

Editorial

Fantastic Progress In Lighting Industry

Last month I took a night drive which showed me the fantastic progress of the lighting industry. I was in a demonstrator car equipped with a Valeo monolithic LED with around 4 kilopixels to make the main beam and a monolithic LED with around 1 kilopixel to project elements on the road.

After several night drives, I've written of driving the best light—that was my impression of the BMW i8 with laser beam, the Mercedes CLS, the Audi A7, and the Mercedes S-Class; each new drive a new best. I can write the same after my night drive with the Valeo car. The main reason is the great progress the automotive lighting industry is making year after year. The new thing this time, I never have had in all the former night drives with ADB, is that the PictureBeam is a real high beam: perfect homogeneity and only the car ahead is shadowed out.

After my visit last week at Marelli-AL in Reutlingen, I am convinced on the future of high resolution ADB. Audi opened the way with matrix beam, Mercedes accelerated the movement with the S-Class, and now μ LEDs are arriving.

The DVN Workshop in Munich, focused on high resolution lights, will emphasise the enormous progress being made by the vehicle lighting industry on lighting performance and dynamic road markings. Watch for news about it!

Don't miss the DVN monthly report on Interior Lighting [published today](#). It includes best-in-class interviews from Audi, BMW, Hella, Valeo, and some other Tier 2 suppliers.

See also the 2 minute video posted on our DVN website which will give you an overview of the Frankfurt lidar conference which took place on 2-3 December 2019



Sincerely yours

DVN President

In Depth Lighting Technology

DVN Test Drive: Valeo's PictureBeam 4,000 pixels ADB

Since the first serial ADB systems developed by Volkswagen with vertical mechanical shadows, two other technologies have been proposed to find the best balance of performance, resolution, and cost.

First came the Matrix Beam on Audi's A8 of 2013, followed by several systems using four to 16 segments per headlamp.

The second wave was launched in 2017 by Mercedes-Benz in the E-Class with three rows of pixels in one single module. In these technologies, increasing the number of pixels to a few hundred brought a lot of improvements in the latest car serial releases in the horizontal resolution, going from a few to 28 pixels on a row with the Mercedes E-Class.

DVN has kept on top of the progress, reporting on wonderful night drives with A8, TT, A7, A6, then E-Class, S-Class and others.

Those solutions offer an ADB mode wherein a complete vertical stripe above the low beam is switched off to prevent glaring the other road users. To improve the resolution for a better light close to oncoming cars and for road markings, we have seen several demo-cars (and now production cars, like the Maybach and e-Tron) with DMD technology.

Valeo, for their part, have developed another solution to improve the resolution. They call it PictureBeam, and it's a lighting and road projection system.

PictureBeam Monolithic ADB - 4,000 pixels

The PictureBeam system provides a high-resolution (around 4,000 pixels) ADB with light all around the detected vehicles. It brings the function one step closer to being a real glare-free high beam, with a high accuracy in the cutoff position.



The technology is based on a monolithic LED, developed and produced by CREE, with 3,696 pixels to produce a high definition beam on the whole field. The main

purpose of this module is to produce a high definition beam on the whole field. This module also makes it possible to do road marking for ADAS, but from 15 m in front of the car.

The 4-kpx Monolithic solution offers a resolution of 0.28° in both directions in the complete angular range of the high Beam, in order to keep a high-intensity light level everywhere where it is not dazzling the other road users.

With a 0.28° resolution over a full horizontal extent of 20° outboards and 16° inboards, this drawback linked with digital functions is now solved and the complete field of view where light needs to be finely adjusted is covered. Up to now, even with a high resolution, a dark shadow only consisting in 0% / 100% deactivation/activation of some pixels is perceived as a disturbing inhomogeneity in the beam (dancing light).

The module is composed of 4 major components corresponding to the main functions to be addressed:

- Monolithic light source to emit light
- Projection optics to project the light emitted by the source
- Cooling system to evacuate the energy emitted by the source
- Electronic board to drive and power the LED allowing driving each pixel individually.



ADB: Monolithic 4k



ADB : Conventional

Compared to other HD systems (like DMD or LCD), for which the luminous source itself is separated from the light spatial modulator, it is the most compact solution and most simple in terms of number of components.

