



Editorial

What A Happiness To Be In The Lighting Community!

The DVN Workshop starting today in Munich is all set to be a great success. I am so happy to welcome the participants from 125 companies, to learn of the latest innovations by seeing 30 lectures and the regulation panel session, visiting the exhibitors, and talking and listening together before enjoying a nice dinner. Soon we'll post on the DVN website pictures and video of this event, and all the information concerning the Workshop.

You'll remember last week we brought you an interview with Marelli Automotive Lighting's CEO and R&D Director. This week we follow up with an illustrated report of my visit to that company's headquarters in Reutlingen. I was impressed by the involvement of the team developing so many technologies all at once. I retain from my visit the challenge of laser technology despite great progress in performance and price; the interesting work on HD pixel beam which will be the greatest lighting ever offered to (and by) car makers; the great achievements in standardised modules, and the interesting strategy of ECU-free system architecture.

After the Munich Workshop wraps up, we will be setting our sights on preparing for the next DVN Workshop in Tokyo on **26–27 May 2020** with the theme Advanced Lighting Technologies and Safety, so save the date! Naturally we'll provide more information in your weekly Driving Vision News as it becomes available.

Don't miss the fruitful report on the CES, DVN just [published now](#).

Sincerely yours



DVN President

In Depth Lighting Technology

A Visit to Marelli Automotive Lighting HQ

During my visit to Reutlingen, Marelli Automotive Lighting presented their developments on laser technologies, ADB and road marking with digital light, standard modules, electronics, and sensors. Today I present this summary of what they showed me, as well as my impressions during the night drive demonstrations they kindly arranged for me.

Laser

After the first generation launched in 2014, and the second generation last year on multiple BMWs and the Audi A5, Marelli's AL unit are working with Nichia on a new generation of laser lighting.



• 2014 Audi R8 LMX

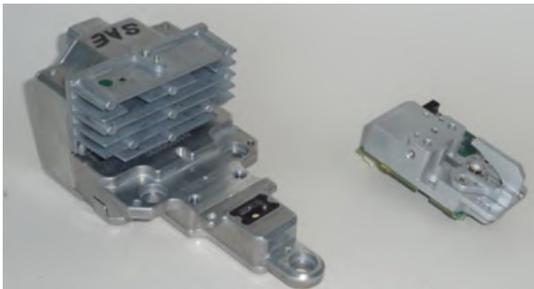


• 2015 Audi R8

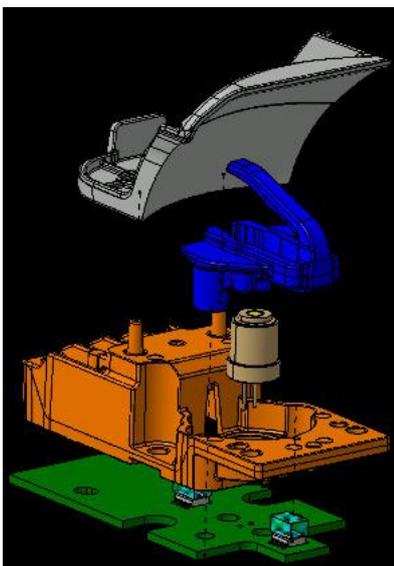


• 2018 BMW: Laser support for High Beam & ADB

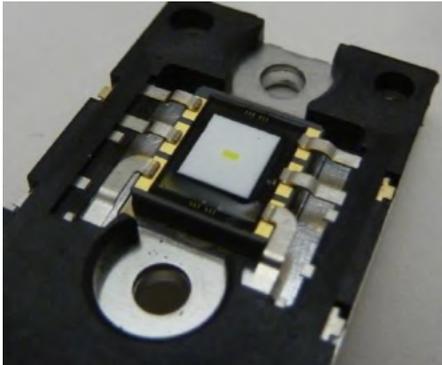
As explained in my last article on night drives with the BMW 5 Series, laser technology is not only used to increase the visibility distance in high beam, but also to make the ADB, with the laser spot being located at the vertical cutoff to increase the visibility close to cars ahead.



• Gen 1 → Gen 2: impressive miniaturisation!



