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CHANGING WHAT'S POSSIBLE

NEXTCAR

Next-Generation Energy Technologies for Connected and Automated Road Vehicles

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Program Director

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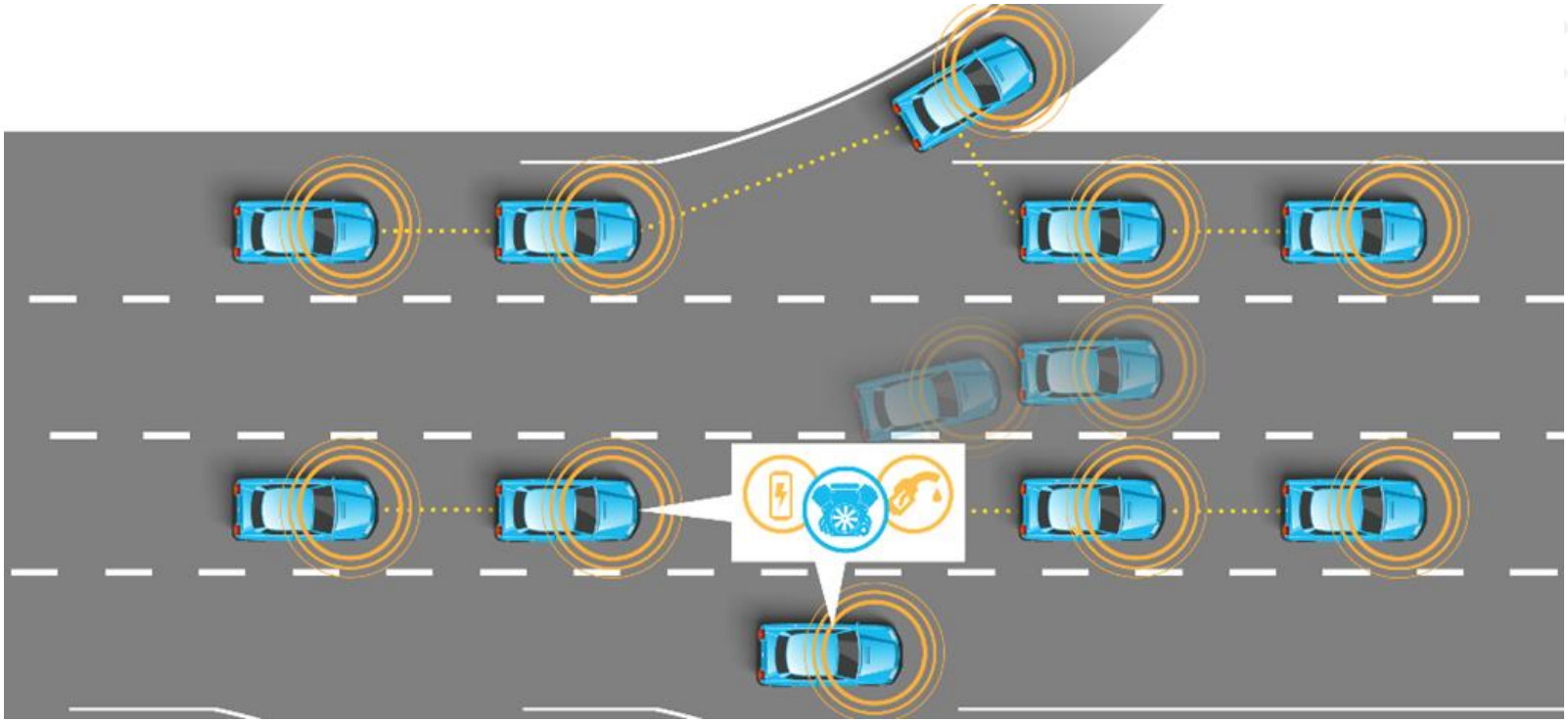
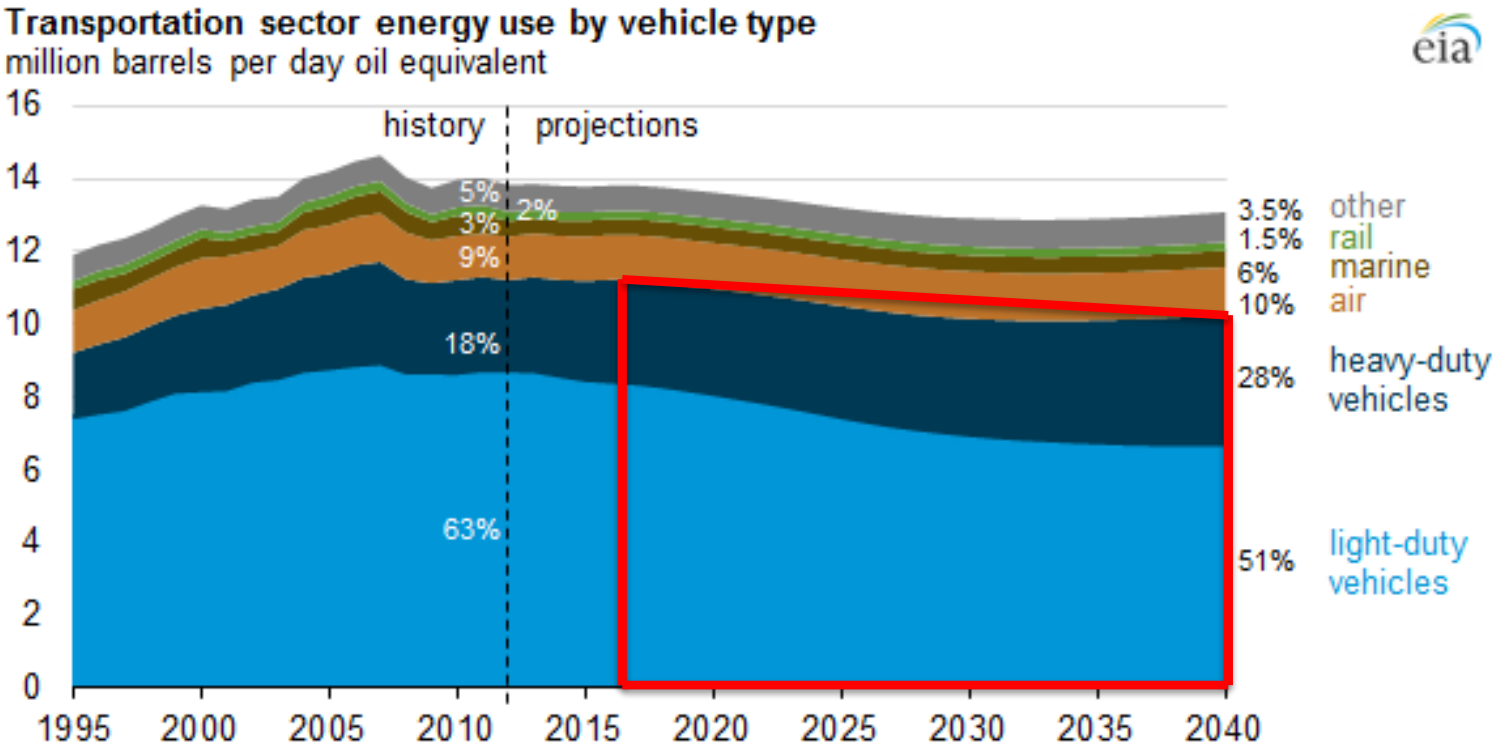
A new program to improve the energy efficiency of the future vehicle fleet