The low beam delivers a flux of 1,250 Lm (with the flat module), a hot spot of 25 Kcd. The high beam delivers a flux of 2,100 Lm with a hot spot of 75 Kcd.

PictureBeam Monolithic Road Projection

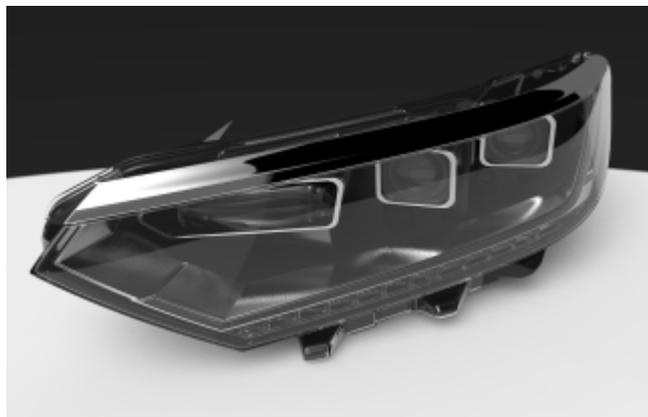
Road marking consists in projecting patterns on the road, with positive or negative contrast. These are to help the driver, as well as other road users, with mostly safety related features. They could be lane marking, highlighting certain areas, road signs projection, information displays.

Until now, most of these functions have been demonstrated with projection units using

hundreds of thousands of pixels, like DMD or LCD technologies, and barely with discreet pixelised light source.

PictureBeam Monolithic Road Projection is based on a monolithic LED with 1,232 pixels to project elements on the road. The solid angle covered by this module roughly corresponds to the solid angle covered by a DMD module. This module also, participates in the ADB.

Night drive



The weather was fine, but maybe too many cars on the road with advantages and disadvantages.

The headlamp is equipped with three modules;

- The module which gives a flat light to have large light close the car
- The PictureBeam Monolithic Lighting based on a monolithic LED with $3 \times 1,232$ pixels to produce a high definition beam on the whole field
- the PictureBeam Monolithic Road Projection GEN1 based on a monolithic LED with 1,232 pixels to project elements on the road. The solid angle covered by this module roughly corresponds to the solid angle covered by a DMD module.

The first feeling, I never have had in all the former night drives with ADB, is that the PictureBeam is a real high beam. Only the opposing car is shadowed out.

The second important feeling is the perfect dynamic homogeneity. The dynamic homogeneity is a key element, to avoid to distract the attention of the driver. The full digital adjustment of each pixel intensity of the 4-kpx module allows perfect dynamic homogeneity in all situations. The glare-free area is finely vertically adjusted, so that there is no potentially disturbing projection of bright-dark contrast lines, and that the surrounding of the glare-free area is lit. This is only achievable with a high number of pixels. The dancing light I objected to in other lights I've assessed, is absent in this light.

What about the new assessed functions?

Few of them are interesting :among the several functions presented:

- One of the most important function made possible by HD Lighting is the **Lane Marking** or **Construction lines** which can be done either with positive or with negative contrast.



Different shapes are also available, with either stripes reproducing the road marking lines, or a complete “carpet” in front of the vehicle, or even “2D Lanes” with also transversal stripes, for example, to provide distance information. This function was not useful in this night drive but I think it is one of the most important fuction about road marking

- The second interesting function is the **projected arrow** located at the exact location of the exit, with dynamic positioning upon the vehicle speed. This can be also used in advance, to help the driver to be positioned on the right lane, before a direction change on the motorway. In that case, a more simple message than an arrow, or a simple light movement, can be helpful. It can also be helpful to reduce the risk of confusion when the driver can use several directions: case of complex motorway exit or of many roundabouts. Other possibility for arros are for example the replication of Turn Signal, with clear arrows.

- **Projection of a sign**



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Pedestrian mark



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No pedestrian mark

The sign on the road could alert the pedestrian of a potential danger. It could be a line on the ground, simulating a “do not cross line”, or a simple halo, or a flash on the lower body area of the pedestrian.

