AUTOMOTIVE LIGHTING SYSTEMS EVOLUTION TOWARDS THE AUTONOMOUS VEHICLE
OVERVIEW OF VALEO GROUP
VALEO IN THE AUTOMOTIVE VALUE CHAIN

Drivers

Tier 1 Suppliers

Car makers

Aftermarket

Components, systems and modules

Materials

Electronic components...
A WELL-BALANCED CUSTOMER BASE

16.5 BN € SALES (1)

- Aftermarket (& other)
- Original equipment

13% 87%

% OF 2016 OEM SALES

- American
- Others
- German
- Asian**
- French*

- Excluding Nissan
- Including Nissan

22% 30%

15% 27%

(1) At end 2016
ORDER INTAKE\textsuperscript{(1)} FUELLED BY INNOVATIONS\textsuperscript{(2)}

- South America: 28%
- North America: 24%
- Europe: 39%
- Asia: 35%

\textsuperscript{(1)} Excluding Access Mechanisms business from 2005 to 2013 and including joint ventures consolidated proportionally.
\textsuperscript{(2)} Products and technologies in series production for less than 3 years.
\textsuperscript{(3)} Order intake in 2016.
\textsuperscript{(4)} Including Africa.
A BALANCED WORLDWIDE PRESENCE

2,634 Employees
6 Production sites
2% of sales*

14,493 Employees
21 Production sites
22% of sales*

46,415 Employees
69 Production sites
49% of sales* (including Africa)

28,258 Employees
59 Production sites
27% of sales* (incl China:14%)

* In % of OEM sales at end 2016
VALEO, A WORLD LEADER IN EACH BUSINESS

- **VISIBILITY SYSTEMS**
  - Wiper Systems #1
  - Lighting Systems #2

- **POWERTRAIN SYSTEMS**
  - Electrical Systems #1
  - Transmission Systems #2

- **THERMAL SYSTEMS**
  - Thermal Powertrain #2
  - Climate Control #2

- **COMFORT & DRIVING ASSISTANCE**
  - Driving Assistance #1
  - Telematics #2
  - Interior Controls #2

end 2016
VALEO’S STRATEGY - BASED ON 2 PRIORITIES

With the ambition to generate growth higher than the market in each production region

CO₂ emissions reduction and intuitive driving

Development in Asia and high growth potential regions
AUTOMOTIVE PRODUCTION: 2016 GEOGRAPHICAL BREAKDOWN

< 50% of global production

> 50% of global production

Worldwide production: 93 million vehicles
China: first worldwide market
VISIBILITY SYSTEMS

Key Figures*

- €4.6 billion Sales
- 28% of Group total
- 29,000 Employees

- 37 Production units
- 15 Development centers
- 5 Research centers

*end of December 2016
MEGATRENDS IN AUTOMOTIVE
## Global Megatrends

<table>
<thead>
<tr>
<th>POPULATION</th>
<th>SCARCITY OF RESOURCES</th>
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<tr>
<td>SOCIETY</td>
<td>POWER OF TECHNOLOGY</td>
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<td>HEALTH</td>
<td>CONNECTED LIVING &amp; DIGITAL WORLD</td>
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<td>URBANISATION</td>
<td>ECONOMY &amp; POLITICS</td>
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<tr>
<td>CLIMATE CHANGE</td>
<td>BUSINESS &amp; WORK</td>
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# AUTOMOTIVE TRENDS OVERVIEW

<table>
<thead>
<tr>
<th>MOBILITY</th>
<th>TRAFFIC DENSITY</th>
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<tr>
<td>AUTOMATED</td>
<td>GREEN CARS</td>
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<tr>
<td>&amp; CONNECTED</td>
<td>&amp; ENERGY EFFICIENCY</td>
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<tr>
<td>CAR</td>
<td></td>
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<tr>
<td>CONSUMER</td>
<td>CAR SEGMENTS</td>
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<tr>
<td>BEHAVIORS</td>
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<tr>
<td>NEW PARADIGMS</td>
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<td>EMOTIONS</td>
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DEVELOPED AND EMERGING MARKETS FACING DIFFERENT CHALLENGES

**Developed Markets**

- Ageing Population
- High Purchase Power
- Limited Economic Growth (<2%)
- Saturation of Existing Cities
- Land-use Plannings: Better Use of Current Assets

