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Faculdade
de Ciências
da Universidade
de Lisboa

DISCIPLINA MIEA 2018

Mobilidade Sustentável

Energy and emissions

Home ⟷ Work/ University

on a regular basis

Commuting by motorized or soft modes

Emissions

Energy

Autonomous....

Autonomous driving

Inter-terminal Gatwick airport 2008

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Autonomous driving

[Barcelona Metro line 9](#) without train driver 2009

Autonomous driving

Heathrow Personal Rapid Transit system 2011

18 low-energy, driverless vehicles can each carry four passengers and their luggage. (Ultra PRT | www.ultraprt.com.)

Autonomous driving

- **Autonomous vehicles**

Washinton D.C. 2016

Autonomous driving

https://www.youtube.com/watch?v=TsaES--OTzM

Autonomous driving

Elon Musk - engenheiro, inventor, investidor, magnata de negócios…

. Aos 12 anos – vendeu 1º jogo computador *Blastar* por 500 $USD

PayPal   SPACEX Space Exploration Technologies   TESLA

Em 2010 - Tesla Roadster : 1º VE de produção a usar células de bateria de lítio-íon e com autonomia de **320 km com 1 só carga**.

2012 – Tesla Model S - Modelo **P85 D**

. Binário : **960 Nm** ; Vel. Máx : **250 km/h**

. Potência : **700 cv** ; 0 -100 km/h **: 3,1 seg**

. Autonomia : **480 km** !!!

. Montra Tecnológica

. > 50.000 Un. vendidas até final 2015 e compra-se pela Internet… !?