Safety distance projection

"When the vehicle is getting too close from the leading one, alert messages as simple as highlighted zones or a series of transversal light bars could be used. The setting of these bars, as well as the projection distance can be defined by the user, while their activation can be coupled with the front radar or lidar.

"Less important for me is the information are road signs display, after their reading thanks to the front lighting camera, or information coming from the vehicle, such as external temperature display, or risks of icy road.

They are also a direct redundancy to images which are usually set on the HUD, In the end, displaying these signs on the road is not suitable, should be and could be replaced by information on HUD,

This night drive shows not only the fantastic job done by lighting industry these last 10 years since the arrival of LEDs, but more important the huge challenges in front of us about the resolution, resolution further than 30 m away to improve light and resolution from 0 to 30 m for road markings.

"You will have more information after the next night drives with AL and then with Hella and ZKW before night drives with the last coming cars in production."

Lighting News

Report on GTB 128th Session



Special to DVN by Geoff Draper, GTB President

The 128th plenary session of GTB was held at Seoul recently, with a participation of more than 70 experts from 15 of the 19 member delegations.

GTB input to the GRE Informal WG on Simplification of Lighting Regulations

This continues to be a major focus for all of the GTB working groups, particularly those responsible for light-signalling (WG-SL), road illuminating devices (WG-FL) and installation (WG-I). The GRE IWG-SLR is meeting frequently and GTB is contributing to the discussions at each session. All documents are available at the [GRE IWG-SLR Website](#).

The 35th meeting of the GRE IWG-SLR took place on 11–13 December, and the GTB working groups were submitting their proposals for amendments to the three new UN Regulations to make them technology-neutral and performance-based to the maximum practicable degree. The opportunity has also been taken to mandate higher performance levels for the headlamps. The plan is to formally submit these proposals for amendment to the April 2020 session of GRE with a deadline of 24 January 2020 and the IWG-SLR will hold its 36th meeting on 08-10 January 2020 to finalise the submission to GRE and to resolve any last-minute issues.

Proposal for projection of driver assistance symbols in R48, R-149 (RID)

GTB presented driver assistance projections as a new feature of the adaptive driving beam with the aim to increase driver's comfort and road safety (GRE-82-40). The presentation was accompanied by a live demonstration of three vehicles equipped with the new feature. To allow for the driver assistance projections, GTB proposed amendments to UN Regulations Nos. 48 and 149 (GRE-82-04).

The reaction of GRE was positive, and GRE welcomed both the GTB presentation and the supporting demonstration. Several experts were of the view that the new system could bring safety benefits provided that road projections symbols are standardised according to UN Regulation № 121, and that they do not distract other drivers. GTB will submit a formal revised proposal, taking account of the comments received, to the next GRE session in April 2020.

Status of GTB-funded research projects

The research projects are almost complete by TUD Darmstadt, KIT Karlsruhe, and ELS about light-signals for autonomous vehicles and road projections to provide information for driver assistance. These research reports will be published by the end of this year. A new research programme for 2020 has been planned by the GTB Strategy and SVP Working Groups and will be discussed at the next Strategy WG meeting in Shanghai on 16 January 2020.

GTB vision 2020-2030

The joint DVN / GTB Workshop held in February 2019 in Torino provided valuable input into the GTB work to define its vision and work programme. The outcome is being combined with input from the GTB Strategy group and a report will be available by the end of this year. A summary will be presented during the Regulatory Session at the DVN Munich Workshop on 28–29 January 2020.

New task force on Vehicle-Level Testing Procedure for Adaptive Lighting Systems

This taskforce met twice by WebEx in March and April 2019 and held a two-day workshop in Karlsruhe on 15/16 July 2019, followed by a further WebEx on 11 October 2019. The taskforce has made good progress and a further WebEx is being arranged for the week commencing 20 January 2020. At this meeting it is expected that the Terms of Reference will be established along with a workplan to demonstrate the feasibility of the laboratory-based test method and its correlation to an on-road test.

New GTB Task Force on ADAS sensors

Draft terms of reference are being prepared for consideration at the launch meeting of this new group that will take place in The Hague (NL) in February 2020 during the GTB Intermediate Session.

