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EU'S CIRCULAR ECONOMY OBJECTIVE

Assessing the Compatibility of Vehicle Electrification With the EU's Circular Economy Objective

Audrey Danthinne* & Michael Picard**

The electrification of vehicles and the transition to a circular economy (CE) are important aspects of the EU's strategy to become climate neutral by 2050. However, the compatibility between these two objectives is questionable. Indeed, the lithium-ion batteries (LIBs) used in most electric vehicles (EVs) are currently difficult to recycle due to economic and practical challenges. This recycling problem increases the risk that end-of-life LIBs end up in landfills. If so, the CE would be severely punctured. Our study analyses how this potential inconsistency is addressed at the EU level by focusing on three EU legal instruments, i. e., the current and proposed regulatory framework for batteries and waste batteries, the End-of-Life Vehicles (ELV) Directive and the new Taxonomy Regulation. It observes that while the EU stands out in imposing sustainability requirements on the battery and vehicle industries, several shortcomings remain, such as the lack of specific legal provisions for LIBs, inappropriate targets and weak extended producer responsibility (EPR), which undermine the credibility of vehicle electrification as a climate change mitigation strategy in the EU.

Keywords: Vehicle Electrification, Circular Economy, Lithium-ion Batteries, Recycling, European Union, Zero-emission, Waste Batteries, Electric Vehicles, Climate Change Mitigation, Sustainability

I. Introduction

In an effort to meet the temperature goal of the 2015 Paris Agreement,¹ many states have pledged to move away from fossil fuels towards zero-emission economies.² The legal force, scope and timeframe of these pledges vary from state to state,³ but the transport sector, and more specifically the electrification of vehicles, feature prominently in most national zero-emission action plans.⁴ The global call for vehicle electrification garners an increased interest in lithium, which is the material used to produce the lithium-ion batteries (LIBs) employed in most electric vehicles (EVs).⁵ In the EU, where the number of newly

registered EVs increased by 5.3% in 2020 compared to 2010,⁶ it has been estimated that the need for lithium will increase by eighteen times by 2030, and by almost sixty times by 2050, compared to the current supply to the whole EU economy.⁷ While EVs are generally considered a more sustainable alternative to fossil fuel-powered engines,⁸ the deployment of LIBs raises significant environmental concerns, notably in terms of waste management.⁹ At present, the rate of recycled LIBs is marginal.¹⁰ For example, in Australia, only 2% of its 3.300 tons of lithium-ion waste was recycled in 2018¹¹

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¹ UNFCCC, *Decision 1/CP.21 Adoption of the Paris Agreement*, FCCC/CP/2015/10/Add.1 (2016), Annex, Art. 2(1)(a).

² UNFCCC, *Decision-/CP.26 Glasgow Climate Pact*, Advance unedited version (2021), para. 20; Takuma Watari et al., *Integrating Circular Economy Strategies With Low-Carbon Scenarios: Lithium Use in Electric Vehicles*, 53 *Envtl. Sci. & Tech.* 11657 (2019).

³ Haleh Moghaddasi, Charles Culp & Jorge Vanegas, *Net Zero Energy Communities: Integrated Power System, Building and Transport Sectors*, 14 *Energies* 7065, 7066 (2021).

⁴ See e.g., UK Department for Environment, Food & Rural Affairs and The Rt Hon Michael Gove MP, *A Green Future: Our 25 Year Plan to Improve the Environment* 98 (2018); *Plan national intégré Energie Climat Belge 2021-2030*, 63 (2019); *Sweden's Integrated National Energy and Climate Plan* 50 (2020); *Climate Action Plan 2050: Principles and Goals of the German Government's Climate Policy* 52 (2016).

⁵ Li-Feng Zhou et al., *The Current Process for the Recycling of Spent Lithium Ion Batteries*, 8 *Frontiers Chemistry* 1 (2020); Oliver Hailes, *Lithium in International Law: Trade, Investment, and the Pursuit of Supply Chain Justice*, 25 *J. Int'l Econ. L.* 148, 151 (2022).

⁶ Statistics for the European Green Deal, <https://ec.europa.eu/eurostat/cache/egd-statistics/> (accessed 15 Jul. 2022).

⁷ European Parliamentary Research Service (EPRS), *New EU Regulatory Framework for Batteries: Setting Sustainability Requirements*, PE 689.337, 3 (4 Mar. 2022).

⁸ James Kliesch, *Why Electric Cars Are Cleaner*, *Mother Earth News* (2011), <https://www.motherearthnews.com/green-transportation/green-vehicles/electric-cars-zm0z11zsto> (accessed 10 Aug. 2022).

⁹ Philip Fliegel, Marco Göllrich, Maximilien Koepp, Arthur Schweitzer, Martin Bruckner & Stefan Giljum, *The Lithium Dilemma. Unveiling the Displaced Costs of Going Green*, 14 *Fineprint Brief* 1, 2 (2021).

¹⁰ Carlito Baltazar Tabelin et al., *Towards a Low-Carbon Society: A Review of Lithium Resource Availability, Challenges and Innovations in Mining, Extraction and Recycling, and Future Perspectives*, 163 *Min. Eng'g* 106743, 106754–106755 (2021).

¹¹ Amit Katwala, *The Spiralling Environmental Cost of Our Lithium Battery Addiction*, *Wired* (2018), <https://www.wired.co.uk/article/lithium-batteries-environment-impact> (accessed 18 May 2022).

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and only about 5% of LIBs are currently recycled in the US.¹² The low recycling rate of LIBs is due to economic and processing challenges,¹³ and to the relatively recent nature of the push for vehicle electrification, which means that the volumes of discarded LIBs are not yet sufficient for large-scale recycling to be economically viable.¹⁴ As a result, no systematic recycling system exists yet.¹⁵ This recycling issue aggravates the global overproduction of waste and runs counter to the concept and objectives of the circular economy (CE), according to which sustainable production and consumption, as well as maximum recycling and resource recovery, must be stimulated in order to limit waste incineration and landfilling.¹⁶ In the EU, more than 2.1 billion tons of total waste were generated in 2020, of which more than 1.6 million tons were waste batteries.¹⁷

The transition to a CE has been described by the European Commission as an 'irreversible, global mega trend'¹⁸ and is one of the fundamental changes required in the European Green Deal.¹⁹ At the same time, the Commission is calling for an increased production and use of EVs in the EU²⁰ in order to achieve a zero-emission passenger and freight transport system by 2050.²¹ In light of the concerns outlined above, the compatibility between these two objectives seems doubtful.²² The promise of 'consuming green' associated with the promotion of EVs in EU laws and policies echoes Bonadiman's argument that law is not just a set of intellectual answers to pragmatic and theoretical problems, but also a profession of faith, associated with promises, 'turning (...) law into a prophecy of redemption'.²³ However, to be truly redemptive, these promises must be based on regulatory coherence. The aim of this study is therefore to consider whether the EU, beyond its promise of a 'green' economy, also addresses the current discordance between the low recycling rate of LIBs and the CE concept of zero waste production. In particular, this article analyses whether the EU's promotion of vehicle electrification as a climate change mitigation strategy is compatible with its CE objective. This compatibility assessment will then allow us to evaluate the credibility of vehicle electrification as a climate change mitigation strategy in the EU.

The transport sector is a major source of greenhouse gas (GHG) emissions.²⁴ It is therefore essential to assess the sustainability of transport electrification, and in particular the electrification of road transport as it is responsible for more than half of all transport-related emissions.²⁵ Are the EU legal instruments applicable to the recycling of LIBs in conformity with the sustainability agenda? To answer this question, particular attention will be given to the current and proposed EU regulatory framework for batteries and waste batteries, the EU Directive on end-of-life vehicles (ELV) and the new EU Taxonomy Regulation.²⁶ It is important to focus on the EU jurisdiction, since Europe claims to be a major player in the fight against climate change and was in 2020 the region with the second largest fleet of EVs.²⁷ Section 2 starts by briefly

¹² Jacob Wallace, *Wave of Investment Just the Beginning for EV Battery Recycling*, WasteDive (2021), <https://www.wastedive.com/news/lithium-ion-battery-recycling-ev-li-cycle-retrieve/608778/> (accessed 10 Aug. 2022).