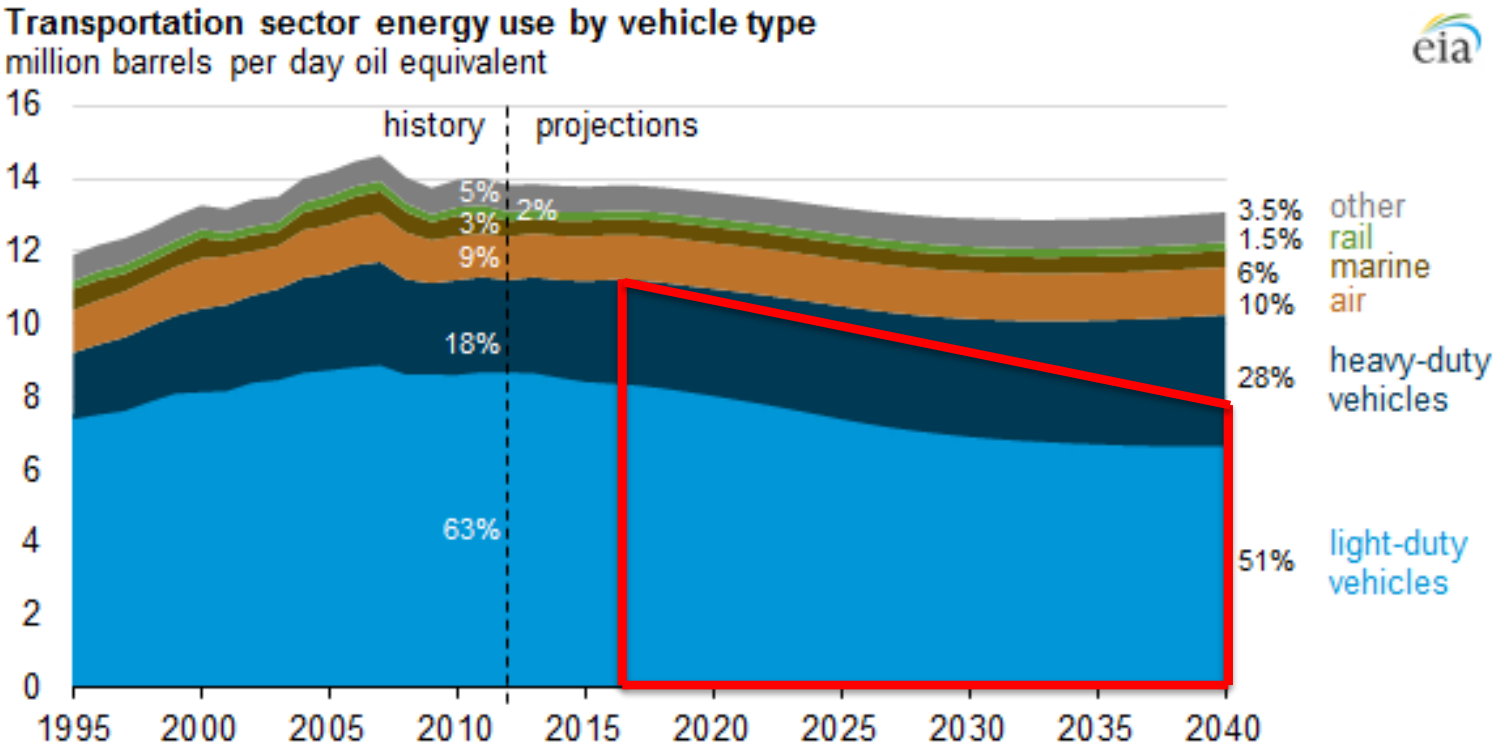
by bringing together experts in powertrains, vehicle dynamics, controls and optimization, and transportation systems.

