



Energy Usage and Green Public Transportation in
Future Smart Cities: An Innovative Teaching Program
for Students, Stakeholders and Entrepreneurs
n° 2020-1-TR01-KA203-094242



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Detail info about Module 4

Module-4

“Green Vehicles and Green Public Transportation Network Design”



In this module, we focus on current public transportation technologies, air pollution problems caused by the vehicles used in current public transportation (Examples from European cities), alternative green transportation technologies, information systems, and efficient tools in green public transportation network planning of future smart cities.

Recently, there is increasing migration to urban areas because of social and economic conditions. Thus, the populations of the cities increase every year and hence people need more transportation means in addition to private car usage. More vehicles in the traffic will cause more pollution due to **CO2 emissions**. CO2 emissions and air pollution from all sectors are the major environmental concerns [1]. CO2 emissions by sector in the EU are given in Figure 1. The transportation sector, as seen in Figure 1, has the second biggest share considering CO2 emissions. Therefore, the transport sector plays a critical role in ensuring environmentally friendly and sustainable economic growth for Europe.

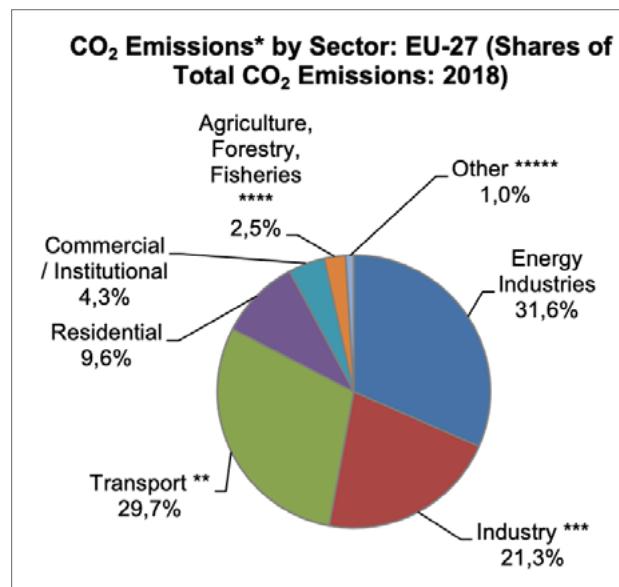


Figure 1. CO2 Emissions by Sector: EU [2].



When the transportation sector is focused, it is realized that the road transportation causes the highest CO₂ emissions in EU (see Figure 2).

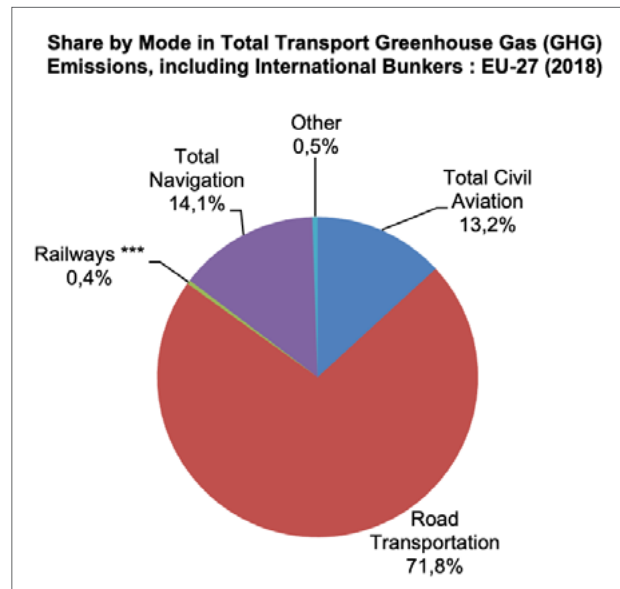


Figure 2. Total Transport Greenhouse Gas Emissions in the EU [2].

Hence, we discuss the air pollution problems and possible solution actions in our module. Increasing pollution caused by the transportation sector due to CO₂ emissions raises the importance of green vehicles used all over the world. A green transportation vehicle (or clean vehicle) is a road motor vehicle that produces less harmful impacts to the environment than the equivalent conventional internal combustion engine vehicles that run on gasoline or diesel [5]. Green vehicles include various low-pollution vehicles, such as a dual-energy vehicle, natural gas vehicles, electric vehicles, hydrogen power vehicles and solar energy vehicles [3].

The majority of traditional transportation methods are no longer adequate for creating and maintaining sustainable road and transportation systems. Therefore, better utilization of existing infrastructures and seamless information and communication technology integration with green transportation systems are required for the development of a sustainable, intelligent transportation system.

