Hisense

Hisense innovates:

Transforming lives through Laser display technology

Produced by EI Studios, the custom division of Economist Impact

Foreword:

As the world adjusts to the "new normal" of living amidst a global pandemic, over the last two years, consumers have been spending—and continue to spend—more time transforming their homes into suitable immersive spaces for both work and play.

This has ushered in a new era of in-home entertainment and in-home offices where displays are more important than they have ever been before.

Consumers are continuing to demand ever bigger TV sizes and better picture quality. However, the larger the screen, the more it exposes the flaws and defects of the picture. This is why we must keep evolving the development of display technologies.

At Hisense, we have focused on developing Laser TVs—groundbreaking displays that combine the interactivity of a smart TV with the world's most cutting-edge RGB panchromatic (triple colour) Laser display technology.

We believe that Laser TVs will outperform all types of panel displays in the near future, and that this technology presents myriad opportunities for many industries. But it hasn't been easy to invent this new category of display technology, and we know that more international cooperation is needed to help the global Laser display industry continue to grow.

I invite you to learn more about Laser displays in our white paper—and to think about how our pioneering, unique technical Chinese innovations could help your business and transform consumers' lives globally.

YU ZHITAO

Vice-president of Hisense Group

President of Hisense Visual Technology Division

Contents:

The evolution of Laser TV development

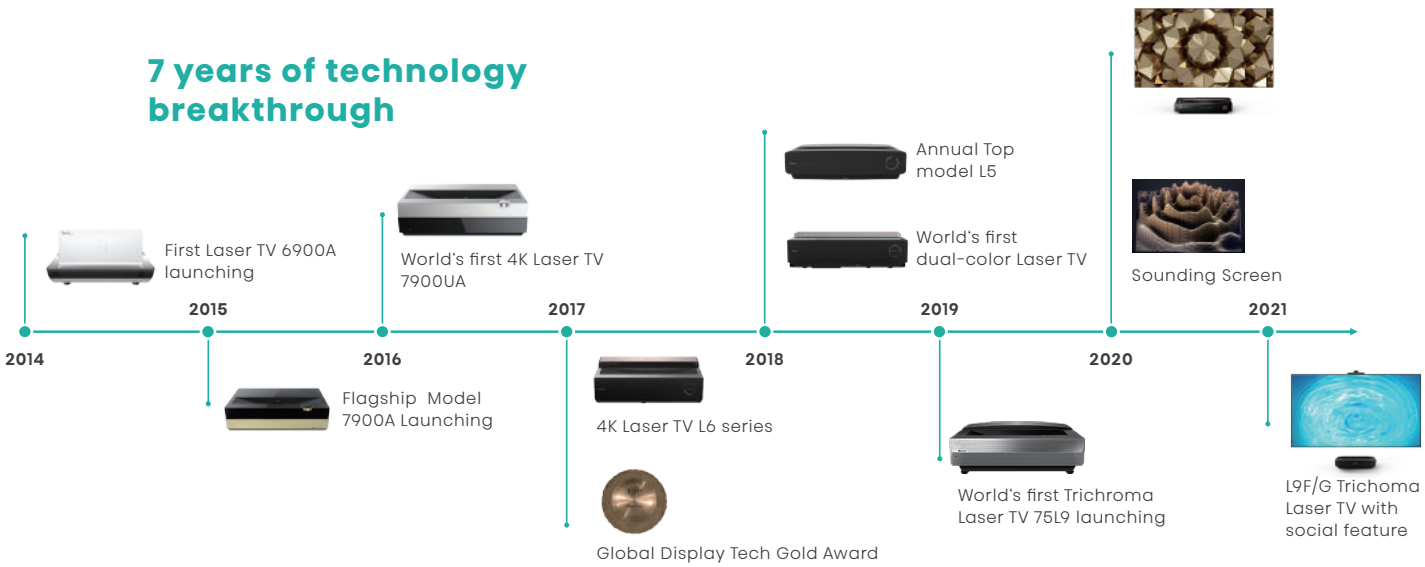
TVs have evolved dramatically over the last three decades. Displays have gotten bigger and smarter than ever before, and display technology has evolved alongside. Amongst these new display technologies, one of the most exciting is Laser TV.

The evolution of Laser TV began in the early to mid-2000s. Initially, during this period, high-end TVs were all liquid crystal display (LCD) screens, but these were limited in size. Back in 2007, the largest these displays could reach was 42-47" (42-47 inches), and while there were plasma TVs available as one-off 100" prototypes, these were never released as products. Rear projection TVs could go up to 100", but these displays were extremely unwieldy.

"Rear projection displays were tremendously bulky, heavy, difficult to move in and out of rooms, required a significant amount of space, and dominated the rooms they were placed in," explains Rob Sabin, editor-in-chief of US projection industry trade magazine ProjectionCentral. "They were deep and long and tall, and the image quality wasn't *ProjectionCentral*t, particularly when you invited it into a room with ambient light."

By 2010, rear projection technology became obsolete in favour of lighter and thinner flat screens, according to CNET[1], a review website. Recognising this shift, Hisense began researching how to evolve it. "We took the front projection technology and redesigned it," says Dr Liu Xianrong, chief scientist and general manager of Hisense Laser Display Co. Ltd. The company is currently developing the world's first 8K Laser TV, slated to be launched by the end of 2022.

7 years of technology breakthrough



Hisense knew consumers would continue to want even bigger displays. It also saw limitations in LCD that would make scaling up the technology difficult over time. “Everyone needs a larger TV,” says Dr Liu. “We had a vision that one day, TVs might be bigger than 100” in size, so we had to get ready for that.”

“We started our research and we concentrated on laser displays. At that time, it was laser projection technology with a laser source, but it was only a technology, not a product.”

Q: What are LCDs?

Liquid crystal display screens, LCDs consist of two pieces of polarised glass. A liquid crystal material passes between the glass, blocking and allowing varying levels of light to produce an image. Today, LCD is used in flat screen consumer TV displays, as well as in home theatre projectors.

The TV of the future

In 2007, Hisense was one of the first companies in the world to develop Laser TV technology. Mr Sabin argues that Hisense was instrumental in rethinking the idea of projectors for the home, and popularising the idea of Laser TV as a direct competitor to conventional flat panel TVs; rather than being in a separate category with other projectors.

“I think Hisense can be given credit for having pioneered the Laser TV category here in the US,” he says. “It started out with Hisense promoting this idea of a console TV with a wall-mounted screen, whose greatest benefit was a more impactful image size.”

This success can be attributed to Hisense’s unique approach to product design. “In the very beginning of our product design, we designed the Laser TV starting from the performance of our image,” Dr Liu explains of the design process. “For other companies, they only design the console or the screen, but we started our design from the total image, so we could try to find the design to match the console and screen together. In our laboratory, we compare our tech with LCD and OLED TVs directly.”

