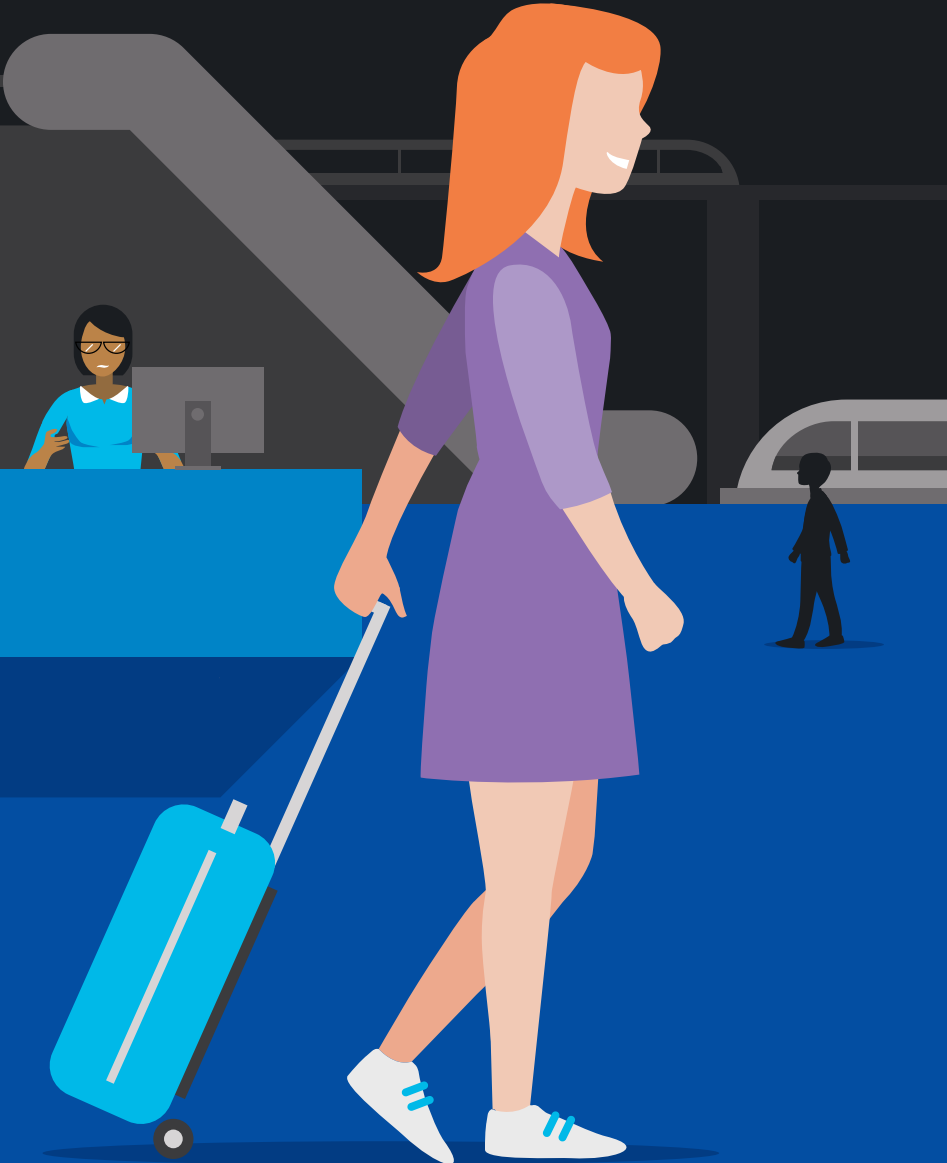


White Paper:

# The New Digital Canvas: Ultimate Guide to Planning and Deploying LED Digital Signage

A digital weather display on a screen. The background is blue with a grid pattern. The text "Weather Now" is in pink. The temperature is "68°F" in white and "20°C" in light blue. There is a white cloud and a yellow sun. Below are three boxes: "Afternoon" with a white cloud icon, "Evening" with a grey cloud icon, and "Overnight" with a white crescent moon icon.

Weather Now		
68°F 20°C		
Afternoon	Evening	Overnight

# The New Digital Canvas

## Direct-view LED technology lets integrators create large digital canvases with unique configurations and no visible seams or gridlines

The rising popularity, competitiveness and adoption of direct-view LED digital signage displays can be explained in two words: no bezels.

LED display technology boasts a healthy list of features, but what excites users most is how direct-view LED technology lets them create very large digital canvases with no visible seams or gridlines.

It's true that LCD display manufacturers have made great strides in reducing the bezel — the physical frame that surrounds commercial LCD videowall panels — to as thin as 1.7 mm, not much more than the width of a dime. But even those super-skinny bezels still create noticeable seams.

By contrast, direct-view LED digital signage displays do away with bezels altogether, so no seams are visible to viewers when they're combined into a single installation.

Furthermore, the building-block nature of the individual LED units allows the displays to be grouped in a wide variety of configurations.

LEDs are also seeing rapid adoption because of their ability to overpower the glare of natural light in outdoor or brightly-lit settings.

**This white paper looks at direct-view LED technology and how and why it's becoming increasingly popular today. You'll learn what you need to make informed decisions about choosing the right technology, service partners and successfully deploying projects.**



# Direct-view LED Basics

Determining whether direct-view LED is the right fit for your project starts with an understanding of the key differences in the technology compared with traditional LCD screens

Think of the giant video screens you've seen at sports stadiums and arenas, or behind performers at concerts. Those are LED displays. So are those large digital billboards in Times Square, in city centers, and perched on pylons along highways.

Those large LED digital signage displays are arrays of much smaller modules contained in "cabinets," and tiled to create large images.

When it comes to videowalls and digital signage, the term direct-view is used to distinguish this technology from LCD displays. White LEDs are the hidden light source that illuminates today's LCDs. They are embedded inside the enclosure, behind the LCD layer, or along the edges. In the case of direct-view LED displays, the LEDs both create the illumination and are the color source for the entire image. For full color direct-view LED displays, each pixel of light is actually three LEDs — red, green and blue — dynamically lit and blended to generate millions of colors.

