aLIFEca

Guide aLIFEca

Virtual open Course of Automotive Life Cycle Assessment

Study on the Requirements for Sustainability Job Roles/LCA training

Co-funded by the European Union

CONTENT

INTRODUCTION

The European Green Deal is the plan to make the EU's economy sustainable. It is possible to do this by turning climate and environmental challenges into opportunities and making the transition just and inclusive for. The understanding of the potential environmental impacts and overall sustainable approach is a part of the strategy in the Automotive/mobility Ecosystem. The automotive industry is committed to environmental goals, including carbon neutrality by 2050. The shift to green mobility causes the unprecedented transformation of the Automotive Industry and overall ecosystem restructuralization. This requires the need for massive support of up-/re-skilling activities of current and future workforce, including students at secondary and tertiary education levels.

According to recommendations of employers in automotive, interdisciplinary education programmes for higher education should be rolled out focusing on STEM, digital and green skills. Adaptation of the curricula is needed. Regarding the sustainability and greening of the automotive sector, specific education requirements and skills for the automotive industry need to be adopted and developed. Sectoral training offer needs to be designed, developed, and continuously updated based on the sectoral needs. In particular, within the sustainability domain of the automotive sector, Life Cycle Assessment (LCA) is of utmost importance. LCA is defined as the systematic analysis of the potential environmental impacts of products or services within their entire life cycle. Therefore, being equipped with solid sectoral trainings on LCA and consequently acquiring strong skills and competences is crucial in order to build a sustainable approach for the automotive industry and analyse its potential environmental impacts. For these reasons, the present study has been carried out. It works as an analysis of current automotive sector requirements on its employees – on both, its current and future ones. On its basis, job roles dealing with environmental issues in automotive are set. The analysis is used for the MOOC aLIFEca, an online training created within the Erasmus+ project 2021-1-CZ01-KA220-HED-000032222, Virtual Open Course on Automotive Life Cycle Assessment to reflect actual needs of labour market in automotive sector. This study is a part of the project result PR1 Guide aLIFEca. The study serves to define the requirements of stakeholders for the course. It enables to identify occasions and opportunities for the course specialization. It reveals key challenges on which basis the

structure of the course is defined. The study reflects the growing need for professionals able to be effectively oriented in order to be up to date with green transport technologies.

In the first part of the study, the project aLIFEca: Virtual Open Course of Automotive Life Cycle Assessment is introduced. Its goals and project results are presented. Then the study devotes to the current automotive sector. It describes automotive in view of its employment footwork. It follows the trends in its development and how it affects the requirements for its workforce. It presents conclusions of blueprints projects aimed at sectoral skills developments which have become a backbone for the study. Important source for MOOC aLIFEca recommendation from the side of the automotive industry has arisen from a study requested by the ITRE committee „The Future of the EU Automotive Sector“ published in October, 2021. It provides the most actual trends in automotive, and the recommendation resulted on its basis is essential.

PROJECT aLIFEca

The main objective of the project aLIFEca is to develop a highly specialised and professional course of top quality on Life Cycle Assessment (LCA) in automotive. The course will be in a form of massive open online courses (MOOC). Nowadays, MOOCs provide an affordable and flexible way to learn new skills, advance the career and deliver quality educational experiences on a large scale. MOOC aLIFEca will be accessed on-line. The course will be open to anyone, regardless of whether or not they have studied before. Students can simply follow the course at their own pace, taking as much time as they need.

The course will present the methodology of environmental impact assessment to develop sustainable technologies in automotive. The LCA approach offers one of the most comprehensive analysis tools on how to assess the transformation of the automotive industry and its transition from conventional fossil fuels such as diesel and petrol to alternative ones such CNG, LPG, electricity and hydrogen. LCA is a systematic process that does not define the impacts of the product on the environment only during its production or use phase but assess the environmental impacts of a product or service from its "cradle to grave". The LCA is a key method for circular economy. It is a reliable tool defining negative externalities in the long-life cycle of products or services. It is possible to determine environmental impact of a product or service in many categories such as Greenhouse Gases Emissions, Human Health, Natural Resources Depletion. It serves for determination of the carbon and water footprint comparable with other products or services.

The awareness and further practical usage of LCA is growing its importance within the automotive industry. The need for the training focused on the sustainability topic, including waste management, was identified by project DRIVES (Development and Research on Innovative Vocational Educational Skills, www.project-drives.eu), as the Blueprint for strategic sectoral cooperation on skills in the Automotive sector. The project partnership, composed of 24 stakeholders from 11 EU partner countries and supervised by umbrella association ACEA (www.acea.be), CLEPA (www.clepa.eu), ETRMA (www.etrma.org), defined 40 emerging and new job roles, and one of them is also Sustainability Manager. Such role is acquiring increasing importance to measure the environmental impact of a product throughout its entire life cycle, from design to development, distribution, use, disposal and finally recycling. The project aLIFEca ensures a comprehensive international cooperation

with transferable know-how to participating institutions and individual European countries. A course specifically designed for the needs of sustainable management and today's fast-growing automotive industry, which is facing the challenges of green mobility, is needed to evaluate the impact of transport and various approaches and strategies in it.

The Implementation of aLIFEca is supported by European Automotive Manufacturers' Association (ACEA) and Automotive Skills Alliance (ASA, www.automotive-skills-alliance.eu) who are included in the project as associated partners. The suggested course will be prepared in a team of experienced staff with high expertise in the field of sustainability management and LCA. It is a team of partners included in international associations and projects with rich know-how to share in this field. The project aLIFEca interconnected the academic sphere and business.

The consortium consists of

- 4 universities - VSB-Technical University of Ostrava, Czech Republic; Silesian University of Technology, Poland; University of Zilina, Slovakia; Newton University, s.r.o., Czech Republic;
- 2 innovative companies: Scoveco, s.r.o., Czech Republic; Spin 360, Italy.