Hisense’s Laser TVs have been well-received by US media. Hisense’s PX1-PRO Laser TV won the ProjectorCentral Editor’s Choice 2022 Award, while the Hisense L9G 4K Laser TV wa*ProjectorCentral* ng of Ultra Short Throw Projectors” by consumer electronics technology magazines, *Value Electronics* and *Dealerscope.*

"In particular, tech journalists have praised Hisense Laser TVs for their intelligent systems and image colour quality, which are lacking in traditional projection products," says Dr Liu.

In 2020, China's display industry was worth 446 billion yuan ($66 billion)—40.3% of the global display market—according to latest data from the Chinese Ministry of Industry and Information Technology (MIIT). While China was behind in the development of CRT and LCD technology, Dr Liu says Laser TV is being seen as a new opportunity for the country to take the lead in display technology worldwide.

279% rise across 60 countries

Exports to 77 countries

In 2021, Hisense reported a 279% year-on-year rise in overseas sales in 60 countries. From January to July 2022, sales surpassed those in 2021, with exports to 77 countries.

Data from: Hisense Laboratory

How Hisense's Laser TV works

Hisense's Laser TV products all contain two elements:

- A console box consisting of the "brains" of the TV
- An ambient light rejection screen

The screen is mounted on the wall, with the console box stationed just below it on a TV stand.

To develop the Laser TV, between 2007 to 2011 Hisense researched the best possible laser source for the console box, starting with a single laser. Then, the firm added an ultra-short throw lens, picture calibration, a sound bar, smart TV capability and a Texas Instruments digital light processing (DLP) chip. Hisense also put its efforts into creating a multi-layered ambient light rejection screen containing "a very complicated artificial structure" of dyes, microstructures and spectral colour calibrations, adds Dr Liu.

This investment into Laser TV resulted in working products. At the Consumer Electronics Show (CES) in 2012, Hisense showed its first Laser TV prototype. Further prototypes followed, until Hisense released its first Laser TV product in September 2014.

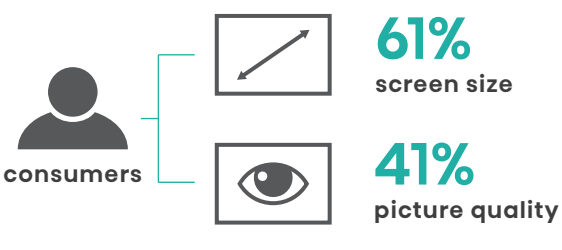
Consumer demand

When it comes to buying a TV, consumer behaviours differ across generations. Compared to older buyers, younger consumers tend to conduct more thorough research before making a purchase decision. According to Kantar, a market research firm, Gen Z (people born 1997-2012) and Millennials (born 1981-1996) tend to be more engaged when buying a TV and will hit multiple touchpoints, including looking at the manufacturer's website and online reviews, before they buy.

"Gen Z, as first-time buyers, are also more likely to listen to advice from friends and families," says Piers Moore, senior global consumer insights director at Kantar. "In contrast, baby boomers [people born 1946-1964] are most likely to wait for their TV to break before purchasing again."

Scaling up the image size

One of the "holy grails" of the TV industry has always been about getting a larger image that doesn't lack in quality, brightness or colour gamut. "What most people want is picture quality… and as big a TV as they can get in their space," says Mr Moore. According to 2021 research from Kantar Worldpanel ComTech, a large market research consumer panel, 61% of consumers identified "screen size", and 41% of consumers said "picture quality" are the most important factors to consider when purchasing a TV.



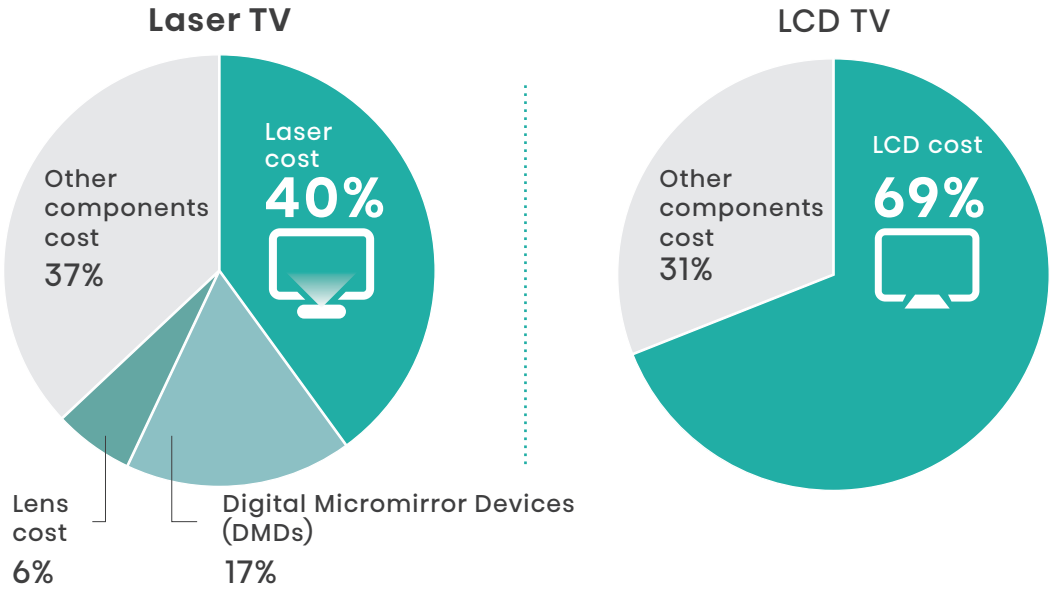
Global research firm Ipsos found that consumers worldwide are most interested in having a TV with high-definition picture quality and high resolution. At the moment, 40-50" and 55-60" are the most popular screen sizes.

However, prior to the development of Laser TVs, the only way to get an image to scale in size up to and over 100" was to use a front projector—more commonly known as a home theatre projector system.

These projectors are complicated to install and require a lot of space and investment. Front projectors must be mounted on the ceiling and far away enough from the screen to enable the long throw lens to work, and the installation requires cables to be run inside walls, which is costly and disruptive. The same is true of flat panels—as they get larger, they become much heavier and harder to move into rooms or to hang on walls.