**Emerging Markets**

- Growing Population Africa and Asia
- Economic Growth (~7/8%)
- Rising Middle-Class
- Emergence Megacities
- Demand for Infrastructure and Transportation
DRIVING AUTOMATION TREND

From Driving Assistance towards Autonomous Vehicle

Connectivity for automation

Fallback Solution

Environment Monitoring

Lateral / Longitudinal Control

According to SAE / BASt

V2V

HD Map
Cloud-based real-time

Adaptation of the legal framework required

Driver

System

Driver

System

Driver

System

Driver

System

Driver

System

0  No Automation

1  No Automation

2  Partial Automation

3  Conditional Automation

4  High Automation

5  Full Automation

From Driving Assistance towards Autonomous Vehicle

18/05/2017

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CAR AUTOMATION FORECASTS

New vehicle market share of fully autonomous vehicles

Percent

High-disruption scenario entails
- Regulatory challenges overcome in key markets
- Safe and reliable technical solutions fully developed
- Consumers enthusiastic and willing to pay

Commercial introduction of full autonomy by new tech players and premium OEMs

Manufacturing capacity for tech players ramps up gradually

Mass market leaders introduce full autonomy

Ramp-up as AV availability spreads across popular consumer models

Slow consumer uptake driven by low perceived value proposition or negative publicity following critical incidents

Technical and regulatory barriers delay commercial scale introduction of autonomous vehicles

15% of vehicles are autonomous at 2040

SOURCE: McKinsey

18/05/2017

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# DISRUPTIVE TRENDS

<table>
<thead>
<tr>
<th>4 TRENDS</th>
<th>HIGH DISRUPTION HYPOTHESIS*</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELECTRIFIED</td>
<td>• 50% of electric vehicles in 2030</td>
</tr>
<tr>
<td>AUTONOMOUS</td>
<td>• 15% of fully autonomous vehicles in 2030</td>
</tr>
<tr>
<td>SHARED</td>
<td>• 10 millions shared vehicles in 2030 • - 23 millions owned vehicles</td>
</tr>
<tr>
<td>CONNECTED</td>
<td>• a $1.5 trillion new market in 2030</td>
</tr>
</tbody>
</table>

* McKinsey | Automotive revolution – perspective towards 2030
DRIVING STRENGTHS FOR LIGHTING
VALEO VISIBILITY SYSTEMS MISSION & PROFILE

THE TASK OF DRIVING

- Provide systems to see ahead and be seen, in all conditions.

THE EXPERIENCE OF TRAVELING

- Make the use of the car an easy and relaxing ride
- Allow sensors to see in all conditions, for self-driving cars.
A BRIEF HISTORY OF FRONT LIGHTING

1898  First Electric Headlamp

69 years

1898  Halogen Directional High Beam 1967

1962  Halogen

39

1967  Xenon Directional Low Beam 2003

1991  Xenon

36

2003  Xenon Advanced Front-lighting Systems (AFS) 2007

1962  Halogen

1991  Xenon

2003  Xenon Glare Free High Beam 2010

2012  LED Glare Free High Beam

2007  LEDs

2013  LED Matrix Beam

2014  Laser spot

2014  Laser

2015  LED Pixel Lighting

Time is accelerating!

Lighting innovations are evolving at a fast pace
VALEO LIGHTING SYSTEMS PRODUCT PORTFOLIO

FRONT LIGHTING
- Main headlamps
- Fog lamps and Auxiliary lamps
- Daytime Running lamps

REAR LIGHTING
- Rear combi lamps
- Central stop lamps
- Small signaling lamps

INTERIOR LIGHTING
- Ambient lighting
- Intuitive lighting
- Connectivity

ELECTRONICS
- Control Units
- RGB modules
- LED Assembly Group
VALEO LIGHTING SYSTEMS MISSION

Style  Safety  Environment
Styling and design of the exterior lighting has become a major differentiation factor in the car branding (Face Strategy).

Approximately 25% of the appearance of a new car model is affected by the lighting systems.

Oliver Wyman

Valeo stylists help OEM stylists and Valeo R&D to focus on the right technology to achieve the right design.

Valeo invent solutions for a differentiated brand signature.