The implementation of aLIFEca will contribute to following intangible project outcomes:

- Enhancement of the quality in tertiary education and life-long learning opportunities with new environmentally awarded approaches and innovations
- Increase the environmental and sustainable awareness in the automotive ecosystem
- Transfer of knowledge and good practice in the automotive ecosystem in direction from industry
- Graduates and workers with appropriate knowledge and skills reflecting the requirements of today labour market in the field of automotive
- Development of international cooperation in LCA training in the field of automotive
- New opportunities for LCA training in other fields
- Promotion of open access to educational resources
- Improvement of teachers' competence in interactive teaching through massive open online course

TODAYS' AUTOMOTIVE SECTOR

The automotive industry is crucial for Europe's prosperity. The turnover generated by the automotive industry represents over 7 % of EU GDP, which totalled around EUR 936 billion in 2020[1]. According to data of European Automotive Manufacturers' Association (ACEA), fiscal income from motor vehicles in 2020 was EUR 398.4 billion. It is a leading industry in research and development funding its innovations from own private sources. In 2019, the automotive R@D investment was EUR 62.0 billion[2]. It is linked to other sectors, and it has an important multiplier effect in the economy. It plays a major role in the economy through its vast supply chain and generating various business services. The automotive is the most integrated ecosystem in intra-EU value chains.

Over 45 % of its production depends upon cross-border value chains within the EU27. This intra-EU value chain brings together vehicle manufacturing, automotive suppliers, manufacturers of motor batteries, electrical equipment, tyres, suppliers of raw materials and car use services. It is important for upstream industries such as steel, chemicals, and textiles, as well as downstream industries such as ICT, repair, and mobility services (Fig. 1). The world's vehicle production is increasing. Today, 243 million cars are on the road in the EU[3] and the automotive sector significantly contributes to EU employment. Around 13.8 million people work in the EU automotive sector, representing 6.1 % of total EU employment. Manufacturing (direct and indirect) accounts for 3.5 million jobs, direct manufacturing presents an 8.5 % share of EU employment in manufacturing. Sales and maintenance account for 4.5 million, and transport for 5.1 million.[4]

[1] David BROWN, Michael FLICKENSCHILD, Caio MAZZI, Alessandro GASPAROTTI, Zinovia PANAGIOTIDOU, Juna DINGEMANSE and Stefan BRATZEL. The Future of the EU Automotive Sector. Study requested by the ITRE committee. (October 2021). Available at: https://www.europarl.europa.eu/RegData/etudes/STUD/2021/695457/IPOL_STU(2021)695457_EN.pdf

[2] Key figures on the EU auto industry - ACEA - European Automobile Manufacturers' Association [online]. Copyright © 2022 ACEA [cit. 06.06.2022]. Available at: https://www.acea.auto/figure/key-figures-eu-auto-industry/

[3] Fact sheet: cars - ACEA - European Automobile Manufacturers' Association. [online]. Copyright © 2022 ACEA [cit. 06.06.2022]. Available at https://www.acea.auto/fact/fact-sheet-cars/

[4] Employment - CLEPA Available at: https://ec.europa.eu/growth/sectors/automotive-industry_en

Fig. 1 – Significant manufacturing employment up-and down stream[5]

Mobility will continue to become increasingly digital, more connected and above all more electric; consumers who have taken sustainability into account in their purchasing decisions have led sales of electric vehicles to increase by 43 % in 2020. This trend is influencing, consequently, the internal organization in car manufacturers, going towards a search for new professional figures, new skills and an increase in upskilling and reskilling. Demand for qualified employees with comprehensive knowledge about environmental impact of cutting-edge transport technologies is high across the whole automotive sector and accompanied services. The employment footprint in jobs and supply sector in automotive (Tab. 1) is the most significant in the countries of central Europe, the highest in the Czech Republic and Slovakia followed by Hungary and Germany.

A very large number in specific segments of the value chain, such as exhausts, interior fittings, precision tooling, are located also France, Spain and Italy, where they play a fundamental role for the ecosystem.

[5] European Association of Automotive Suppliers CLEPA. Available at: https://clepa.eu/who-and-what-werepresent/suppliers-eu-employment-footprint/employment/

Tab. 1 Automotive manufacturing % of employment (direct and indirect)[5]

Country	**%**
Czech Republic	13,1
Slovakia	12,3
Hungary	8,9
Germany	8,5
Romania	7,6
Poland	7,4
Slovenia	6,6
Sweden	5,3
Austria	5
Spain	5
Italy	4,6
France	4
Portugal	3,9
Belgium	3,9
Bulgaria	3,6
Netherland	3,5
Croatia	3
Estonia	2,9
Finland	2,8
Latvia	2,2
Lithuania	2,2

Today's automotive sector is one of the fastest-growing industry, which is facing the challenges of cutting-edge technologies and requirements of green politics. Governments all over the world are faced with the transition to sustainable mobility and renewable energy. New jobs are created to replace the ones lost in the fossil fuel industry. For these new jobs, qualified personnel are needed. The European Commission estimates that more than 900,000 jobs will need to be filled in the automotive sector by 2025, of which about half will require high skills.[6] The analytics-related skills and environmental awareness become a must to stand out as an employee or job candidate for all qualified positions in automotive and all kinds of related industries and services.

[6] Project DRIVES [online]. Copyright © 2022 PROJECT DRIVES [cit. 06.06.2022]. Available at: https://www.project-drives.eu/en/aboutus

SKILLS FOR THE AUTOMOTIVE SECTOR

In November 2020 The European Commission launched the Pact for Skills, a shared engagement model for skills development in Europe. Based on the Pact, public and private organisations are invited to join forces and take concrete action to upskill and reskill employees in various kinds of industrial ecosystems in Europe, including automotive industry. The roundtable with the automotive sector suggested a number of ideas and principles for the automotive partnership including:

- The need to address the fragmentation of skills initiatives in the EU and encourage closer cooperation between companies and educational institutes.
- A key first step is to map those initiatives and identify ways that they can cooperate
- The whole value chain (including SMEs) and workforce with the different levels of skills required must be considered
- Important role that local and regional training centres and clusters can play in identifying skill needs (especially for SMEs) and help in the delivery of training.

The Pact of Skills in Automotive is built on the work of DRIVES (blueprint project Development and Research on Innovative Vocational Educational Skills) and related blueprints such as ALBATTS (Alliance for Batteries Technology, Training and Skills).

DEVELOPMENT AND RESEARCH ON INNOVATIVE VOCATIONAL EDUCATIONAL SKILLS

The aim of the project DRIVES was to address the future needs of the automotive sector at all levels of the value chain (vehicle manufacturing, car suppliers and car sales and after-sales services) through the creation of the Skills Alliance in the automotive sector. This project ran from January 2018 to December 2021 with a budget of EUR 3,987,590, involving 24 European partners from 11 EU partner countries. Its objectives were the following:[7]

- Analyse key trends, covering the whole value-chain

[7] Project ALBATTS [online]. Copyright © 2022 PROJECT ALBATTS [cit. 06.06.2022]. Available at: https://www.project-drives.eu/en/aboutus

- Define future skills and job roles
- Identify skills gaps for foreseen changes
- Analyse the current offering of training/upskilling/reskilling
- Provide clear guidance for education and training providers

The platform https://learn.drives-compass.eu/ created within the project DRIVES offers courses developed by DRIVES partnership, a blueprint endeavour for sectoral cooperation on skills in the Automotive sector. The teaching offer is available online as MOOC courses. They can be provided, on demand, as on-site courses in partner regions. The training materials result from identified reskilling and upskilling needs stemming from the sector after new mobility dynamics and automotive industrial transformations.