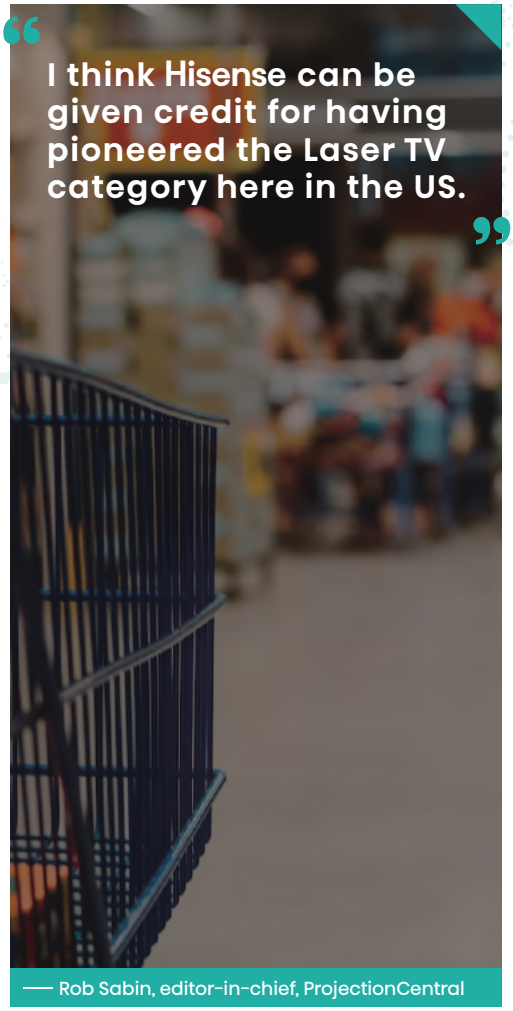
Despite their limitations, projectors were the affordable option to watch a big screen. "Projection has always been the cheapest way to get a large image," explains Mr Sabin. Dr Euan Smith, managing consultant at UK-based consultancy firm 42 Technology, agrees. "The bottom line really is having a system that can get a very large screen area for a much more cost-effective price point," he explains. Currently, the largest flat panel screens consumers can buy are 98" or bigger, while in comparison, "the Hisense system is a lot cheaper than any of the equivalent flat panel technologies at that size," says Mr Smith.

Laser TVs are cost effective to produce



Laser TV key components' cost (Laser light source + UST Lens + ambient light rejection) is lower than that of LCD TVs' screens

Data source: Appotronics, Wind, Changjiang Securities Research Institute



Consumer demand for affordable ultra-large screen sizes is reflected in global sales. In 2021, there was 7% year-on-year growth in the 65" and above display category in the US TV industry. That year, Hisense reported a 41% jump in US sales. Similarly, in 2020, Hisense reported a 288% rise in overseas sales of Laser TVs in 17 countries, including the US, Mexico and Australia.

Other consumer sub-sets, such as gamers, are also demanding larger screens—and have the money to pay for them. Kantar's Worldpanel ComTech data shows that 30% of console gamers own a TV larger than 55 inches, compared to 20% for the average consumer. Gamers also spend more on their TV compared to the average shopper. Kantar data shows that over half of console owners who purchased a new TV spent more than €501 (US$503.37) , with 17% spending over €1,001 (US$1,003.73)

Ultra-short throw lens

To combat problems with front and rear projection technology, Hisense developed an ultra-short throw lens to get closer to the screen. In 2014 and 2015, the firm released a 2K Laser TV with 1080p resolution that was 55cm away from the wall, while in 2016, the 4K Laser TV was only 50cm (20") away from the screen, which was a world first at the time. By the end of 2022, Hisense's 8K Laser TVs will be just 45cm (18") away from the wall. "Ultra-short throw projection has been around for a really long time," says Mr Sabin. "What hadn't been done was using ultra short throw for a consumer display." Hisense, he says "had a great idea".

The innovation did not stop there. Today, Hisense has produced the world's first 100" ultra-short throw Laser TV, the world's first 100" 4K ultra short throw Laser TV, the world's first ultra-short throw dual-colour Laser TV, and the world's first 300" laser cinema.

Cracking the brightness problem

When selecting a new TV, image quality is key. “Projectors, up until recently, have required a dark room in order for the projection to look as good as a regular TV looks,” explains Mr Sabin.

“What Hisense managed to do is figure out how to put a large image into a traditionally lit family room—a room with moderate or bright lighting in it—and have it look as good as a regular TV image in many respects.”

“The breakthrough,” says Mr Sabin, “was the brightness of the lasers.” Hisense’s laser technology was able to overcome the issue of ambient light in a normally lit household. For example, Hisense’s latest TriChroma Laser TV range is 20% brighter at the pixel level with a 430-nit picture brightness, exceeding that of a regular TV.

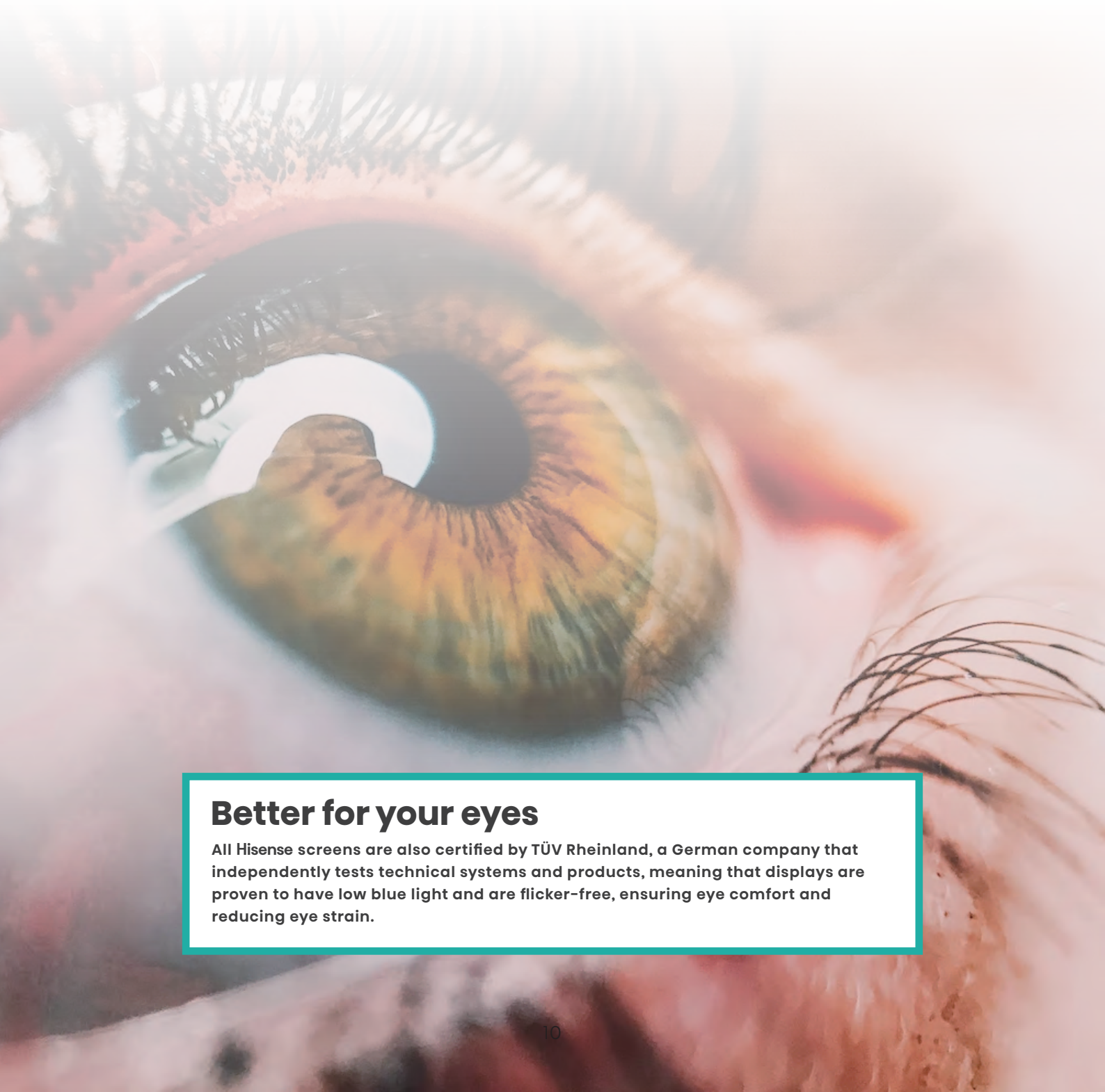
Ambient light rejection

For Laser TVs to compete with flat panels, they must be able to filter the amount of light seen on screen, i.e. the colour contrast ratio, also known as the screen’s “luminance”, so whites look brighter and blacks look darker.