The Energy Opportunity



Heavy-duty and light-duty vehicles consume **~11 million barrels per day** oil equivalent, totaling **81%** of transportation sector energy consumption, or **~23%** of the US primary energy usage.

The Energy Opportunity

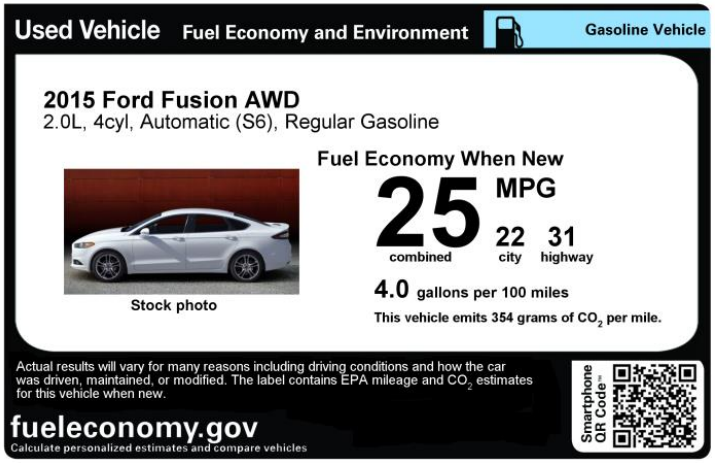


A **20% reduction** in the energy consumption of the entire vehicle fleet would save **4.4 quads** of primary energy and **0.3 GT** of CO_2 per year.

3 Trends in Automotive Transportation

Trend 1 – Fuel Economy

- Future **fuel economy** of the light-duty vehicle fleet will be required to be significantly higher than today (54.5 mpg CAFE by 2025).

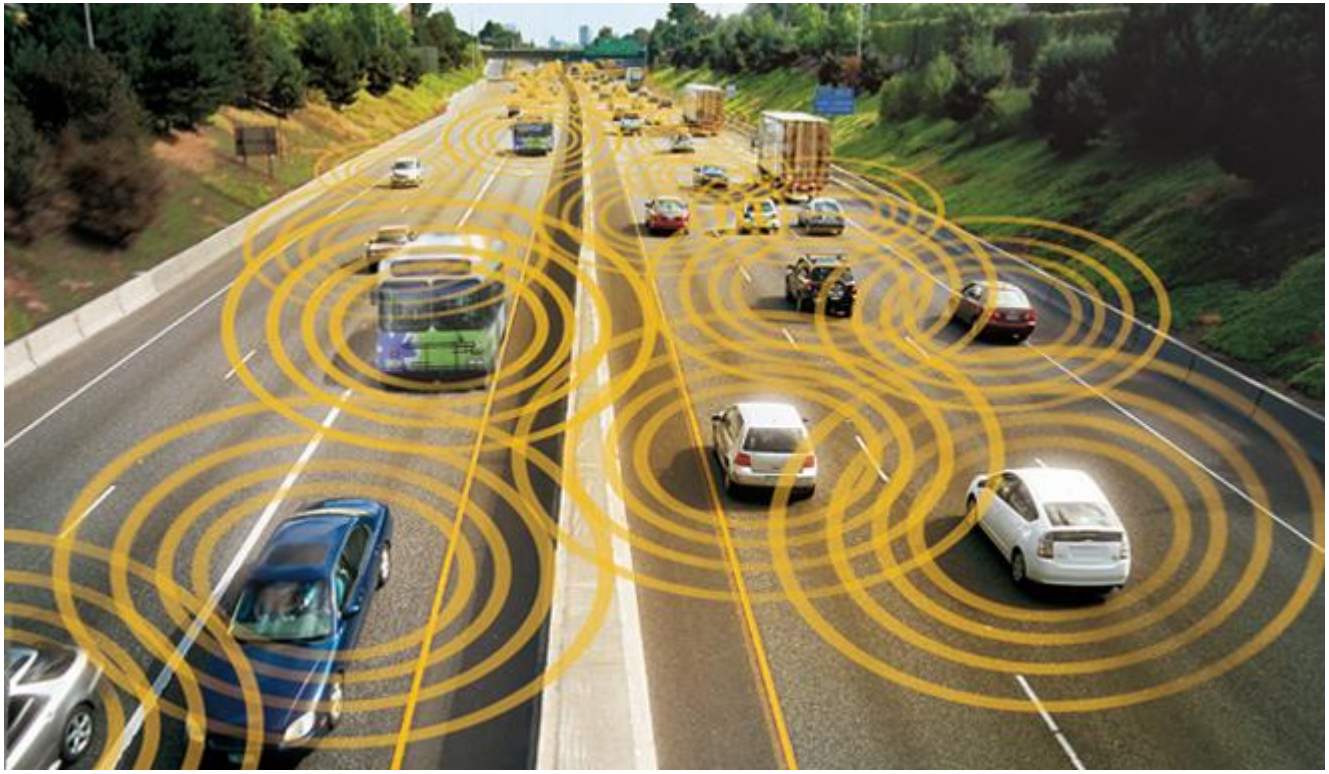


- Heavy-duty fuel economy regulated by EPA/NHTSA Phase 2 GHG rules.