The platform, which is also mentioned in the European Parliament's study on the future of the European automotive sector[1], offers a large number of courses, divided into four main categories. Production category offers three training courses mainly in the automotive industry, such as Automotive Engineer in Quality and Metrology. In Maintenance category, there are three courses focused primarily on gaining knowledge about how to collect special data from machines, machine breakdown symptoms and more. In Engineering R&D category, there are 20 courses available bringing a full range of skills from Advanced Powertrain Engineer to Cybersecurity Engineer. And in the last category General there are seven courses, such as Automotive Engineer or Sustainability Manager. On the whole, on the basis of intelligence gathered among stakeholders and identified needs in automotive, more than 40 different trainings and MOOC courses were created within the DRIVES project. The courses devote to nowadays challenges and drivers of change in the automotive sector. Their scope is wide (Tab. 2).

The MOOC prepared within the project aLIFEca will follow the trainings specialised in the field of sustainable automotive. It will extend the job role of Sustainable Manager. Automotive manufacturers and suppliers are expected to pursue effective environmental throughout the life cycle of the product in order to reduce the environmental footprint. All products manufactured within automotive sector, and the applied materials and substances used in the process are expected to meet environmental standards for design, development, distribution, use, disposal or recycling. The training of Sustainable Manager consists of three

training units concluded by a self-test containing 15 questions with a choice of multiple answers.

Tab. 2 – Trainings offered within the DRIVES[6]

Job Roles Titles
ADAS/ADF Testing and Validation Engineer
Artificial intelligence Technician
Computer Vision Expert
Machine Learning Engineer
Sensor Fusion Expert
Automotive Engineering CAD, CAE, CAM
Practitioner in Automotive Spice ®
Connected Vehicles Expert
Connected Vehicles Technician
Automotive Cybersecurity Engineer
Automotive Cybersecurity Tester
Automotive Cybersecurity Manager
Rubber Technologist - Basic Level
Advanced Powertrain Engineer
Functional Safety Manager Strategy Level
Functional Safety Project Manager
Functional Safety Engineer
Highly Automated Drive Engineer
Automotive Mechatronics Manager Awareness Level
Automotive Mechatronics Manager Basic Level
Automotive Mechatronics Expert
Automotive Mechatronics Developer
Advanced Manufacturing Press Line Set-UP
Automotive Engineer in Quality and Metrology
Lean Six Sigma Yellow Belt
Lean Six Sigma Green Belt
Lean Six Sigma Black Belt
Robotic Engineer
Robotic Technician
Automotive Engineer in Tool and Die Production and Maintenance
Automotive Engineer (Working in Automotive)
Automotive Quality Engineer
Innovation Agent - Basic Level
Innovation Agent - Product Innovation
Innovation Agent – Organisation Innovation
Innovation Agent – Business Model Innovation
Sustainability Manager
Predictive Maintenance Engineer
Predictive Maintenance Technician
Predictive Maintenance Expert

The training has the following sections:

- **General**

- At the outset, the expectation is emphasized that car manufacturers and suppliers will strive to protect the environment effectively throughout the product life cycle in order to reduce the environmental footprint.

- The section also describes the work and responsibilities of the sustainability manager, the skills needed and the need for further training.

- **Course Overview**

- This section describes the course organization

- Candidates take the course on their own with the help of provided materials and information links

- **U1 - What is Sustainability Management**

- Describes Sustainability Management based on definition and industry applications.
- It contains a presentation divided into three parts, namely:
    - *Sustainability Management* definition for knowledge of the definition of sustainability management and its application
    - *Sustainability Automotive Sector* explaining the motivation and guidelines of the automotive industry for sustainability together with the policy and strategy in the sustainable automotive sector
    - *Industry Application* describes how sustainable management is applied in industry, including examples

- **U2 - Environment and Society**

- The section brings a narrated recording of the presentation and the presentation itself, which has four main parts:
    - *Introduction to Global Climate Changes* to identify the problems associated with global climate change
    - *Environmental Law & Policy* explains how to interpret them along with examples
    - *Ecological Economics* describes the basics of Ecological Economics
    - *Environmental Management* explains the basics of Environmental Management

- **U2 -References**

- It contains links to three sites dedicated to sustainability in the automotive sector:

- https://www.oecd-ilibrary.org/sites/4a4dc6ca en/index.html?itemId=/content/publication/4a4dc6ca-en
- https://www.pwc.de/en/sustainability/sustainability-in-the-automotive-industry.html
- https://www.capgemini.com/sustainability-a-strategic-priority-for-the-automotive-industry/
- and seven other links to YouTube videos on the same topic, for example
- Benefits of a Sustainability Manager (by City of Columbus)
- 10 leading automotive companies on addressing sustainability issues in raw materials sourcing (by CSR Europe)
- Sustainability Trends in the Automotive Industry [Climate Risk Analytics] (by Refinitiv)
- Drive Sustainability: Insights from Volkswagen/FORD/Toyota/ Volvo Group (by CSR Europe)

- **U3 - Strategy and Planning**

- This section deals with three main topics:
  - *Definition of strategy* and its importance for sustainability management
  - *Definition of planning* as a concept and process
  - *Structure and development of a strategic plan* contains concepts of a strategic plan, such as mission, objectives, vision, swot analysis, Porte´s Five Forces and helps identify the different business development strategies.