For many years, LED has been used primarily for outdoor displays or indoor situations where viewers would see the screens at considerable distances, for example as stadium replay boards and sideline ads along athletic fields. That's

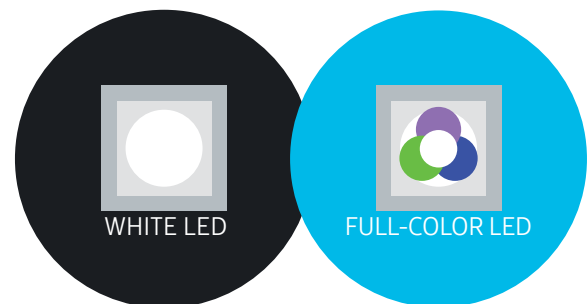


because the distance between the LED pixels, called the "pitch," was generally substantial. At a distance, the human eye cannot see the gaps between the diodes, and the visuals look blended and uniform. As viewers start to get closer the individual lights become visible and the visuals degrade.

In the past five years, technology and manufacturing advances have created much smaller diodes and made it possible to pack a lot of them in a small area. The result has been fine pixel pitch, or narrow pitch, LED displays that look good even from relatively close distances.

A digital ad billboard on a roadside typically has a 16 mm or even higher pitch. It looks crisp to motorists passing hundreds of feet away, but that same display, fixed behind a sales counter at a retail flagship store, would look terrible. The retailer is more likely to use a display with a 2.5 mm pitch or even finer.

The viewing experiences of the finest pitch direct-view LEDs now rival full HD LCD videowalls, and the technology's attributes make it the preferred choice for professional A/V integrators, architects and clients.



"Narrow pixel pitch LED ... has been hugely disruptive in the commercial display space, challenging LCD and projection platforms."

Chris McIntyre-Brown, Futuresource Consulting

# Why the Market is Shifting to LED

Installed properly, an array of direct-view LEDs will have a uniform surface with no evident gaps or lines showing between the individual modules.

Manufacturers are now selling direct-view LED technology with pixel pitches as fine as 0.9mm, but the sweet spot among buyers has settled in at about 2mm. In rough terms, that's a display that will look good to viewers starting at about 15-20 feet.

The LED light "packages" account for a lot of the manufacturing cost of LED modules, so increasingly fine pixel pitches add more and more LED packages per module, raising the price. That's why the market has not simply moved to the finest possible pitch, with those displays currently aimed at specialty and luxury markets, where budget is secondary to image quality.

However, the buyer market has gradually shifted to tighter pitches as prices have dropped. "Today, 2.5 mm is the new 4 mm," says Mitch Mittler, VP of sales, design and technology

for Diversified, one of the largest A/V systems integrators in North America.

The primary attraction of LED over LCD screens stem from the ability to create seamless displays. Installed properly, an array of direct-view LEDs will have a uniform surface with no evident gaps or lines showing between the individual modules. By contrast, even premium "extreme narrow bezel" LCD videowalls result in hairline-thin vertical and horizontal gridlines that show where the individual LCD units are placed against each other.

To some observers, those lines are inoffensive and acceptable based on factors like the type of content and the viewing distance of the wall. The further viewers are from an LCD videowall, the less evident the seams will be.

LED videowalls can generate twice the brightness, overpowering building lighting or even full daylight.

At nighttime, an LED needs only a fraction of daytime brightness to make the same visual impression.



## Flexible Configurations

Luxury clients in advertising and retail settings, don't want a vertical or horizontal line bisecting a supermodel's face, running the height of a perfume bottle or cutting through a logo. In a very different circumstance, a videowall in a control room showing the readouts and schematics for a power generation facility can't have extra lines in a layout, or bisecting a critical visual. None of that happens when using a seamless LED wall.

Conventional LCD display panels also constrain the possibilities for creating digital canvases that work with and conform to the shapes of a physical space. With the exception of some specialty products, LCD units are uniform rectangles with a 16:9 ratio. When grouped as videowalls, they effectively scale to a larger rectangle, whether tall or wide. But architects looking to create visual experiences in physical spaces, like airport arrival halls and office tower lobbies, want to think and build outside those rectangular boxes.

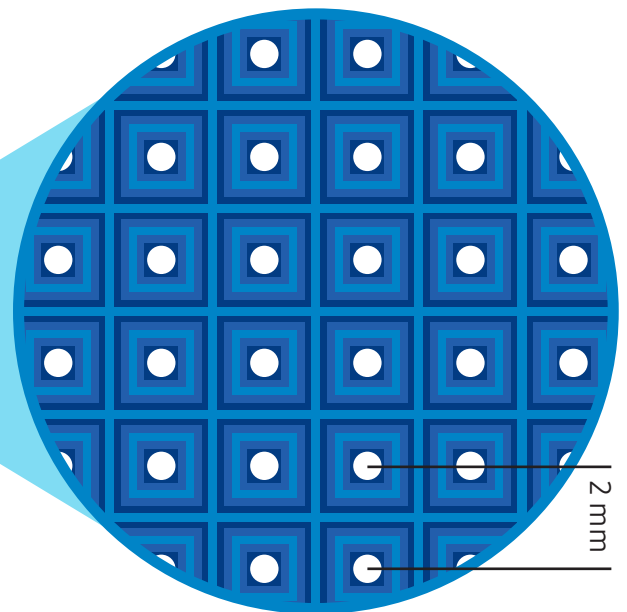


Direct-view LED cabinets are much smaller than videowall displays, and can therefore be grouped and tiled in different ways. They can far more readily match up the shape of a physical space, whether that's creating a super-wide ribbon display, or fitting beside and over elevator lobby entryways in a building. Direct-view LED displays can do things like cover curved arches at an entryway, or be suspended facing down to create virtual, digital ceilings.

In short, LEDs open up design possibilities by overcoming the constraints of older display technology.

LEDs also bring more lighting power. Where the brightest LCD videowall displays max out at 800 lumens, LED videowalls can generate twice the brightness, overpowering building lighting or even full daylight. In settings like naturally-lit building atriums, viewers may struggle to clearly see an LCD videowall image. A projection-based system won't stand a chance, either. But direct-view LEDs cut through the sunlight for an easy viewing experience.

These units can also be controlled, through scheduling or using light sensors that dynamically raise or lower brightness levels based on ambient lighting conditions, which ensure optimal viewability. At nighttime, an LED needs only a fraction of daytime brightness to make the same visual impression. That matters in terms of visual quality, but also in power consumption and the operating life of the display, as lowering the light output uses less energy and results in less wear on the diodes and other components.