¹³ Tabelin et al., *supra* n. 10, at 106754–106755.

¹⁴ Zhou et al., *supra* n. 5, at 1; Louis Dawson, Jyoti Ahuja & Robert Lee, *Steering Extended Producer Responsibility for Electric Vehicle Batteries*, 23 *Envtl. L. Rev.* 128, 131 (2021).

¹⁵ *Ibid.*

¹⁶ Atiq Uz Zaman, *A Comprehensive Review of the Development of Zero Waste Management: Lessons Learned and Guidelines*, 91 *J. Cleaner Production* 12 (2015).

¹⁷ Eurostat, *Generation of Waste by Waste Category, Hazardousness and NACE Rev. 2 Activity* (31 May 2022), https://ec.europa.eu/eurostat/databrowser/view/env_wasgen/default/table?lang=en (accessed 25 Sep. 2022).

¹⁸ Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the implementation of the Circular Economy Action Plan, Brussels, 4 Mar. 2019, COM(2019) 190 final, at 10.

¹⁹ Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions, *The European Green Deal*, Brussels, 11 Dec. 2019, COM(2019) 640 final, para. 2.1.3; Martin Calisto Friant, Walter J. V. Vermeulen & Roberta Salomone, *Analysing European Union Circular Economy Policies: Words Versus Actions*, 27 *Sust. Production & Consumption* 337 (2021).

²⁰ See for instance Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, *A European Strategy for Low-Emission Mobility*, Brussels, 20 Jul. 2016, COM(2016) 501 final; Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank, *A Clean Planet for All: A European Strategic Long-Term Vision for a Prosperous, Modern, Competitive and Climate Neutral Economy*, Brussels, 28 Nov. 2018, COM(2018) 773 final, at 8.

²¹ Nathalie Ortar & Marianne Ryghaug, *Should All Cars Be Electric by 2025? The Electric Car Debate in Europe*, 11 *Sustainability* 1868, 1869 (2019).

²² See the notion of *Successive, Parallel and Contradictory Commitments*, in *A Landscape of Contemporary Theories of International Law* 597 (Emmanuel Roucouas ed., BRILL 2019).

²³ Luca Bonadiman, *Faith, in Concepts of International Law* 297, 300 and 314 (Jean d'Aspremont & Sahib Singh eds, Edward Elgar Publishing 2019).

²⁴ *The European Green Deal*, *supra* n. 19, para. 2.1.5.

²⁵ Runsen Zhang & Shinichiro Fujimori, *The Role of Transport Electrification in Global Climate Change Mitigation Scenarios*, 15 *Envtl. Res. Ltr.* 034019, 034019 (2020).

²⁶ See e.g., Directive 2008/98/EC of the European Parliament and of the Council of 19 Nov. 2008 on waste and repealing certain Directives (Text with EEA relevance), OJ L 312, 22 Nov. 2008; and Directive (EU) 2019/1161 of the European Parliament and of the Council of 20 Jun. 2019 amending Directive 2009/33/EC on the promotion of clean and energy-efficient road transport vehicles (Text with EEA relevance), PE/57/2019/REV/2, OJ L 188, 12 Jul. 2019.

²⁷ International Energy Agency, <https://www.iea.org/topics/transport> (accessed 15 May 2022).

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presenting the EU's CE objective in relation to batteries and transport. Section 3 then assesses the EU legal framework for vehicle electrification, focusing on three legal instruments and the Extended Producer Responsibility (EPR) rule. Section 4 reflects on what has been presented earlier and provides an interim conclusion on the credibility of vehicle electrification as a climate change mitigation strategy in the EU. Section 5 concludes.

II. EU CE Objective

Moving towards a CE has been one of the EU's objectives since 2014, when the Commission published a first communication on this matter.²⁸ In 2015, the Commission published the EU's first Circular Economy Action Plan advocating a more ambitious approach to CE.²⁹ The latter concept was defined therein as an economy 'where the value of products, materials and resources is maintained in the economy for as long as possible, and the generation of waste minimized'.³⁰ Although there is no single, static definition of the concept,³¹ this definition was adopted in subsequent policy instruments, with reference to the 2015 action plan as the starting point for the EU's CE strategy.³² In March 2020, the Commission adopted its latest EU Circular Economy Action Plan for a cleaner and more competitive Europe to implement and accelerate the changes required by the European Green Deal.³³ Building on the measures implemented since 2015, the new plan focuses on designing sustainable products, empowering consumers and public buyers and circularizing production processes to make sustainability the norm and achieve zero waste.³⁴ Unlike the first action plan, which only refers to batteries in its annex, this plan foregrounds batteries and vehicles among the key product value chains.³⁵ Among others, the plan recommends a new regulatory framework for batteries by 2020, a revision of the rules on ELV by 2021, and other measures requiring waste reduction by 2021 or 2022.³⁶

Recurring themes such as 'recycled content', 'collection and recycling rates', 'recovery of valuable materials', 'recycling efficiency' and 'guidance to consumers' outline key elements of the EU's strategy to increase circularity in the battery and vehicle industries.³⁷ These terms are also used by Giosuè and others who present the CE concept as a 'cradle-to-cradle' process which, in the context of LIBs, can be summarized in several steps³⁸ echoing the waste hierarchy established by the Waste Framework Directive, which prioritizes prevention, followed by reuse, recycling, other forms of recovery and finally disposal.³⁹ The idea is to create a continuous circular lifecycle for LIBs⁴⁰ in order to reduce energy consumption and CO₂ emissions, save natural resources, minimize environmental impact, create economic gain, reduce waste and manage safety issues.⁴¹

With particular attention to the actions required by the new EU Circular Economy Action Plan, this study now turns to the EU legal instruments applicable to LIBs and EVs in order to assess whether the EU's promotion of

vehicle electrification as a climate change mitigation strategy aligns with its CE objective.

III. EU Legal Framework for Vehicle Electrification

3.1 EU regulatory framework for batteries and waste batteries

To date, Directive 2006/66/EC (the Batteries Directive) is the main legal instrument regulating batteries and waste batteries in the EU.⁴² It covers several types of batteries, including 'industrial batteries', i.e., 'any battery or accumulator designed for exclusively industrial or professional uses or used in any type of electric vehicle',⁴³ thus also covering LIBs. The Directive requires Member States to take the necessary measures to maximize the separate collection of waste batteries and minimize their disposal in order to achieve a high level of recycling.⁴⁴ To this end, it requires them to ensure that appropriate

²⁸ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, *Towards a Circular Economy: A Zero Waste Programme for Europe*, Brussels, 2 Jul. 2014, COM(2014) 398 final.

²⁹ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, *Closing the Loop – An EU Action Plan for the Circular Economy*, Brussels, 2 Dec. 2015, COM(2015) 614 final; Zora Kovacic, Roger Strand & Thomas Völker, *The Circular Economy in Europe: Critical Perspectives on Policies and Imaginaries* 39 (Routledge 2019).

³⁰ Commission's Communication, *Closing the Loop*, *supra* n. 29, at 2.

³¹ Kovacic, Strand & Völker, *supra* n. 29, at 6.

³² *Ibid.*, at 41.

³³ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, *A New Circular Economy Action Plan For a Cleaner and More Competitive Europe*, Brussels, 11 Mar. 2020, COM(2020) 98 final, at 1–2.

³⁴ *Ibid.*

³⁵ *Ibid.*, at 7–8.

³⁶ *Ibid.*, Annex, 1–2.