- **Self-test**

- Contains 15 questions from previous areas with a choice of multiple answers
- Test has 3 attempts

- **Skill Browsing and Certification**

- Contains a link to

  https://www.iscn.com/projects/exam_portal/DirTree/index.php?id=159

  on which nothing can be run
- Also contains a link to MOOC Exam Registration

  https://www.iscn.com/projects/exam_portal/index.php?dom=159&org=193

- Test is not limited in time and can be re-taken any number of times
- Most of the questions are the same as in the previous self-test, one question is even there twice

- **Feedback**
  - It contains a questionnaire to find out whether the study materials were understandable and whether they contained ideas needed for future work
  - Which topic the user would like to know more about and whether he would recommend the course to others
  - It also contains a short section where the user has to complete their data such as gender and age and the type of organization he comes from

- **About the Authors**
  - Informs that the Sustainability Manager course was prepared by a team of APIA, SPIN360, IPV involving six people and brief info on each

- **Acknowledgements**
  - Contains the Erasmus+ logo and information that The European Commission support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein

ALLIANCE FOR BATTERIES TECHNOLOGY, TRAINING AND SKILLS

The project of Alliance for Batteries Technology, Training and Skills (ALBATTS) aims to be a major contribution to the green mobility in Europe. As the European battery value chain is being developed, organisations from the demand and supply side of skills/competences are brought together, to establish a blueprint for preparedness of future skills across Europe. The project runs from 2019 to 2023 involving 20 European partners, from 10 countries and supported by a budget of EUR 3 985 074.[7] The project aims are divided into those with short term impact and long-term impact. The most important ones are:

- Analysis of the overall battery sector on its strengths and weaknesses.
- Involving all levels of stakeholders in the sector, along the value chain (raw materials and processing, cell components and manufacturing, battery and battery pack

manufacturing, recycling and second use - and all that horizontally supported in each step by research and development).

- Training preparations based on the needs of the sector
- Creation of knowledge and skills to start new vocational education training and high degree programs within the sector,
- Development of knowledge and skills from vocational education training providers' staff.

ALBATTS defines "climate goals, regulation and environmental challenges" (together with "globalization" and "new technologies") as one of the Drivers of Changes influencing the sector.

Batteries are one of the most important climate targets drivers to decarbonize road transportation and support the transition to a renewable power system. Among the subcategories to be taken into consideration within the Driver of Change "climate goals, regulation and environmental challenges", we can identify:

a. Reducing CO_2 emissions from battery manufacturing: since the production of batteries requires significant amounts of energy, an increase in the share of renewable energies and energy efficiency in the battery value chain would be a substantial step for decreasing CO_2 emissions from battery production.

b. Electrification and green energy: batteries can fundamentally reduce GHG emissions in the transport and power sectors as they systematically enable a substantial shift to bring transportation and power to greenhouse gas neutrality playing an increasingly important role.

c. Widespread charging/refuelling infrastructure: commercialization of a technology based on batteries. The easier the access to a reliable and suitable charging infrastructure is, the quicker the development of such new technologies will occur.

According to the project Deliverable D3.6 Analysis of Sectoral Intelligence – Release I [8], analysing the importance of each sub-category, "reducing CO_2 emissions from battery manufacturing" remains the most important for sectoral stakeholders. Also, "electrification and green energy" was the most frequently quoted in the literature.

The alliance ALBATTS recommend for training to explore various re-/up-skilling instruments and tools such as: (1) work-based learning; (2) on-boarding training in factories;

[8] Project ALBATTS [online]. Copyright © 2022 [cit. 06.06.2022]. Available at: https://www.project-albatts.eu/Media/Publications/35/Publications_35_20211203_10553.pdf

(3) innovative and up-to-date programs; (4) training by internal and external experts; (5) digital and specific seminars for industry; (6) standardized online courses (MOOCs and SPOCs); (7) training of trainers; (8) access to learning infrastructure for SME's and other target groups; (9) centres of excellence and innovation; (10) specialized training centres with simulated training environment - AR/VR training, e.g. VR Labs; (11) adult education and learning programmes; (12) education testbeds; (13) flexible and blended learning solutions; and (14) double degree education programmes.

In addition, proper training methods are recommended to be selected for different target groups, e.g., blue- or white-collar workers, or mass re-skilling or up-skilling for the battery production, or other parts of the ecosystem. It emphasises to select the proper language of the target group. It is necessary to facilitate training in various languages to increase accessibility. Multi-lingual training is essential, especially for vocational education training and lower levels of education. It is vital to identify different language needs for different training and job positions. It suggests to introduce training certification and the microcredential system for the successful trainees. Introducing a learning account can boost the recognition and management of the learning achievements. The ALBATTS consortium proposes to point out in the trainings:

- Strengthening the awareness on the critical raw materials questions for Europe and connected emerging trends.
- Considerations for the value chain step of cells and components manufacturing cover aspects of (1) production; (2) maintenance; (3) logistics; (4) quality; as well as other aspects: purchasing, human resources, finance, sales, and digitalization.

AUTOMOTIVE SKILLS ALLIANCE

ALBATTS together with its "brother" project DRIVES, with involvement together of 38 individual organisations as full partners and number of associated partners, provides a basis for the Skills Agenda in the Automotive Ecosystem. One of the three pilot partnerships launched under the Pact for Skills action is presented by Automotive Skills Alliance (ASA)[9]. ASA is a large-scale partnership of Automotive ecosystem where DRIVEs and ALBATTS partnerships are taken as the basis. It coordinates and proves continuous cooperation, sharing

[9] AUTOMOTIVE SKILLS ALLIANCE. [online]. Available at: https://automotive-skills-alliance.eu/ https://automotive-skills-alliance.eu/

best practices and the operational solution including methodology, tools, data, experts, training providers for pilot projects and other initiatives. The mission of the ASA is to create an up-/re-skilling framework that would maximise automotive industry competitiveness, job retention and help create new job opportunities across the entire automotive ecosystem, paving the way to an EU-wide skills partnership. It represents an open partnership for all already existing or future stakeholders, initiatives or projects to cooperate under one European umbrella for the Automotive Ecosystem. The association fully supports key ideas of the Pacts for Skills.

- It provides reaction to the COVID-19 crisis and creates a platform to mobilise support for the automotive industry, by ramping-up the scale of trainings provided in the EU in a short period of time and mitigate negative implications of the COVID-19 and through that also accelerate restructuring of the system
- It contributes to the Green Deal agenda, by speeding up the transition towards green and digital mobility and follows the New Industrial Strategy
- Mobilises and supports the positive trends in the sector and new emerging technologies, environmental standards and job opportunities in the sector to contribute to the green and digital mobility of the future
- It builds upon the Blueprint DRIVES partnership collaboration and outcomes to setup EU-wide system for trainings and education in the automotive sector to reflect whole public-private partnership around the automotive ecosystem, including current or new players to reflect the overall variety of future trends and skills needs in the system
- It inspires private and public responsible cooperation to bring coherence into skills identification, description and recognition by establishing an EU-wide umbrella framework based on commonly agreed definitions of skills, job roles and accredited system of e-badges (mirroring the “micro-credentials” in the Communication).