Choose the Right Pixel Pitch:

As a general rule, a 2mm pixel pitch will look good at 15-20 feet.

# The Marketplace is Adopting LED

Advertising, sports, hospitality and retail have been the most active early adopters of direct view LED technology.

For the last decade, media companies have been investing more and more in big city square "spectaculars" and busy highway billboards, replacing large-format print assets in light boxes with fine-pitch digital displays. There are several advantages to the switch, including the ability to have multiple messages in a rotation, the addition of motion graphics, dynamically updated content and rapid scheduling changes.

For example, changing advertising media at a poster light box in an airport arrivals hall can take weeks of planning and permissions, overtime labor and special equipment like man-lifts. Once digital, making a change to an advertising campaign involves a few keystrokes, or can be largely automated.

Sports and entertainment complexes are using fine-pitch LED inside and outside major venues for a variety of different applications. Increasingly, large LED screens outside of arenas bring live games in HD quality to designated fan zones, catering to crowds as they move around the stadium.

Facility operators love LED because they get very large-format visuals that can be changed to reflect new teams and sponsors in just minutes. That means game nights for a professional basketball team can be blanketed with branding visuals for the sponsoring wireless carrier, and

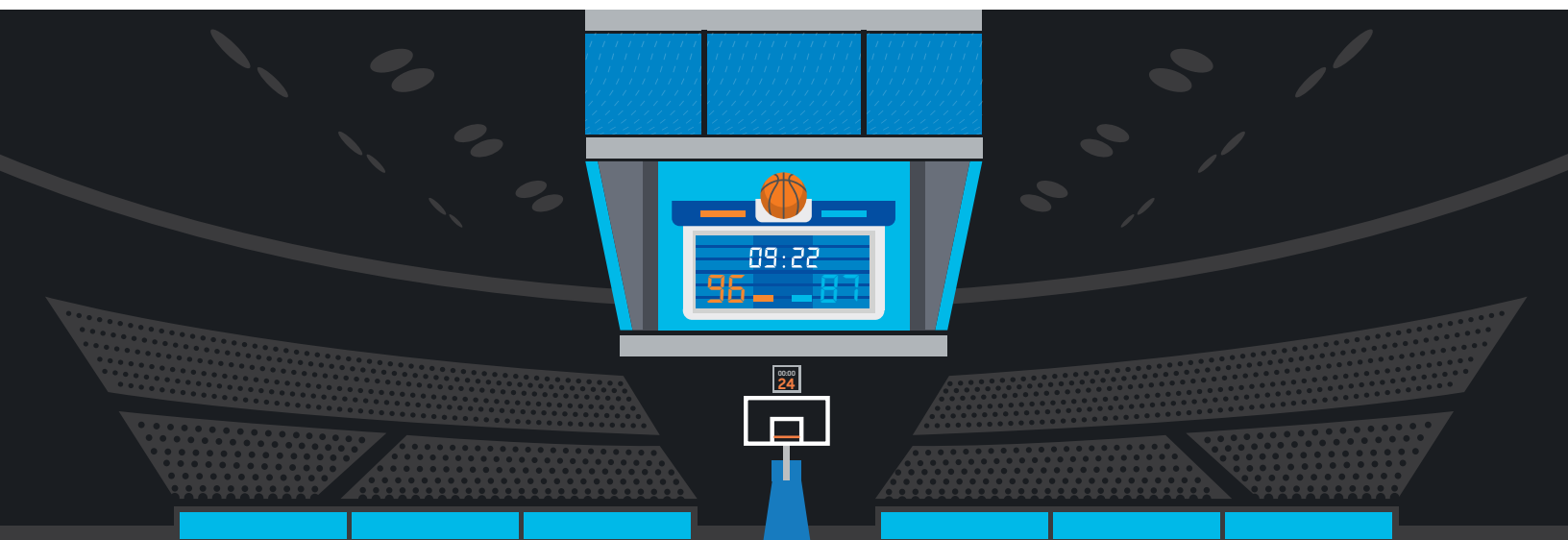
24 hours later, the entire complex can show imagery for an insurance company sponsoring the professional hockey team.

Direct-view LED is also gaining traction in resort properties and destination entertainment complexes. Casinos, for example, are transitioning their sports book betting rooms from projection systems or LCD videowalls to giant, seamless LED walls that can show multiple games or races at once, or fill the entire digital canvas with the feed from a major sporting event like the Super Bowl or World Series.

Retailers can outfit entire walls of their flagship stores with giant LEDs that set the store's overall tone, market the brand and create immersive experiences for shoppers.

Major city police departments, government bureaus and private corporations are using the wide, vivid canvases made possible by direct-view LED as their main control room dashboards — giving operators a full view of anything and everything they need to know minute to minute — with no seams and no glare from ceiling lights.

LED screens are even being used as replacements for projection systems in corporate boardrooms and executive briefing centers. Their biggest selling point is that the module brightness can put an end to closing blinds and dimming lights for presentations.



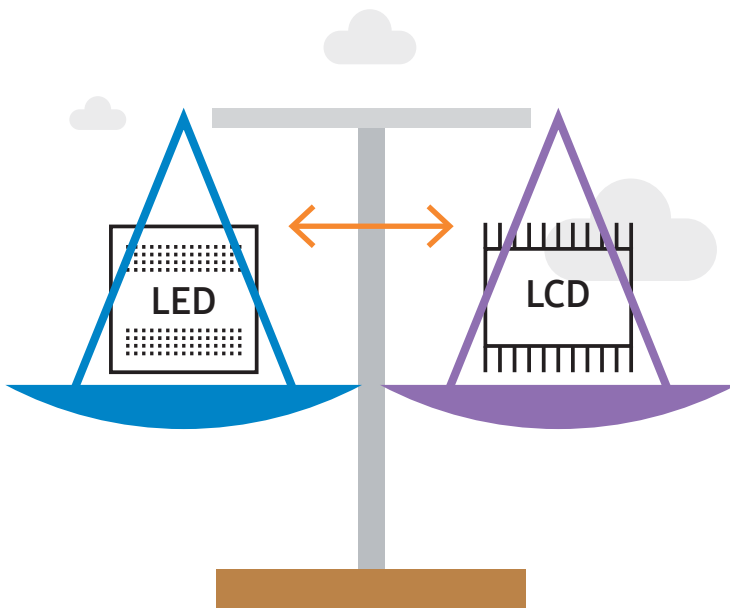
# Is LED the Right Choice?