• Laser source using a reflector 30 mm high × 40 mm wide

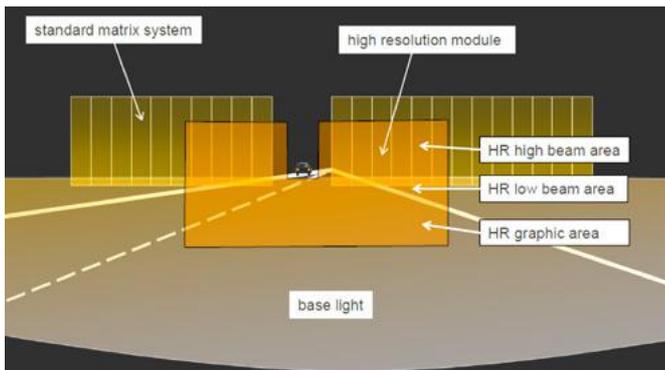


In the next generation to be launched with Nichia, there are now two laser sources illuminating one converter and producing twice the luminous flux: now about 800 lumens (hot). This will boost the laser performance to a new level with larger volume.

Great progress has been made over about five years on laser technology. An onboard electrical safety system integrated on the laser converter has, in the meantime, been standardised. The main challenge is now to drive down the system cost so that it is competitive with LED systems accounting not only for technology, but also for the volume.

High resolution pixel beam

For high resolution headlamp technology, Marelli Automotive Lighting focus their development efforts on DMD technology and LED and micro-LED arrays. For both technologies the high resolution module is combined with a supporting conventional background matrix system with 12 to 84 segments.



Digital light module with DMD from TI



Digital light module h-Digi®

The main benefits of DMD technology are:

- Improved resolution of the ADB.



without high resolution



with high resolution

- New lighting functions enabled by high resolution, such as vehicle-width guidelines projected forward on the road (for construction zones, etc), lane departure warning, distance warning, symbols (ice, speed), etc. A research study shows that nighttime traffic safety is significantly supported by guiding projections of this nature.



- Possibility of high-precision dynamic bending light.
- Flexible cutoff line shaping (country light, motorway light, town light, etc) without moving parts.

AL are on the front line in this technology, launching their first-generation DMD module in the Mercedes S-class Maybach, then in the Audi e-tron Sportback.



Audi e-tron Sportback 2019

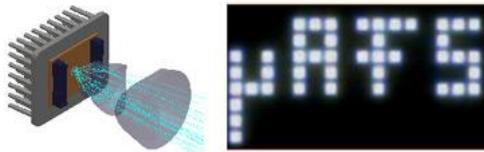


Mercedes Maybach S-Class 2018

The second generation design with a lower cost will equip several other cars currently under series development. Now, the two big challenges are about the definition of standardised warning and information symbols, and the regulations allowing driver assisting light patterns on the road with clear boundary conditions and minimum constraints.

LED and MicroLED Arrays

The first generation of microLED light sources was developed by Osram with 1,024 pixels (1 kilopixel).



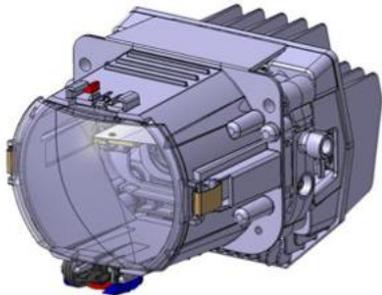
More such sources are coming from Nichia, Osram, and Lumileds. These have much smaller pixels and much greater resolution: around 20 kilopixels on about 40 mm², compared to 1 kilopixel on 16 mm² from the first-generation units. The light beam of the optical module will have a pitch resolution of about 0.1° and a rectangular shape. Production start is expected in 2022. The total light combined with this gen-2 setup and an LED bifunction module with segmented high beam is a good way to optimise cost, quantity of light, and high resolution for the ADB, with flexible low beam and road projections.

LED Modules

AL are using several standard modules and developing more. Their module library includes:

- **e-Light and s-Light**

The s-Light with ADB and 12 segments equips the Audi e-tron sportback together with digital light module h-Digi®. The s-Light also equips the Fiat 500 and the Škoda Fabia.