“With the high 3,000 lumen brightness in our Laser TVs, we can have picture quality close to that of LCD displays, so it satisfies the consumer’s requirements for watching TV in their living rooms in the daytime,” says Dr Liu. All Hisense screens are also certified by TÜV Rheinland, meaning that displays are proven to have low blue light and are flicker-free, ensuring eye comfort and reducing eye strain.

The primary objective of the anti-light screen is to resist the influence of ambient light and improve the screen's contrast. Though this results in a loss of screen perspective, as screen technology improves, the screen contrast will increase and the loss of screen perspective will diminish.

Dr Liu says Hisense believes it will be able to get the Laser TV screen to be as dark as LCD in the next two to three years.



Better for your eyes

All Hisense screens are also certified by TÜV Rheinland, a German company that independently tests technical systems and products, meaning that displays are proven to have low blue light and are flicker-free, ensuring eye comfort and reducing eye strain.

Standardising the global Laser TV industry

Standardisation, in any industry, improves product compatibility, safety or operating standards, quality control and competitiveness. A pioneer in Laser TV production and development, Hisense has played a key role in shaping and driving global industry standards, developing and perfecting some of the best product testing methods through its R&D efforts.

“In our opinion, we solved the fundamental technical issues for Laser TVs in the last seven to eight years,” says Dr Liu. To date, Hisense has published six international standards, two national standards and 13 group standards, with more standards in development.

According to Chinese patent database provider IncoPat’s list of the top 100 companies behind published and pending Laser display technology patents in China in 2021, Hisense ranked number one with 753 patents. Hisense has decided to share another 1,000 patents and technology and intellectual property rights over the next five years with its competitors; in a bid to boost industrial cooperation to accelerate the development of the global Laser TV industry.

International cooperation

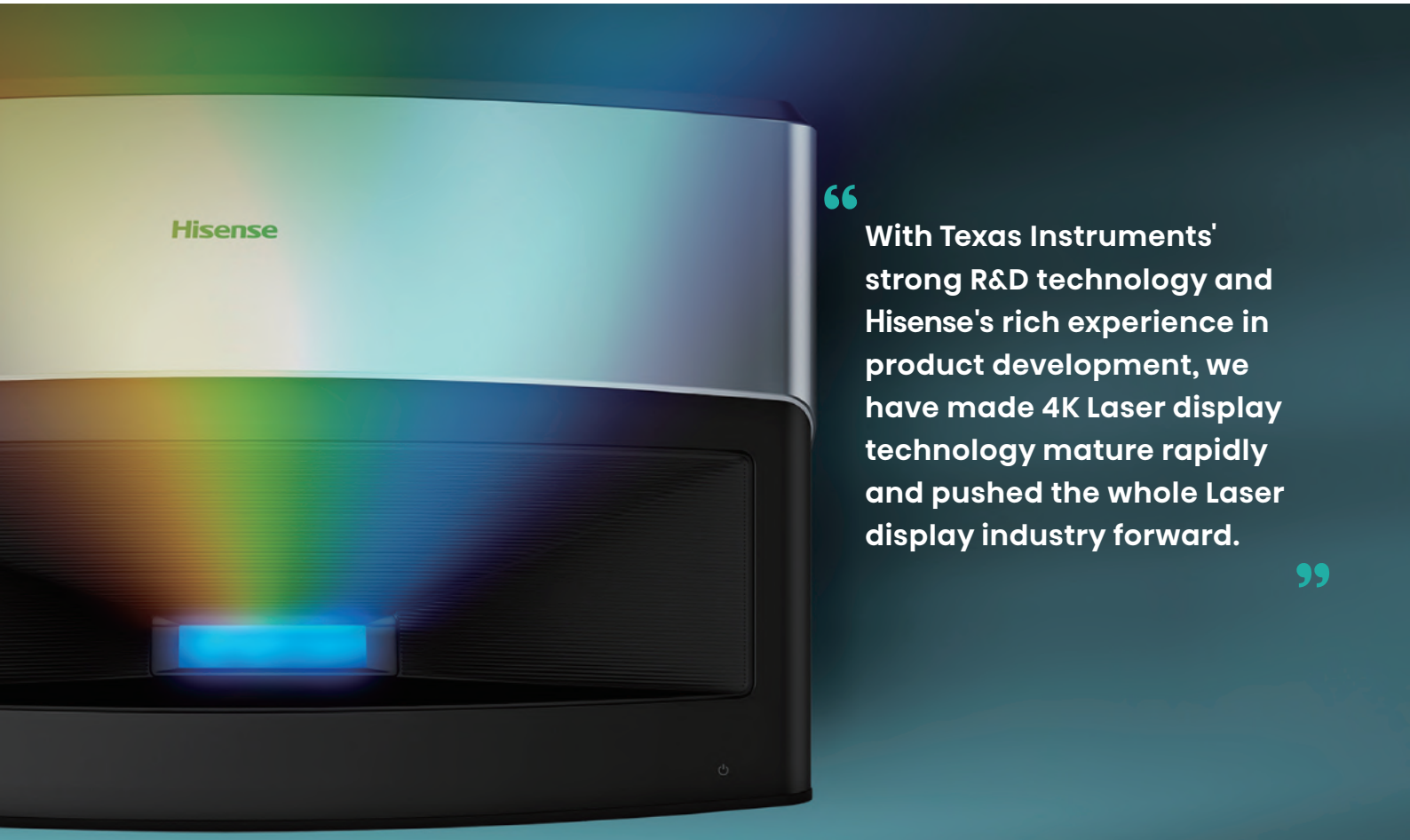
Hisense has been a significant contributor to the International Electrotechnical Commission (IEC), the body that creates international standards for all electronic technologies. In 2014, the IEC Electronic Display Technology Committee (IEC TC110) formally established the Working Group on Laser Displays Standard, which focused on establishing standards around laser display picture quality, durability and reliability. Hisense’s chief scientist Dr Liu Weidong was elected as the group’s convener. “The contribution Hisense has made is to convene Working Group 10, which is about steering laser projection standards through to publication,” says Dr Smith.

“The difficulty comes in different experts from various countries and companies having different opinions,” says Dr Smith. “They all have their own agendas and they've all got an eye on, ‘What standards will make our products look better?’ It's not an easy job for the convener to have to steer through all of that.”