Direct-view LED comes at a cost premium to LCD, but also delivers some key advantages.

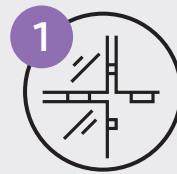
The finest pitch LEDs are best viewed from a minimum of five feet back where the human eye starts to see the individual diodes. When a videowall application has content that invites and demands viewers come close to read or see fine detail, full HD or 4K LCD displays are better options. However, fine pitch LED is being successfully deployed in corporate boardrooms and presentation theater settings, as well as control rooms, that have the right viewing conditions.

LED modules contain hundreds or thousands of tiny lights mounted on a wafer, with those lights running to the very edge of each. They're vulnerable to bumps and idle hands, and best kept out of reach of viewers. A direct-view LED wall that is within easy reach of viewers can get bumped by shopping or luggage carts, or touched by curious viewers. Due to heat dispersion concerns, LED technology is not well-suited to having protective glass in front.

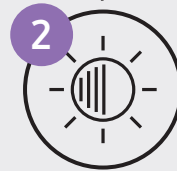
This is changing, but LEDs are not really designed to serve as touch displays. There are ways to add interactivity through tools such as gesture sensors or apps paired to the display via tablets or smartphones. But the individual light packages surface-mounted on typical displays are fragile and will last longer if they're protected from direct contact.



Direct-view LED may be the preferred display canvas for projects for a variety of reasons. Here are some key questions to ask:

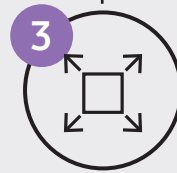


**1 Is it important that the visuals are entirely seamless?** If yes, that rules out LCD-based videowalls because of their visibly evident bezels.



**2 What are the ambient lighting conditions of the targeted environment?**

If the area is exposed to natural light in an atrium or window-filled lobby, LCDs and particularly projector-based solutions will struggle to counteract and cut through glare.



**3 What is the shape of targeted surface, or digital canvas?**

Unusually wide, tall or irregular areas are most easily filled by smaller displays, like LEDs, that can conform to dimensions and even work with gently curved surfaces.



**4 What's the anticipated lifespan?**

If the videowall is expected to have a useful life of just 3 to 4 years, then other technologies like LCD will be less costly. But LEDs are rated to last 10 years or longer, with minimal servicing requirements. LCD and projectors require costly servicing to extend their lives.



**5 What's your budget?** Fine-pitch LED walls — particularly premium products — are more expensive than other options.

# Comparing Costs

Fine pixel pitch technology is relatively new, and still more costly than more established video wall technologies like narrow bezel LCD displays.

The cost per square foot of the finest pixel pitch LED displays is roughly five times as great as for LCD videowall displays. LEDs with greater pixel pitches are less costly because the density of LED light packages is lower — with a 1.5 mm screen costing about 3.5 times as much as an LCD, and a 2.5 mm module costing roughly twice as much.

Futuresource Consulting tracks the fine pitch LED industry, and says prices are steadily dropping, but not as rapidly as 2-3 years ago.

Actual costs will vary greatly by supplier, and it is possible to buy fine-pitch display modules for prices that come close to matching LCD pricing. However, these are modules from commodity-grade manufacturers, using a much wider variety of LED chips. The supplier will typically offer minimal product support, and the quality differences are readily evident when the displays are switched on.

Here's a real-world example, using late 2017 prices, comparing the estimated cost of LED and LCD walls of roughly the same dimension, both delivering full HD resolution. Both walls produce a 16:9 rectangular image.

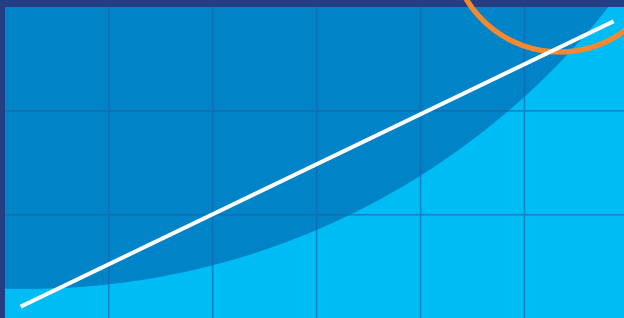
## 1.5 mm Pixel Pitch LED Wall

### Core equipment:

18 LED Module Cabinets  
1 Media Player  
Est. Cost - \$127,000 (Minimum Advertised Price)

# \$127,000

130  
inches



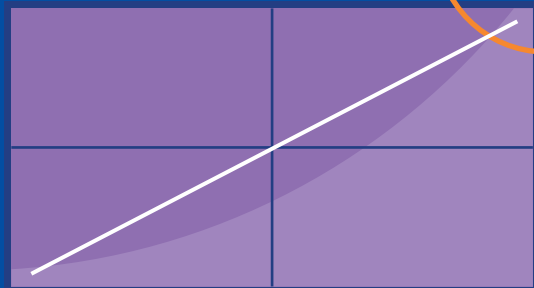
## Ultra Narrow Bezel LCD Video Wall

### Core equipment:

4 55-inch premium LCD displays  
1 Media Player  
Est. Cost - \$26,000 (Minimum Advertised Price)

# \$26,000

110  
inches





# Modeling Total Cost Of Ownership

Direct-view LED modules are rated for at least 100,000 hours of use, whereas commercial LCDs may be rated for half to a third of that.

