAL  
**35%**



OLED  
**27%**



LCD 7-SEGMENT  
**19%**



E-PAPER  
ACTIVE MATRIX  
**10%**

**60%**  
**are likely or very likely**  
to try e-paper in the future



## A DISPLAY DISCONNECT?

### How are displays selected? Who has the final say?

In this section our findings highlight a potential disconnect between the process engineers are using to select displays and their stated need to innovate new features (as previously highlighted in this report).

The majority of our respondents (36%) said they have free reign to suggest the display solution they use in their designs. However only 1 in 5 (20%) say they are conducting a rigorous assessment of lots of different display technology options. Encouragingly only a very small percentage (3%) just stick with what they've always done but this overall lack of due diligence and experimentation

implies huge opportunities to create differentiation and competitive advantage are routinely missed. The use of external consultants to help guide selection is also quite small (16%).

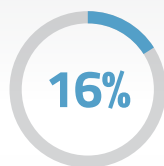
Our poll suggests that in the majority of cases (58%), the chief designer has the final say on the display technologies used in designs — although we question this figure. While they may have sign off, this is likely only subject to a BOM budget which marketing/sales believe the product can sell at. Almost 1 in 10 (9%) say they have the autonomy to make the decision themselves and the decision sits with the end customer for 13% of respondents.



Free Reign  
to Choose



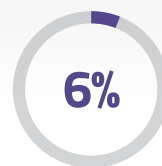
Rigorous Assessment  
of Different Options



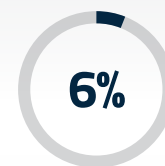
Consult with  
Display Distributor



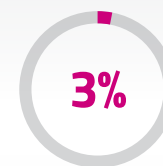
Industry  
Mandate/Compliance



Told by  
Marketing



Other



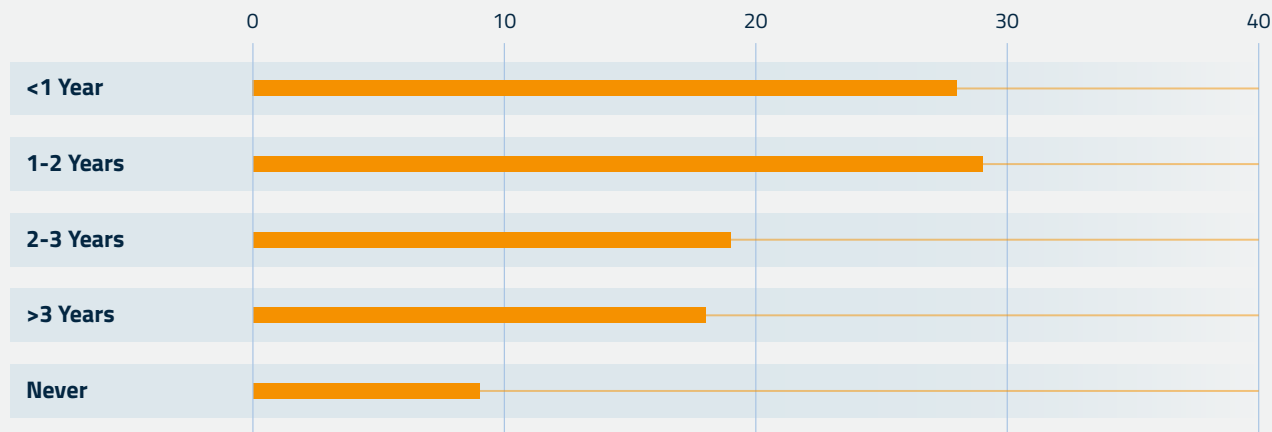
Stick with What  
Always Done

## A DISPLAY DISCONNECT?

### How often are designs refreshed?

Surprisingly, nearly 1 in 10 (8%) say they never review or refresh the display technology in their products but almost half (49%) review/refresh within two years. The majority (25%) review every 1-2 years closely followed by <1 year (24%).