In China, Hisense has also played an important role in establishing a national

framework for Laser TV standards. Along with 25 other organisations, Hisense helped the China Electronics Standardisation Institute draft China's first industry standards for Laser TV. These specifications, issued in April 2022, set clear standards and requirements for Laser TV's optical performance, contrast, luminance and audio. Dr Liu says Hisense has transformed supply chains. "When 4K became popular in TVs, Laser projection was still in the 1080p era. Since Laser projection is mainly used to display PowerPoint text presentations, its picture quality requirement is very low. Therefore, chipmakers like Texas Instruments did not have enough incentive to develop 4K chips."

"But after Hisense went to the US to promote the development of 4K chips and 4K Laser TV, things changed. With Texas Instruments' strong R&D technology and Hisense's rich experience in product development, we have made 4K Laser display technology mature rapidly and pushed the whole Laser display industry forward."



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— Dr Liu Xianrong, chief scientist and general manager of Hisense Laser Display Co. Ltd

Durability

One issue with projector-based TVs is the durability and reliability of the laser optical engine. Ultimately, all projectors eventually burn out. However, while traditional tungsten halogen lamp projector bulbs can last for as little as 2,500 hours and LED projector bulbs can go for between 10,000 to 15,000 hours, laser projectors have a lifespan of at least 20,000 hours.

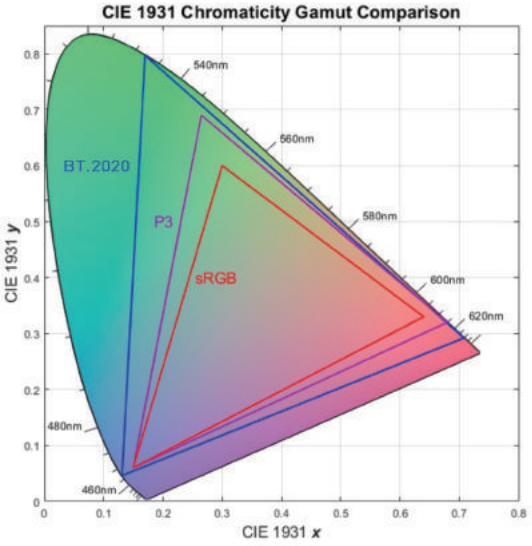
Hisense products last even longer, guaranteeing a lifespan of 25,000 hours with its XFusion technology. "Originally, the optical engine could do 3,000 hours and now it is able to handle 30,000-40,000 hours," says Dr Liu. He says Hisense managed to solve the problem of keeping dust out of the light path by itself.

The key to this success is persistence. "At the very beginning, in 2013 or 2014, some Korean companies had some TVs and they called them 'Laser TVs', but they only released one generation of the product," reminisces Dr Liu. "They didn't have any further products. We talked to them, and they said they also encountered the problem of durability and they gave up."

Colour is a big deal

The colours displayed on a TV screen, their hues, saturations and purity, are crucially important to the TV industry and new standards have been developed to ensure future displays look their best.

The International Telecommunications Union (ITU)[2] introduced a series of standards, called BT2020, that helps define multiple parameters for 4K and 8K video broadcasting on Ultra HD projectors and TVs, including colour range, frame rate, resolution and bit depth. According to Dr Smith, BT2020 is "the best" or truest range of colours (known in the industry as "gamut") that can be achieved using the primary colours red, green and blue.



Measuring the colour gamut

In display technology, the colour gamut, also known as the colour spectrum, describes the range of actual colours a screen can reproduce in quantifiable data. In general, the colour gamut is expressed as the percentage based on colour standards plotted on the CIE chromaticity diagram. For example, if a display meets sRGB[3] (Standard Red Green Blue) 100% coverage, it means that a display is covering the sRGB colour gamut 100% or more and the display can accurately represent all kinds of colours in the sRGB colour gamut.

The chart above shows the following:

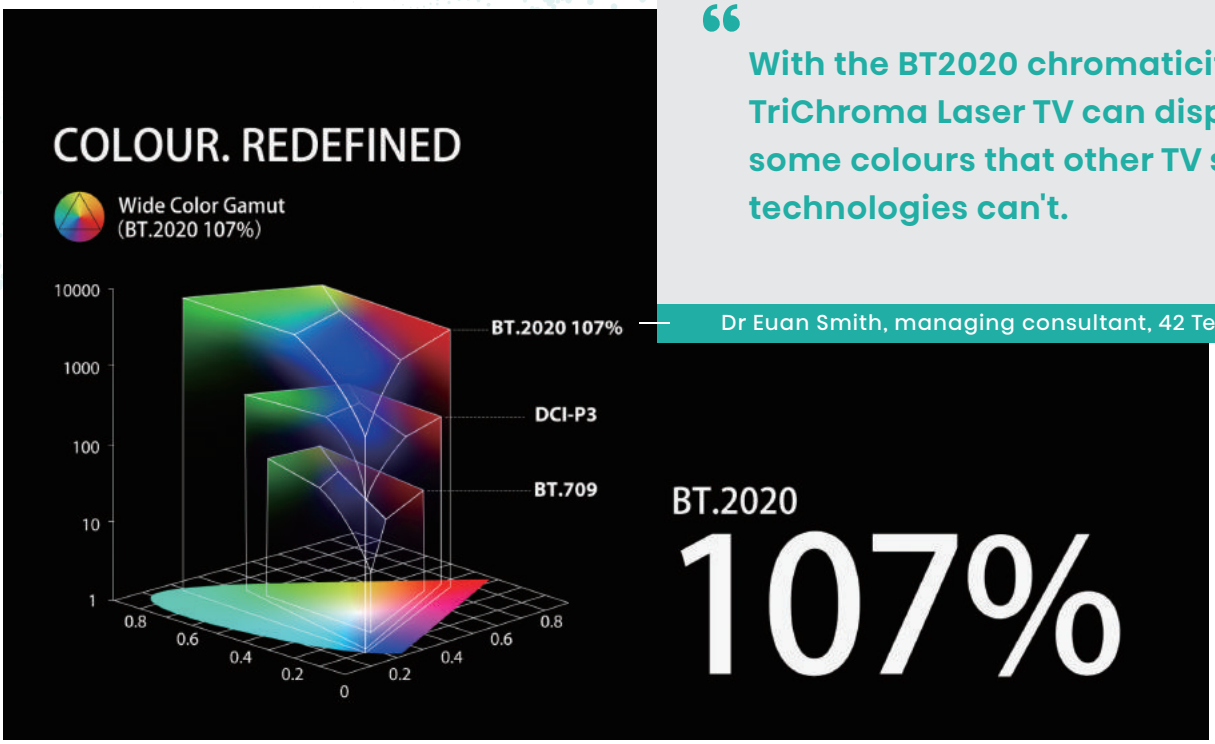
- sRGB, the standardised range of colours that you can see on a typical laptop computer screen

- P3, which refers to the Digital Cinema Initiative – Protocol 3 (DCI-P3) standard[4], is the range of colours that cinema screens today can show

- The BT2020 standard is a much wider gamut of colours that many TV manufacturers are striving to achieve now with new displays

Remarkably, Hisense has achieved 107% BT2020 with its latest range of TriChroma Laser TVs—a 128% improvement over the original RGB colour and a 151% improvement on DCI-P3.