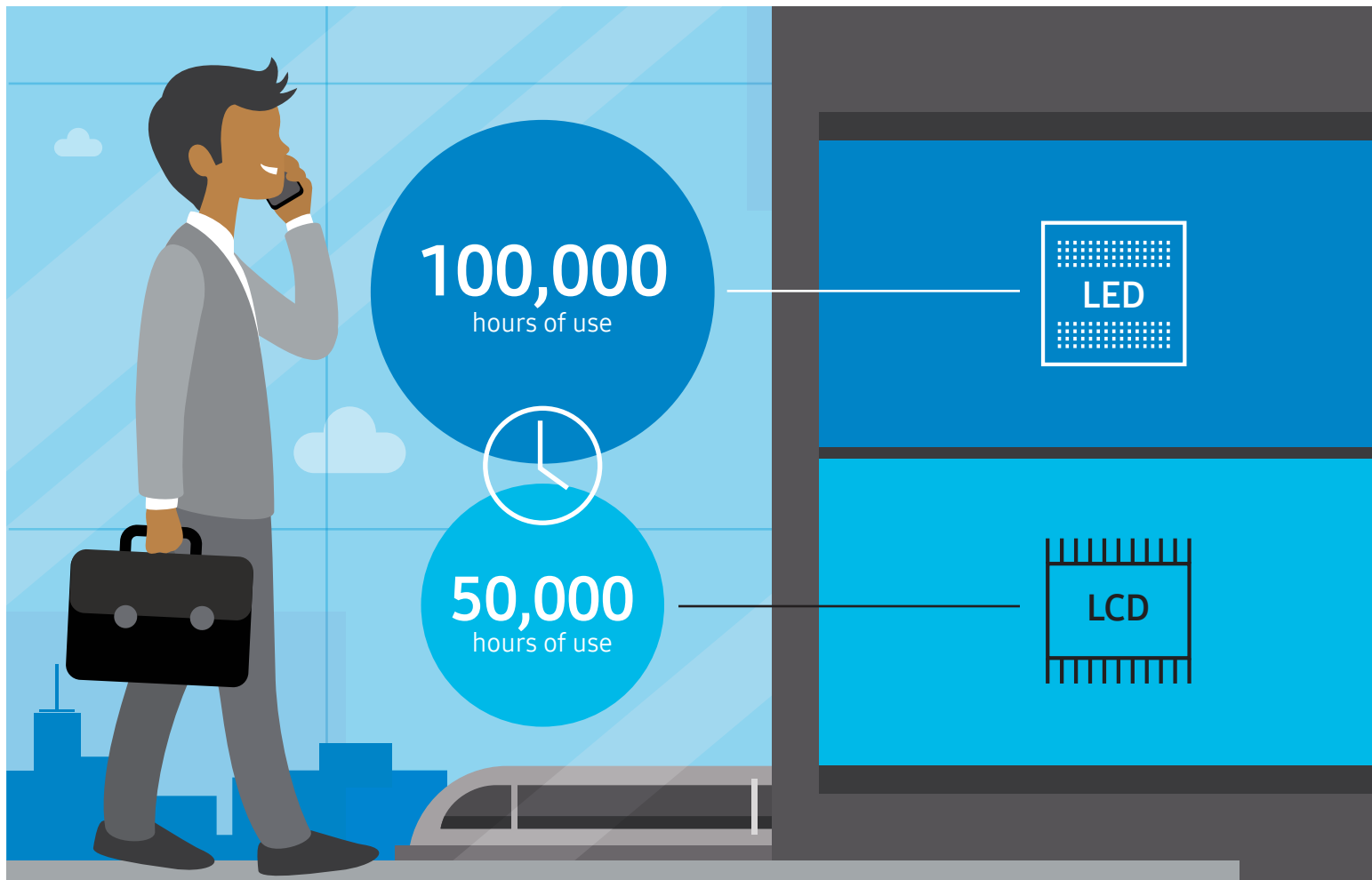
Projection system bulbs — with the exception of very expensive laser systems — have bulbs rated at 3,000 to 5,000 hours.

That matters over the course of 10 years in a Total Cost of Ownership analysis for a videowall project, as there are many more repair and replacement costs associated with LCDs and projectors than with LED systems.

Typical LCD video display walls, running on a 24/7 basis, will need regular maintenance — at least annually and possibly more frequently — to calibrate the displays so they all match.

LCD video walls need regular color calibration by expert technicians, to match the color and brightness properties of each LCD. They're calibrated when first installed, but color and uniformity will drift. It's visually obvious when that happens, and the technical adjustments need to be done on site — which adds cost to the annual operating budget.

By comparison, a properly installed fine-pitch LED video wall running quality management software will typically run for several years before any calibration work is required.



# LED Project Planning Guide

An LED videowall can transform an environment with high impact visuals, and choosing the right technology and supplier is critical. But there are many other aspects to properly planning and executing a successful LED video wall project.

## SAMSUNG Direct-View LED

Samsung's IF series of fine pixel pitch LED displays offers pitches of 1.5 mm, 2.0 mm, 2.5 mm, 4.0 mm and 6.0 mm.



**HDR**

The IF series runs at 2,400 nits of brightness and creates a premium viewing experience through High Dynamic Range (HDR) technology.

The IF series' design allows uniform installation across a range of settings and wall types by eliminating the gaps between frames or cabinets. The specialized Direct Mount Kit offers provides mounting points for each individual module, and users can orient each screen in a simple motion without laborious user effort.

[Click here for more info about Samsung Direct-View LED](#)



# Keys to Planning

## Define the Objectives

Develop and then get the answers to the core "W" questions: the who, what, when, where and why of a project.

For example, ask questions such as who will "own" and manage the project before and after launch? When does it need to go live? Where will it be located, and what impacts do environmental elements like direct sunlight, heat, humidity, weight and service accessibility have on that selection?

Finally, determine why the LED project is being considered and budgeted, as opposed to other technologies or forms of communication.

The discipline of defining answers to these questions will determine everything from technology and service provider choices to the types of content and the long-term implications on resources and budgets.

Get the answers to the core "W" questions: the who, what, when, where and why of a project.



- 1 Who will "own" and manage the project before and after launch?
- 2 When does it need to go live?
- 3 Where will it be located?
- 4 What impacts do environmental elements like direct sunlight, heat, humidity, weight and service accessibility have on that selection?
- 5 Why the LED project is being considered and budgeted, versus other technologies or forms of communication?

What you are trying to avoid is a project that is driven purely by a technology choice, such as designing a video wall in a hotel or corporate lobby without any real plan about its purpose or management.

## Establish the Final Location and Its Characteristics

Location directly informs LED technology choices. There are obvious factors, like the brightness levels needed to overpower direct sunlight in a building's atrium lobby. But building engineers and even architects may need to be involved to discuss the weight of the displays and their support structure, wall clearance and access to the rear for initial installation and servicing, and even heating and cooling systems that can affect condensation on the display and the internal electronics.