Its aim is to upskill 5 % of the workforce every year resulting in 700.000 employees to be upskilled along the automotive ecosystem. This effort will allow for a higher mobility through the value chain/ecosystem and growth of a sustainable talent pipeline.

CHALLENGES OF THE CURRENT AUTOMOTIVE SECTOR

As it is defined in the study requested by the ITRE committee "The Future of the EU Automotive Sector"[1], the biggest challenges of the current automotive industry are:

- its greening
- its digitalization.

In its official policy, the European Union (EU) emphasises on clean and emission-free transport, that is substituting fossil fuels with alternatives ones. The main objective in this respect is to reduce the greenhouse gas (GHG) emission from the transport sector. Various strategic documents of the European Commission stress on the legitimacy of use of EVs. The 2011 White Paper titled *Roadmap to a single European transport area – towards a competitive and resource-efficient transport system*[10] highlights the need to decouple transport from oil dependence, including the development of alternative fuels, and forecasts a 60 % reduction in GHG emissions from the transport sector by 2050, as compared to 1990. In its communication titled *Clean Power for Transport: A European alternative fuels strategy*[11] the European Commission proposed a set of actions and targets for the construction of infrastructure for the distribution of alternative fuels (electricity, natural gas, and hydrogen), based on technical standards that would be identical for all member states.

The European Green Deal[12] announced on 11 December 2019 and subsequently endorsed by the European Parliament and Member States, sets out a detailed vision to make Europe the first climate neutral continent by 2050, establish a circular economy and eliminate pollution, while boosting the competitiveness of European industry and ensuring a just transition for the regions and workers affected. In the industrial strategy, the Commission notes that in order to reduce carbon footprints and accelerate the transition, access to clean technologies, energy, and raw material is key. Stepping up investment in research, innovation, deployment and up-to-date infrastructure will help develop new production processes and create jobs in the process.

[10] European Commission (2011), White Paper: Roadmap to a single European transport area – towards a competitive and resource-efficient transport system, COM (2011) 144 final, Brussels.
[11] European Commission (2013), Communication from the Commission to the European Parliament, the Council, the European Social and Economic Committee and the Committee of the Regions: Clean Power for Transport: A European alternative fuels strategy, COM (206) 017 final, Brussels
[12] European Commission (2019), The European Green Deal. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2019%3A640%3AFIN

The Commission presented its Circular Economy Action Plan[13] on 11 March 2020, with the ambition of decoupling economic growth from resource use, reducing consumption footprint and doubling circular material use rate in the coming decades. Batteries and vehicles are among the key value chains selected to increase sectoral actions aimed at expanding the market for circular products. The plan sets a priority for different EU actions aimed at updating rules to increase the sustainability and transparency requirements for batteries, including the revision of rules on end-of-life vehicles[14]. The goal is to promote more circular business models, linking design issues to end-of-life treatments, improving safe and environmentally sound production, recollection, dismantling and disposal of end-of-life vehicles.

The recent market shift towards electric vehicles (EVs) in Europe has been impressive. In 2020, Europe surpassed China to become the biggest market in the world in both the number of EVs sold and the share of EVs in total car sales. All European carmakers are set to increase widely the offer of EVs in the coming years, with the Volkswagen (VW) group leading the way. It resulted in an explosion in the offer of EVs in the European market in 2020, with many more models expected for 2021 and beyond. The consequent market shift towards EVs in the European market has been monumental. As mentioned above, the current opportunity for this shift towards EVs comes first of all from a regulatory perspective, but it is also important considering the consumer behaviour. Consumer behaviour and awareness are changing as more and more people accept alternative and sustainable modes of mobility. Mobility services like car-sharing and ride-hailing will be increasingly important, as the increase in traffic means mobility has to become more individualised.

EVs and Fuel Cell Electric Vehicles (FCEVs), the two technologies are likely needed to help significantly lower CO_2 emissions to profoundly enhance the 'greening' of the sector. Green hydrogen (zero-carbon hydrogen) is still by far the most expensive hydrogen to produce, but as its cost falls in the coming years, the case for HFCs will strengthen over the next decade. it is in the EU's best interest to further enable the innovation and greening of the two power sources.

[13] European Commission (2020), Circular Economy Action Plan for a cleaner and more competitive Europe. Available at: https://ec.europa.eu/environment/pdf/circular-economy/new_circular_economy_action_plan.pdf.

[14] The revision of the ELV Directive sets targets based on the weight of a vehicle (minimum of 95% for reuse and recovery; 85% for reuse and recycling) with European automotive manufacturers being responsible for disposal/recycling costs. It also imposes provisions on vehicle design (e.g. use of chemicals). See: European commission (2021), End-of-Life Vehicles. Available at: https://ec.europa.eu/environment/topics/waste-and-recycling/end-life-vehicles_en

Electromobility is creating considerable employment, investment, and value-added opportunities. Regarding it, the training of current and future workers in automotive must follow this trend. European manufacturers must still boost their innovation performance as lead novelties are coming from Tesla or China. The greening transition works for the environment industry. European workers in automotive must be able to provide advanced intelligence enabling all companies in the EU automotive industry to be better prepared and resourced for new challenges. On basis of studied relevant materials, several recommendations for training in life cycle assessment in automotive has been identified. Specifically, from the study" The future of the EU Automotive Sector [12]", it is:

Recommendation 2: Simultaneously drive the local sourcing and "greening" agenda

Environmentally, it is imperative to track emissions and the carbon footprint from beginning to end right along with all elements of the automotive supply chain. This topic is resonating with a rapidly rising number of consumers to the point it is already a key differentiator for the record number of buyers with a commitment or intention to purchase an EV. The eagerness to drive a new car out of a showroom with zero emissions makes for a compelling proposition. However, the cumulative metric tons of CO_2 to get to the point whereby a new car arrives in the showroom makes this once compelling proposition significantly lose its appeal. There are many interdependencies at play, but in summary, the greener the end-to-end automotive supply chain, the higher the demand for EVs, thereby representing the confluence of a strong environmental and commercial viability case.

Recommendation 5: Promote the development of skills in digital and software as well as electrical engineering and increase access to skills across the EU

The transformations reshaping the automotive sector in the EU might lead to a strong repositioning of the sector in the coming years. Such transformations bring about – among others – important questions related to human capital. Businesses are already reporting a lack of staff with adequate digital skills. This 'red flags' the challenge for the EU to provide and attract sufficient talent within the new technology areas. Within it, trainings in key fields are encouraged. They are promoted to attract talents to maintain EU leadership and competitiveness especially in related areas to develop electromobility.