³⁷ *Ibid.*, at 7–8.

³⁸ Chiara Giosuè et al., *An Exploratory Study of the Policies and Legislative Perspectives on the End-of-Life of Lithium-Ion Batteries from the Perspective of Producer Obligation*, 13 Sustainability 11154, 11157 (2021).

³⁹ Directive 2008/98/EC, *supra* n. 26, Art. 4(1).

⁴⁰ Dawson, Ahuja & Lee, *supra* n. 14, at 133.

⁴¹ Giosuè et al., *supra* n. 38, at 11157.

⁴² Directive 2006/66/EC of the European Parliament and of the Council of 6 Sep. 2006 on batteries and accumulators and waste batteries and accumulators and repealing Directive 91/157/EEC (Text with EEA relevance), OJ L 266, 26 Sep. 2006, at 1–14.

⁴³ Directive 2006/66/EC (consolidated version), *supra* n. 42, Art. 3(6).

⁴⁴ *Ibid.*, Art. 7.

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collection and recycling schemes for waste batteries are in place, placing particular emphasis on producers,⁴⁵ and that certain minimum collection rates and minimum recycling efficiency targets are met.⁴⁶

At first glance, the Batteries Directive aligns with the EU's CE objective in that it promotes recycling rather than disposal of waste batteries and imposes minimum collection and recycling efficiency targets. Nevertheless, in its 2019 ex-post evaluation and implementation report on the Directive, the Commission identified a number of shortcomings, two of which are highlighted here.⁴⁷ First, although LIBs fall within the scope of the Directive, they are not specifically addressed by its provisions but rather fall under the broader category of 'industrial batteries', which undermines the relevance of the Directive.⁴⁸ Indeed, to date, EVs are mainly used by private individuals for private purposes, as opposed to 'industrial' use,⁴⁹ and, as Giosuè and others note, the classification of LIBs as industrial batteries means that 'their take-back, collection, and recycling procedures are regulated as products whose safety issues, market availability, and logistic frameworks are totally different'.⁵⁰ In addition, while the Directive provides specific recycling efficiency targets for lead-acid and nickel-cadmium batteries, LIBs are included in the residual category of 'other waste batteries' with the lowest recycling efficiency target (50% by average weight, compared to 65% and 75% by average weight for the first two types of batteries).⁵¹ Finally, the current Directive does not contain any recycled content target and does not support the achievement of recycling efficiencies beyond the minimum requirements.⁵² While the Batteries Directive differs from other LIB regulations around the world in setting minimum targets,⁵³ the Commission believes that these requirements are not appropriate to promote a high level of recycling of waste batteries.⁵⁴

The omission of LIBs and the lack of recycled content rates means that there is currently no specific obligation for recycling LIBs and lithium under the Batteries Directive, and this leads to an increased risk of generating waste.⁵⁵ In view of these deficiencies and in line with the requirement of the new EU Circular Economy Action Plan, the Commission proposed a new regulatory framework for batteries and waste batteries that would repeal and replace the current Batteries Directive.⁵⁶ Among the changes that the proposed Regulation would bring, EV batteries would be a specific category, distinct from industrial batteries.⁵⁷ In addition, a recycled content declaration would be required from 2027 for certain types of batteries, including EV batteries; mandatory minimum levels of recycled content would be set, including 4% of lithium in 2030 and 10% in 2035; specific targets would be set for LIB recycling efficiencies, i.e., 65% by average weight by 2025 and 70% by 2030; specific material recovery targets would be introduced, including 35% for lithium by the end of 2025 and 70% by 2030, and second-life requirements would be set for EVs.⁵⁸ The proposal also includes a due diligence obligation for economic operators that place rechargeable industrial batteries and EV batteries on the market.⁵⁹

While the proposal addresses many of the key gaps identified in 2019, it has generated mixed reactions. Some have questioned the need to set recycled content targets now, as this could hold back innovative and fast-moving industries.⁶⁰ Others are calling for more ambitious targets, such as the European Parliament's Committee on the Environment, Public Health and Food Safety (ENVI) which asks for example that the material recovery target for lithium be raised to 70% by 2026 and 90% in 2030.⁶¹

⁴⁵ *Ibid.*, Arts 8(3) and 12(1).

⁴⁶ *Ibid.*, Arts 10(2), 12(4) and Annex III Part B.

⁴⁷ Commission Staff Working Document on the evaluation of the Directive 2006/66/EC on batteries and accumulators and waste batteries and accumulators and repealing Directive 91/157/EEC, Brussels, 9 Apr. 2019, SWD(2019) 1300 final; Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the implementation and the impact on the environment and the functioning of the internal market of Directive 2006/66/EC of the European Parliament and of the Council of 6 Sep. 2006 on batteries and accumulators and waste batteries and accumulators and repealing Directive 91/157/EEC, COM/2019/166 final.

⁴⁸ European Parliamentary Research Service (EPRS), *Implementation Appraisal on the Batteries Directive*, PE 654.184, 3–4 (1 Oct. 2020).

⁴⁹ Dawson, Ahuja & Lee, *supra* n. 14, at 135 and 139.

⁵⁰ Giosuè et al., *supra* n. 38, at 11159.

⁵¹ Directive 2006/66/EC (consolidated version), *supra* n. 42, Annex III part B.

⁵² European Parliamentary Research Service (EPRS), *supra* n. 48, at 3.

⁵³ Kevin M. Winslow, Steven J. Laux & Timothy G. Townsend, *A Review on the Growing Concern and Potential Management Strategies of Waste Lithium-Ion Batteries*, 129 *Resources Conserv. & Recycling* 263, 272 (2018); Tabelin et al., *supra* n. 10, at 106746.

⁵⁴ European Parliamentary Research Service (EPRS), *supra* n. 48, at 4.

⁵⁵ European Commission, Directorate-General for Environment, Hartmut Stahl, Georg Mehlhart, Martin Gsell et al., *Assessment of Options to Improve Particular Aspects of the EU Regulatory Framework on Batteries: Final Report* (Publications Office 2021), para. 5.3.2.

⁵⁶ Proposal for a Regulation of the European Parliament and of the Council concerning batteries and waste batteries, repealing Directive 2006/66/EC and amending Regulation (EU) No 2019/1020 (Text with EEA relevance), Brussels, 10 Dec. 2020, COM (2020) 798 final, at 2.

⁵⁷ *Ibid.*, Art. 2(12).

⁵⁸ European Parliamentary Research Service (EPRS), *supra* n. 7, at 6.

⁵⁹ *Ibid.*

⁶⁰ *Ibid.*, at 7.

⁶¹ Amendments adopted by the European Parliament on 10 Mar. 2022 on the proposal for a Regulation of the European Parliament and of the Council concerning batteries and waste batteries, repealing Directive 2006/66/EC and amending Regulation (EU) 2019/1020 (COM(2020)0798 – C9-0400/2020 – 2020/0353(COD)), Strasbourg, 10 Mar. 2022, P9_TA (2022)0077, amendments 487 and 488.

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Dawson and others have a more critical view: they argue that instead of having recycling efficiency targets based on the average weight of the battery, they should be based on specific materials identified as important for recycling efficiency. Indeed, a large amount of the weight of the battery is attributable to the casing alone, thus making it easy to achieve the targets without significant material recovery and recycling.⁶² Surprisingly, this view is already shared by the Commission with regard to the targets set in the ELV Directive, which are also based on the weight of the vehicle.⁶³ Why, then, did the Commission propose such a benchmark for batteries, considering it recognized elsewhere that it is potentially inadequate for material recovery?