- **k-Light**

AL also have developed the k-Light module, with a rectangular lens of 35 mm, at lower cost. The k-Light only uses 7 parts versus 11 parts with the s-Light SOP is expected in 2022 from plants in China, Mexico, and Czechia.

- **m-Light**

This is an ADB module with a lens height of 35 mm, delivering ADB with one or two rows, using 12 to 36 segments. Production started this year. This module can be combined with the low beam s-Light module. Luminous flux is between 650 and 800 lm with a 1.5° resolution in the central region of the beam.

- **d-Light**

d-Light is an ADB module with a very slim lens of only 30 mm height × 100 mm width. The module delivers 950 lumens with a hot spot of 81,250 cd, and is configurable from 16 to 24 segments. With proper styling, the lens height can be reduced to 25 mm. SOP is planned for 2021.

With these modules, AL have a range allowing to achieve most automaker specifications for performance, volume, weight, functionality, and cost.

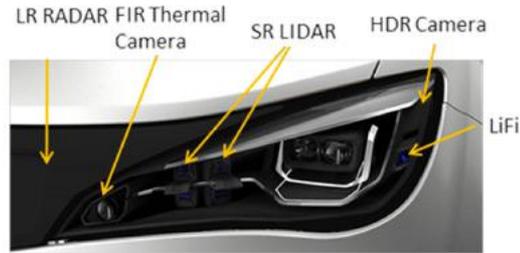
Electronics innovations

Many new features are demanded: software-based light distributions, strong trend towards animations, and downloadable and customisable features. It makes pressure on R&D efforts for dynamic features and more than ever, cooperation is required amongst optical, electronics, and software experts. That's the new approach required to meet the future requirements for E/E architecture and to reduce cost for lighting electronics.

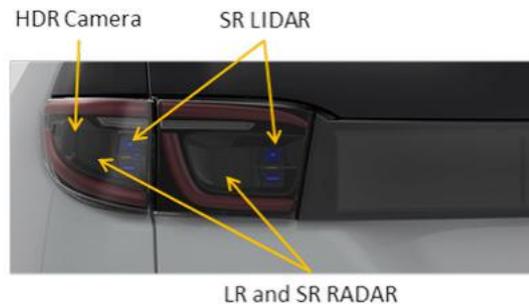
The key success factor is to enable optical experts to easily tune digital light features without the need of extensive software expertise. This new reality leads AL to develop an ECU-free system: no ECU to drive LED light functions, and simplified electronics to reduce cost and wiring complexity. For headlamps, architecture studies are ongoing with automakers and semiconductor suppliers; SOPs are scheduled from 2023.

Sensors

In parallel with new innovations on the lighting side, Marelli Automotive Lighting also work on solutions to integrate sensors for ADAS in headlamps and rear lamps. Main sensors planned are lidar, radar, and cameras—as already shown at CES 2019 where AL won a CES Innovation Award for their Smart Corner concept. As the lidar sensors will be in future one of the main sensors for highly automated vehicles, AL have also been working to develop their own range of them, based on joined activities with Xenomatix. Here's a look at what they've got going on, first for front applications:



...and then for rear-of-car applications:



Light Hall

The Light Hall is the name given to the new building in Reutlingen, housing a light tunnel of more than 60 × 12 metres for static headlamp investigations and demonstrations.



Light Hall

Lights from the Audi A4 and e-tron, Mercedes Maybach with DMD, and Porsche 911 with 84 pixels, show the huge progress being made by the lighting industry—and especially Marelli Automotive Lighting—on light quantity and performance, static and dynamic homogeneity, and functional versatility.

Night drive

Two vehicles with prototype lights were presented. Unfortunately, bad weather prevented an assessment of the light comparable to good-weather night drives with other systems, but on the other hand, inclement weather provides an extra-tough test of headlighting capability.