#### FREQUENCY DESIGNS ARE REFRESHED/REVIEWED



Only **20%** conduct a rigorous assessment of lots of display technologies



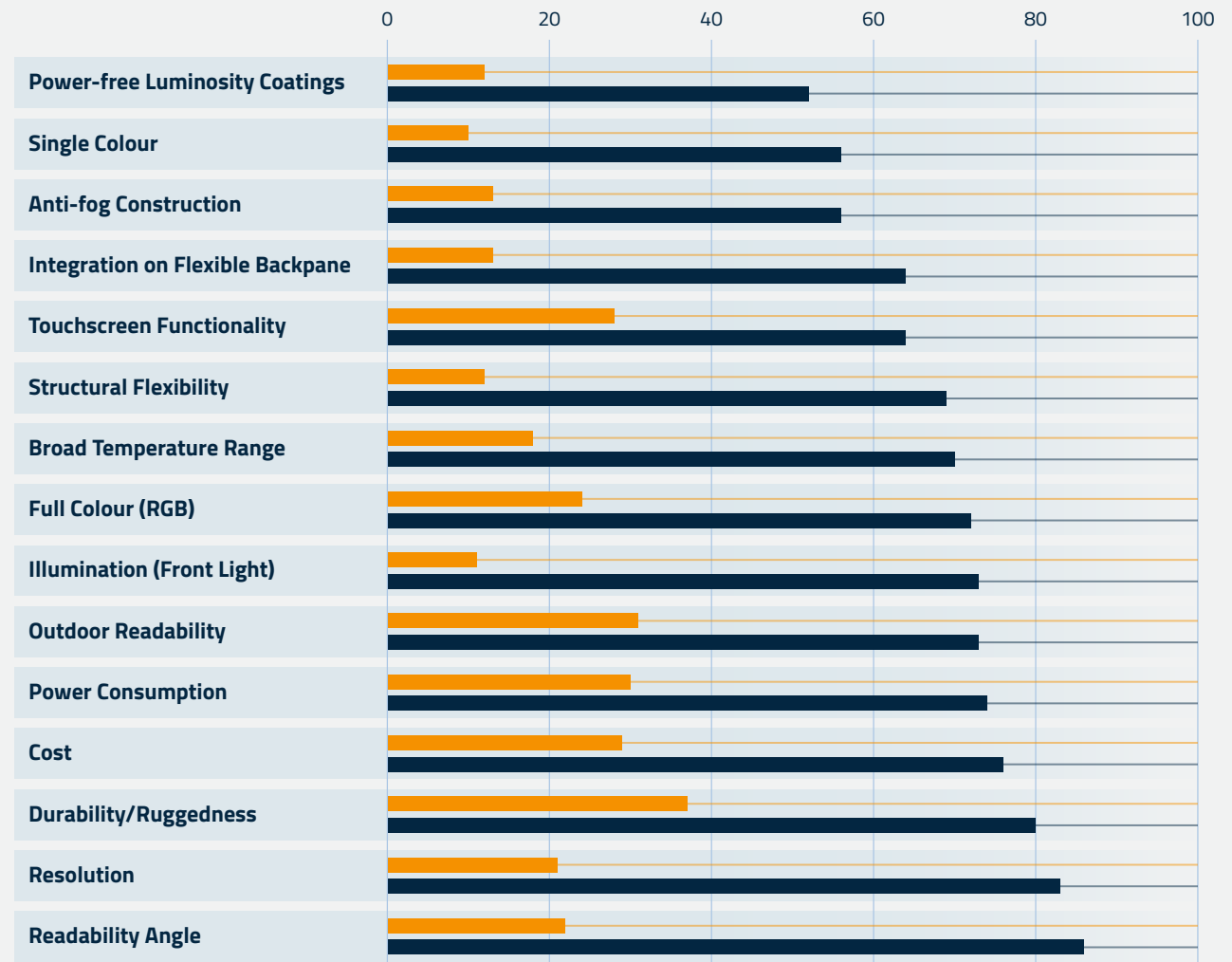
**1 in 10** never review/refresh the display technology in their products

## THE DISPLAY SPECIFICATION

### What's important?

Ruggedness (37%), outdoor readability (31%) and power consumption (30%) come out as our engineers' three most critical specification elements.

This makes the low e-paper adoption rates revealed earlier in this paper all the more ironic, given that these elements really play to the strengths of e-paper technology. The bi-stable nature of e-paper displays is a particular power advantage, for example.



% of respondents classifying as **CRITICAL**

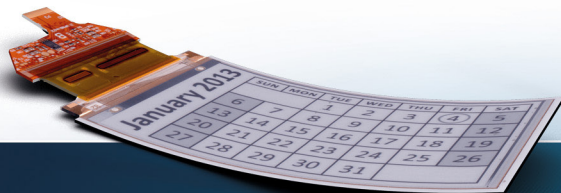
% of respondents classifying as **IMPORTANT** (to some extent)

## THE DISPLAY SPECIFICATION

Given the fact that everyone is constrained by some kind of BOM budget, unsurprisingly cost was the fourth most critical part of the specification (29%). The reality for e-paper is that, compared to more traditional glass display types, it is a more expensive choice of display. However, the e-paper market is now maturing and thanks to a fully industrialised manufacturing process, those costs are slowly falling for the right business cases.

Full colour (24%) and resolution (21%) also feature reasonably high in terms of critical priorities on the specification. Much like cost, the reality is that there are other display technologies with much higher resolutions and better colour performance. However, early in 2018 Plastic Logic produced sample displays with a pixel density of 500ppi (a 155% improvement on previous generations) that is closing the gap in certain use cases.

The SID 2018 Display Week conference in Los Angeles also showcased some advanced colour e-paper breakthroughs that will be commercially available in the future and could be a gamechanger.