There are updates and improvements in public transportation systems due to the development in information technology. However, because of the various disturbances and uncertainties such as extreme weather, unstable demand of passengers, traffic conditions, and environmental problems, it is a challenge for municipalities and private companies to manage, control, and schedule public transportation systems. As a solution, Intelligent Transportation Systems (ITS) can be defined as a controlled system that uses sophisticated road and telecommunication infrastructure to communicate between vehicles and the highway to improve the safety, vehicle and road efficiency, as well as adequately manage traffic flow within the road network [4].



Throughout the module, there are 8 lecture hours and different topics related to green vehicles and green public transportation network design which are discussed in detail at each hour. The first hour is a review of current public transportation technologies. In the second hour, air pollution problems caused by the vehicles used in the current public transportation are discussed and air pollution in three different European cities is analyzed according to air pollution and public transportation data. Then, different green public vehicles to be used in future smart cities are introduced, and the current status of green public vehicles in European cities is evaluated by considering a report published by the European Automobile Manufacturers' Association (ACEA) and European Alternative Fuels Observatory (EAFO).

In the scope of the 2030 Agenda for sustainable development by the United Nations, 17 Sustainable Development Goals (SDGs) are specified and these are an urgent call for action by all countries [7]. It is important to take action about green and sustainable transportation. Several countries made a research on the consistency between existing transportation services and SDGs. Therefore, the fourth hour explains the integration of green and intelligent public vehicles into future public transportation technologies within the scope of SDGs. Please see Figure 3 for different SDGs in connection with transport.

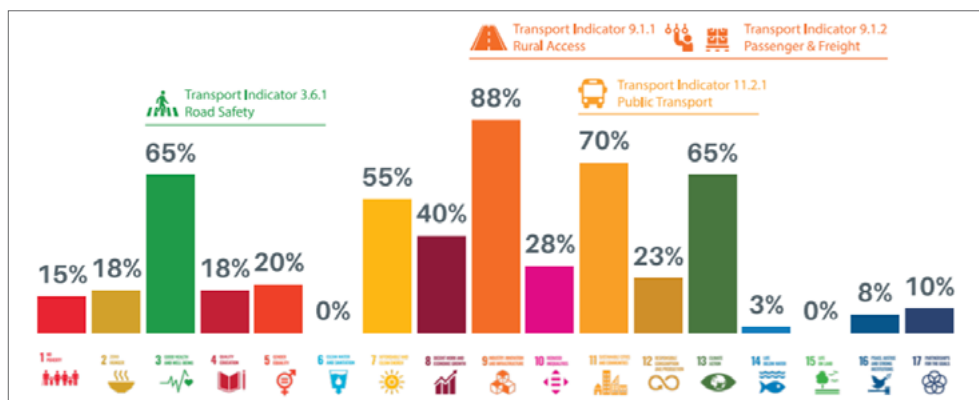


Figure 3. Different SDGs connect with transport [6].

Next, team-based word limit game related to green vehicles and green public transportation is organized to increase the awareness and engagement between participants. In addition, a green transportation map game which includes the public transportation map of two European cities will be played. Participants in this game aim to provide possible solutions not only for greener public transportation options in those cities but also solutions to decrease traffic congestion and private car usage.

Furthermore, we focus on different information systems and efficient transportation methods and tools in public transportation network planning such as fleet and real-time management, passenger information systems, real-time vehicle monitoring, and autonomous vehicle public transportation systems in the following lecture hour.

Finally, in the seventh and eighth hours, a business canvas model is developed together with participants. The learners are divided into teams to discuss different problems related to public transportation. Next, using the information that they have learned up to lecture hour 7, those teams are expected to offer creative ideas to make public transportation greener.



Zafer Yılmaz

Dr. Zafer Yılmaz received his PhD degree from the Turkish Military Academy Defense Sciences Institute, Department of Supply and Logistics Management. He worked at Turkish Land Forces as a Project Director and Instructor. Before joining TED University, he was a post-doctoral researcher at McGill University for 1.5 years. His interests include Operations Management, Management Science, Supply Chain Management, Inventory Management, Network Analysis, Modelling, and Simulation. His current research focuses on the Comparison of Transport Modes in Terms of Energy Consumption and he published book chapters in the books: "Intelligent Transportation and Planning", "Engineering Tools and Solutions for Sustainable Transportation Planning", and "Using Decision Support Systems for Transportation Planning Efficiency". He also has researched about Hazardous Materials Transportation and Disaster Logistics.



Gizem Çelik

Gizem Çelik graduated from Middle East Technical University, Department of Business Administration. In 2021, she received her MS degree from İstanbul Technical University, Business Administration Department. She continues her PhD studies in Business Administration Graduate Program at Hacettepe University. She has been working as a Research and Teaching Assistant at TED University since February 2019. Her research interests are green vehicles, green public transportation, and vehicle routing.





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