SEEJSD

SOUTH EAST EUROPEAN JOURNAL OF SUSTAINABLE DEVELOPMENT

Vol.9 (2/2025)

Publisher: Mother Teresa University in Skopje, Republic of North Macedonia

South East European Journal of Sustainable Development

Editor:
Bekim Fetaji, PhD
Editor in Chief:
Zoran Gacovski, PhD

ISSN (print) 2545-4463
ISSN (online) 2545-4471
is published three times per year.
Account No. 160016267778815

723019 - 45
Tax No. 4080016561272

Bank: Narodna Banka RM

Technical Editing/Layout: Korab Ballanca
Editorial Office: South East European Journal of Sustainable Development

Mother Teresa University in Skopje,
Republic of North Macedonia
Mirce Acev 4, VII floor, Skopje, North Macedonia

Phone: +389 2 3161 004

E-mail: seejsd@unt.edu.mk
Web: www.seejsd.unt.edu.mk

The publication of the Journal is supported by:

Ministry of Culture of Republic of North Macedonia

Editorial Foreword

Prof.Dr. Bekim Fetaji

Editor

ACKNOWLEDGEMENT

Welcome to the new Issue of the SEEJSD Journal with ISSN: 2545-4471. The topics covered by this Issue are related to the current trends of research, original research that uncovers sustainable development.

SEEJSD Journal as an international journal that effectively provides a forum for academics, professionals, graduate and undergraduate students, fellows and associates to share the latest developments and advances in knowledge and practice of Economics and Business; Information Technology and Engineering, Technics and Technology; Humanities and Social Sciences. Our interest in promoting high-quality research is clearly reflected in having an established peer reviewing process and a high-profile expert group of Associate Editors and Editorial Board Members.

Hopefully you find this Issue valuable and we definitely look forward to receiving your high-quality studies for the next issue of the Journal.

Prof. Dr. Bekim Fetaji
Editor

South-East European Journal of Sustainable Development 2025

Table of Content

12	Arbresh Raveni (UNT)	Determinants of emigrants' decision to invest in their homeland: Case study of the south-western region in North Macedonia	
13	Stevan Kjosevski, Monika Lutovska, Zoran Trifunov (UNT) Milan Dimitrievski (UKIM)	New development of car propulsion systems and market trends in the context of sustainable transport at West Balkan region	
14	Bujar Chahili, Bukurije Imeri-Jusufi (UNT)	Income Taxation in the Republic of North Macedonia	
15	Bukurie Imeri Jusufi, Bujamin Bela, Teuta Jusufi Zenku (UNT), Azir Jusufi (UT)	Interpolation and Analysis of some Economic Functions of the Enterprise "MSA Kompani" Dooel-Skopje	
16	Miki Runtev (EURM)	The Financial Policy of the Republic of North Macedonia Under Conditions of Changes Due to multiple crises, challenges for International Investment And Decision-Making	
17	Olivera Petrovska (UNT), Vesna Knights (UKLO), Zoran Trifunov (UNT), Arjeta Fazliju Turkeshi (ARDI)	Modeling and Implementation of Smart Parking System	
18	Ivan Petrov (UACS), Kire Jakimoski (UGD), Toni Janevski (UKIM), Stojan Kitanov (UNT)	Telco's Perspective View of Open RAN in 6G Networks	
19	Bekim Fetaji, Mirlinda Ebibi Majlinda Axhiu (UNT)	AI-Driven Cybersecurity Risk Assessment of Business Assets	
20	Bekim Fetaji (UNT)	The Role of Machine Learning and AI-Driven Defenses in Cyber Security Threat Mitigation	
21	Bekim Fetaji (UNT)	Investigating The Role of Artificial Intelligence in Education	
22	Mirlinda Ebibi (UNT), Majlinda Fetaji (SEEU)	A Mixed-Methods Study of Gamification's Effectiveness in Mobile-Based STEM Education	
23	Majlinda Fetaji (SEEU), Mirlinda Ebibi (UMT), Fjolla Fetaji (UKIM)	Investigating The Impact of Virtual Reality on Educational Outcomes: Potentials and Pathways	
24	Bujamin Bela, Gresa Xhemaili (UNT)	Increase efficiency of the customs procedures in the Republic of North Macedonia - A case study on the use of information and communication technology	