Very small 2-module system

This was the first time I assessed such thin modules. The two d-Light modules have a height of 30 mm and width of 100 mm, each. One makes the low beam and the other makes the ADB functions. My impressions:

- Good performance of the low beam; surprising for such a thin module, with a good spread and homogeneity.
- The matrix ADB gives a good feeling of high beam. The trees and the walls along the roads are very well seen, but the large ADB shadows interfere with good visibility close to degraded vehicles. Optimisation of the ECU-software control should bring the prototype to an improved performance level.

Lighting with h-Digi[®] DMD module

One LED projection module is used, plus a DMD module. The bifunctional module delivers the low beam and the ADB matrix light with 12 segments. The h-Digi[®] delivers light from 4° left to 12° right in the right headlamp, and 12° left to 4° right in the left headlamp, and 2° up to 5° down from both. It also produces the hot spot of the low beam, including the cutoff kink.

The low beam delivers 1,000 lm (including about 200 lm from h-Digi[®]) with the digital part making bending light, town light, motorway light, and also left/right traffic adjustment. The ADB provides a real feeling of a soft movement, with smaller glare zones for much better visibility close to the opposite cars. A very interesting point of this night drive was the possibility to achieve several new functions like sign projections.



• Speed limit warning symbol projection

Or information to help and to warn the driver as guiding elements or collision warning



• Vehicle-width guidelines



• Collision warning

Conclusion of the visit

- Laser technology has earned its place in technical terms, and there's great developmental progress, but questions stand prominently now as to what will be the trend of the cost vs. LED.
- Interesting works on the high resolution pixel beam which will be the greatest needs of the car makers. After introduction of DMD technology, microLED will follow to introduce high resolution technology into further brands and car segments.
- Great achievements in standardised modules, which— considering cost, volume and functionality—will increasingly be used in new vehicle models.
- Interesting strategy of ECU-free system architecture and steady work toward headlamp sensor integration.
- Strong involvement of AL's R&D team to succeed in their developments.

Lighting News

DVN Study - Automotive Lidar: Hype or Must-Have?



The number of companies developing lidar is still increasing with new companies emerging regularly. Most of them are targeting automotive applications and today, there might be too many lidar manufacturers—they probably can't all survive in the long run. As of today, major tier-1s are working on the integration of lidar and have made partnerships with lidar companies or have developed their own lidar (e.g., Valeo).

The vehicle lighting industry is increasingly showing strong interest in lidar technologies, so it's essential get conversant with automotive lidar:

- What are the technologies and the applications?
- What are the prospects and possibilities for integration of lidar in the car?
- What's the status of apposite regulations?
- What's the outlook for market development and new business opportunities

To answer these questions and more, DVN worked at length with lidar and lighting experts to put together a study: **Automotive Lidar: Hype or Must-Have?** Many uncertainties exist around the lidar technology, not least of which is what will be the winning technologies and the winning companies among the dozens of lidar makers?

Reading this DVN study will help you to identify new business opportunities and smart strategies in the nascent automotive lidar market. [Get your copy](#) today.

ZKW Integrates LG's Taillight Business



Last month ZKW Group established a branch near Seoul in Incheon, Korea, and are integrating the rear light business of LG Electronics and the development centre and sales offices. In addition, ZKW is integrating the rear light production of LG Electronics in Ningbo, China. The aim is to further expand business in the Korean automotive market and the Asia-Pacific region, and optimise structurally for a future wherein sensors for assistance systems

will surely be installed in rear lights.

ZKW CEO Oliver Schubert says "The new locations supplement our portfolio with the strategically important area of rear lights. They are a further milestone towards our commitment to provide 360° service for the automotive industry".

The Exterior Lighting for Automotive business unit will be jointly developed from that point, and ZKW's core competence in headlights will be merged with LG's rear light business, making ZKW the competence centre for lighting in LG Electronics' Vehicle Solution segment. Schubert: "The rear light business is a strategically valuable component for us because we have not been active in this segment in the past. ZKW Korea will be a key development office and by adding these specialists in Korea, we gain additional expertise and capacity. We are very pleased that we were able to bring the highly qualified LG Electronics employees on board".