**1/3 of engineers** would find a display's physical flexibility **valuable to their design**





## BUSTING THE MYTHS

### Why we must stop the innovative potential of e-paper from being undermined

Clearly as an e-paper display vendor we're biased but our interpretation of our survey results sends us a clear message — the innovative potential of e-paper is being undermined by many myths and misconceptions that simply aren't true. Here are some examples expressed in our survey:

- 30% of respondents didn't realise you can get e-paper in a range of sizes (not just e-reader/tablet size)
- Almost a quarter (25%) believe driving e-paper displays to be complicated
- 31% believe e-paper displays have a shorter operational life than glass-based displays

**While we're on the subject, here are five other key facts about e-paper that it's worth stating in an attempt to debunk other commonly heard myths:**

- 1. E-paper** will use considerably less power than an LCD display of the same size — particularly in use cases with infrequent display updates. E-paper only consumes power when what's on the display changes. Once an image is visible, e-paper requires no power to keep it there. Also if the battery dies you won't lose what's shown on an e-paper display.
- 2. Unlike LCDs, e-paper displays** perform really well in bright sunlight.
- 3. E-paper displays** are available to buy off-the-shelf in a range of sizes. They aren't only available as expensive build-to-order products that you have to buy in large volume.
- 4. E-paper displays** don't have to be read-only. By incorporating appropriate technology, they can be used as interactive touchscreens.
- 5. E-paper** will operate at a wide range of temperatures... not just room temperature.

**WHEN IT COMES TO E-PAPER DISPLAYS IT'S BEST TO KEEP AN OPEN MIND AND NOT BELIEVE EVERYTHING YOU HEAR.**

Our advice is always to take the time to do thorough research and due diligence to properly assess the technology's suitability for your requirement. While e-paper is certainly not a panacea for every display-related challenge, for many applications and use cases these displays have a very powerful business case that can contribute to the success of your product.

## IS THE DISPLAY SUPPLY CHAIN ACTIVELY STIFLING INNOVATION?

Another area of concern that our survey shines a spotlight on are the frustrations engineers are experiencing with the display supply chain. For example:

- **55% find getting development kits to operate quickly** a challenge when integrating displays into their products
- **49% say they struggle** with prototyping because of display sample availability
- **37% find it difficult** to match unusual display requirements with what's available from suppliers
- **22% strongly agree** that display suppliers are only interested in massive volume potentials

Clearly from our perspective, making e-paper displays as easy to source and evaluate as possible is the best way to inspire innovation and allow customers to experience first-hand how the technology can benefit their devices.

At Plastic Logic we like to think of ourselves as that agile and affordable partner that can support and enable our customers to bring robust, flexible, functional, low-power glass-free display-based products to market. Our leading-edge plastic electronic technology, proven manufacturing process and can-do customer focus combine to make this possible.

If we're going to be successful in stimulating experimentation with display technologies like e-paper and encouraging more focus on display innovation then it's crucial we aren't creating unnecessary barriers in the supply chain and making things harder for the engineers.



## CHANGING MINDSETS

So what have we learned from our State of Display litmus test into the world of product design and display innovation?

Here are our five key takeaways.

### 1. FIGHT COMPROMISE

Display choice has a major impact on the end design/product yet many aren't satisfied with the display in their most recent design.

### 2. BE RIGOROUS

Producing innovative new product features is a critical priority so more engineers should be assessing lots of different display technologies as part of their design process.

### 3. OPEN YOUR MIND

E-paper is under-utilised but the features and benefits of the technology tick a lot of the critical boxes on the display specification.

### 4. BE INFORMED

Perceptions of different display technologies should be formed based on facts not fiction.

### 5. FIND A PARTNER

Display expertise isn't abundant. Working with a strong and supportive partner will help avoid design and supply chain frustrations.

## LET'S GIVE THE USERS WHAT THEY WANT TOO

As well as 115 engineers we also polled 1,986 consumers to get their views on the devices they own.

- **84% value** the display as an important feature
- **47.2% feel** something is missing from the overall user experience of their devices
- Battery life (64%); cost (55.4%); practicality and comfort (53%) durability of the device (49.2%) and screen quality (48%) **were the top 5 features they value most.**

The provides further unequivocal evidence of the need for differentiation and innovation — **something e-paper is potentially very well placed to meet.**

## PLASTIC LOGIC

Here at Plastic Logic we're on a mission to smash the glass ceiling that is holding back display innovation.

Taking on board the insights in this paper can help you to unshackle yourself from stifled thinking and me-too product design. It will help you see the display as a creative canvas for innovation with the potential to unlock new streams of competitive advantage and differentiation.

**If you want to use e-paper displays to help your products stand out from the crowd, be more enticing to customers and ultimately disrupt the status quo we'd love to hear from you.**



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