Additionally, building and workplace regulations might affect design and technology choices, determining which types of displays make the most sense.

## Develop the Content Model

A videowall — no matter how amazing the technology might be — fails if it doesn't have an audience. The content needs to attract viewers and hold them.

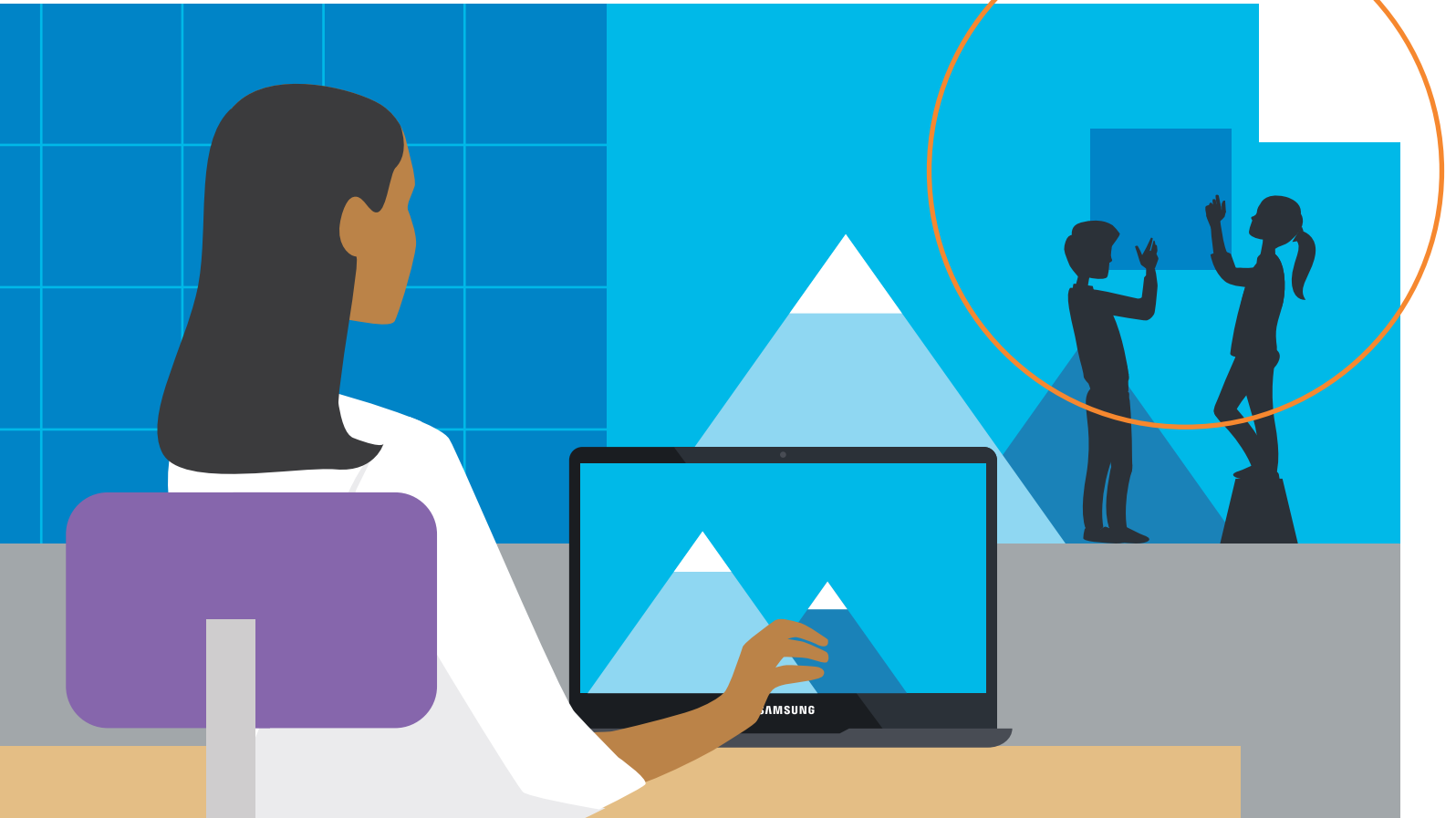
The type and nature of content also directly informs the technology choices, particularly when it comes to aspects such as the resolution of the video and graphics intended for this big visual canvas.

If the source content will never be greater than full HD, building a 4K LED wall would add unnecessary cost. Conversely, rich 4K or even 8K content will be underserved by a display canvas that doesn't have the pixels needed to show the high, deep definition of content.

Content is also an often-forgotten cost in operating budgets for LED video wall projects. While the initial files to play for the launch of the video wall may have been budgeted, the project team must determine how often the programming on the wall needs to be refreshed, and what new creative content will cost with each of those refresh cycles.

The project team should also determine what technology will be needed — in terms of playback hardware and software — to drive the content on the LED canvas. That's particularly important with 4K and even higher resolution jobs.

# Keys to Design



## Enlist Experienced Help

Bring in some experienced help and advice. For an end-user, like a facilities manager or business communications team, that means a systems integration or professional A/V design firm that has a track record in planning and deploying successful LED projects.

That experience should be relevant. For example, a background working on outdoor LED billboards and scoreboards has value, but fine-pitch indoor LED technology projects are substantially different not only in the technology but the planning and execution aspects of them. Figuring out what types of specialties needed for an installation will help narrow down the list of suitable integration partners.

Integrators and other types of solutions providers working on fine pitch LED for the first time should consider engaging an A/V design consultant who has direct experience, knows the business and technology, and can help navigate the hardware selection process.

## Respect and Adjust to the Location's Shape

LED displays open up opportunities to go beyond traditional 16:9 ratio rectangles and develop novel shapes and even display placements.

LED modules can blend into the architectural contours of buildings, because they are smaller than LCD videowalls. They can be tiled together to fit over arches and even conform to curves in ways not possible with narrow-bezel LCDs.

However, not all LED modules are the same, and some will work better than others depending on the requirements. Smaller modules will work better for odd shapes. Concave wall designs are often easier than convex surfaces because of the way the edges of the modules are designed. Some products are designed to allow gentle curves on the module.

LEDs also open up the possibility to do things like ceilings, something that for technical reasons is not possible with LCD displays.