The rear lights developed are manufactured in Ningbo, China, previously managed by LG Electronics' Vehicle Solutions and now under the responsibility of ZKW. Schubert says the acquisition of the Ningbo plant makes ZKW into a full-range supplier of headlights and rear lights, with global footprint: "We are striving to achieve strong growth in the Asian market and intend to increasingly supply local customers locally. We benefit from LG's strong network".

TDK Invest in SLD



SLDLASER

Japan-based electronics giant TDK have made an investment from a USD \$50m fund into SLD Laser, a company started by blue/white LED inventor Dr. Shuji Nakamura to develop GaN materials and commercialise laser-based light sources. TDK Ventures commented that "SLD Laser fulfills [our] mission targeting innovation in materials science, energy/power and related areas typically underrepresented in venture capital portfolios".

SLD Laser is TDK Ventures' third investment target since its July 2019 launch with a stated mission to "invest its expertise in innovative materials science, energy, power and related areas for a sustainable world where digital and energy transformation will improve billions of lives".

TDKV Managing Director Nicolas Sauvage called SLD "a pioneer in innovative and meaningful applications leveraging semipolar GaN materials, and we are impressed by their team and their ambitious roadmap of a wide spectrum of applications around the future of light".

SLD Laser took root in 2013, founded by solid state lighting specialists Dr. Shuji Nakamura, 2014 Nobel Laureate in Physics and father of modern LED lighting, Dr. Steve Denbaars, Dr. James Raring, and Dr. Paul Rudy. This independent spin-off from lighting giant Soraa holds an intellectual property portfolio with over 500 patents.

SLD's Beyond Lighting technology combines dynamic illumination with high-resolution sensing and ultra-high speed LiFi communication. SLD Laser products are used in applications including automotive, mobility, specialty and portable lighting, projection and AR/VR displays, biomedical instrumentation, industrial imaging, and materials processing.

Plessey: Latest μ LED Technologies at CES

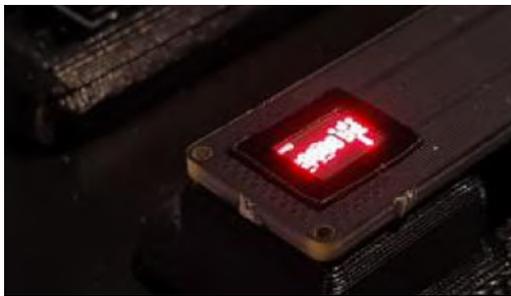


Plessey Semiconductor demonstrated several new microLED technologies at CES.

- Head Up Display (HUD) for automotive applications, that is based on a 0.7" blue monochrome MicroLED display:



- Display of a native red InGaN microLED. First time this display was demonstrated:



- Sample of the company's new segmented microdisplay technology with 0.3" full-color made from blue microLEDs with green and red color conversion materials



UK-based Plessey is a design and manufacturing company focused on GaN-on-Silicon LEDs for various applications, including displays, sensors and lighting.

The company developed unique monolithic micro-LED process technology that can be used to produce Micro-LED displays without a pick-and-place stage.

2020 Skoda Vision IN Teaser: Crystalline Elements



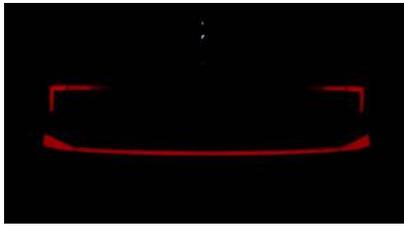
The concept SUV is scheduled to be unveiled at the 2020 Auto Expo. The Vision IN Concept is a new mid-size SUV. It is expected to be based on the MQB A0 IN platform.

Up front, the show car features prominent illuminated twin ribs outlined in crystal and a lit logo that shape the visual identity together with the split LED headlights.

The back end is only partially visible, but sports a unique lighting signature.

More crystalline elements can be found inside, on the dashboard, gear selector and under the virtual cockpit.

The study previews a production model that will launch locally before the end of the year. Skoda will drop the full details and perhaps an extensive image gallery of the Vision IN Concept during the Auto Expo in New Delhi, which takes next week.