New GTB Task Force on NCAP assessment for Lighting.

In view of the growing interest in developing NCAP testing protocols for adaptive lighting systems, a GTB Forum is being arranged during the GTB Intermediate sessions in February 2020 in The Hague (NL). The intention is to establish a GTB working group to develop a globally acceptable test protocol.

Launch of the new GTB website

The new GTB website is now operative. It has been developed to make information about GTB and its activities more easily available. The GTB website can be accessed at www.gtb-lighting.org.

The 129th GTB session will be held on 11-15 May 2020 in Estonia.

Harder IIHS Tests for 2020 Awards

The IIHS (Insurance Institute for Highway Safety) have announced that starting next year, headlights ranking "good" or at least "acceptable" on the institute's tests must



be standard equipment for vehicles to qualify for the Top Safety Pick+ award, the highest award from IIHS. Up to now, such a rating was required for Top Safety Pick, while a good rating was needed to achieve the "plus".

"In the past, a vehicle would get the award because it has the optional, available headlights. But this year, we want to see

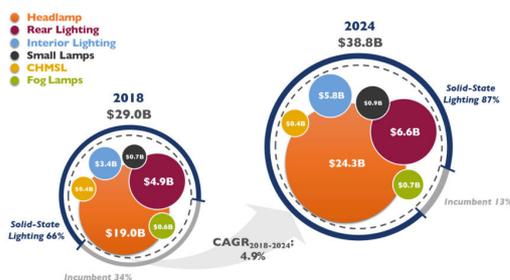
those headlights as standard equipment. This is a good way to encourage automakers to stop equipping vehicles with crummy headlights that don't light the road. Decent headlights should be a given, and we hope this change to our criteria will push manufacturers to make them standard across their lineups," said David Zuby, IIHS chief research officer, IIHS launched its headlight ratings in 2016. Only three headlight systems from the 2016 model year earned a good rating out of 224 evaluated by IIHS. Another 36 earned an acceptable rating.

Since then, the number of good and acceptable ratings has greatly increased. In the 2019 model year, 68 out of 465 systems evaluated were rated good, and

Osram's Coming 25,000 Digital Lights

2018-2024 Automotive lighting market forecast

(Source: Automotive Advanced Front-Lighting Systems 2019 report, Yole Développement, 2019)



Digital lighting is a key area of investigation for the automotive lighting supply chain. It enables smarter lighting functionalities, safer ADB designs with cameras.

Osram's first-generation Eviyos hybrid LED, slated for SOP early next year, consists of 1,024 individually controllable pixels with an integrated IC. But Osram

are already developing the Eviyos range's second-generation iteration, which will feature more than 25,000 individually controllable pixels. Market entry for this multi-pixel technology is planned for 2023. The higher resolution means it will be possible to project symbols or short messages in HD-quality on the street with the second generation of Eviyos.

ZKW Expand Mexico, Slovakia Plants

ZKW are pouring money—over €210m—in production plants lately. They're expanding their manufacturing capacity at Silao, Mexico, which went into operation in 2015, by 19,000 m² by a year from now, and plan to double the staffing level by 2023. High-quality headlamps for premium automobile manufacturers such as BMW, Daimler, and Volvo are manufactured there, and ZKW are investing a total of around €67m at the site. Construction began in November 2019 and the plant will be expanded from 22,000 to 41,000 square metres. The extension will be equipped with state-of-the-art technologies for the manufacture of innovative automotive lighting systems—such as



plastic injection molding systems, hard coating equipment, painting systems, metallisation equipment for reflectors, and headlight assembly lines. Completion is scheduled for October 2020 and the start of production is scheduled for August 2021. The number of employees is to rise from 700 at present to around 1,400.

And the largest expansion project in ZKW's history has already gone into operation in Krušovce, Slovakia. The production space here has been doubled to around 42,000 m². With around 2,500 employees, the plant is ZKW's second largest production site. In Krušovce, main headlamps and fog lamps are manufactured and new lighting systems developed. "Despite the tense economic situation in the automotive industry, we are continuing to expand our locations in order to remain competitive in the long term," says CEO Oliver Schubert. In Krušovce, ZKW expanded the plant built in 2007 by an additional 37,500 m². The expansion, for which ZKW invested around €155m, doubled the production area and created a new office wing with a training center. In addition to the manufacturing of plastic parts with 45 injection molding machines, in the future plastic lenses and modules will also be manufactured at the Krušovce site.