## Understand Viewing Distances

Where will the average viewer see the LED screen? Up close, or from across a large room? Or something in between? Viewing distance has a direct bearing on the pixel pitch choice. The most simple rule of thumb is that 1 mm of pitch equates to 8 feet of proper viewing distance, so a 2 mm pitch display is best seen from 16 feet away or more, 2.5 mm at 20 feet, and so on.

This matters because if average viewers will be 20 feet away, they will see the individual LEDs on a lower cost 4 mm pitch LED display, or get no visual benefit from a premium-priced 1 mm pitch display that will look the same as a less costly 2.5mm pitch display at that distance. This can help you decide if investing in a finer pitch display will be worth the investment, or if a more middle-market solution will fit the role.

## Determine How the Resolution Will Fit the Space

If the LED application requires very high resolution imagery - such as an operations control room or retailer that wants to use 4K or even 8K imagery - then resolution has a direct impact on the overall cost of the display, and its size.

Resolution relates directly to the number of pixels of light. Getting to a 4K resolution involves using enough LED display tiles to realize 3840 vertical and 2160 horizontal lines of pixels. There are more pixels on a super-fine pitch display, so it takes less space to create a 4K or 8K digital canvas.

Using LED modules with lower pixel densities will cost less, but more modules will be needed, and take up more space, to get to the desired resolution. Figure out how much display space and technology will be necessary to address the resolution needs for content.

## Define the Necessary Screen Controls

Ensure that you understand, or have a services partner who can employ, the controlling software and hardware that will drive visuals to the screen. Many lower-cost options on the market use third-party controller systems that limit content capabilities, such as scaling or non-standard resolution, while more premium options have developed proprietary control systems that optimize the output of the screens.

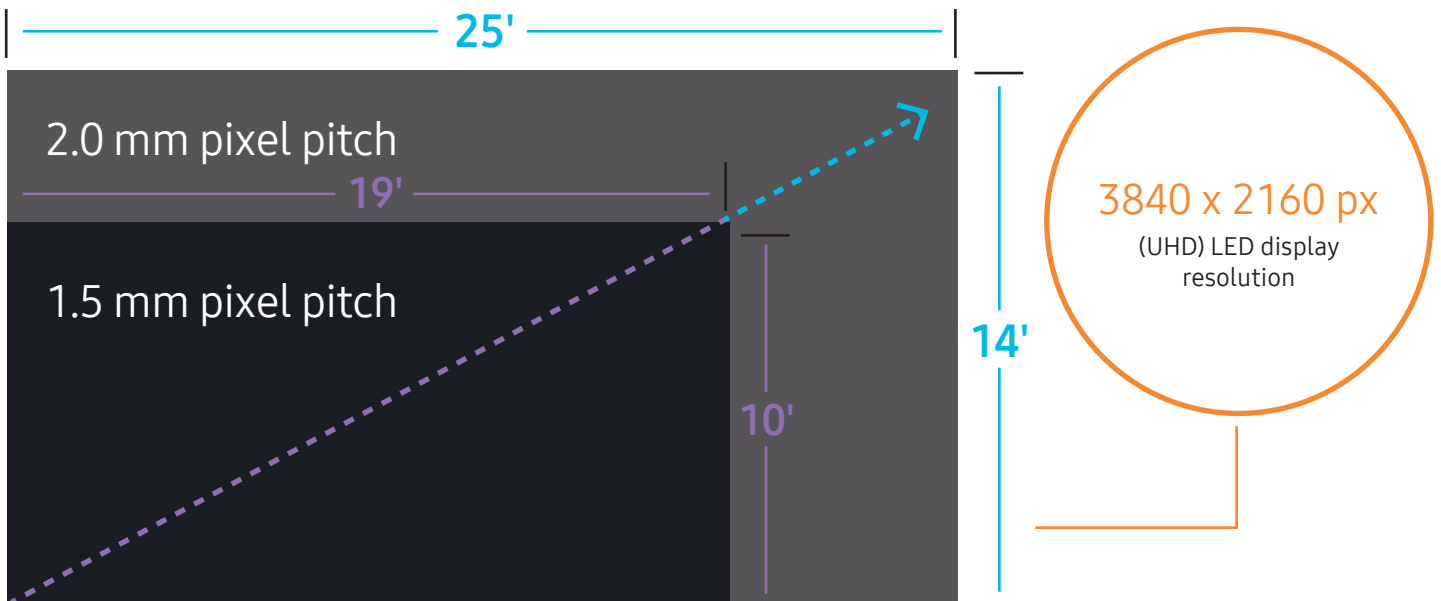
This is one of those areas - particularly when it comes to very large or odd-shaped displays - that particularly benefits from expert insight.

## Size Versus Resolution

The target resolution for a direct-view LED videowall directly affects the physical space required for that videowall. With tighter pixel displays, there are more pixels packed into the same physical space - so a finer pitch display can achieve full HD in a smaller space than a display with a greater pitch.

Here's how the math works:

A videowall built with 1.5mm pixel pitch display (UHD) LED displays must be 19 feet wide by 10 feet tall in order to achieve UHD (3840 by 2160 pixel) resolution. To achieve UHD resolution with a 2 mm pitch LED wall, increase the dimensions to 25 feet wide by 14 feet tall.



# Keys to Technology Selection

## Ensure the Technology Is Certified and Legal

Lower-cost LED options may cut corners by manufacturing and shipping products that don't have the necessary licenses and certifications for major markets. All electronic devices used in the U.S. must be tested and certified that electromagnetic interference (EMI) emissions from them are under the limits approved by the FCC.

LED displays, like all electronics, generate EMI and if the interference is above acceptable standards, it can adversely affect the performance of nearby wireless devices, including smartphones and emergency communications.

Most, if not all, major manufacturers have FCC and other required certifications, but anyone considering products from lesser-known brands should seek reassurance and hard proof. With uncertified technology, owners risk stiff fines or having their equipment shut down by regulators.

## Understand the Key Components "Under the Hood"

LED displays are not that much different from other electronics products, in that quality equipment generally costs more because it employs superior components. Some TVs in a big box store are a lot cheaper than others, and most consumers intuitively understand that reduced costs are due to what's behind the screen.

The biggest factor in LED cost and quality is the tiniest part: The near-microscopic diode that gets "packaged" and integrated by the thousands in modules. Within the premium market, there are different quality tiers that are sorted by what are called bins.