25	Blerta Idrizi, Elmedina Kasami, Majlinda Axhiu (UNT)	Predicting Credit Card Approvals by using Machine Learning techniques	

New development of car propulsion systems and market trends in the context of sustainable transport at West Balkan region

Stevan Kjosevski[1] †
Faculty of Technical Sciences, Mother Teresa University, Skopje, N. Macedonia,
stevan.kjosevski@unt.edu.mk

Monika Lutovska
Faculty of Technical Sciences, Mother Teresa University, Skopje, N. Macedonia, monika.lutovska@unt.edu.mk

Zoran Trifunov
Faculty of Technical Sciences, Mother Teresa University, Skopje, N. Macedonia, zoran.trifunov@unt.edu.mk

Milan Dimitrievski
Faculty of Mechanical engineering, University "Ss. Cyril and Methodius", Skopje, N. Macedonia,
PhD student
milandimitrievski@outlook.com

† Corresponding author

ABSTRACT

Transport has significant role in achieving more general sustainable development goals. This is especially a case in the regions where road transport is a dominant, as in the Western Balkan countries. Due to that, it is of permanent interest to improve this economic area into the direction of global sustainable development as a whole.
Battery electric vehicles and plug-in hybrids have notable improvements in last decade in terms of their performances and range. Their prices have been lowered and are comparable with traditionally Internal Combustion Engine (ICE) powered vehicles, as well. On the other hand, technology development of propulsion systems employing ICE and of the fuel for them resulted in more acceptable energy efficiency and emission characteristics.
The automotive area, as one of the main economic areas, is subject of policies on different levels (state, municipality, company, etc.). Decision making on each of those levels should be related to the capacities of different types of vehicles to contribute in the effort to achieve sustainable development goals.
This paper gives a view on the way the development of car technology, and market situation to the possibilities of further contribution to the sustainable transport in Western Balkan countries.

KEYWORDS
sustainable transport, car, propulsion systems, sustainability, development.

1 Introduction

UN strategy of sustainable development defines the goals that the international community should achieve in foreseeable future, [1]. Transport, as one of the main economic areas, has a responsibility to transform itself, and contribute to a number of sustainable development goals. In that context, road transport, specifically in the region of the Western Balkan region has been a topic of wide research for almost a decade ago, [2]. That research has focused on the capacity of six alternatives of cars with different propulsion systems (Battery – electric vehicles, Plug-in hybrids, Hybrids without external plug, Gasoline, Alternative fuel vehicles, and Diesel). A large number of indicators have been identified and many professionals have been interviewed in the process employing Analytic Hierarchy Process (AHP) as a toll for processing the data. The results have shown the capacity of different car alternatives to contribute to the sustainable transport/development in the period of research.
Due to the intensive technology development ([3]), and market changes (prices, and accessibility of the cars, [3], [4], [5], [6]) it is

time to make a new tuning of the data changed in the meantime and to see if previous research findings are still valid, or if some significant aspects have been changed which should not be neglected.

2 Research methodology

The research method is the same like in the base research ([2]) with identifying of the main changes in vehicle technology, and finding technical data illustrating the changes for the car alternatives in focus ([7], [8], [9], [10], [11], [12], [13], [14] and [15]). In addition, changes on the market have been identified, and valued in the context of the used research methodology ([3], [4], [5], [6]). With such changed parameters, AHP has been employed again using the same software tool, as in the base research [2]. Comparison of results allow clarifying if technology and market changes have any significant effects for the region of Western Balkan.

3 What is new?

As mentioned, main changes for the period under observations are in the technology and market area.

Technology wise, main improvement of the ICE equipped vehicles is improving the economy and reducing the emissions, [13] (Figure 1).

In the area of electric (battery) vehicles, main gains are in the improving of their performances and range. Those characteristics are now comparable with the vehicles equipped with ICE power units.

At the same time, the prices of new electric vehicles are getting closer to the those with traditional power train (ICE). The said development is illustrated in the Table 1, [3] (here shown only partially).

In the developed countries (USA), there are some new signs when talking about the price of used cars, [6]:

- The average price for a used electric vehicle has fallen below similar cars powered with gasoline for the first time, according to a new analysis from iSeeCars;
- The average used EV price fell 29.5% over the last year;
- The average gas-powered car price fell 6.1% over the same time period;
- The Jaguar I-PACE EV led the list of used cars with the biggest year-over-year price drops, followed by the Chevrolet Bolt EV and Hyundai Kona Electric.