Lighting is Integral to Design: Hyundai's Lee



Hyundai will focus more on a typical customer's lifestyle and needs when designing their future cars, says SangYup Lee, in charge of the brand's global design centre. Up to now, Hyundai's model range has had a family look with all cars having the same face, Lee said.

In the future the design of new models will have more diversity. The Vision T plug-in hybrid concept unveiled at the Los Angeles auto show last month, shows the styling of future Hyundai cars, he said, and now Hyundai aim to find a design element that can give the brand a distinctive image like Audi did 10 years ago with their lighting.

Lee hinted that the concept previews the next generation Tucson SUV. "The show car is a very strong statement. You will be surprised by how close the production car to the Vision T...the Vision T's new grille and lighting elements are part of the updated design theme", Lee said. On the concept, the grille and front lighting are integrated. When stationary, the grille is closed to create a seamless appearance.



Vision T plug-in hybrid concept

Magna Lighting : from LED to ADAS sensor integration



Magna is a technology oriented company, one of the world's largest suppliers to the automotive industry. From LED to ADAS sensor integration, Magna offers numerous advanced lighting solutions that provide flexible styling, enhanced safety and improved visibility. These technologies enable Magna to meet today's needs while illuminating the path

towards future mobility through innovation.

With the recent acquisitions and integration of OLSA and lighting engineering firm WIPAC Czech s.r.o., Magna Lighting is now positioned to develop and deliver lighting solutions for global programs and regional applications.



Here are 2 of their newest products ready early 2020 for RFQ to customer exterior design lighting applications