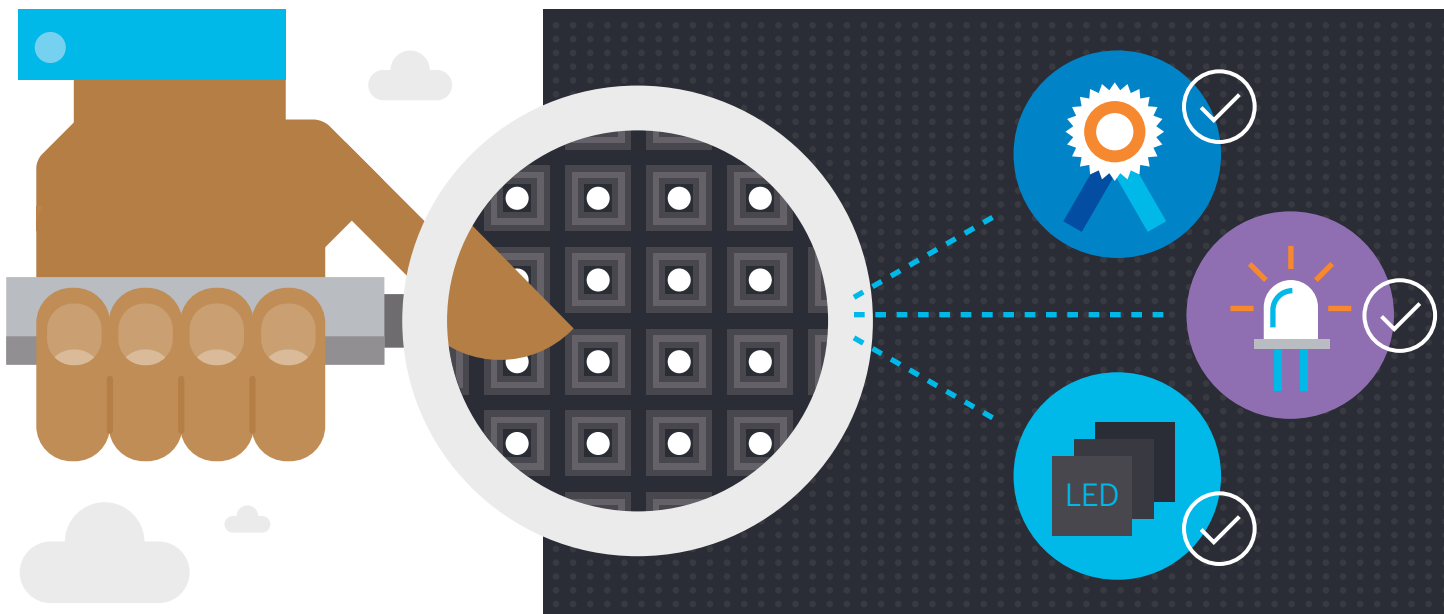
The differences between tiers are based mostly around the brightness of the diodes. Diodes with very high brightness properties are capable of therefore delivering visuals at lower brightness levels, which extended their operating life.

Cheaper LEDs will age faster and eventually burn out faster because they need to run hotter to achieve the required brightness.

## Ensure the Supply Chain Meets Needs and Expectations

Top LED display manufacturers have the volume and buying power to maintain larger quantities of the best LED bins, which ensures quality with the initial purchase and with repair and replacement materials.

It's a good practice when ordering and building an LED videowall to order and locally store extra LED modules that come from the same production run as the installed display, so that if there is an outage or damage, a replacement module is readily available that will match the exact performance properties of the other, still working modules. Different runs of the same module may have subtly different characteristics, resulting in uneven imagery.



# Keys to Implementation

When creating a LED direct-view videowall, it is critical to work with an integrator with experience installing the technology.

## Build Capital and Operating Budgets Early

The cost of the finest-pitch LED videowalls per 10 square feet, for the modules alone, can exceed \$20,000. In addition, there will be additional costs for controller software and hardware, the mounting system, other infrastructure like electrical and installation labor.

There's also the initial cost of creative production and, often forgotten, the operating costs of the display, including energy consumption, maintenance and the regular development of refreshed content. Remember to factor these into both capital acquisition budgets and operating budgets.

## Determine What Service and Support Look Like

When there are problems, what kind of support will be available? Evaluate the various hardware and software services businesses and figure out what factors are most important. Do you want a more local outfit that can come on-site to fix issues? Or a larger variety of solutions that might come from a larger manufacturer? If your software and content is managed by an outside party, how easily are they able to adjust potential bugs or updates? Can it be done remotely or does it need to be done in-house? How long has the service provider been in business?

Experienced integrators recommend working with companies who have the people, facilities and inventory to fully support customers in their region.

"Service and support, that's really what comes up top of list for us," says Mittler, explaining how major display manufacturers and US-based LED-only companies have people ready to help, a phone call away.



\$ = 1000



-----  
The finest pixel pitch LED videowalls cost per 10 square feet can exceed

**\$20,000**

# A Very Bright Future

Five years ago, indoor LED had very limited applications and fine-pitch videowalls were rarely seen outside of trade show exhibits. But they're now increasingly commonplace, and few industry observers think the rate of adoption will slow.

Most commercial display industry insiders fully expect much of the business now seen in LCD-based videowalls will transition to LED as manufacturing volumes increase, competition and buyer awareness grows, and prices continue to drop.

LED brings to life the idea of a digital canvas that can be installed anywhere, for all sorts of applications, and create a vivid and seamless viewing experience. The water fountain that used to be the centerpiece of a shopping mall or office tower can now be a virtual fountain — which saves on plumbing costs. The plants on a feature wall can be a virtual rainforest. A dealership can replace a few static displays or monitors with a vivid depiction of a driving experience on a road like the Pacific Coast Highway.

The possibilities are endless.

---

[Learn more: Samsung LED Digital Signage](#)

---

Learn more: [samsung.com/digitalsignage](https://samsung.com/digitalsignage) | [insights.samsung.com](https://insights.samsung.com) | 1-866-SAM4BIZ

Follow us: [▶ youtube.com/samsungbizusa](https://www.youtube.com/samsungbizusa) | [🐦 @samsungbizusa](https://twitter.com/samsungbizusa)

**SAMSUNG**