

V O L V O

Freedom to move
in a personal, sustainable and safe way.



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Lighting and sustainability



What are the stakes for OEM ?

- Sustainability is one of the main stakes for the coming years
- OEM are facing some new challenges in Europe from 2020
 - New WLTP homologation cycle
 - **95gCO₂ / car** threshold, with **100€ penalty / car /gCO₂** above the threshold.
 - WLTP cycle : only daytime mode (Daytime running light)
 - Possibility to have Eco-Bonus 1gCO₂ / car if Low beam consumption < 30W (Eco-innovation)
 - In discussion for 2025 WLTP cycle : inc. Night time
- Development of BEV, PH-EV .. To reduce CO₂ consumption

The screenshot shows a report from JATO Dynamics France, dated 3 days ago. The main chart is a 'CO2 Penalty-Profit ratio' table. The table lists various OEMs and their performance metrics in 2018. The 'Penalty as % of profits' column is color-coded: orange for 75% (Volkswagen), red for 158% (PSA), yellow for 81% (Renault), orange for 53% (BMW), red for 118% (Hyundai), orange for 82% (Ford), yellow for 76% (FCA), yellow for 46% (Daimler), green for 2% (Toyota), and green for 18% (Nissan).

	Regs. in Europe 2018 (000)	Global Net Profits 2018 (billion euro)	European regs share out of global	Penalty** (billion euro)	Penalty as % of profits
VOLKSWAGEN	3,638	12.15	38%	9.07	75%
PSA	2,457	2.83	84%	4.48	158%
GRUPE RENAULT	1,615	3.45	59%	2.79	81%
BMW GROUP	1,018	5.82	42%	3.11	53%
HYUNDAI	1,011	2.19	15%	2.58	118%
Ford	992	3.29	25%	2.71	82%
FCA	961	3.63	26%	2.77	76%
DAIMLER	941	7.58	44%	3.52	46%
TOYOTA	733	20.08*	8%	0.44	2%
NISSAN MOTOR COMPANY	630	6.01*	12%	1.07	18%

Extract of JATO analysis in 2018 about penalty simulation

Relation between CO2, Watt and autonomy











- Internal combustion Engine (ICE)
 - 1gCO2 ~ 50W power consumption
- PHEV (Hybrid)
 - Battery size ~10-15 KWh
- BEV (full electrical vehicle)
 - Battery size ~ 50-80 KWh

Example of optical systems currently used in automotive lighting

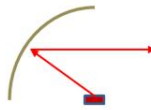
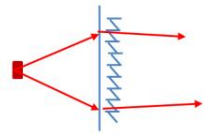

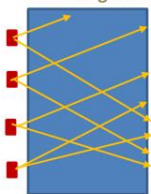
- Extract from “The wonderful story of lighting” - DVN


Optical systems for LEDs signaling

– Targets: Style flexibility with numerous aspect possibilities

				
Single dot	Multi-dot	Linear	Surface	Volumic
				

– Thanks to many possible optical systems

Reflector direct	Direct through Fresnel lens	Linear light guide	Surface guide
			


 Driving Vision News.com
Automotive lighting and driver assistance technologies

Daytime running light



Bulb	LED reflector	LED light guide / multi screen
<p>50 W / car</p> <p>1g CO2</p> <p>0,5% of PHEV battery autonomy</p> <p>0,1% of BEV battery autonomy</p>	<p>10 W car</p> <p>Optical efficiency ~ 50%</p> <p>0,2gCO2</p> <p>0,1% of PHEV battery autonomy</p> <p>0,0x% of BEV battery autonomy</p>	<p>30W – 60W</p> <p>Optical efficiency ~ 10%</p> <p>0,6-1,2gCO2</p> <p>0,3-0,6% of PHEV battery autonomy</p>

Low beam (night mode)



Height 100mm – light source ~ 1500 lm



Height 60mm –
light source ~ 1000-1500lm
Renault Captur 2020



Height 20mm – 40mm
light source ~ 2000-3000 lm
Volvo S90

Bulb	LED system - Entry	LED system – Premium
<p>150 W / car</p> <p>3g CO2</p> <p>1,5% of PHEV battery autonomy</p>	<p>30 W / car</p> <p>Optical efficiency ~ 40-50%</p> <p>0,6gCO2</p> <p>0,3% of PHEV battery autonomy</p>	<p>60W – 120W / car</p> <p>Optical efficiency ~ 20-30%</p> <p>1,2-2,4gCO2</p> <p>0,6-1,2% of PHEV battery autonomy</p>

Opportunities for photonic community

- Very High importance of power consumption
- Volvo strategy to have slim headlamp, very homogeneous lighting signature, and high performance to see and to be seen
- Low efficiency {lm / W ; €/W} of current optical systems
- To participate to the Volvo strategy

Innovation for new optical concept / New electrical HW / SW to drive LED system

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Thank you !