Despite its shortcomings, the Commission's proposal could make the EU's promotion of EVs more consistent with its CE objective, since it includes higher recycling targets and requirements. However, the proposal has not been adopted yet, and while members of the European Parliament and the Council are generally in favour of ambitious sustainability targets, some members of the Council have asked for 'reasonable deadlines' to allow industry to adapt to the proposed stricter targets and requirements.⁶⁴ The risk is that long deadlines could jeopardize the achievement of the EU's CE objective as they would allow more waste batteries to be disposed of in landfills. Moreover, the reform's success depends on effective implementation by all Member States, in an e-waste management sector traditionally marred by improper labelling, municipal mismanagement and bureaucratic corruption.⁶⁵

3.2 EU Directive on ELV

Another key instrument for assessing the promotion of EVs is EU Directive 2000/53/EC on ELV Directive.⁶⁶ Although it does not refer to EVs as such, its scope does not exclude them either,⁶⁷ and, as mentioned in the preamble of the Batteries Directive, 'industrial batteries and accumulators used in vehicles should meet the requirements of Directive 2000/53/EC'.⁶⁸ Since half of all passenger vehicles sold in the EU are expected to be electric or hybrid by 2030, the importance of this Directive for the future of LIB recycling becomes clear.⁶⁹

The ELV Directive pursues three key objectives: prevent waste from vehicles; reuse, recycle and recover ELV and their components to reduce waste disposal; and improve the environmental performance of economic operators involved in the lifecycle of vehicles.⁷⁰ The Directive includes requirements on waste prevention (reducing hazardous substances in vehicles; smart design and production processes that facilitate dismantling; reuse and recovery including recycling; and increasing amount of recycled materials in vehicles),⁷¹ collection of ELV (establishing collection schemes and facilities,⁷² transferring ELV to authorized treatment facilities),⁷³ treatment of ELV (depollution treatment),⁷⁴ the reuse, recovery and recycling of ELV and their components with minimum targets (by 2015, reuse and recovery of ELV shall increase to a minimum of 95% by average weight per

vehicle per year, and 85% for reuse and recycling),⁷⁵ and the provision of information to facilitate the identification of components and materials used in vehicles that can be reused and recovered.⁷⁶

While the ELV Directive also appears at first glance to be consistent with the EU's CE objective, here too the Commission identified certain shortcomings in a 2021 evaluation.⁷⁷ For example, while the Commission noted that '[t]he data reported by Member States indicate that the recovery/reuse and recycling/reuse targets set out in the ELV Directive have largely been met',⁷⁸ it also noted that no targets were set for the period after 2015, although this should have been done.⁷⁹ The Commission also found that the increased use of electrical and electronic components in vehicles could make the recovery and recycling targets difficult to meet in the future, as the treatment methods for ELV envisaged in the ELV Directive (i.e., shredding after depollution) are not appropriate to ensure the separation and recovery of valuable materials contained in those electric components, thus making the recovery and recycling of ELV more difficult.⁸⁰ Furthermore, the targets are based on the weight of the vehicle, which may not be the most effective way to recover valuable materials, as explained earlier.⁸¹

Although the new EU Circular Economy Action Plan required a revision of the rules on ELV by 2021, this

⁶² Dawson, Ahuja & Lee, *supra* n. 14, at 140.

⁶³ Commission Staff Working Document, *Evaluation of Directive (EC) 2000/53 of 18 September 2000 on End-of-Life Vehicles*, Brussels, 15 Mar. 2021, SWD(2021) 60 final, at 72.

⁶⁴ Council of the European Union, *Proposal for a Regulation of the European Parliament and of the Council Concerning Batteries and Waste Batteries, Repealing Directive 2006/66/EC and Amending Regulation (EU) No 2019/1020: Progress Report*, Brussels, 7 Dec. 2021, 14568/21, at 4.

⁶⁵ United Nations University, *Discarded Electronics Mismanaged Within Europe Equals ~10 Times the Volume of E-Waste Exported*, Press release, Bonn (31 Aug. 2015).

⁶⁶ Directive 2000/53/EC of the European Parliament and of the Council of 18 Sep. 2000 on end-of life vehicles, OJ L 269, 21 Oct. 2000, at 34–43.

⁶⁷ Directive 2000/53/EC (consolidated version), *supra* n. 66, Art. 3.

⁶⁸ Directive 2006/66/EC, *supra* n. 42, preamble recital 30.

⁶⁹ Commission Staff Working Document, *supra* n. 63, at 72.

⁷⁰ Directive 2000/53/EC (consolidated version), *supra* n. 66, Art. 1.

⁷¹ *Ibid.*, Art. 4(1).

⁷² *Ibid.*, Art. 5(1).

⁷³ *Ibid.*, Arts. 5(2) and (3).

⁷⁴ *Ibid.*, Art. 6(3).

⁷⁵ *Ibid.*, Arts. 7(1) and (2).

⁷⁶ *Ibid.*, Art. 8(1).

⁷⁷ Commission Staff Working Document, *supra* n. 63.

⁷⁸ *Ibid.*, at 24.

⁷⁹ *Ibid.*, at 25.

⁸⁰ *Ibid.*, at 45 and 71.

⁸¹ *Ibid.*, at 72.

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revision has not taken place yet.⁸² The last amendment to the ELV Directive dates back to 2018, mainly to strengthen the Commission's powers.⁸³ A revision in 2021 might have addressed the shortcomings identified by the Commission in its 2021 evaluation and allowed the ELV Directive to improve reusability of EV materials to conform with the EU's CE objective.

3.3 EU approach to EPR

EPR has been defined as 'an environmental protection strategy to reach an environmental objective of a decreased total environmental impact from a product, by making the manufacturer of the product responsible for the entire lifecycle of the product and especially for the take-back, recycling and final disposal of the product'.⁸⁴ The concept is promoted in several EU legal instruments in relation to waste, including in the Batteries Directive and the ELV Directive. In particular, the Batteries Directive provides that Member States shall ensure that producers do not refuse to take back waste industrial batteries from end-users,⁸⁵ that they set up treatment and recycling schemes,⁸⁶ and that they finance the net costs of collecting, treating and recycling all waste industrial batteries.⁸⁷ The ELV Directive requires Member States to ensure that economic operators set up collection schemes for all ELV⁸⁸ and that producers provide dismantling information for all new vehicles put on the market⁸⁹ and meet all, or a significant part of, the costs for the delivery and/or take back of ELV.⁹⁰

For Dawson and others, the current Batteries Directive and the ELV Directive do not provide a sufficiently strong EPR framework to facilitate a CE for EVs.⁹¹ For example, while the Batteries Directive requires that appropriate collection schemes be set up for waste portable and automotive batteries, i.e., a proactive obligation with specific collection targets, it only requires, in the case of waste industrial batteries (which include LIBs), that producers do not refuse to take them back, without specific take-back targets.⁹² As far as the ELV Directive is concerned, its EPR elements were considered relevant but rather limited by the Commission, compared to EPR systems in place in other EU legal instruments, such as the Waste Framework Directive, where producers assume greater financial and/or administrative responsibility for the management of their end-of-life products.⁹³ Both Directives also allow producers to delegate part of their financial and/or physical responsibility to a third party,⁹⁴ which establishes a regime of collective responsibility.⁹⁵ Yet, according to Dawson and others, a more stringent individual responsibility can better serve the EU's CE objective as it provides greater incentives for producers who bear the recycling costs to design their products in an environmentally friendly way.⁹⁶ However, the proposed new Regulation for batteries and waste batteries also provides that producers should be able to exercise their EPR collectively, through producer responsibility organizations acting on their behalf.⁹⁷

According to Dawson and others, the reason why waste industrial batteries, and therefore LIBs, are currently subject to less stringent EPR obligations under the Batteries

Directive is that at the time the Directive was drafted, EVs were not widely used in the EU and waste portable batteries were considered the most problematic by the Commission because of their size and the ease with which they could be landfilled.⁹⁸ However, with the growing number of EVs in the EU, LIBs are now just as likely to be disposed of in landfills. This could change with the recognition of EV batteries as a specific category in the new Regulation for batteries and waste batteries.