https://www.youtube.com/watch?v=AiOxUcDgsa8

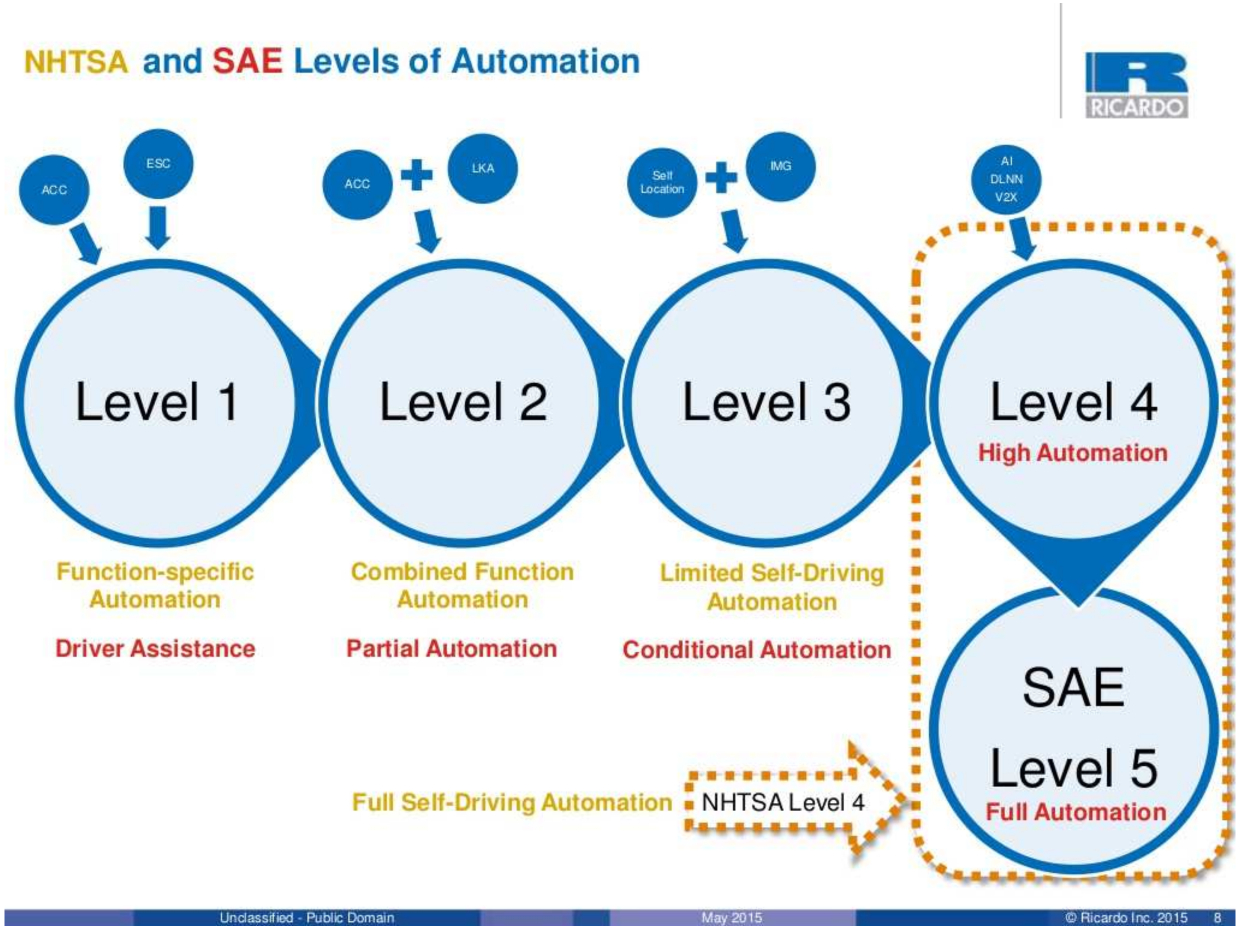
Autonomous driving

https://www.youtube.com/watch?v=XZxZC0lgOlc

Autonomous vehicle classifications

Levels of automation

- National Highway Traffic Safety administration;
- Society of Automotive Engineers.



Autonomous vehicle classifications

National Highway Traffic Safety Administration (NHTSA) automated vehicle classifications:

Level 0: The driver completely controls the vehicle at all times.
Level 1: Individual vehicle controls are automated, such as electronic stability control or automatic braking.
Level 2: At least two controls can be automated in unison, such as adaptive cruise control in combination with lane keeping.
Level 3: The driver can fully cede control of all safety-critical functions in certain conditions. The car senses when conditions require the driver to retake control and provides a "sufficiently comfortable transition time" for the driver to do so.
Level 4: The vehicle performs all safety-critical functions for the entire trip, with the driver not expected to control the vehicle at any time. As this vehicle would control all functions from start to stop, including all parking functions, it could include unoccupied cars

Autonomous vehicle classifications

Society of Automotive Engineers (SAE) automated vehicle classifications:

Level 0: Automated system has no vehicle control, but may issue warnings.
Level 1: Driver must be ready to take control at any time. Automated system may include features such as Adaptive Cruise Control (ACC), Parking Assistance with automated steering, and Lane Keeping Assistance (LKA) Type II in any combination.
Level 2: The driver is obliged to detect objects and events and respond if the automated system fails to respond properly. The automated system executes accelerating, braking, and steering. The automated system can deactivate immediately upon takeover by the driver.
Level 3: Within known, limited environments (such as freeways), the driver can safely turn their attention away from driving tasks.
Level 4: The automated system can control the vehicle in all but a few environments such as severe weather. The driver must enable the automated system only when it is safe to do so. When enabled, driver attention is not required.
Level 5: Other than setting the destination and starting the system, no human intervention is required. The automatic system can drive to any location where it is legal to drive.