The cited data may be a picture for short period of time, but the authors do not see indication it will change soon.

In the new simulation (2024), these trends have been involved.

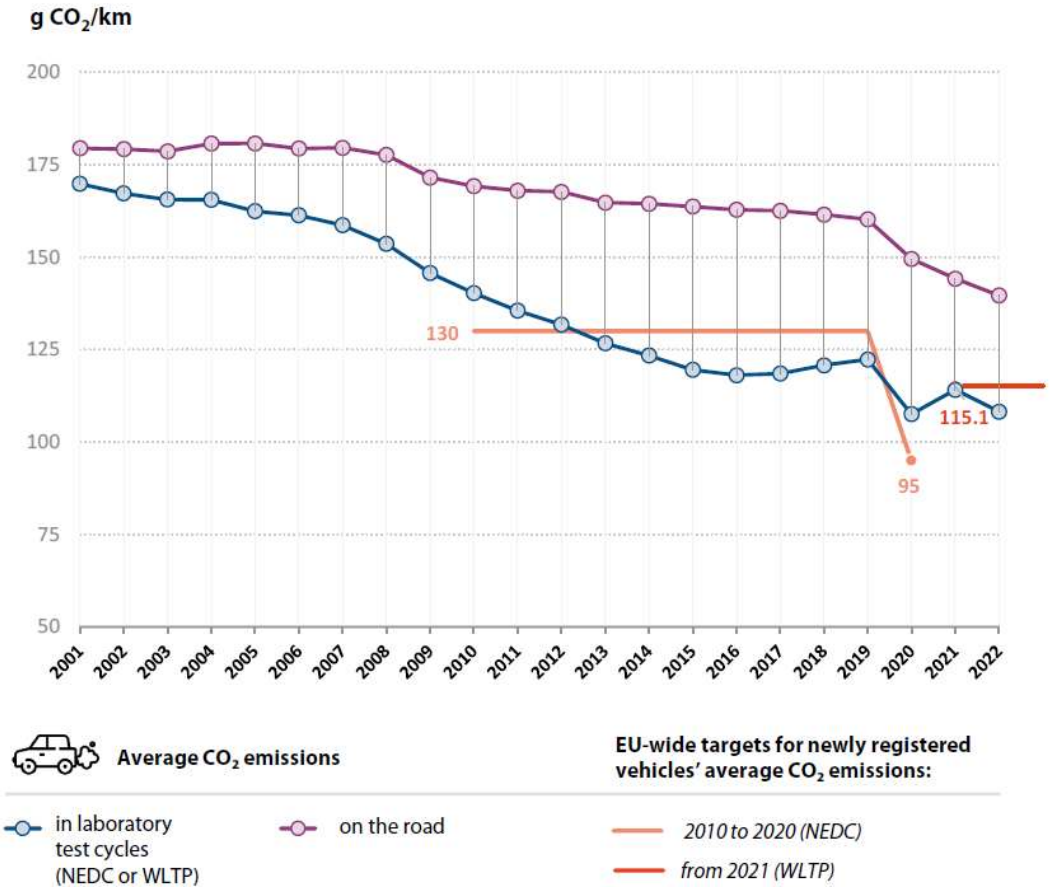

Figure 1. Emision of CO_2/km of vehicles in last decade

Table 1. Electric vehicles available in US in 2024, compared by range and price

Make and model	Range	Base Price (MSRP)	Price Per Mile of Range	Vehicle Type
Audi Q4 E-Tron SUV, Sportback	258	$58,200	$226	SUV
BMW i4	276	$52,200	$189	Sedan
Chevrolet Blazer EV	324	$48,800	$151	SUV
Fiat 500e	149	$32,500	$218	Hatchback
Ford Mustang Mach-E	300	$39,995	$133	SUV
Hyundai Ioniq 5	303	$41,800	$138	SUV
Hyundai Kona Electric	261	$32,675	$125	SUV
Kia EV6	310	$43,975	$142	SUV
Lexus RZ	245	$55,150	$225	SUV
Mercedes EQB	245	$53,900	$220	SUV
Mercedes EQE	298	$76,050	$255	Sedan
Mini Cooper SE	114	$30,900	$271	Hatchback
Nissan Leaf	212	$28,140	$133	Sedan
Porsche Taycan	208	$90,900	$437	Sedan
Subaru Solterra	227	$44,995	$198	SUV
Tesla Model 3 RWD	272	$38,990	$143	Sedan
Toyota bZ4X	252	$43,070	$171	SUV
Volkswagen ID 4	291	$39,735	$137	SUV
Volvo C40 Recharge	297	$54,895	$185	SUV