Will be achieved by vehicle light-weighting, reducing aerodynamic and rolling losses, engine downsizing, boosting, improved transmissions, increased electrification, hybridization, waste energy recovery, and reductions in friction and parasitic losses.

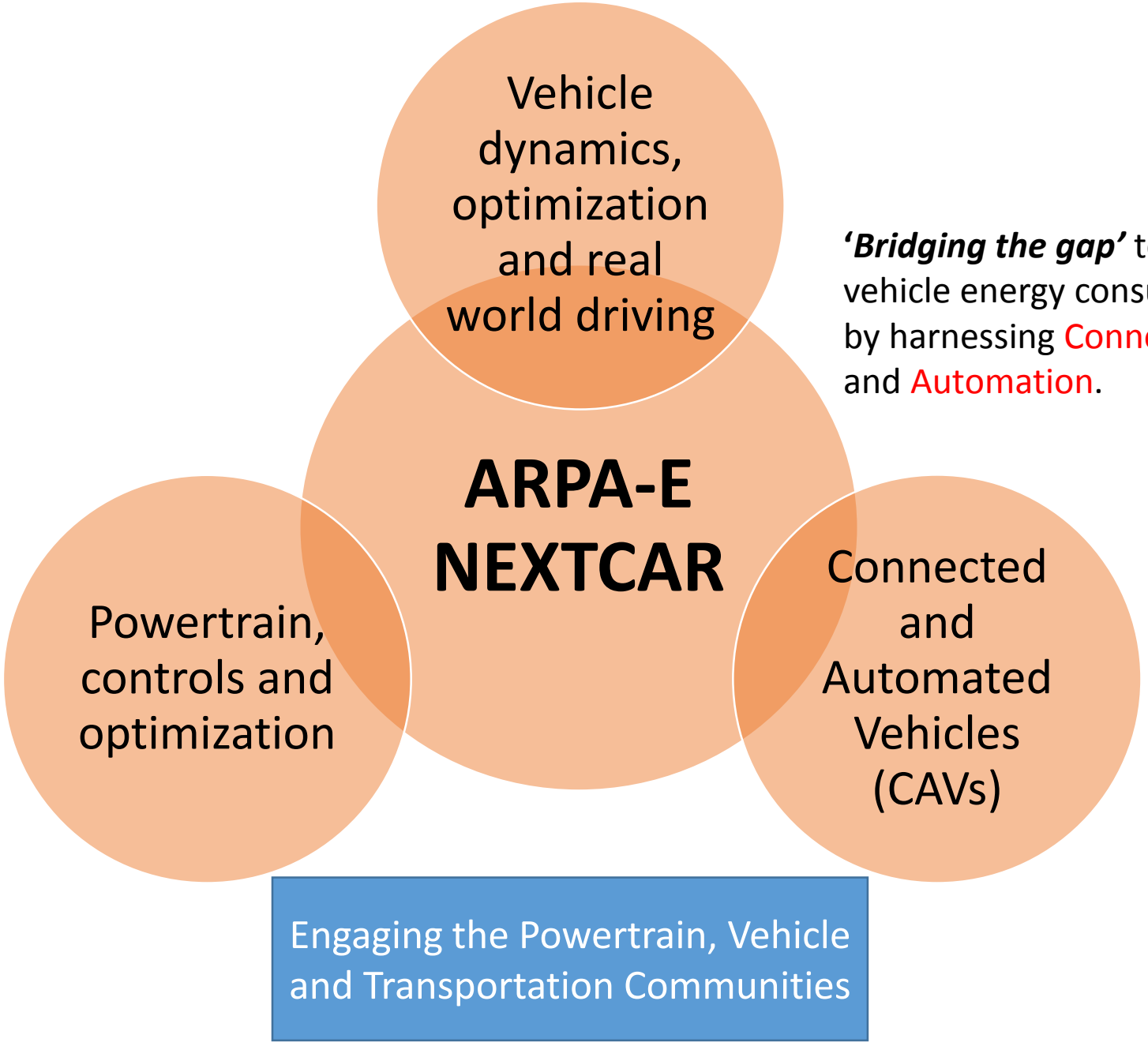
Trend 2 – Connectivity

- Future vehicles will utilize greater levels of **connectivity** – V2V, V2I, V2X – this trend is driven primarily by road traffic **safety** considerations.