Marelli Headlight Module is PACE Award Finalist



The h-Digi[®] lighting module from Marelli Automotive Lighting has been named a PACE Award finalist for 2020.

It's the first lighting innovation of its kind, incorporating a chip containing 1.3 million micro-mirrors that provide glare-free high beam and image projection on the road.

h-Digi[®] stands to elevate the effect vehicle lighting could have on driver safety and comfort, when used as a communication tool. Leveraging vehicle-to-everything (V2X) technology, future-state image projections could include speed limit warnings, weather and road condition advisories, vehicle-width guidelines, and construction alerts.

2020 Sapphire Awards: Illumineer finalists



LEDS Magazine communicated the finalists for the Illumineer of the Year award. Illumineer of the Year submissions are individuals or teams nominated by colleagues to bring attention to groundbreaking efforts in R&D, product design, and leadership in applying engineering expertise to commercial successes in the LED and SSL industry.

Innovation lies at the heart of every nomination, along with a passion to exceed performance expectations and drive SSL capabilities into new applications or form factors. Nominees are evaluated based on the perceived level of viability and impact their contributions have made or will continue to make on the growth prospects of LED and SSL as a technology market. The technology and Illumineer finalists will be recognized at the Sapphire Awards reception

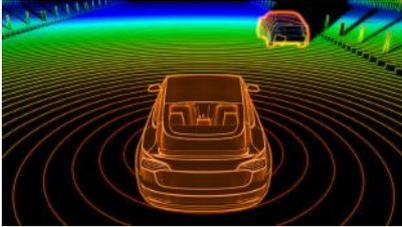
during the week of Strategies in Light.
Illumineer of the Year finalists are :

- **Nichia** Shinya Matsuda and Naofumi Sumitani, managers, Lighting & Automotive LED Development, Koji Kajikawa, manager, Phosphor R&D Center have recently developed and introduced several innovative LED technologies.
- **Heliospectra** Karin Dankis, director, Product Management and Engineering, has been the driver of [are] centered around two driving factors to offer an unprecedented amount of customer installation possibilities and satisfaction: simplicity and modularity.
- **Cree** Kory Liszt and Bob Rogers, Software Engineering Managers, led the software development for the Cadiant dynamic skylight, which is an LED daylighting solution that delivers the dynamic, sensory experience of being under a natural sky.

LEDS Magazine's Sapphire Awards program was launched in 2014 to recognize achievements in the LED and SSL sectors, representing technologies and people driving LED technology forward and revolutionizing the lighting industry.

Driver Assistance News

Packed Lidar Supplier Field Won't Clear Soon



The automotive lidar industry is crowded with competitors, from startups hoping to disrupt clear on up to long-established tier-1s branching out successfully into the lidar field. Which companies will make a successful go of it, which ones will merge, which ones will fail in the long run...none of that's at all clear. It's difficult to make predictions because the field is so new and the differences among all these suppliers aren't just a matter of business strategy—they're placing different technical bets. The laser pulses to make a lidar system work can be anywhere from 900 to 1,550 nanometres. Receivers can be based on at least two different materials. There's continuous-wave lidar, there's flash lidar, pulse lidar, prismatic lidar. There's solid-state lidar and spinner lidar.

Before this plethora of options weeds itself out and yields a dominant winner or two, it seems likely the lidar market, in the foreseeable future, will come to comprise a variety of niches based on who is using a vehicle, and how. Valeo have won close to USD \$600m in orders for their Scala lidar, while Israel-based Innoviz have teamed with Magna and won a contract to produce sensors for BMW. And that's just two examples. Overall, major differences among the many companies, and the wide variety of opportunities for success, are keeping many of them alive. DVN worked at length with lidar and lighting experts to put together a study: **Automotive Lidar: Hype or Must-Have?** Many uncertainties exist around the lidar technology, not least of which is what will be the winning technologies and the winning companies among the dozens of lidar makers?

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Aisin, Vayyar in Radar Pact



Tier-1 supplier Aisin Seiki and 4D imaging sensor technology company Vayyar Imaging are collaborating to provide high resolution SRR (short-range radar) for exterior vehicle sensing.