4 Results and discussion

The results achieved with the simulation of the new situation (year 2024) are in a form (tabular and graphic) typical for the software package used (Expert choice). Since research methodology employed in this occasion intends to compare the results of the simulation in basic research (year 2017, [2]), with new ones, an additional tabular post processing has been done from which comparison of the old and new results could be done in an illustrative way. Graphical presentation of the comparison of results is shown in following figures.

Figure 2 shows comparison of the capacities of different car alternatives to contribute to the economic column of sustainability.

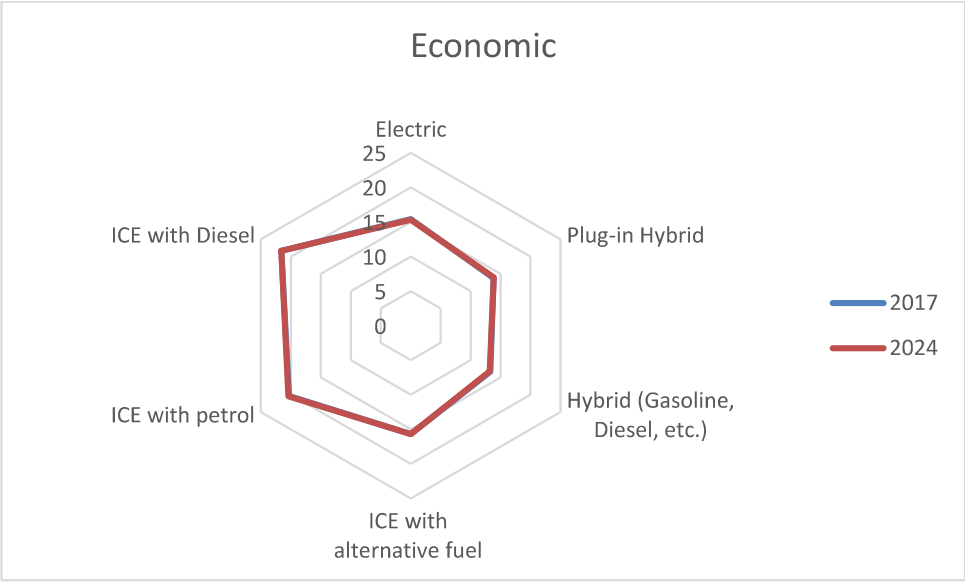

Figure 2. Capacity [%] of contribution of different car alternatives to the economy column of sustainability

Figure 3 shows comparison of capacities of different alternatives of cars to contribute to the social column of sustainability.