Autonomous and sustainability

Conclusion

Why AVs are coming

- Mega-cities population growth
- Increased need for on-demand mobility
- Millennials and post-millennials are not that into cars to
- Increased demand for safety and energy efficiency
- AV will have a significant positive impact on the lives of the elderly and disabled
- Gain in individual productivity while not driving
- Technology readiness

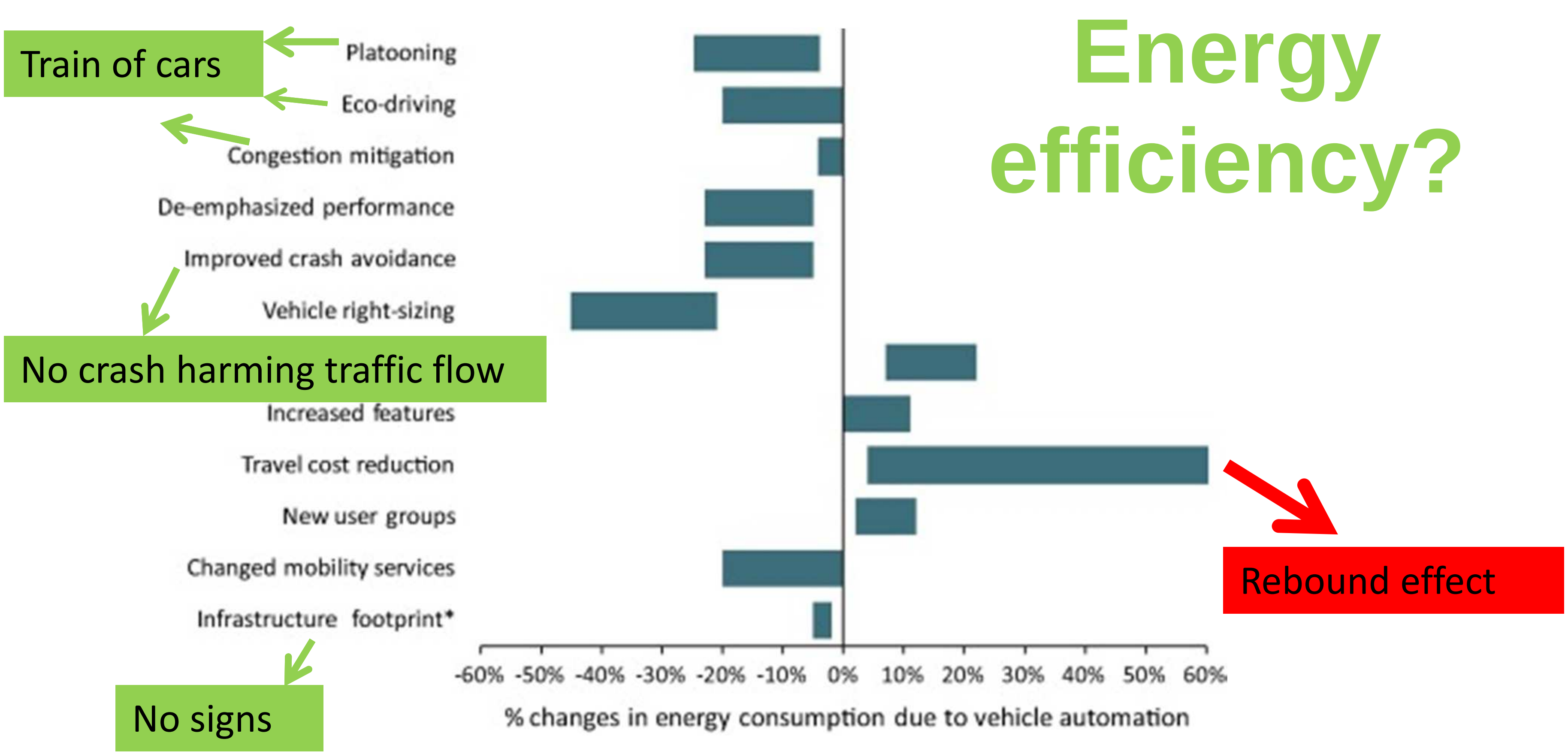
Sea change in our industry

- U.S. auto sales may drop about 40 percent in the next 25 years
- The low and mid range conventional vehicles may disappear
- The largest contribution to the value chain will come from advanced electronics and algorithms