The partnership will combine Aisin's in-vehicle system expertise with Vayyar's 4D high-resolution SRR to develop exterior sensing capabilities for vehicles, such as blind spot detection for low-speed driving support. By providing a single-chip radar sensor, the Israeli company will contribute to Aisin's goal of safer functionality and advanced control.

Ian Podkamien, Vayyar's Director of Automotive Business Development, says his company's MIMO 4D SRR "offers a high-resolution point cloud with wide field of view, resilience to harsh weather conditions, and the ability to cope with semi-transparent materials—all at a very affordable price."

General News

Tesla Market Cap Tops \$100bn, Surpassing VW



Tesla's market value has climbed above Volkswagen Group's for the first time to more than \$100bn, a threshold that will make Elon Musk even more of a billionaire if he can sustain that level of market value for months.

Many are skeptical that Tesla should be worth more than a carmaker that sold almost 30 times as many vehicles last year, but VW CEO Herbert Diess isn't so dismissive. He's been arguably the most vocal CEO among traditional carmakers to praise Tesla and point to its role in a radical shakeup of the more than century-old auto industry.

After saying three months ago that Tesla are no longer a niche manufacturer, Diess told top VW executives last week that connected vehicles will almost double the time consumers spend online, and that cars will "become the most important mobile device".

Diess is rolling out the industry's largest electric-car fleet and aims to boost the company's value to a level rivaling Toyota, whose \$232bn market cap is still more than Tesla and VW combined.

Stefan Bratzel, a researcher at the Center of Automotive Management in Germany, says Tesla have "high innovative strength regarding battery-electric vehicles as well as connectivity, which can partly explain the high market capitalisation". The relatively low valuation of traditional automakers is linked to uncertainty over whether they can navigate the looming industry shift, he said.

Volkswagen CEO aims to catch Tesla in EV race



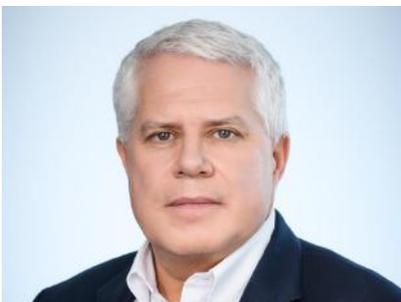
While Tesla is paving the way in electric cars, VW is buying software companies and ramping up investments in sustainable vehicles and battery cells, Diess said Friday at the World Economic Forum in Davos, Switzerland.

Volkswagen has started building its first mass-market EV, the ID3, in Germany. The compact hatchback will be a rival to Tesla's Model 3, which has helped lift the U.S. automaker's sales in Europe.

Still, Tesla has a competitive edge in electric cars and software, technologies that are underpinning a shift toward cleaner mobility. The threat is underscored by Musk's plan to establish a factory close Berlin in the heart of Germany's automotive industry.

Diess last week called on his top managers to speed up overhaul efforts to make the company more agile or risk being pushed aside. "The company which adopts fastest and is most innovative but also which has enough scale in the new world will make the race. 2020 for the auto industry will be a very difficult year, but we're doing the right things to be competitive." Diess said last week.

Thorsten Muschal is New CLEPA President



CLEPA, Europe's Association of Automotive Suppliers, has elected Thorsten Muschal as new president for the 2020–21 term, succeeding Roberto Vavassori, who had held the position since 2016.

Muschal is EVP of Sales and Programme Management at Paris-based multinational Faurecia. He has been CLEPA's Vice President for the last four years, and says "Automotive suppliers are key contributors to change in mobility and industry. Europe must succeed in reaping the industrial benefits of climate and digital leadership, and on this crucial question, CLEPA stands ready to help with technology solutions and proposals for policy."

The automotive industry is undergoing the biggest transformation in more than 100 years, largely because of the need to decarbonise transport. The other two major trends are assisted and automated driving, as well as data-fuelled connectivity, which enables new mobility types and services.

"As consumer priorities and ever-stricter emissions regulations transform the automotive industry, CLEPA is committed to working with policymakers and nurturing the business conditions that ensure European suppliers maintain their leading position on the global market", Muschal says.