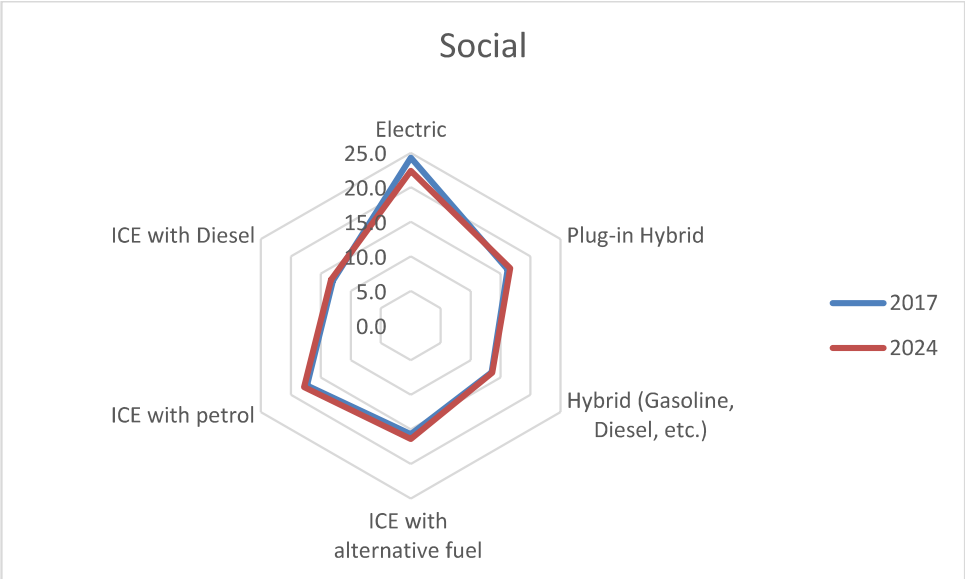

Figure 3. Capacity [%] of contribution of different car alternatives to the social column of sustainability

Figure 4 shows comparison of capacities of different alternatives of cars to contribute to the environmental column of sustainability.

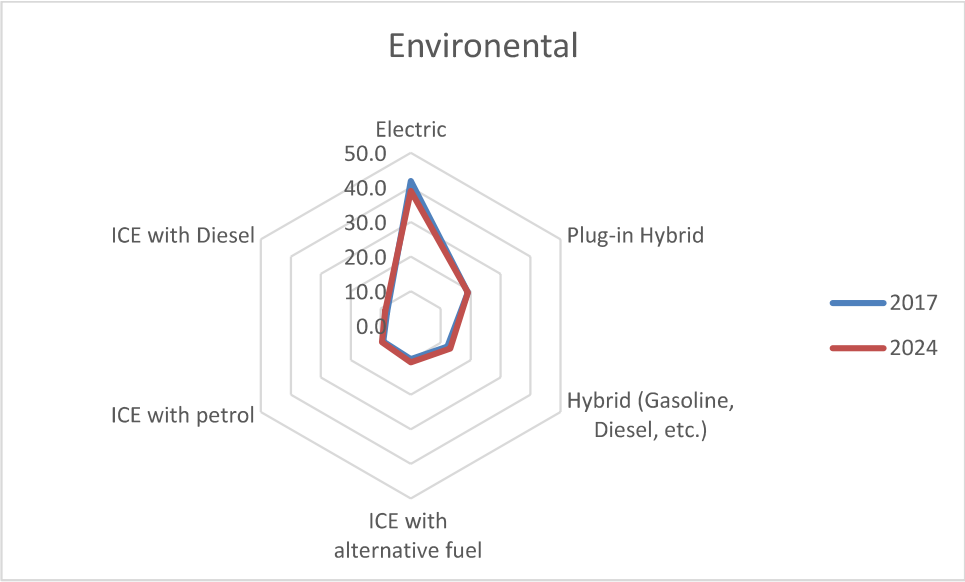

Figure 4. Capacity [%] of contribution of different car alternatives to the Environmental column of sustainamility

Figure 5 shows comparison of capacities of different alternatives of cars to contribute to the main goal - sustainability.