Unclassified - Public Domain May 2015 © Ricardo Inc. 2015 35

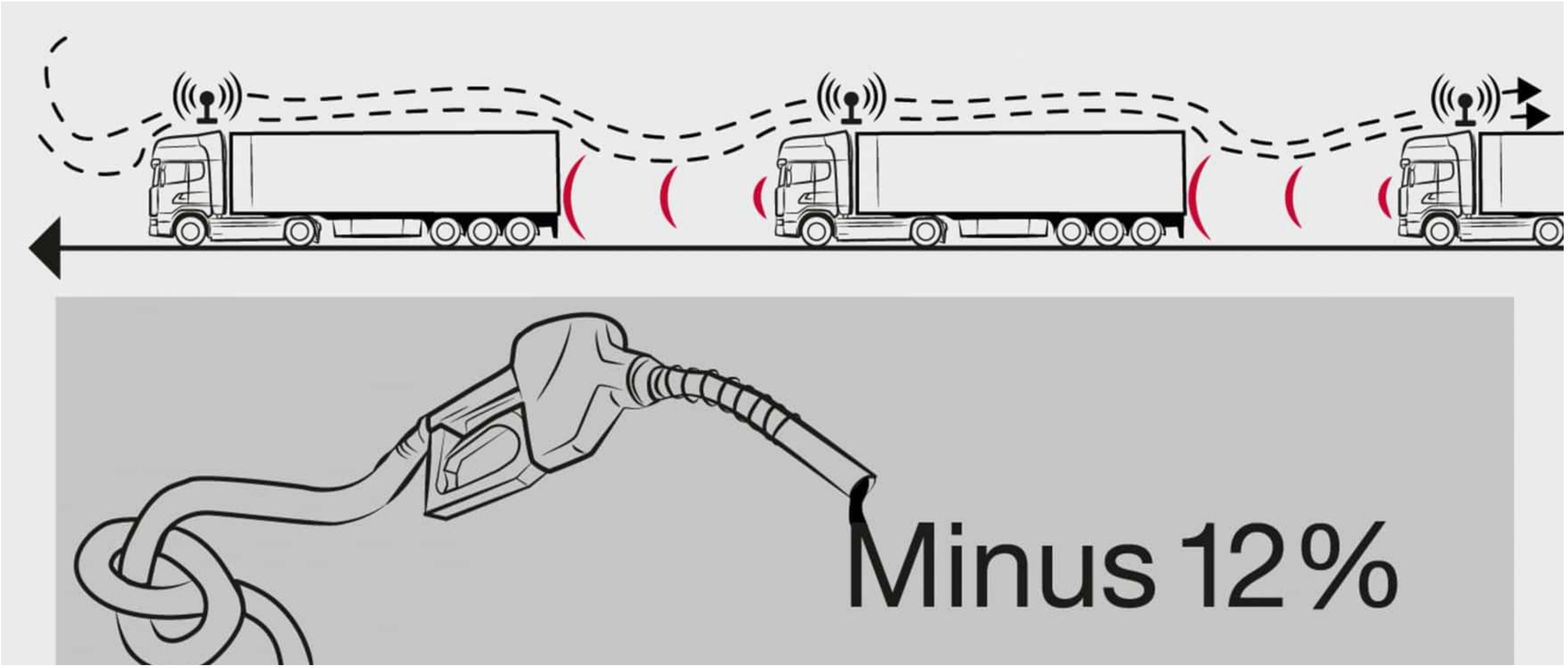
Sustainable Mobility

Self-driving cars and energy consumption



@ Help or hindrance? The travel, energy and carbon impact of highly automated vehicles Article · Apr 2016 · Transportation Research Part A Policy and Practice