Appealing Lighting Systems make cars.
BMW 4-SERIES
LED GLARE-FREE HIGH BEAM HEADLIGHT

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AUDI Q5
HOMOGENEOUS 3D TAIL LAMP
BUGATTI CHIRON
HIGH PERFORMANCE FULL LED HEADLIGHT
BUGATTI CHIRON
FULL-WIDTH TAIL LIGHT WITH MASSIVE LIGHT GUIDE
CITROEN C6
FULL LED HEADLIGHT WITH POWERFULLLED40
DS 4S
FULL LED HEADLIGHT WITH BILED GEN 2
PORSCHE 718 CAYMAN & BOXSTER
FULL LED REAR LAMP WITH 3D HOMOGENEOUS TAIL
RANGE ROVER VELAR
THIN LENS MATRIX BEAM & LASER SPOT HEADLIGHT
VOLVO S90
LED GLARE-FREE HIGH BEAM HEADLIGHT WITH BEAMATIC® SAIL BEAM

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VOLVO S90
FULL LED REAR LAMP WITH GRAPHIC LIGHT® TECHNOLOGY
60% of accidents occurring at night on countryside could be avoided if all cars would be equipped with high end front lighting

Accident statistics - TÜV Rheinland - 2007

Glare Free high beams give an additional 1.3 seconds to react at 80 km/h

Performance Evaluation of Vehicles with Adaptive Headlamp Systems – Darmstadt University - 2013

LED stop lamps reduce by 4.5 m the breaking distance at 80 km/h

Ambient Lighting makes drivers feel safer

BMW and the Lighting Engineering Group at Ilmenau University of Technology - 2010

Performing Lighting Systems save lives
GLARE FREE HIGH BEAM

BeamAtic® PremiumLED

Glare-Free High Beam
Driving permanently in High Beam without glaring other drivers

VOLVO XC90 / S90 / V90
SAIL BEAM ADD

BMW 4-SERIES
SAIL BEAM ADD

AUDI A3
MATRIX BEAM

RANGE ROVER VELAR
MATRIX BEAM
LEDs systems are 5 times more efficient than halogen systems and 2 times more efficient than xenon systems.

Weight reduction by design optimization and development of lightweight materials.

Development of recyclable and green materials.

Continuous improvement of environmental performances with 92% certified ISO 14001 sites and implementation of ISO 50001 certification.

CO₂ reduction is not an option.
FRONT LIGHTING EVOLUTION
FRONT LIGHTING: FROM ILLUMINATING TO ROAD WRITING

2000: Spread light

2010: Provide safety

2020: Ease my drive

2025: Communicate

2030:
FRONT LIGHTING TAKE AWAY

FROM

• Spread light
• High beam / low beam
• Lighten area
• Light for driving

TO

• Sculptured beam
• Glare free and bending light
• Pixelated scene
• Light for communicating
REAR LIGHTING EVOLUTION
REAR LIGHTING: FROM SIGNALING TO COMMUNICATION

- **See me**
  - 2000: See me (homogeneous)

- **Welcome me (animated 3D)**
  - 2010: Welcome me (animated 3D)

- **Display to the rear**
  - 2020: Display to the rear

- **Project to the rear**
  - 2025: Project to the rear
  - 2030
REAR LIGHTING TAKE AWAY

FROM

• Light to be seen
• Static lighting
• “You see me”
• My place (displayed light)

TO

• Light to be stylish
• Dynamic lighting (welcome scenario)
• “I see you and communicate to you”
• Your place (projected light)
INTERIOR LIGHTING EVOLUTION
INTERIOR LIGHTING: FROM AMBIENCE TO HOME PLACE

- **2000**: Light when entering
- **2010**: Ambient light
- **2020**: Light for value added tasks
- **2025**: Connected light to in & out vision
- **2030**: Light for my mobile home
## INTERIOR LIGHTING TAKE AWAY

**FROM**
- Light to enter the vehicle
- Light to see in the vehicle
- Light for all
- Light for the interior only

**TO**
- Light to live in the vehicle
- Light to work, light to relax
- Light for each and very one
- Light connected to outside scene
DISRUPTION IS ON ITS WAY…. 

AUTOMATED & CONNECTED

MOBILITY & DIGITAL

ELECTRIFICATION

…AND VALEO WILL BE A PART OF IT