Even though electric vehicles are simpler to assemble than combustion engine vehicles, the electromobility market requires a different range of skills from workers compared to combustion engine vehicles. Studies indicate that, if excluded the production of battery

cells, the total number of workhours needed for components is 15 % - 30 % lower for BEVs. In fact, about 31 % of the content per vehicle of ICEs, related mostly to the engine and transmission, is completely eliminated in BEVs and replaced with electric motors, battery packs and power electronics. This shift means the set of suppliers and manufacturers that will be demanded by the automotive industry in the future will completely change. The electromobility market requires a different range of skills from workers compared to combustion engine vehicles. The main field in which specialised skills are needed is primarily in:

Research, development, and innovation

Electric vehicles and batteries represent a new technology demanding a significantly stronger innovation push. More scientists are needed to conduct research to improve electric vehicle technology, such as chemists and material scientists to conduct research on batteries, recharging, and new materials. There are opportunities in EVs design, engineering, their maintenance and infrastructure development. Highly qualified urban and regional planners aware of environmental approaches are needed to develop infrastructural upgrades.

Raw materials

Raw materials Another major factor condition for electromobility is the availability of raw materials for batteries. The metals mainly used to produce these central components are lithium, nickel, and cobalt. Demand in those three raw materials is expected to dramatically increase in Europe by 2030.

Batteries

The establishment of battery production in Europe is essential to fill an important gap in electric vehicles value chains, anchoring a very large part of the value-added and jobs generated by the EV industry. Based on current investment announcements, the European production capacity is expected to be enough to satisfy the region's needs until 2030, escalating to 20 % - 25 % of the world's supply by 2030.[1]

REQUIREMENTS FOR THE MOOC aLIFEca

Life Cycle Assessment (LCA) is a method used to assess the environmental impact of products and services over their life cycle, from the acquisition of raw materials and their processing to the manufacture of goods, throughout the operation phase until their end-of-life disposal (Fig. 2).

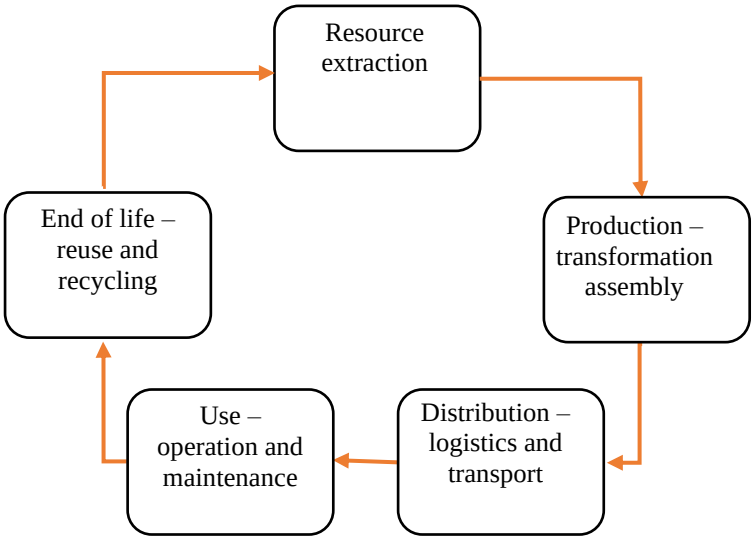

Fig. 2 Life cycle approach

LCA makes it possible to compare the environmental aspects of different products as well as technological solutions, and to choose products or solutions having the smallest environmental impact throughout their life cycle. LCA considers environmental impact over the entire vehicle life cycle from the production stage, through the vehicle manufacturing process, the operation stage, to the end-of-life cycle of a vehicle, including waste management. LCA is used as a means to comprehensively evaluate processes, material choices and their effects on life cycle emissions of GHG as well as other impact and damage categories. The LCA method enable analysis to cover the life cycle from cradle to grave. This approach enables calculation and comparison of the energy used and the relevant environmental impacts for different products across the supply chain. It also provides the opportunity for companies and policymakers to consider the organisation and its impacts on the entire system, rather than a single link within the supply chain. LCA is the subject of international standards ISO 14040:2006. LCA consists of four phases, as shown in Fig. 3

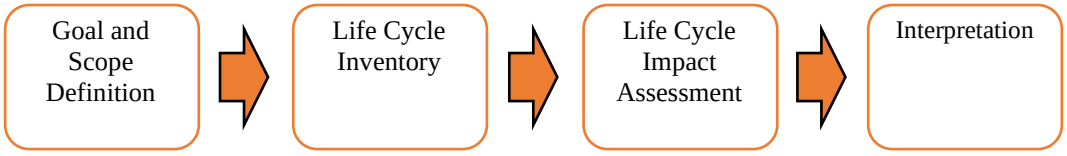

Fig. 3 Phases of life cycle assessment

MOOC aLIFEca CONTENT

The training prepared within the project aLIFEca will reflect the greening trend of the current automotive sector in the EU emphasising the development of electromobility together with FCEVs. The course content will be addressed to main defined barriers such as:

- low awareness regarding the actual environmental performance of electric vehicles
- weaknesses of the electromobility ecosystem in Europe is the absence of a dynamic start-up scene amongst carmakers

The course will be designed to reflect ambitions sustainability goals and regulations set down by the European Commission:

- to increase the use of alternative fuels in transport,
- to reduce emissions of hazardous greenhouse gases and the use of fossil fuels.

A chapter will be devoted to the topic of life cycle assessment of alternative fuelled vehicles and environmental aspects of BEVs and FCEVs. On the other hand, comparison with conventional fuelled vehicles is necessary to objectively evaluate environmental impact of those technologies. Therefore, a chapter dealing with life cycle assessment of internal combustion engine is necessary and will be included in the course. The course must be interactive and supplied with case studies. It is important to include case calculations and software simulation for environmental impact determination. A chapter dealing with various kinds of tools and aids for life cycle assessment such as SimaPro, Umberto or Gabi is essential. The software presentation will help to develop digital skills of trainees and enhance their capability to carry out the LCA analysis. To summarize it, the chapters included in the training will be specialised in:

- Introduction to sustainability and LCA
- LCA in automotive: conventional fuel vehicles,
- LCA in automotive: alternative fuel vehicles,
- Tools for LCA and environmental impact assessment

There are significant differences between vehicles conventionally fuelled and those ones using alternative fuels such as electricity or hydrogen. The main elements distinguishing BEVs from traditional vehicles are the use of batteries and electric motors. Batteries are the main single cost component of BEVs. Therefore, the life cycle assessment of these technologies is recommended in view of fuel and battery charging.