Hisense has succeeded in producing display television technology that gives viewers colours other TVs can't reproduce. This feat, says Dr Smith, is significant when compared with flat panel technologies. "With the BT2020 chromaticity, the TriChroma Laser TV can display some colours that other TV screen technologies can't. For example, even the best OLED TVs only have a DCI-P3 colour gamut, and typical mid-market LCD screens don't even have a colour gamut as wide as that."



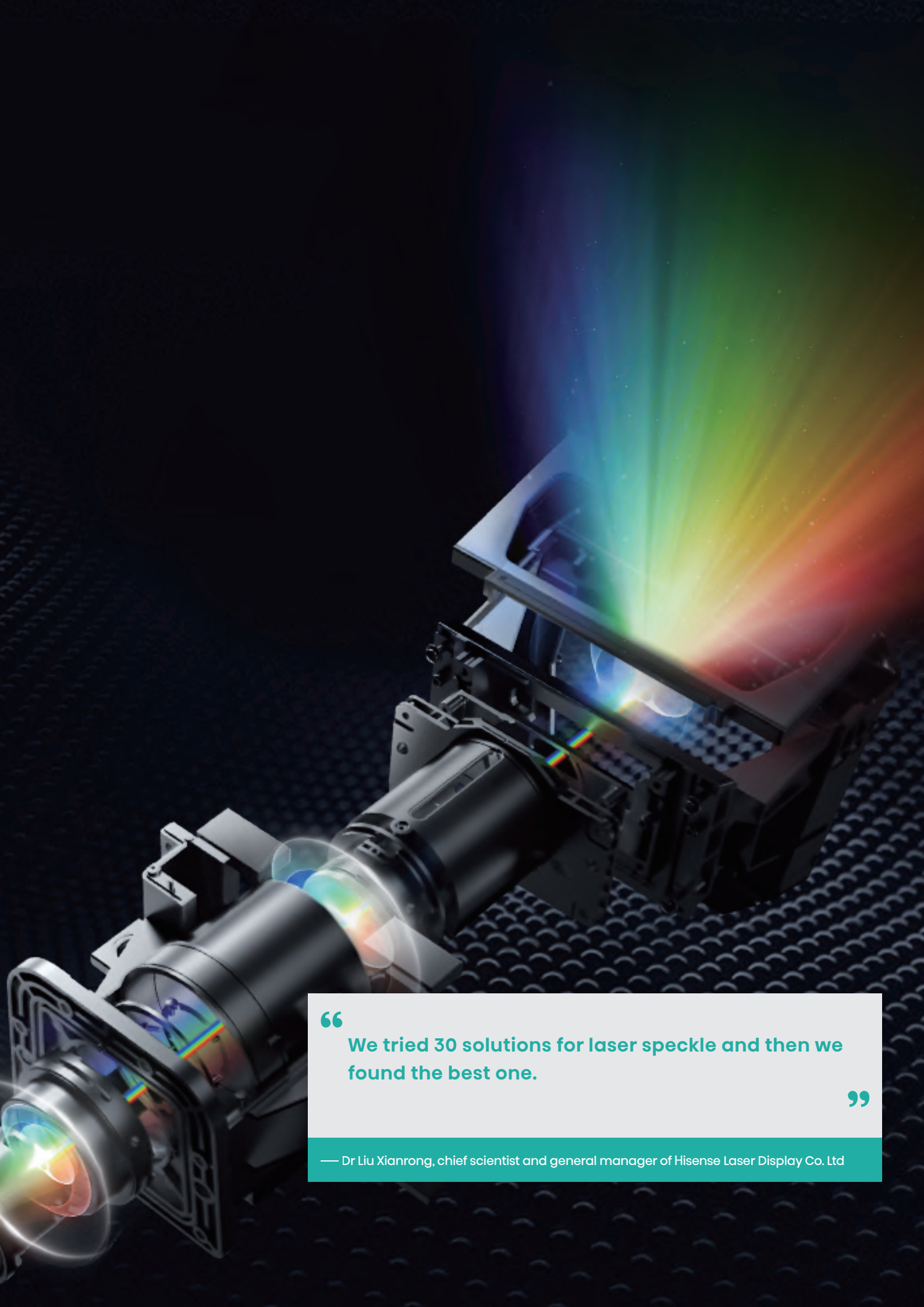
> **With the BT2020 chromaticity, the TriChroma Laser TV can display some colours that other TV screen technologies can't.**
>
> Dr Euan Smith, managing consultant, 42 Technology

Helping solve the speckle problem

Another obstacle to developing Laser TVs is laser speckle—a random granular pattern that occurs when a laser is diffusely reflected at a 'complicated' or rough surface. This can cause a haze of light spots to appear on the television screen, particularly when the colours red and magenta are displayed. Laser speckle seriously affects picture quality and user experience, and was a major obstacle for the industry to overcome if Laser TVs were to take off commercially.

To tackle this issue, Hisense collaborated with both the private sector and academia globally to implement the speckle testing system. They were able to develop the "fixed + diffuser" method of reducing speckle. "We worked with universities in China and Europe, as well as European companies, on different solutions on the speckle," says Dr Liu. "We tried 30 solutions for laser speckle and then we found the best one."

The company's efforts in this field over the last five years have helped both the projection and television industries to innovate within the Laser TV sector. Hisense's TriChroma Laser TV console has reduced laser speckle from 20% to less than 10%—a leading benchmark in the Laser display industry that has greatly improved image quality of Laser TV products.



> **We tried 30 solutions for laser speckle and then we found the best one.**
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The future of big displays

Hisense is committed to making people's lives simpler, better and more entertaining through carefully designed and well-built products and services. To this end, the firm works with multiple industries to develop innovations for new business and consumer applications.

Currently, lasers are used to solve problems in multiple industries, from using laser scanners to do intelligent mapping in town planning, to the use of laser cladding to protect mining equipment, to commercial laser projections for businesses, entertainment venues and academic institutions.

"On one hand, we are developing displays that can work anywhere, like gaming monitors and cloud platforms for various industries; while on the other, we have verticalised our R&D efforts, from the Tcon display driver chip and picture quality chip, to our operating systems, apps and terminals that can work with different technologies like LCD, Laser display and ULED," says Dr Liu. "In future, displays must not only be used to 'see', but also as a point of contact between humans and machines, and humans and services."

But more exciting use cases and applications for lasers are emerging.

Holographic displays

Technologies like virtual reality, augmented reality and 3D holograms are maturing. As they enter mainstream use, there will be increased demand for cutting-edge laser projectors able to generate and convey these images, to assist businesses in bringing to life authentic experiences, live shows and large arena advertising.

Laser TV, and the projection technologies behind it, are best placed to help humankind break through flat displays into spatial stereoscopic displays and one day even 3D holographic displays.