3.4 EU Taxonomy Regulation 2020

In order to improve investment in sustainable, and therefore more circular, battery production capacity, battery-related projects, such as vehicle electrification, should comply with the new EU Taxonomy Regulation.⁹⁹ According to the latter, an economic activity shall qualify as environmentally sustainable where (1) it contributes substantially to at least one of the environmental objectives of the Regulation; (2) it does not significantly harm any of these objectives; (3) it is carried out in compliance with certain minimum safeguards; and (4) it complies with technical screening criteria developed by the Commission under the Regulation.¹⁰⁰

⁸² Commission's Communication, *A New Circular Economy Action Plan*, *supra* n. 33, Annex, 1.

⁸³ Directive (EU) 2018/849 of the European Parliament and of the Council of 30 May 2018 amending Directives 2000/53/EC on end-of-life vehicles, 2006/66/EC on batteries and accumulators and waste batteries and accumulators, and 2012/19/EU on waste electrical and electronic equipment (Text with EEA relevance), PE/9/2018/REV/1, OJ L 150, 14 Jun. 2018, at 93–99.

⁸⁴ Thomas Lindhqvist, *Extended Producer Responsibility in Cleaner Production: Policy Principle to Promote Environmental Improvements of Product Systems* (thesis/docmono, Lund University 2000).

⁸⁵ Directive 2006/66/EC (consolidated version), *supra* n. 42, Art. 8(3).

⁸⁶ *Ibid.*, Art. 12.

⁸⁷ *Ibid.*, Art. 16(1)(b). Small producers may be exempted from this obligation, *see* Art. 18(1).

⁸⁸ Directive 2000/53/EC (consolidated version), *supra* n. 66, Art. 5(1).

⁸⁹ *Ibid.*, Art. 8(3).

⁹⁰ *Ibid.*, Art. 5(4).

⁹¹ Dawson, Ahuja & Lee, *supra* n. 14, at 129.

⁹² Directive 2006/66/EC (consolidated version), *supra* n. 42, Art. 8; *ibid.*, at 139.

⁹³ Commission Staff Working Document, *supra* n. 63, at 58–59.

⁹⁴ Directive 2006/66/EC (consolidated version), *supra* n. 42, Arts 8(3), 12(1) and 16(1); Directive 2000/53/EC (consolidated version), *supra* n. 66, Arts 5(3) and 2(10).

⁹⁵ Dawson, Ahuja & Lee, *supra* n. 14, at 133–134.

⁹⁶ *Ibid.*, at 133.

⁹⁷ Commission's proposal, *supra* n. 56, preamble recital 76.

⁹⁸ Dawson, Ahuja & Lee, *supra* n. 14, at 139.

⁹⁹ European Economic and Social Committee, *Towards a Sustainable Batteries Industry in the EU: Position Paper – May 2021* 1 (Publications Office 2021).

¹⁰⁰ Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 Jun. 2020 on the establishment of a

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With regard to the first condition, the EU's call for the electrification of vehicles is aimed at moving towards a low-carbon economy.¹⁰¹ A correlation can therefore be made with the first environmental objective of the Regulation, i.e., climate change mitigation. For an economic activity to qualify as making a substantial contribution to climate change mitigation under the Regulation, it shall contribute substantially to the stabilization of GHG concentrations in the atmosphere at a level that prevents dangerous anthropogenic interference with the climate system, in line with the temperature goal of the Paris Agreement. To do so, it shall avoid or reduce GHG emissions, including 'by increasing clean or climate-neutral mobility'.¹⁰² The promotion of vehicle electrification, which offers a cleaner alternative to fossil fuel-powered vehicles as no GHGs are emitted at the tailpipe,¹⁰³ could therefore qualify as an activity substantially contributing to climate change mitigation. However, as Zhang and Fujimori note, '[d]espite the powerful and effective impact of transport electrification on reducing direct CO₂ emissions from the transport sector, it is unwise to reach an overly optimistic conclusion by ignoring the indirect CO₂ emissions from the electricity generation that energises EVs'.¹⁰⁴ They add that 'without decarbonization of the future power supply by means of energy policies (...) electrified transport would [actually] lead to an increase in total emissions'.¹⁰⁵ Ortar and Ryghaug also note that 'the contribution of EVs to decarbonisation is contingent on the country's electricity generation mix'-¹⁰⁶ and that '[w]hile some countries, like Norway, mostly produce electricity from clean energy sources, other countries like Poland see the push towards EVs as a way to re-launch the coal mining industry, not to mention France, which remains heavily dependent on its nuclear industry and nuclear electricity production'.¹⁰⁷ To meet the first condition, the EU must therefore also promote a sustainable energy mix and, given the relationship between vehicle electrification and the power sector, adopt harmonized transport and energy policies to avoid any risk of transferring emissions from one sector to the other.¹⁰⁸ In addition, although this article focuses on the recycling of LIBs, the EU must monitor the amount of emissions emitted throughout the lifecycle of EVs, during the manufacturing process of the different parts that make up the vehicle, such as the outer shell.

The second condition requires that none of the environmental objectives of the Regulation are significantly harmed by the economic activity in question. Given the poor recycling rate of LIBs, it is questionable whether the electrification of vehicles actually undermines the fourth objective of the Regulation, i.e., the transition to a CE. An activity is considered to significantly harm the CE if it leads to significant inefficiencies in the use of materials or natural resources, such as raw materials, during the lifecycle of the products supplied by that activity; if the activity leads to a significant increase in the generation, incineration or disposal of waste; or if the long-term disposal of waste may cause significant and long-term damage to the environment.¹⁰⁹ Vehicle electrification

arguably leads to significant inefficiencies in the use of lithium when LIBs reach the end of their life as today almost no lithium is recovered in the EU.¹¹⁰ The growing demand for LIBs resulting from the rapid development of EVs and their low recycling rate also means that more LIBs are likely to enter the waste stream in the future,¹¹¹ significantly increasing the risk of waste generation, incineration and disposal.¹¹² Although it is not possible to give precise and definite estimates as sales of EVs in the EU have only increased significantly in recent years and LIBs have a relatively long lifetime, waste streams from LIBs are nevertheless expected to increase significantly in the coming years.¹¹³ According to an estimate of the European Environment Agency, the amount of waste generated by the energy-storage and mobility sectors as part of the EU's clean energy transition is expected to increase by 600% in 2030 compared to 2020 levels.¹¹⁴ The disposal of an important amount of waste LIBs can in the long-term have a significant impact on the environment due to the potential leakage of organic electrolytes, the presence of heavy metals, reactive lithium salts and a high amount of carbonaceous materials.¹¹⁵ Following this line of reasoning, it could therefore be said that the EU's call for vehicle electrification might risk contravening the second condition of the new EU Taxonomy Regulation, as it currently leads to an inefficient use of lithium, a possible substantial increase in waste generation and disposal, and a potential significant harm to the environment. If the Commission's proposal for a new Regulation for batteries and waste batteries is adopted, it remains to be seen whether the LIB transition still leads to 'significant' inefficiencies and increased waste.

framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088 (Text with EEA relevance), PE/20/2020/INIT, OJ L 198, 22 Jun. 2020, Art. 3.

¹⁰¹ Commission's Communication, *supra* n. 20.

¹⁰² Regulation (EU) 2020/852, *supra* n. 100, Art. 10(1)(c).

¹⁰³ Kliesch, *supra* n. 8.

¹⁰⁴ Zhang & Fujimori, *supra* n. 25, at 034022.

¹⁰⁵ *Ibid.*

¹⁰⁶ Ortar & Ryghaug, *supra* n. 21, at 1879.

¹⁰⁷ *Ibid.*

¹⁰⁸ Zhang & Fujimori, *supra* n. 25, at 034027.