MOOC aLIFEca METHOD [15]

Many life cycle assessment methods are used to perform life cycle analyses:

- ILCD Midpoint method recommended by the European Commission as representative of European conditions
- IPPC method developed ty the Intergovernmental Panel on Climate Change and used to assess the impact on GHG emissions
- Cumulative Energy Demand method which enables determination of cumulative energy demand
- IMPACT2002+ method making it possible to compile data inventories and assess them under more than a dozen intermediate categories assigned to the four primary damage categories
- ReCiPe 2008 method representing one of the most comprehensive assessment models

Companies operating in the automotive sector use the life cycle analysis method known as well to wheel (WTW). The WTW method makes it possible to assess the energy consumption and greenhouse gas emission associated with production, transport and distribution of fuel. A WTW study on automotive fuels has been developed by collaboration between the European Council for Automotive Research and Development (EUCAR), Environmental Science for European Refining (CONCAWE), and the Joint Research Centre of the European Commission (JRC). According to WTW, environmental assessment considers the phases connected with extraction of raw materials refining and distribution of fuels and fuel utilisation. Compared to LCA, the WTW approach only takes into account the impact categories related to energy consumption and greenhouse gas emissions over the fuel life cycle. The fuel life cycle covers two phases Well-to-Tank (WTT) and Tank-to-Wheel (TTW):

[15] Dorota Burchart. Application of Advanced Environmental Life Cycle Assessment Methods to Pathways of Alternative Transport Fuels. Wydawnictwo Polytechniky Slaskiej, Gliwice 2021, ISBN 978-83-7880-782-7.

- well-to tank (WTT), where the environmental burden associated with the extraction of the raw materials from which the fuel is produced is consider, as well as the fuel production, transport and storage
- tank-to wheel (TTW), which considers the environmental loads associated with vehicle fuel consumption, refuelling and combustion during the operation of vehicles

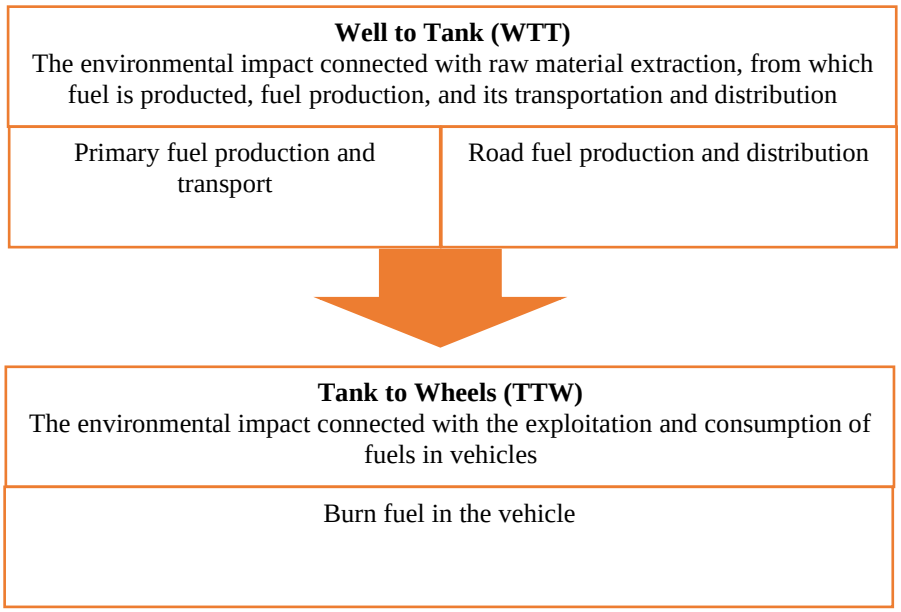

Fig. 4 Phases included in WTW analysis

The WTW analysis method is that one typically applied to determine the vehicle's environmental impact, although the WTW approach only considers the impact categories related to energy consumption and greenhouse gas emissions over the fuel life cycle not considering many other stages of the vehicle life cycle and environmental impact categories such as materials used in the vehicle production process. Thanks to difficulties related to obtaining data concerning the environmental impact of vehicle production, the WTW analysis method and its variants is widely spread and used in the automotive sector. For the course aLIFEca, it is sufficient and using WTW analysis method, the training of life cycle assessment can be carried out to show basic principles of life cycle assessment.

MOOC aLIFEca FORMAT

The course will be in format of massive online course (MOOC). MOOCs represent innovative teaching and learning in their own character, being run online, aimed at unlimited participation worldwide and open access via the web. MOOCs deliver in an online environment, free and open classes to anyone who registers regardless of their skin colour, religion, age, gender, medical condition or even previous education or qualification. MOOCs

give an option of studying a subject in depth without the constraints of a traditional university course. Their students can be anywhere in the world as the resources are all online. The courses are open to anyone, regardless of whether or not they have studied before. Students can simply follow the course at their own pace, taking as much time as they need. Nowadays, MOOCs provide an affordable and flexible way to learn new skills, advance the career and deliver quality educational experiences on a large scale. At the same time, open and massive course should not mean low professionality or low quality.

The alliance ALBATTS recommend for training to explore various re-/up-skilling instruments. Based on them, for the MOOC aLIFEca the following approaches and tools are proposed to be used:

1) **Work-based learning;**

The course should consist of practical examples. The trainees might carry out their own calculation, use software tools or find the right answer in multiple tests. The tutorials are proposed to be alternated with videos, interviews, quizzes and games,

2) **Innovative and up-to-date programs;**

In the course should be presented and practically applied the software tools for life cycle assessment calculation. There are a wide range of commercial software. The trial versions are often free of charge to be downloaded and used for a month. Moreover, there are known other tools for calculations of greenhouse gas emissions or energy consumption which have been developed by research institutions. They are recommended to be also presented as innovative approaches to LCA.

3) **Training by internal and external experts;**

The MOOC aLIFEca will be interactively presented to the target group at National MOOC workshops. The target group will be trained in life cycle assessment by MOOC aLIFEca designers specialised in LCA and sustainability who are included in the project team. The high qualification of the training and its trainers is guaranteed by the interconnection of partners from academic sphere with strong scientific results in the field of LCA and business companies oriented in the sustainable and circular economy.