"Realising holographic displays will transform supply chains and subvert existing display technologies like panels—it will be a revolution for the whole display industry," says Dr Liu.

Huge, immersive displays

Partnering with chipset manufacturer Texas Instruments, Hisense has developed sophisticated laser displays so museums, art galleries and even restaurants can provide fully immersive experiences.

Hisense has successfully joined multiple laser projection displays together using a technology called "edge blending". This method combines several projected images that are spliced and fused to make a single seamless image, which can be used to create huge visual displays covering 50-60 metres of wall and floors at once. To support this, Hisense developed debugging software that quickly supports geometric correction, image fusion and screen splicing. "Our partner, an entertainment company that was building a metaverse-themed art exhibition needed tens of computers to join the image together," explains Dr Liu. "The traditional method took them two weeks. We took our laser projection technology and combined it with Texas Instruments' technology—it helped the client save a lot of money and we could build it in two days."

Hisense used a 16K display source to achieve a full 4K stereoscopic display in a measuring 1,000m² immersive space.

Mr Sabin thinks this use case has great promise for the future of entertainment and live experiences. "Immersive projection is definitely a big deal, it's one of the things projectors can do that regular TVs and micro-LED tiles can't do without great expense."

"Laser display is much more suitable for creating large and extra-large screens that need to be seen by multiple viewers—an effect traditional projectors cannot yet achieve," says Dr Liu. "And laser displays offer a high image quality compared to traditional projectors, at a much lower imaging cost."

> **"The traditional method took them two weeks. We could build a 50-60 metre visual display in only two days."**
>
> — Dr Liu Xianrong, chief scientist and general manager of Hisense Laser Display Co. Ltd

Personal, portable projectors

Asia has some of the most digitally connected, social- and mobile-first young people in the world. Early adopters of technology, Asian teenagers have led the way when it comes to discovering new, unusual uses for technology.

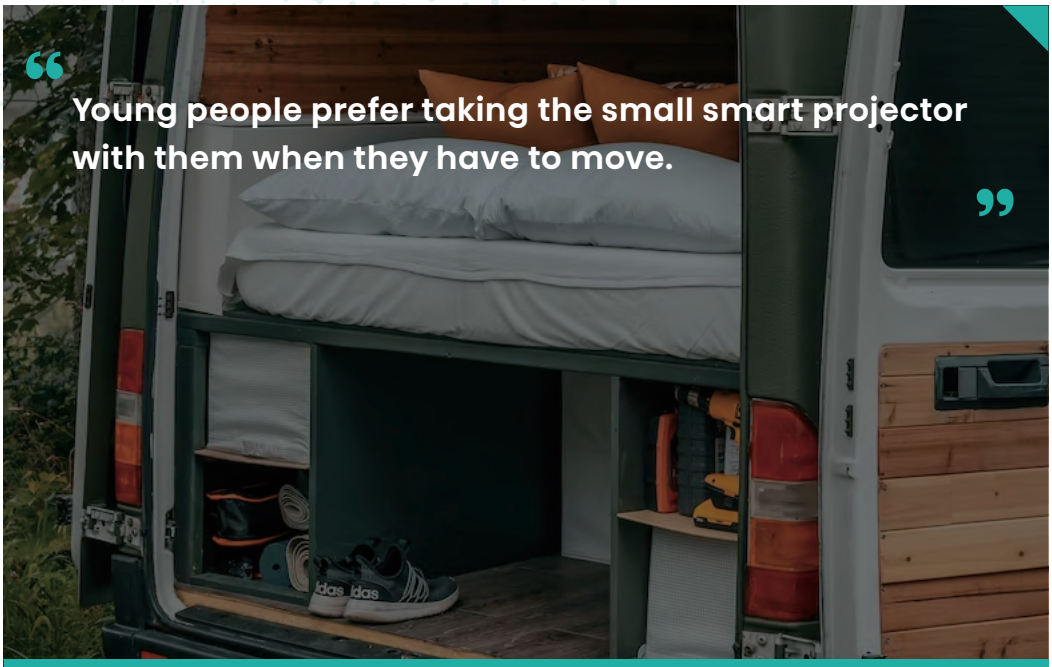
Vidda C1 4K Full Color Laser Projector

To stay ahead of this hard-to-predict innovation curve, Hisense has closely followed the trends of how young people in China work, play, live and move around the country after they graduate. It noticed that Gen Z young adults are behaving differently to Millennials. When they get their first jobs, Gen Z young adults move to large cities where they typically share accommodation with several housemates. But when they come home from the office, they no longer want to congregate around a flat panel TV based in the living room, says Dr Liu.

Instead, young people in China now want a portable entertainment device that they can quickly set up and enjoy a large display experience for online streaming content in their rooms, take to their friends' homes for parties or on trips away.

To meet this need, Hisense has developed the Vidda C1 4K Full Color Laser Projector, a tiny smart projector using its signature TriChroma laser technology. "Young people prefer taking the small smart projector with them when they have to move," explains Dr Liu.

While this use case is yet to take off in Europe, Mr Sabin is seeing similar trends amongst Gen Z in the US. “My adult children now have a conventional flat screen TV in the living room and a smaller projector set up in their bedrooms to stream content.”



— Dr Liu Xianrong, chief scientist and general manager of Hisense Laser Display Co. Ltd

Mini-LEDs for medical displays

Another field where high-tech displays make a difference is medicine. In April 2022, Hisense launched the world’s first 55” mini-LED medical endoscopic display. The result of eight years of R&D efforts, the technology enables doctors to detect sudden bleeds and look inside difficult-to-see cavities during surgery more easily.

Hisense says the technology also enables doctors to make out deep tissue details and legions more clearly with a greater depth of field, by greatly improving the contrast ratio to 200,000:1.