¹⁰⁹ Regulation (EU) 2020/852, *supra* n. 100, Art. 17(1)(d).

¹¹⁰ European Parliamentary Research Service (EPRS), *supra* n. 7, at 3.

¹¹¹ Winslow, Laux & Townsend, *supra* n. 53, at 265.

¹¹² *Ibid.*, at 266; Zhou et al., *supra* n. 5, at 2.

¹¹³ Öko-Institut e.V., Kathrin Graulich, Winfried Bulach et al., *Emerging Waste Streams – Challenges and Opportunities* 33 (Freiburg 12 Feb. 2021), <https://www.oeko.de/publikationen/p-details/emerging-waste-streams-challenges-and-opportunities> (accessed 29 Jun. 2022).

¹¹⁴ European Environment Agency, <https://www.eea.europa.eu/data-and-maps/figures/expected-growth-of-waste-materials> (accessed 29 Jun. 2022).

¹¹⁵ Kirti Richa et al., *A Future Perspective on Lithium-Ion Battery Waste Flows from Electric Vehicles*, 83 Res. Conserv. & Recycling 63, 74 (2014); Zhou et al., *supra* n. 5, at 2.

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The third condition concerns minimum safeguards that undertakings must respect when carrying out an economic activity. In particular, they shall implement procedures that:

ensure the alignment with the OECD Guidelines for Multinational Enterprises and the UN Guiding Principles on Business and Human Rights, including the principles and rights set out in the eight fundamental conventions identified in the Declaration of the International Labour Organisation on Fundamental Principles and Rights at Work and the International Bill of Human Rights.¹¹⁶

When implementing these procedures, undertakings shall comply with the 'no significantly harm' principle found in the definition of 'sustainable investment' in Regulation (EU) 2019/2088 on sustainability-related disclosures in the financial services sector.¹¹⁷ The third condition therefore requires market actors to take into account environmental and social considerations when engaging in the production and deployment of EVs in the EU. While both the Batteries Directive and the ELV Directive contain sustainability requirements, neither contains a due diligence obligation for producers nor mentions relevant guidelines in this regard. In contrast, the proposed new regulatory framework for batteries and waste batteries contains an explicit supply chain due diligence obligation for economic operators, requiring them to comply with certain standards set out by the Organisation for Economic Co-operation and Development (OECD).¹¹⁸ This condition would therefore be met if the Commission's proposal were adopted and properly implemented.

The last condition eventually requires the economic activity to comply with the relevant technical screening criteria established by the Commission under the new Taxonomy Regulation. In December 2021, a delegated act on sustainable activities for climate change mitigation and adaptation (the Climate Delegated Act) was published.¹¹⁹ It contains a list of criteria for determining the conditions under which an economic activity can be considered to contribute substantially to climate change mitigation and for determining whether that activity does not cause significant harm to any of the other environmental objectives of the Taxonomy Regulation.¹²⁰ Among the areas of action covered, manufacture of low-carbon technologies for transport and manufacture of batteries are specifically mentioned. As regards the former, the manufacture of low-carbon road passenger transports can be considered a substantial contributor to climate change mitigation if the direct CO₂ emissions of the vehicles, i.e., at the tailpipe, are zero.¹²¹ Since EVs do not consume petrol, their direct emission level is zero and this criterion is therefore met.¹²² As explained above, this does not mean that their production and use do not emit CO₂ at all, but what matters here are the emissions from the tailpipe. With regard to the manufacture of batteries, an economic activity can be said to contribute significantly to climate change mitigation if it manufactures rechargeable batteries that result in substantial reductions

in GHG emissions in, among others, the transport sector, or if it recycles end-of-life batteries.¹²³ One of the advantages of LIBs over other batteries is their relatively higher energy density for a given size, which gives them a greater charging capacity.¹²⁴ The EU's promotion of EVs using rechargeable LIBs is therefore in line with the first screening criterion developed by the Commission. With regard to the second criterion, the aforementioned embryonic and deficient nature of LIB recycling calls for an analysis of the second list of criteria set by the Commission for determining whether an activity is not significantly detrimental to one of the other environmental objectives of the Taxonomy Regulation (in this case, the transition to a CE).

For both types of manufacture, the Commission's Climate Delegated Act provides that an economic activity does not significantly harm the transition to a CE if it 'assesses the availability of and, where feasible, adopts techniques that support' reuse and use of secondary raw materials, ecodesign, and information on and traceability of hazardous substances throughout the lifecycle of the manufactured products.¹²⁵ Additionally, the Climate Delegated Act provides that the transition to a CE is not significantly compromised if priority is given to recycling rather than disposal in the manufacture of low-carbon technologies for transport,¹²⁶ and if recycling processes in batteries manufacturing meet the requirements of the current Batteries Directive and achieve a high degree of recyclability while avoiding excessive costs.¹²⁷ The threshold imposed by these criteria is quite low, as evidenced by the language used by the Commission, which means that the EU has some leeway in promoting vehicle

¹¹⁶ Regulation (EU) 2020/852, *supra* n. 100, Art. 18(1).

¹¹⁷ *Ibid.*, Art. 18(2); Regulation (EU) 2019/2088 of the European Parliament and of the Council of 27 Nov. 2019 on sustainability-related disclosures in the financial services sector (Text with EEA relevance), PE/87/2019/REV/1, OJ L 317, 9 Dec. 2019, Art. 2(17).

¹¹⁸ Commission's Proposal, *supra* n. 56, Art. 39.

¹¹⁹ Commission Delegated Regulation (EU) 2021/2139 of 4 Jun. 2021 supplementing Regulation (EU) 2020/852 of the European Parliament and of the Council by establishing the technical screening criteria for determining the conditions under which an economic activity qualifies as contributing substantially to climate change mitigation or climate change adaptation and for determining whether that economic activity causes no significant harm to any of the other environmental objectives (Text with EEA relevance), C/2021/2800, OJ L 442, 9 Dec. 2021, at 1–349.

¹²⁰ *Ibid.*, Art. 1.

¹²¹ *Ibid.*, Annex I, para. 3.3.

¹²² Kliesch, *supra* n. 8.

¹²³ Commission Delegated Regulation (EU) 2021/2139, *supra* n. 119, Annex I, para. 3.4.

¹²⁴ Tabelin et al., *supra* n. 10, at 106744.

¹²⁵ Commission Delegated Regulation (EU) 2021/2139, *supra* n. 119, Annex I, paras 3.3 and 3.4.

¹²⁶ *Ibid.*, para. 3.3.

¹²⁷ *Ibid.*, para. 3.4.

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electrification and the use of LIBs without this being seen as significantly harming the transition towards a CE. The Commission's desire to attract investment by labelling activities as environmentally sustainable may explain the weakness in language, which in the case of EVs, could be at the expense of the EU's CE objective.

Looking more closely at these criteria, four terms stand out: secondary raw materials; recycling; information; and design. With regard to the first term, the Commission recognized that the deployment of EVs in the EU is leading to a significant increase in demand for lithium, which, if left unmanaged, could lead to supply problems.¹²⁸ As a result, lithium was added in 2020 to the EU Critical Raw Materials List,¹²⁹ and recycling rather than disposal is required in the current Batteries Directive.¹³⁰ The EU is already trying to secure its lithium needs by aiming, among other things, for 80% of the EU's lithium demand to be supplied from European sources by 2025 (note that in 2020, the EU imported 78% of its lithium from Chile).¹³¹ However, while this initiative would reduce emissions leakage outside the EU and relieve the natural resources of Chile, which is currently facing significant social and environmental problems due to its lithium mining activities,¹³² it remains to be seen whether the populations of EU countries are willing to agree to future lithium mining projects, in Serbia, Portugal and elsewhere.¹³³ This popular opposition is reminiscent of the discrepancy highlighted by Fliegel and others between the desire to consume 'clean' technologies and the corresponding, often dirty, displaced and neglected environmental costs of their production.¹³⁴ Interestingly, Liu and others note that the concentration of lithium in waste LIBs is actually much higher than in the natural resource itself.¹³⁵ Recycling LIBs is therefore all the more important as it creates a secondary source of lithium, which avoids supply problems and is coherent with the CE concept.¹³⁶ However, the market does not yet value the environmental benefit of recycled materials, placing secondary raw materials at an economic disadvantage on the market.¹³⁷ Contribution of recycled lithium to raw materials demand is almost non-existent.¹³⁸ So far, battery recycling processes have mostly focused on the recovery of cobalt and nickel due to their higher value. In 2019 only 0.1% of recycled lithium contributed to materials demand.¹³⁹ The explicit inclusion of lithium in the proposed new Regulation for batteries and waste batteries and in the EU Critical Raw Materials List would make recovered lithium more attractive on the market and encourage its recycling.