Trend 3 – Automation

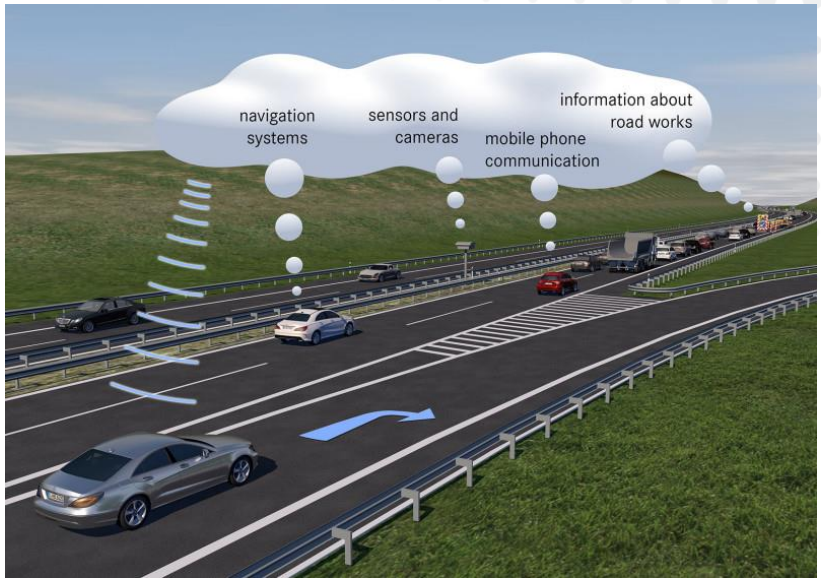
- Future vehicles will display greater levels of **automation** – from advanced driver assistance systems (ADAS) to L3 automation (automated operation with a driver present) and L4 (full automation – no driver required).



'Bridging the gap' to reduce vehicle energy consumption by harnessing Connectivity and Automation.

ARPA-E's Vision

- What if a vehicle had perfect information about
  - Its route and topography
  - Environmental conditions
  - Traffic conditions ahead
  - Traffic behavior
  - Condition of its powertrain and aftertreatment systems (if any)
  - The quality of its fuel
  - ……and everything else?



Source: Daimler

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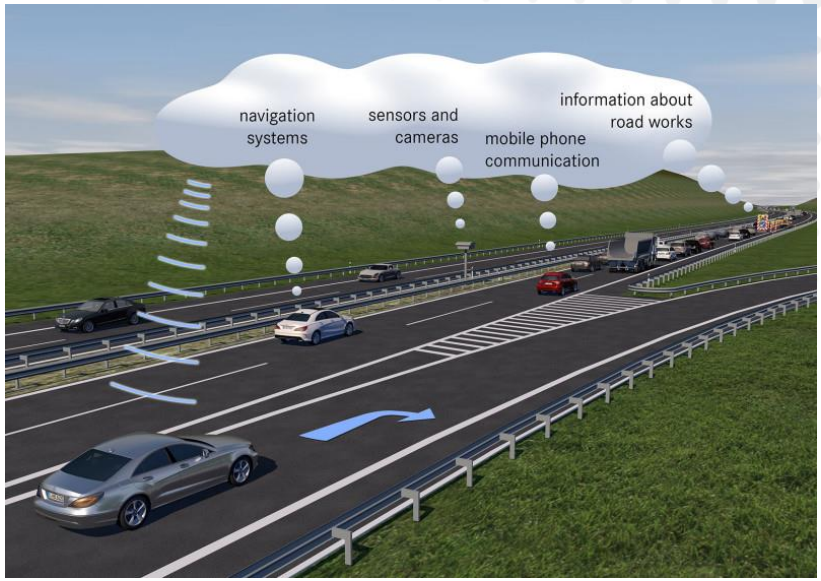
  - ……and everything else?
- And it cooperates with all the vehicles around it in order to reduce its energy consumption
- With perfect control and optimization



Source: Daimler

→ while platooning, employing speed harmonization for congestion mitigation, eco-approach and departure from traffic signals, as well as a single vehicle driving alone, and all other real-world driving scenarios….

