5GAA POSITION PAPER
Environmental benefits of CCAM

The new European Commission recently outlined its political priorities, based on two fundamental and complementary pillars: environmental protection through the **European Green Deal**, and the digitalisation of Europe. Transport still represents around 25% of Europe's total CO_2 emissions. Road-based travel is responsible for the largest share of these emissions, which are expected[1] to double by 2050. Therefore, decisive actions need to be taken by policymakers and stakeholders to ensure that the objective laid out by the European Union[2] of **cutting greenhouse gas emission** by more than 80% in 2050 compared to 1990's level is met.

5G technology enables a fully connected and automated mobility which begins with the availability of the LTE-V2X technology today. Vehicles and infrastructure are able to exchange relevant information via LTE-V2X either through direct short-range communication, which does not require network coverage, or long-range communication via the network, creating **a real-time connection between all actors of road mobility**. The upcoming 5G revolution will reinforce those interactions and spark a whole new set of services, dramatically changing the mobility landscape.

Cooperative, Connected and Automated Mobility (CCAM) will be a cornerstone to improve road transport's environmental footprint. This positive impact is expected to result from a host of sources, e.g. a reduction of congestion, thus of fuel consumption, the increase of shared mobility as well as potential synergies with the development of clean mobility.

A connected environment for streamlined road mobility (LTE-V2X)

In a globally connected environment, **mobility options will be easier to access** (e.g. pre-trip information and en-route information will influence mode choices and departure time as well as the rout and specific vehicle movements). Hence, vehicles will be easily shared, and mobility options will abound for users. **Travel will be more efficient and reduce congestion** and therefore fuel consumption, energy use, leading to a decrease of CO_2 emissions.

- Travel planning, mode choices, as well as the simplification of shared demand-responsive mobility (i.e. mobility as a service or MaaS) will be enabled via seamless and ubiquitous long-range communication. In short, interaction through improved connectivity with other transportation services, as public transport, or transportation modes, as Rail and Air Transport, will lead to **more efficient "door-to-door" journeys**, reducing overall vehicle travel.
- Connected Intelligent Transport System (C-ITS) will gather data from the smart road infrastructure and other vehicles en-route via both long and short range (LTE-V2X) communication **to optimise driving itineraries and related services**, such as parking availability.
- LTE-V2X will also enable further **traffic efficiency services** e.g. via "Vehicle Speed Harmonisation"[3] or coordination between the infrastructure to ensure the efficient flow of vehicles (as through "Continuous Traffic Flow via Green Lights Coordination").
- Connectivity will also allow for **real-time sharing of information** between road traffic authorities and drivers, leading to the possibility to enforce certain restrictions on speed limits in case of emission peaks, for instance ("Vehicle emissions-based speed control").

[1] https://www.ipcc.ch/report/ar5/wg3/
[2] https://ec.europa.eu/clima/citizens/eu_en
[3] https://5gaa.org/wp-content/uploads/2019/07/5GAA_191906_WP_CV2X_UCs_v1.pdf

- In addition to better traffic management, C-ITS safety services (Day 1/1.5) will also improve road safety, thus **reducing collisions and the related non-recurring congestion**.

Projects like **EcoMove** have evaluated applications for eco-driving, fleet and traffic management and estimated that they can deliver overall more than 10% fuel savings and CO_2 emissions reduction in urban networks.[4] Whereas C-ITS safety services' benefits will occur first in urban environments where congestion and traffic efficiency offer the most significant potential for improvement, in a longer time frame, **5G-V2X allows the deployment of new mobility services targeted at highways and the secondary road network**.

Automated mobility to reach environmental challenges (5G-V2X)

Fully automated mobility requires vehicles not only to see their surroundings but also to talk with and listen to other traffic actors. For embedded autonomous systems to make real-time decisions in traffic, new applications are required e.g. sensor-sharing or trajectory alignment between vehicles. 5G roll-out and the introduction of enhanced direct communication via 5G-V2X sidelink will provide the necessary connectivity step-up, both in terms of scope, reliability and speed of data exchanges among the entire mobility ecosystem. **Reaching higher level of automation (4 and above[5]) will reshape cities and urban mobility.** Overall, benefits are maximized when combining shared mobility and vehicle automation:

- Removing drivers from cars, generalising on-demand mobility, creates a tremendous potential to address greenhouse gas emissions. **The 1.2 billion cars worldwide currently sit idle for 95 % of the time**.[6] Studies have shown that in case of total removal and replacement of the cars and buses by automated vehicles, the CO2 emissions would decrease by more than 83%.[7]
- Moreover, 5G-V2X may enable **high-added-value services**, e.g. "Vehicle Platooning" or "Vehicle Group Start" at intersections, coordinating speed and driving behaviour to reduce overall emissions. However, some challenges remain before such services hit the road as the business case and real-life benefits have been recently downgraded by tests conducted by Daimler.[8]
- The digitalisation of vehicles and the automation of mobility will also lead to a **reduction of the required infrastructure** (e.g. traffic signs and signals), its maintenance and related emissions.[9]

All the benefits listed above are, however, **conditioned to a high penetration rate** of the Cooperative Connected and Automated Mobility (CCAM) as connected vehicles must reach a critical mass for these services to have a significant impact.

Connectivity can also support **the uptake of clean mobility**, by overcoming certain challenges which prevents the deployment of EVs with services as onboard energy management strategies, optimised route selection, data exchange for the charging infrastructure availability but also by enabling more efficient grid management and distributed renewable energy generation.[10] The **combination of both trends, CCAM and clean mobility**, will allow the reduction of road transport emissions to reach the COP21[11] targets for 2050. A such, Europe's regulatory framework needs to foster the development of CCAM to ensure Europe's competitiveness with other leading regions.

[4] http://www.ecomove-project.eu
[5] https://www.sae.org/standards/content/j3016_201806/
[6] The High Cost of Free Parking, Donald Shoup
[7] https://www.sipotra.it/old/wp-content/uploads/2018/12/The-path-towards-digitalisation-in-road-infrastructure.pdf
[8] https://media.daimler.com/marsMediaSite/en/instance/ko/Daimler-Trucks-invests-half-a-billion-Euros-in-highly-automated-trucks.xhtml?oid=42188247
[9] https://www.sipotra.it/old/wp-content/uploads/2018/12/The-path-towards-digitalisation-in-road-infrastructure.pdf
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[11] https://ec.europa.eu/clima/policies/international/negotiations/paris_en