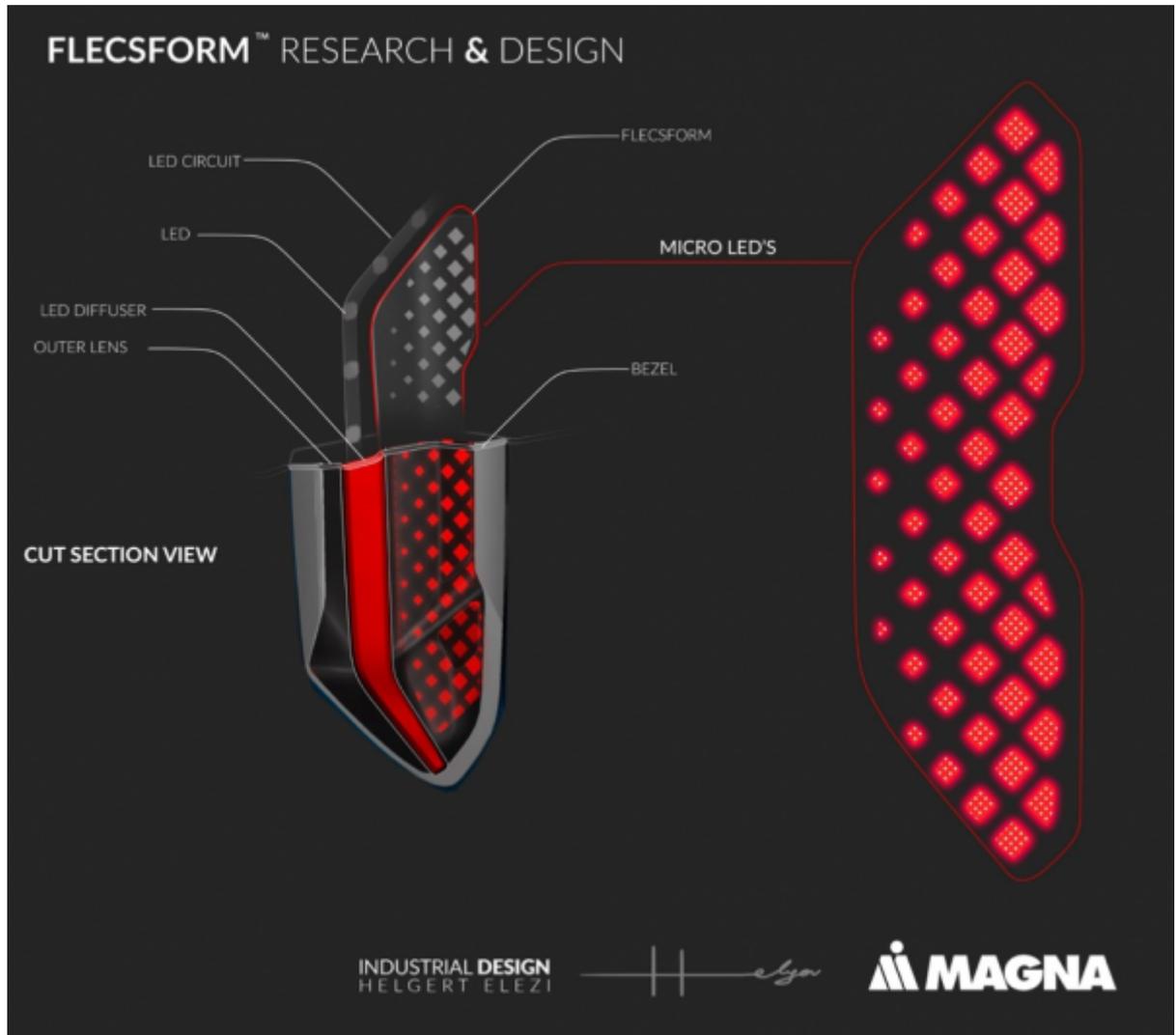
FLECSFORM™

Utilizes high-speed direct transfer of micro LEDs onto flexible circuits to enable thinner, more efficient lighting solutions that enhance styling.

Competitive advantages/differentiators:

- Uniform lighting in an extremely thin package
- Flexible substrate to enable complex shapes
- Provides styling freedom for brand/series signature lighting
- Robust and cost efficient OLED alternative source
- Thermally efficient
- Communication display capabilities
- Supports intricate animation functions

Applications: Signal lighting: tail, stop, rear turn, reverse



INVISION™ GFHB

Adaptive Driving Beam system that performs Glare Free High Beam. Scalable matrix technology allowing unique lighting features for improved driver visibility.

Competitive advantages/differentiators:

- Enables increased safety without glaring other vehicles
- LED array allows for dynamic beam pattern
- Extremely uniform beam with full HB
- Utilizes forward camera vision inputs



INVISION Dual Projector GFHB system

Features:

- Glare Free High Beam
- Removing glare from oncoming drivers and traffic signs
- Additional illumination
- Speed dependent lighting
- Virtual dynamic bending
- Hazard/pedestrian detection and marking
- Tourist conversion

INVISION comes in 2 versions :

- Entry-level: 11 segment Single Projector GFHB system
- High performance: 60 segment Dual projector GFHB. Also included additional functionalities of virtual dynamic bending, sign de-glare, hazard detection/targeting, dynamic city/urban roadway and more.

Driver Assistance News

LeddarTech Team with First Sensor



LeddarTech have announced a collaboration with First Sensor for lidar options. The platform provides the following benefits a set of solutions which addresses the requirements of automakers and tier-1 suppliers.

LeddarTech and First Sensor will initiate the collaboration with the development of a lidar evaluation kit, demonstrating a technical concept in a working lidar and creating a tool for tier-1s and system integrators to develop their own lidar based on LeddarEngine technology, First Sensor APDs and additional ecosystem partners' technologies, products, and services. The evaluation kit will be primarily targeting automotive front lidar applications for high-speed highway driving such as Highway Pilot and Traffic Jam Assist.

First Sensor is a supplier of Avalanche-Photodiodes and is developing the receiver submodule based on its APDs for the lidar evaluation kit. The receiver submodule leverages LeddarTech's LeddarCore SoC and LeddarSP signal processing software to capture the reflected pulse coming from the objects in the field of view in order to provide time-of-flight data for rendering a 3D image that includes depth information. "We are delighted to partner with First Sensor, one of the world's leading developers and producers of chips, components, sensors and sensor systems as a strategic partner" stated LeddarTech VP, Product Management, Michael Poulin. "First Sensor, LeddarTech and other select members, working synergistically as part of the Leddar Ecosystem, will provide increased value to our customers."