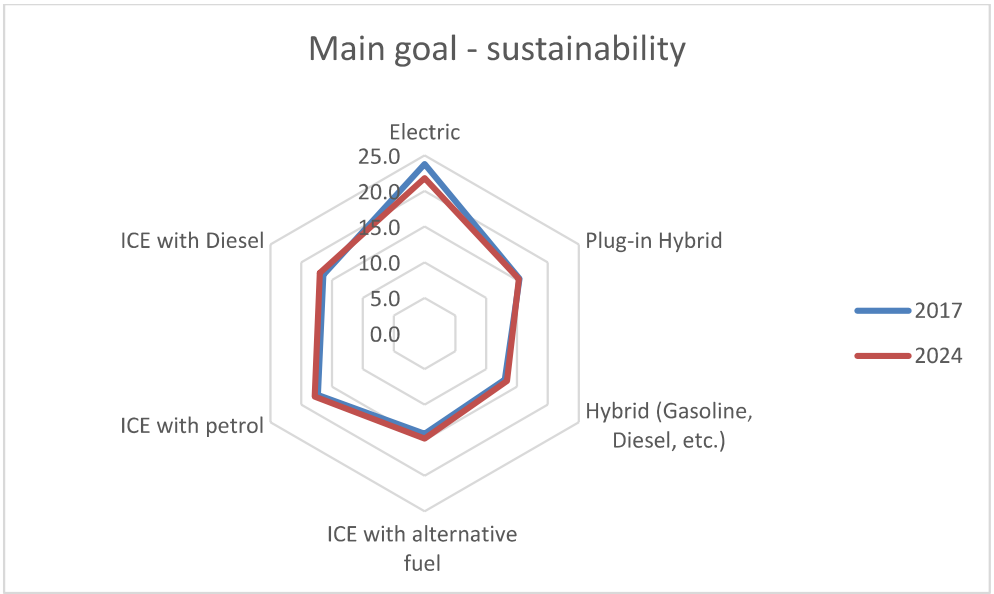

Figure 5. Capacity [%] of contribution of different car alternatives to the main goal – sustainability

A simple view on the results show that there are no major changes in the results illustrating this year (2024) and seven years ago. That is a case in all three main columns of sustainability (economic – Figure 2, social – Figure 3, and environmental – Figure 4), and regarding the main goal – Figure 5.

It is obvious that Electric (battery) have best capacity to contribute to the sustainable development, but it is obvious that some of

others alternatives (like ICE with petrol, ICE with alternative fuel) are still to be considered.
The results achieved show that the efforts of the car manufacturers of electric cars to improve their range and performances are answered by the efforts of the car manufacturers of cars equipped with internal combustion engines (ICE) to improve their energy efficiency, economy and further lowering of emission of gases and noise.
In other hand, regardless of the general reducing of the electric cars prices they are still not on the level customers in Western Balkan countries can afford. At the same time, significant incentives are missing. In addition to that, there is not serious development of charging stations network.

4. Conclusions and Recommendations

As said in the basic research ([2]), the results can be used on different decision-making levels for policies making. In such a way, in Western Balkan region there is a large room for further using the obvious capacity of Battery (electric) vehicles to reach new levels in fight for meeting the sustainable development goals. There are many examples for that in Europe, and globally, as well. These directions are defined by limited further improvement of the cars equipped with internal combustion engines and the limited economic power of the customers. It is up to the state strategies whether it wants to accelerate introducing of electric cars, or to allow further enlargement of the gap between it and the developed countries.

REFERENCES

[1] United Nations: Transforming our World: The 2030 Agenda for Sustainable Development; United Nations;
[2] Kjosevski S. (2018). Decision-making and policy to introduce electric vehicles as a contribution to regional sustainable development, PhD thesis, University Ss Cyril and Methodius in Skopje, Faculty of Mechanical Engineering – Skopje;
[3] Electric Car Range and Price Comparison 2024, Coltura, https://coltura.org/electric-car-battery-range/, approached August 2024;
[4] Average electric vehicles price worldwide from 2018 to 2028, Statista, https://www.statista.com/markets/419/topic/487/vehicles-road-traffic/, approached August 2024;
[5] The Global Electric Vehicle Market Overview in 2024, Vrta, https://www.virta.global/global-electric-vehicle-market, approached August 2024;
[6] Used EV prices fall below gas-powered cars for the first time, Spectrum, https://spectrumnews1.com/ca/southern-california/transportation/2024/06/11/used-ev-prices-fall-below-gas-powered-cars-for-first-time, approached August 2024;
[7] Life Cycle Analyses of Electric and Internal Combustion Vehicles, Fuels Institute, January 2022;
[8] Report Comparing Electric and Other Alternative Fuel Non-Tactical Vehicles with Internal Combustion Engine Vehicles, Report to Congress, US Department of Defense, March 2023;
[9] Global EV Outlook 2024, International Energy Agency, 2024;
[10] How clean are electric cars? T&E's analysis of electric car lifecycle CO_2 emissions, Transport & Environment, 2020;
[11] Emissions testing for cars and environmental regulations, Brief N0 4, Information Service United Nations Economic Commission for Europe, 2016;
[12] CO2 emission standards for new passenger cars and vans in the European Union, Policy update, International Council on Clean Transportation, May 2023;
[13] Reducing carbon dioxide emissions from passenger cars, Special report, European Court of Auditore, 2024;
[14] 2025 and 2030 CO2 emission targets for Light Duty Vehicles, JRC Science for Policy Report, 2023;
[15] Whole Vehicle Type Approval (WVTA) of different car producers, 2017-2024.