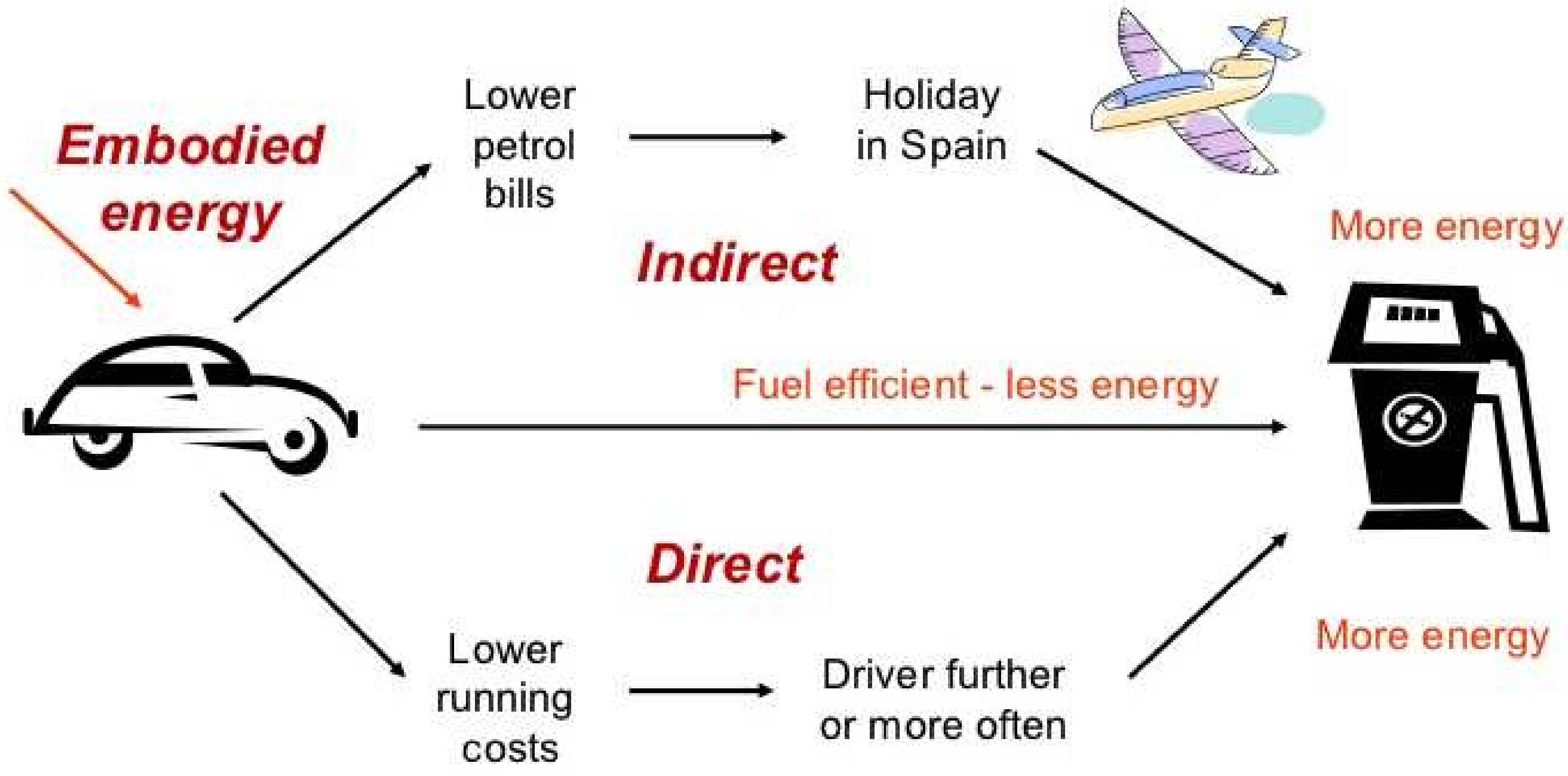
Transport.....energy



@ https://www.scania.com/group/en/platooning-saves-up-to-12-percent-fuel/

Transport…..energy

The rebound effect in plain terms is the misconception that using energy-efficient technology significantly cuts energy consumption and greenhouse gas emissions



You learned....

- Autonomous driving effect on final energy consumption;
- Arduino and sensors for autonomous electric car.

Obrigado

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