4) **Training of trainers;**

The researchers included in the project team aLIFEca will be trained in LCA and prepared MOOC aLIFEca at its beginning. Within the project, an activity called MOOC training will be held to open field for brainstorming of the team. The training will arrange an opportunity for the good practice transfer and contribute to better orientation of future trainers presenting MOOC aLIFEca in National MOOC workshops.

TARGET GROUP AND ITS NEEDS FOR THE COURSE

MOOC aLIFEca will be tailored to the target groups. aLIFEca is aimed at wide target group including:

1) **future green automotive/mobility workers,**

such as university students, early-stage researchers/Ph.D. students, secondary students, current automotive/mobility workers and employees including managers and engineers dealing with sustainability topic and future product development, mobility strategies and support for green automotive development together with entrepreneurs interested in environmentally sustainable innovations.

2) **lecturers, trainers, teachers**

who can use the course aLIFEca MOOC or its chapters created within the project for their trainings, lectures and lessons.

Reflecting the target group needs, the format of the training should not be too academic. It should use language close to the target group. The course should be supplemented with interactive schemes and comparison cases. The course will present LCA as an environmental management tool owing to its numerous useful applications. For example, it will present to be used by the industry for sustainable product development and strategic planning to support life cycle thinking and decision making. Once graduated from the course, the target group will understand the assessment of GHG emissions and other environmental impacts like depletion of abiotic resources, demand for fossil fuels, minerals and metals, ecotoxicity, eutrophication, cumulative energy demand, human health ecosystem quality, etc. It will be able to underscore the effect of different life cycle phases and, by that means, avoid transmission of environmental burdens.

LANGUAGE OF MOOC aLIFEca

MOOC aLIFEca will be in English but the guide, Guide aLIFEca, for it will be in other languages. The languages have been selected regarding the languages of partners in the project team. The course materials will be in Czech and Slovak. These countries are typical with the highest employment in automotive sector in the EU (Tab.1). Then it will be in Polish. Poland is a country with strong automotive employment footprint. Finally, in Italian as Italy has a long automotive tradition and significant employment footprint in specific segments of the value chain. Obviously, the selected languages will help to cover

needs for training of the future or current workers in the countries with an important automotive share in employment.

CONCLUSIONS

The transition to electromobility can offer a range of opportunities for sustainable innovation, growth, and employment. However, there is noticed limited consumer awareness regarding costs and benefits, and efficiencies and a scepticism that still exists among consumers regarding the actual environmental performance of electric vehicles. Therefore, education and training in this field is necessary.

The aLIFEca project will bring a new LCA training that will help automotive industry on the way to green and sustainable mobility to up-/re-skill its workers as well as schools and universities to educate its students. Understanding the environmental impacts of today's automotive innovations is in the interest of the entire automotive ecosystem - vehicle manufacturers and distributors, manufacturing and management staff working in automotive, but also municipalities which decide on the direction of mobility and the support for the introduction of technological innovations in this area.

REFERENCES

1. David BROWN, Michael FLICKENSCHILD, Caio MAZZI, Alessandro GASPAROTTI, Zinovia PANAGIOTIDOU, Juna DINGEMANSE and Stefan BRATZEL. The Future of the EU Automotive Sector. Study requested by the ITRE committee. October 2021. Available at https://www.europarl.europa.eu/RegData/etudes/STUD/2021/695457/IPOL_STU(2021)695457_EN.pdf
2. Key figures on the EU auto industry - ACEA - European Automobile Manufacturers' Association [online]. Copyright © 2022 ACEA [cit. 06.06.2022]. Available at: https://www.acea.auto/figure/key-figures-eu-auto-industry/
3. Fact sheet: cars - ACEA - European Automobile Manufacturers' Association. [online]. Copyright © 2022 ACEA [cit. 06.06.2022]. Available at https://www.acea.auto/fact/fact-sheet-cars/https://www.acea.auto/fact/fact-sheet-cars/
4. Automotive industry. European Commission [online]. Available at: https://ec.europa.eu/growth/sectors/automotive-industry_en
5. European Association of Automotive Suppliers CLEPA. Employment - CLEPA Available at: https://clepa.eu/who-and-what-werepresent/suppliers-eu-employment-footprint/employment/
6. Project DRIVES [online]. Copyright © 2022 PROJECT DRIVES [cit. 06.06.2022Available at: https://www.project-drives.eu/en/aboutus
7. Project ALBATTS [online]. Copyright © 2022 PROJECT ALBATTS [cit. 06.06.2022]. Available at: https://www.project-albatts.eu/en/results
8. Project ALBATTS [online]. Copyright © 2022 [cit. 06.06.2022]. Available at: https://www.projectalbatts.eu/Media/Publications/35/Publications_35_20211203_10553.pdf
9. AUTOMOTIVE SKILLS ALLIANCE. [online]. Available at: https://automotive-skills-alliance.eu/ https://automotive-skills-alliance.eu/
10. European Commission, 2021, The Future of the EU Automotive Sector. Available at" https://www.europarl.europa.eu/RegData/etudes/STUD/2021/695457/IPOL_STU(2021)695457_EN.pdf

11. European Commission (2011), White Paper: Roadmap to a single European transport area – towards a competitive and resource-efficient transport system, COM (2011) 144 final, Brussels.
12. European Commission (2013), Communication from the Commission to the European Parliament, the Council, the European Social and Economic Committee and the Committee of the Regions: Clean Power for Transport: A European alternative fuels strategy, COM (206) 017 final, Brussels
13. European Commission, 2019, The European Green Deal., Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2019%3A640%3AFIN
14. European Commission, 2020, Circular Economy Action Plan for a cleaner and more competitive Europe. Available at: https://ec.europa.eu/environment/pdf/circular-economy/new_circular_economy_action_plan.pdf.
15. The revision of the ELV Directive sets targets based on the weight of a vehicle (minimum of 95% for reuse and recovery; 85% for reuse and recycling) with European automotive manufacturers being responsible for disposal/recycling costs. It also imposes provisions on vehicle design (e.g. use of chemicals). See: European commission, 2021, End-of-Life Vehicles. Available at: https://ec.europa.eu/environment/topics/waste-and-recycling/end-life-vehicles_en
16. Dorota Burchart. Application of Advanced Environmental Life Cycle Assessment Methods to Pathways of Alternative Transport Fuels. Wydawnictwo Polytechniky Slaskiej, Gliwice 2021, ISBN 978-83-7880-782-7.