General News

Tesla to Build 500k Cars a Year in German Plant



Tesla plan to build 500,000 electric vehicles a year at their new factory on the outskirts of Berlin, while creating 10,000 jobs, according to planning documents to develop the enormous "gigafactory" site. Construction will start next year.

Last month, Tesla CEO Elon Musk said that a site in Gruenheide, Brandenburg, had been chosen to build Tesla vehicles. Tesla also will establish an engineering and design center in Berlin near the German capital city's new airport.

The factory will make batteries, powertrains and vehicles, beginning with the Model Y crossover, Musk said. The Model 3 will be built there later, according to reports.

German newspaper *Frankfurter Allgemeine Zeitung* reported that Tesla will invest up to €4bn in the plant.

Renault Board Wants VW Group's de Meo as CEO



Renault's board wants Luca de Meo, who heads SEAT brand, to become the automaker's next CEO, French media reports say. De Meo won out over Patrick Koller, CEO of the supplier Faurecia, according to Agence France-Presse and *Les Echos*. The board chose de Meo as their preferred candidate at its meeting last week, the reports said.

De Meo, 52, won the support of the French government, Renault's biggest shareholder with a 15% stake, AFP said. However, a stumbling block to de Meo's appointment could be a non-compete clause he has with VW Group, *Les Echos* said.

De Meo, an Italian executive, emerged as favorite, for the Renault CEO post because of his success in making the Spanish brand profitable. He also speaks French and started his career at Renault before working for Toyota and Fiat.

Renault have been searching for a new CEO since their board ousted Thierry Bollore in mid-October, as the French automaker and its alliance partner, Nissan, cleared out managers closely associated with the Carlos Ghosn era.

West European Up Again in November



West European new car sales grew by 4.2% year-on-year (YoY) in November, according to data released by LMC Automotive.

LMC said the result is one of relative improvement, against November 2018. Gradual normalisation from a weak September 2019. The West European selling rate reached 14.0m units a year in November, moving upwards from 13.5m units a year in October and 13.1m units a

year in September.

- The German annualised sales rate rose to 3.5m units a year in November, while YoY growth in sales remained strong at 9.7%.
- UK sales were down 1.3% YoY last month.
- In Spain, sales rose modestly at 2.3% YoY, with the annualised selling rate remaining in line with October's 1.2m units a year.
- Italy saw a selling rate in line with October at 1.9m units a year, paired with YoY growth of 2.2% in sales.
- French new registrations saw little growth YoY in November, at just 0.7%, though the selling rate remains solid at 2.2m units a year.

Regionally, year-to-date (YTD) sales were marginally down from 2018, though by the close of the year LMC said it expects to see a similar outturn to 2018 (around 14.2m units). The forecasters say they are a 'little more cautious on 2020', with overall volumes expected to be lower than this year at 14.06m units. LMC noted that economic challenges remain, particularly in light of the external trade environment and Brexit uncertainty, and 'there is a risk that OEMs may have to take action that could have an impact on total market volumes because of forthcoming CO2 targets.'

FCA CEO to head ACEA

Fiat Chrysler Automobiles CEO Mike Manley has been elected President of the European Automobile Manufacturers' Association, or ACEA, taking over from PSA Group CEO Carlos Tavares who was President in 2018 and 2019.



Manley's one-year term will begin in January and is renewable for one additional term. Manley, born in England, has been CEO of FCA since July 2018, succeeding the late Sergio Marchionne. He has been head of the Jeep and Ram brands, and also served as chief operating officer of FCA's Asian operations.

ACEA, based in Brussels, represents 15 Europe-based car, van, bus and truck manufacturers. In recent years, the organisation has lobbied EU lawmakers to minimize cuts to emissions limits, arguing that more stringent targets do not give automakers enough time to prepare and will cost thousands of jobs in a mass transition to electrification.