With regard to information, Directive 1999/94/EC already requires Member States to ensure that information on fuel consumption and CO₂ emissions is available to consumers when marketing new passenger cars.¹⁴⁰ The ELV Directive also requires producers to provide information on the components and materials used in vehicles in order to facilitate their identification for reuse and recovery.¹⁴¹ The current Batteries Directive provides for labelling and information requirements.¹⁴² In particular, Member States shall ensure that end-users are fully informed of the potential environmental and health impacts of the substances used in batteries, of the desirability of collecting and recycling batteries and of their role in this

respect, and of the collection and recycling schemes available to them.¹⁴³ The proposed new regulatory framework for batteries and waste batteries also contains labelling and information requirements to identify the type of battery concerned and its main characteristics, such as the presence of hazardous substances, and establishes a battery passport for every industrial battery and EV battery placed on the market.¹⁴⁴ The information requirements of the EU legal framework are therefore compatible with the Taxonomy Regulation's screening criteria.

¹²⁸ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, *Critical Raw Materials Resilience: Charting a Path Towards Greater Security and Sustainability*, Brussels, 3 Sep. 2020 COM(2020) 474 final, at 5.

¹²⁹ *Ibid.*, at 3.

¹³⁰ Directive 2006/66/EC (consolidated version), *supra* n. 42, Art. 7.

¹³¹ Commission's Communication, *supra* n. 128, at 7 and 20.

¹³² Bárbara Jerez, Ingrid Garcés & Robinson Torres, *Lithium Extractivism and Water Injustices in the Salar de Atacama, Chile: The Colonial Shadow of Green Electromobility*, 87 *Pol. Geography* 102382, 102382 (2021).

¹³³ Jillian Ambrose & A. F. P. Belgrade, *Serbia Scraps Plans for Rio Tinto Lithium Mine After Protests*, *The Guardian* (21 Jan. 2022), <https://www.theguardian.com/world/2022/jan/20/serbia-scraps-plans-for-rio-tinto-lithium-mine-after-protests> (accessed 3 Oct. 2022); Rebekah Daunt, *Portugal's Government Approves Lithium Mining Despite Growing Concerns*, *Euronews* (5 Feb. 2022), <https://www.euronews.com/2022/02/05/portugal-s-government-approves-lithium-mining-despite-protests-concerns> (accessed 24 Jul. 2022).

¹³⁴ Fliegel et al., *supra* n. 9, at 5.

¹³⁵ Chunwei Liu et al., *Recycling of Spent Lithium-Ion Batteries in View of Lithium Recovery: A Critical Review*, 228 *J. Cleaner Production* 801, 802 (2019).

¹³⁶ Amato Alessia et al., *Challenges for Sustainable Lithium Supply: A Critical Review*, 300 *J. Cleaner Production* 126954, 126959–126960 (2021).

¹³⁷ Öko-Institut e.V. et al., *supra* n. 113, at 43.

¹³⁸ Alessia et al., *supra* n. 136, at 126959.

¹³⁹ Liu et al., *supra* n. 135, at 802; John T. Warner, *The Handbook of Lithium-Ion Battery Pack Design: Chemistry, Components, Types and Terminology* 176 (Elsevier Science & Technology 2015); Eurostat, *Contribution of Recycled Materials to Raw Materials Demand – End-of-Life Recycling Input Rates (online data code: CEI_SRM010; last updated 17 Mar. 2022)*, https://ec.europa.eu/eurostat/databrowser/view/CEI_SRM010_custom_3071373/default/table?lang=en (accessed 15 Jul. 2022).

¹⁴⁰ Directive 1999/94/EC of the European Parliament and of the Council of 13 Dec. 1999 relating to the availability of consumer information on fuel economy and CO₂ emissions in respect of the marketing of new passenger cars, OJ L 12, 18 Jan. 2000 (consolidated version), Arts 1 and 3.

¹⁴¹ Directive 2000/53/EC (consolidated version), *supra* n. 66, Art. 8(1).

¹⁴² Directive 2006/66/EC, *supra* n. 42, Arts 20 and 21.

¹⁴³ *Ibid.*, Art. 20(1).

¹⁴⁴ European Parliamentary Research Service (EPRS), *supra* n. 7, at 6–7.

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Battery design is also an important factor to consider in privileging recycling over disposal. The recycling of LIBs can be technically challenging, since LIBs contain toxic materials, and their complex structure create difficulties for their manual dismantling.¹⁴⁵ To date, the Batteries Directive lacks any requirement for battery design.¹⁴⁶ In light of this loophole, the proposed new Regulation for batteries and waste batteries requires that when placing a battery on the market or putting it into service, producers shall ensure that the battery has been designed, produced and labelled in a certain way.¹⁴⁷ The proposal provides that EV batteries must have been designed and manufactured in accordance with the requirements relating to restrictions of hazardous substances, carbon footprint, use of recovered raw materials, electrochemical performance and durability, and labelling and information.¹⁴⁸ Pending the adoption of the new Regulation, the ecodesign of the whole vehicle is partly addressed in the ELV Directive, which calls for the design of vehicles to facilitate their dismantling and the use of recycled materials.¹⁴⁹ Although the Commission considers the design requirement of the ELV Directive in line with the EU's CE objective, it is 'not sufficiently detailed, specific and/or measurable' to bring about 'real improvements at the EU level to match the expectations that the car industry is truly a circular industry'.¹⁵⁰ By the Commission's own admission, additional ecodesign requirements for batteries are needed to make the EV industry more consistent with the EU's CE objective.

To summarize, the EU's promotion of vehicle electrification may be considered an environmentally sustainable activity under the new EU Taxonomy Regulation, provided that the energy mix used to power EVs is sustainable, that GHG emissions emitted throughout the supply chain and lifecycle of vehicles are monitored and that the Commission's proposal for a new regulatory framework for batteries and waste batteries is adopted and effectively implemented by Member States to close the loopholes left by the current Batteries Directive and the ELV Directive.

IV. Vehicle Electrification as a Climate Change Mitigation Strategy in the EU

The sustainability of LIBs is essential to make EVs a credible 'green technology'.¹⁵¹ The EU is well aware of this and, compared to other legal systems, it is far from lagging behind when it comes to promoting sustainability in the battery industry.¹⁵² LIBs and EVs using LIBs are regulated by several EU legal instruments, which impose sustainability requirements and are the subject of various initiatives that aim to promote sustainability throughout the battery lifecycle, such as the European Battery Alliance.¹⁵³ However, as demonstrated in section 3, some significant obstacles remain to make EVs a credible climate change mitigation strategy in the EU.