Program Goal

Reduce the energy consumption of all future vehicles by an **additional 20%** through the use of connectivity and automation,

- in any vehicle application,
- in an energy and fuel agnostic fashion,
- while meeting future exhaust emissions regulations, as well as customer acceptability requirements (including acceleration, range, utility, driveability etc.),

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with a **$50/% energy consumption reduction** target.

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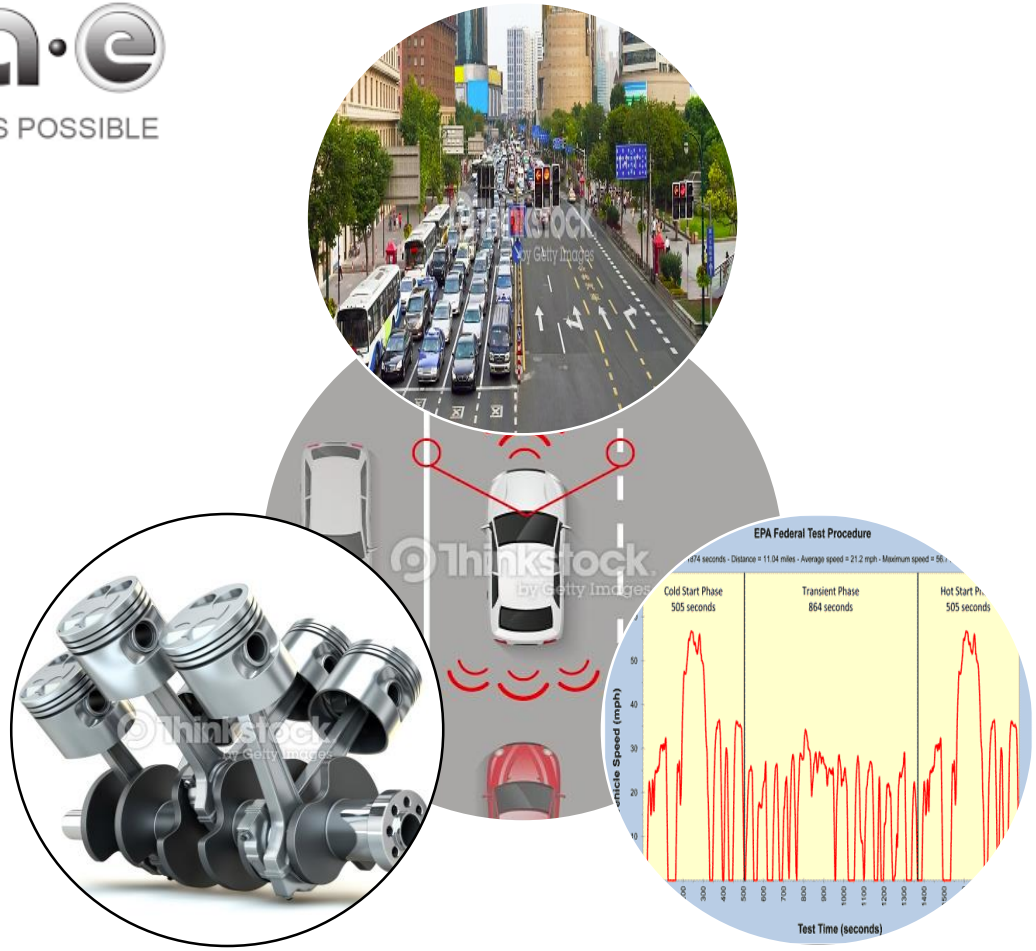

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