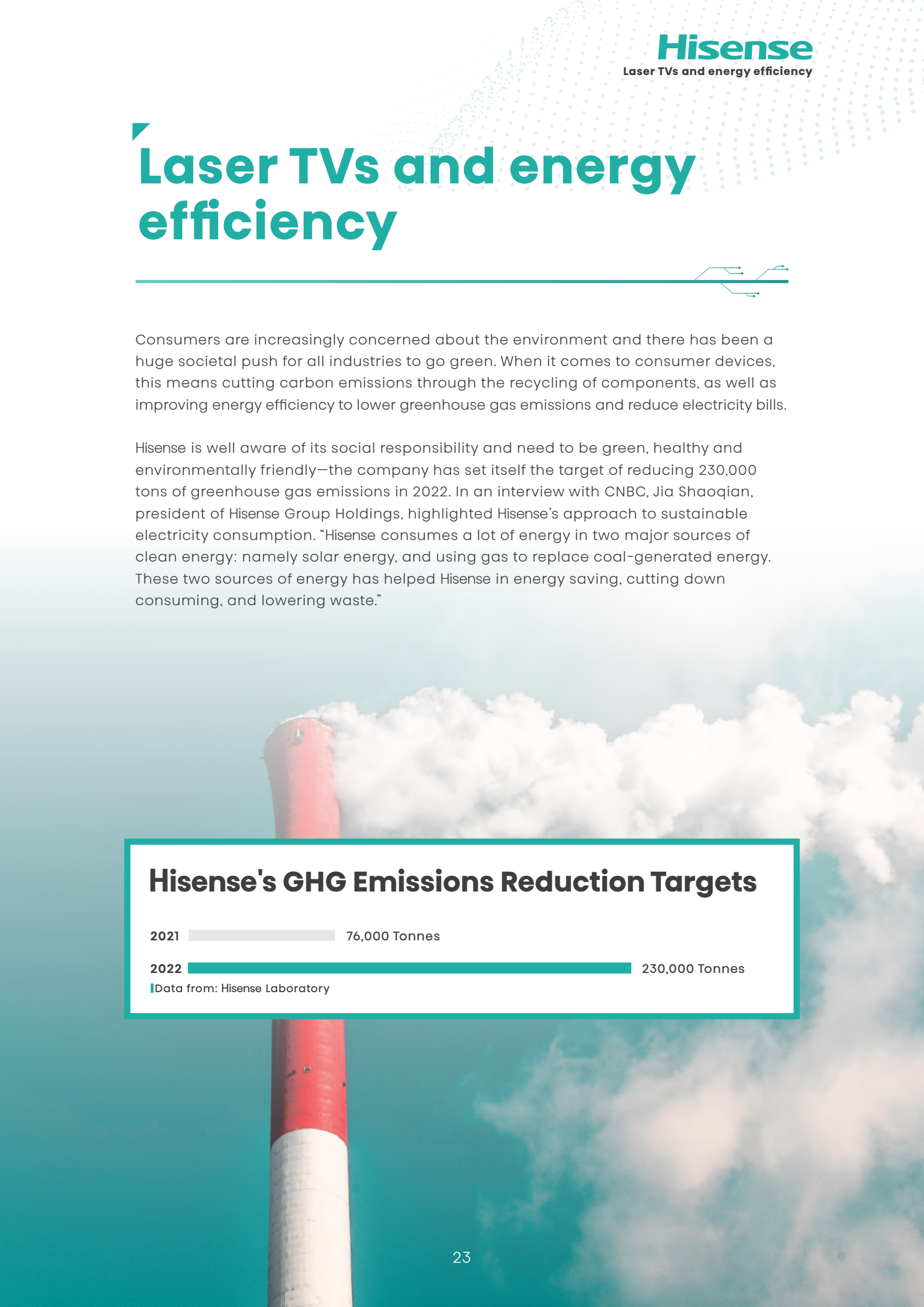
To help speed up the detection of bleeds and nerves, Hisense has also increased the colour gamut of the screen, particularly focusing on boosting the detection of the colour red up to 100% BT2020, while other colours are at 85% BT2020.

These are amongst the highest colour standards ever achieved for a medical display product. Hisense’s computer-assisted surgery system is currently being used in more than 200 hospitals across China.

Laser TVs and energy efficiency

Consumers are increasingly concerned about the environment and there has been a huge societal push for all industries to go green. When it comes to consumer devices, this means cutting carbon emissions through the recycling of components, as well as improving energy efficiency to lower greenhouse gas emissions and reduce electricity bills.

Hisense is well aware of its social responsibility and need to be green, healthy and environmentally friendly—the company has set itself the target of reducing 230,000 tons of greenhouse gas emissions in 2022. In an interview with CNBC, Jia Shaoqian, president of Hisense Group Holdings, highlighted Hisense's approach to sustainable electricity consumption. "Hisense consumes a lot of energy in two major sources of clean energy: namely solar energy, and using gas to replace coal-generated energy. These two sources of energy has helped Hisense in energy saving, cutting down consuming, and lowering waste."



Hisense's GHG Emissions Reduction Targets

Data from: Hisense Laboratory

Recycling

Hisense is leading the way with Laser TV sustainability, as the products' components are easier to recycle than flat panels. "At the end of the product life cycle of the LCD TVs, the recycle rate is 70% or lower. We are collaborating with some facilities and Laser TVs can reach a 90% recycle rate," says Dr Liu.

He explains that the most difficult part of a TV to recycle is the screen, which typically features multiple technologies in layers. "For the LCD panel screen, it cannot be recycled, but for Laser TVs, it is a passive polymer screen, you can recycle it easily," Dr Liu adds. "Most of the components in the console are metals and plastics."

"We have plans to encourage consumers to return their used or broken products," says Mr Jia. "With recycled products, we sort it with professional companies, to recycle the parts that can be reused, and dispose of the parts that cannot be reused responsibly into compostable elements. This has cut costs for Hisense, as well as saving money for consumers."

Recyclability Rate for Laser TVs vs LCD TVs

Item	LCD	Laser TV
Structural component	94%	98.2%
Screen component	3.2%	63.7%
Electronic component	51.25%	86.1%
Total recyclability	**72.75%**	**92.3%**

Data from: Hisense Laboratory

Energy efficiency

Optimising and minimising energy consumption is a priority for Hisense. For example, its new 8K TriChroma Laser TV is expected to debut with a 350-watt power supply, but this could go down to 250 watts by 2023. "For LCDs, our 98" screen's power consumption is 800 watts. Optical panels waste a lot of energy. And OLED generates about 50% more power consumption than LCD," explains Dr Liu. "OLEDs look like they save a lot of power, but actually it wastes a lot of energy. The Laser TV display is the most efficient way and will get even more efficient over the next three to five years. We're expecting to save another 30% of power."

The power consumption of Laser TV is around one-third that of a LCD TV with an equivalent screen size, according to Hisense research. At present, the power consumption of Hisense Laser TV is about 260W. "I can believe Laser TVs are more power efficient," agrees Dr Smith. "Whether it's LCD, DLP or an LCOS system, they all basically shine light on a screen and block some of the light to form an image, so

it means they're generating more light than you need to display an image on a screen. An OLED only generates light where it's needed, but the light isn't generated as efficiently as laser."

	Unit	Hisense 100L9F	LCD TV of the same size
Standard Mode Power Consumption	kw.h	0.654	1.813
Cinema Mode Power Consumption	kw.h	0.525	1.180

Data from: China Electronics Standardization Institute CESI Laboratory

Green TVs

Corporate social responsibility is also important to Hisense, and thus it makes extensive use of solar energy as an alternative to highly-polluting coal energy in everything from the sourcing of raw materials, to TV manufacturing processes, to its supply chains. Hisense also uses gas in order to reduce the amount of energy used in its processes.

Using Rapid Thermal Cycle Injection technology, Hisense has been able to reduce its use of standard coal by 345 tons per year, effectively reducing carbon emissions by approximately 986 tons. And by reducing the amount of plastic used for the rear of TV displays, Hisense has saved 4,626 tons of plastic per year, equivalent to 514 million plastic bags.

Seven of Hisense's factories have received the "Green Factories Award" from the Chinese government by proving their sustainability, low carbon emissions and environmental friendliness.

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