The scattered nature of the EU legal framework is also a matter of concern. The multiplication of directives and regulations may become a source of confusion and uncertainty for industries and governments, who must bear the cost of compliance with a whole range of instruments. This is the case, for example, for the European Automobile Manufacturers' Association, according to which the ELV Directive 'should prevail over any other legislation [including the Batteries Directive] as the ELV Directive deals with the complete vehicle, including any automotive battery or industrial battery'.¹⁵⁴ While the ELV Directive does indeed cover components and materials of vehicles and ELV,¹⁵⁵ thus including batteries in theory, it does not contain any substantive provisions on batteries.¹⁵⁶ Quoting the Commission, 'it is unclear if the ELV Directive in its current form is sufficient to ensure that (...) [the materials contained in EVs] are properly recovered and recycled'.¹⁵⁷ In light of the growing transition to e-mobility and the potential inadequacy of the ELV Directive to regulate the sector alone, it is difficult to argue that it takes precedence over the Batteries Directive. Instead, the two instruments must be read in tandem: the ELV Directive requires that batteries be removed from ELV as part of their depollution process;¹⁵⁸ the treatment and recycling of these batteries is then governed by the Batteries Directive, and what results from the recycling of the dismantled batteries contributes to the recycling target of the ELV.¹⁵⁹ However, one pitfall mentioned in section 3 concerns the recycling efficiency target for LIBs under the current Batteries Directive, which is only 50% by average weight, so '[d]epending on the growing share of the battery in the total weight of the vehicle, achieving the

¹⁴⁵ Tabelin et al., *supra* n. 10, at 106754.

¹⁴⁶ Öko-Institut e.V. et al., *supra* n. 113, at 39.

¹⁴⁷ Commission's Proposal, *supra* n. 56, Art. 38(1).

¹⁴⁸ *Ibid.*, Arts 6, 7, 8, 10, 13 and 14.

¹⁴⁹ Directive 2000/53/EC (consolidated version), *supra* n. 66, Art. 4(1).

¹⁵⁰ Commission Staff Working Document, *supra* n. 63, at 69.

¹⁵¹ Stefan Doose et al., *Challenges in Ecofriendly Battery Recycling and Closed Material Cycles: A Perspective on Future Lithium Battery Generations*, 11 *Metals* 291 (2021).

¹⁵² Winslow, Laux & Townsend, *supra* n. 53, at 272.

¹⁵³ https://ec.europa.eu/growth/industry/strategy/industrial-alliances/european-battery-alliance_en (accessed 17 Jul. 2022).

¹⁵⁴ European Automobile Manufacturers Association, *ACEA Position Paper: Revision of Batteries Directive 2006/66/EC 3* (EAMA 2017), https://www.acea.auto/uploads/publications/ACEA_Position_Paper-Revision_of_Batteries_Directive_200666EC.pdf (accessed 3 Jul. 2022).

¹⁵⁵ Directive 2000/53/EC (consolidated version), *supra* n. 66, Art. 3(1).

¹⁵⁶ Except for the requirement to remove them for the purpose of depolluting end-of-life vehicles, see Directive 2000/53/EC (consolidated version), *supra* n. 66, Annex I para. 3.

¹⁵⁷ Commission Staff Working Document, *supra* n. 63, at 72.

¹⁵⁸ Directive 2000/53/EC (consolidated version), *supra* n. 66, Annex I para. 3.

¹⁵⁹ Commission Staff Working Document, *supra* n. 63, at 62.

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target of the Batteries Directive might not be sufficient to achieve the recycling target of the ELV Directive'.¹⁶⁰ Therefore, the adoption of the proposed new Regulation for batteries and waste batteries will significantly impact the effectiveness of the ELV Directive.¹⁶¹ Legibility of the complex EU legal framework is crucial for industry to properly understand its depollution and recycling responsibilities.

Another barrier to the electrification of vehicles as a credible climate change mitigation strategy in the EU is the continued preference for combustion engine vehicles. As Zhang and Fujimori note, although many countries have proposed bans on diesel and petrol vehicles, only a few countries or individual cities have actually legislated against combustion engine vehicles.¹⁶² In 2021, the Commission published a proposal for a new Regulation that would amend Regulation (EU) 2019/631 on CO₂ emission performance standards for new passenger cars and new light commercial vehicles.¹⁶³ The proposed Regulation provides that from 2035, the average emissions from the new passenger car fleet and the new light commercial vehicles fleet shall be reduced by 100% compared to 2021 levels, thus making sales of new petrol and diesel cars in the EU impossible from 2035.¹⁶⁴ However, coming back to Zhang and Fujimori's argument, it remains to be seen whether the proposed ban and its timeframe are adopted and effectively implemented by Member States.

The effectiveness of the EU rules and instruments analysed in section 3 is uncertain at this stage. Many rules have been amended or await adoption and it remains premature to measure their results.¹⁶⁵ While the proposed new regulatory framework for batteries and waste batteries would address many of the shortcomings of the current Batteries Directive and the ELV Directive, allowing for greater consistency with the CE concept, it awaits ratification by the Council and European Parliament, and this process may take some time. Significant drawbacks remain with the new proposal, such as targets based on battery weight and collective rather than strict individual EPR obligation. If passed, the Regulation can only achieve success in waste LIBs management with effective compliance mechanisms at the national level. Unfortunately, as widely demonstrated in the field of environmental law, 'practical implementation usually lags behind the legal requirements'.¹⁶⁶ This implementation deficit applies to the provisions of the ELV Directive, which, according to the Commission, although broadly in line with the EU's CE objective, lack effectiveness in terms of design requirement or reuse, recovery and recycling targets.¹⁶⁷

Accordingly, although the EU sets the example in promoting sustainability in the battery and vehicle industries through a variety of legal instruments and initiatives,

there are still several practical and legal shortcomings to overcome in making the EU's promotion of vehicle electrification a credible climate change mitigation strategy in the EU.

V. Conclusion

While the EU requires a certain degree of sustainability, and therefore circularity, in the battery and vehicle industries by imposing collection, reuse, recovery, recycling and design conditions, its legal requirements insufficiently ensure that LIBs are prevented from entering the waste stream. Lack of economic incentives and battery design are important issues that the EU needs to address in order to improve LIB recycling and ensure consistency with its CE objective. The EU's Batteries Directive and ELV Directive do not provide for a fully credible climate change mitigation strategy. The EU's CE action plan is punctured, increasing the risk of LIB disposal and significant environmental harm. Adding lithium to the EU Critical Raw Materials List and qualifying vehicle electrification as an environmentally sustainable activity under the new EU Taxonomy Regulation provide some economic incentives. However, the latter is contingent on the sustainability of the energy source used to power EVs, the emissions emitted throughout the supply chain and lifecycle of EVs, and the adoption of the Commission's proposal for a new regulatory framework for batteries and waste batteries. Ensuring the circularity of LIBs is not the only requirement for vehicle electrification to become a credible climate change mitigation strategy in the EU. This policy must go hand in hand with an effective phase out of new petrol and diesel vehicles, greater enforceability of the EU legal framework, and improved sustainability of all vehicle components. Further discussion is warranted once the Commission's proposal for a new regulatory framework for batteries and waste batteries is adopted, if it is, and its effectiveness assessed.

¹⁶⁰ *Ibid.*

¹⁶¹ *Ibid.*

¹⁶² Zhang & Fujimori, *supra* n. 25, at 034020.

¹⁶³ Commission's Proposal, *supra* n. 56, at 2.

¹⁶⁴ Proposal for a Regulation of the European Parliament and of the Council amending Regulation (EU) 2019/631 as regards strengthening the CO₂ emission performance standards for new passenger cars and new light commercial vehicles in line with the Union's increased climate ambition, Brussels, 14 Jul. 2021, COM(2021) 556 final, Art. 1(1).

¹⁶⁵ Calisto Friant, Vermeulen & Salomone, *supra* n. 19, at 350.

¹⁶⁶ Öko-Institut e.V. et al., *supra* n. 113, at 43–44.

¹⁶⁷ Commission Staff Working Document, *supra* n. 63, at 72.