How the new EU battery law can make ‘made in Europe’ green batteries a reality

March 2021

Summary

Fully decarbonising road transport requires a complete shift away from fossil fuel-powered combustion engine vehicles towards zero emission mobility. Thanks in part to significant improvements in quality as well as steep cost reductions, a surge in the sales of lithium-ion battery (LIB) powered electric vehicles is underway. More than a million plug-in cars were registered in the EU in 2020 as carmakers sought to meet the EU’s current 95g CO2/km car CO2 standard, whilst the European Commission has set a target of getting at least 30 million zero-emission cars (the vast majority of which will be battery electric) on Europe’s roads by 2030[1].

Dozens of battery gigafactories are also on track to be built in Europe over the next few years. Thanks to investments by CATL, Northvolt, Tesla, LG, Umicore and others, the EU is now much better placed to secure autonomy in this strategic supply chain of the future and play a leading role in the global battery race.

To ensure the transition to e-mobility is fully sustainable and ethically responsible - unlike the current oil-based system - a wider regulatory framework on battery supply chains is needed. This is now on track, following the European Commission’s recent proposal for the world’s first ever sustainable battery law. The proposal provides a unique opportunity to introduce smart regulations that can underpin the rapid development of a green, ethical and world-leading battery supply chain in Europe. To do so, policymakers should address three key areas along the battery value chain: the sourcing of key minerals; battery carbon footprint; as well as the rules governing battery reuse and recycling.

[1] European Commission, Sustainable and Smart Mobility Strategy.

To ensure the new battery regulation establishes Europe as a green battery powerhouse, it should:

1. **Ensure the ethical sourcing of battery materials** by requiring battery makers (or importers) to apply the OECD Due Diligence guidelines (devised to respect human rights and ensure ethical supply chains) on their activities globally and along their entire supply chain. Additional requirements on environmental protection should also be put in place, and copper should be added to the list of materials covered to avoid loopholes in the battery supply chain.
2. **Incentivise low carbon battery production** by setting robust carbon footprint rules from upstream to downstream through the battery value chain, to ensure battery makers use clean (or green) energy and best-in-class production processes. Guarantees of Origin alone should not be accepted as evidence for renewable energy use in production.
3. **Promote a circular battery value chain** and reduce demand for new mining by removing barriers to reuse applications and setting ambitious recycling targets requiring recovery rates of at least 90% (and higher where possible) for each of the key battery materials. Much higher targets than currently proposed should, in particular, be set for lithium recovery.

Introduction

As Europe strives to meet its objective of becoming carbon neutral by 2050, as well as reaching the newly agreed economy-wide 2030 Greenhouse Gas (GHG)reduction target of -55% compared to 1990 levels, the need to decarbonise (and electrify) road transport is becoming ever more urgent. Batteries are the key technology underpinning the transition of road vehicles to zero emissions and freeing the sector from its dependency on fossil-fuels. With the European (and global) electric vehicle (EV) market continuing to grow[2], batteries are poised to become one of the 21st century's key strategic technologies. In this context, the Commission rightly launched the EU Battery Alliance that is successfully supporting the creation and development of a battery value chain in Europe. At least 22 gigafactories are planned or announced so far in Europe, with an estimated capacity of 460 GWh in 2025 (enough for around 8 million battery electric cars) and 730 GWh in 2030 (for comparison the production capacity in 2020 was 49 GWh[3]).

On 10 December, the Commission published its proposal for the world's first ever sustainable battery law. There is much to be welcomed in draft text, which, if implemented swiftly and with ambition, can make Europe a world leader in this strategic zero emissions technology. Key provisions include:

- Mandatory supply chain due diligence (*Arts. 39, 72, and Annex X*) checks that battery makers (and companies placing a battery on the market) must undertake on the raw materials used in industrial and EV batteries. The Commission's proposal to align these requirements with the current best practice 'OECD Due Diligence' guidelines is an important first step towards addressing social and environmental risks related to raw material extraction.
- New rules for battery makers to measure and report on the carbon footprint performance of industrial and EV batteries placed on the EU market, followed by the introduction of mandatory maximum emission thresholds (*Art. 7, Annex II*). These new provisions can - with robust rules and enforcement - further improve batteries' and EVs' contribution to climate mitigation.
- Measures that - with the right ambition - can facilitate a circular battery value chain with new rules for battery reuse (*Art. 59*), which are currently lacking, and binding targets for the recovery of key battery metals (*Art.57, Annex XII*).
- As investments in electric vehicles and battery production ramp up in Europe and globally, now is the time to put in place rules to ensure all batteries used here are ethically sourced,

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[2] Despite the COVID-19 pandemic, electric mobility surged across Europe, as plug-in vehicles made up 10.5% of the market, compared to only 3% in 2019.
[3] European Investment Bank (2020), *EIB reaffirms commitment to a European battery industry to boost green recovery*.

produced with clean energy, and reused and recycled at the end of their lives. With the proposal now with the European Parliamentand member states, this paper outlines T&E's vision and recommendations on how the new European battery law can maximise the industrial, environmental and climate benefits the technology offers.

1. Responsible sourcing of raw materials globally

The vast majority of materials used in batteries today are extracted outside Europe. The growing demand for batteries for mobile and grid applications has put into spotlight the key metals used in lithium-ion technology, such as cobalt, lithium and nickel. Attention has especially turned to the implications of the electric vehicle boom on cobalt, specifically on the working conditions in the mines of the Democratic Republic of Congo (DRC), where around two thirds of global cobalt production is today. The transition to a zero emission economy in Europe must not export environmental or social problems elsewhere. On the contrary, if done responsibly, increased demand for minerals mined in countries such as the DRC or Chile could help support much-needed development in these countries. However, this requires materials such as cobalt and lithium to be sourced in socially and environmentally responsible ways. The new battery regulation represents exactly this opportunity to improve the global supply chain of batteries placed on the EU market.

It is important to acknowledge that mining challenges in places like Congo are much older and deeper than the recent push for e-mobility (for example it is integral to our laptops and mobile phones), and that the extraction and refining practices in the oil and gas industry are often no better. Instead of bashing electric cars, we should use their rise as leverage to put pressure on downstream companies to clean up their supply chains, and on governments to put robust governance structures in place to solve problems in both large scale and artisanal mining. Furthermore, battery metals alone should not be singled out, and all companies that rely on extraction of fuels and metals globally, including oil, should apply strict due diligence in their supply chains. The upcoming horizontal due diligence legislation expected in Q2 2021 should do just that, by placing comparable and strict requirements on the fossil fuel industry to ensure a level playing field.

Various certification schemes have sought to improve sourcing of materials such as copper, aluminium, and cobalt for a while, with the (currently voluntary) OECD Due Diligence Guidance for responsible supply chains, supported by the Responsible Business Conduct guidelines, widely acknowledged as the best practice in this field. T&E undertook a detailed comparative analysis of the six largest global supply chain certification schemes applicable to industrial cobalt production in the DRC. This analysis shows that while most schemes are comprehensive in their design and sustainability criteria, most lack rigorous and independent enforcement. Crucially, traceability on where cobalt is extracted and transparent information on mining conditions on the ground remain the weakest spots of most schemes. This is of course also applicable to other battery metals such as lithium and nickel, especially with demand set to increase over the coming years.

This underscores that there is no need for *new* standards or certification schemes – the focus should rather be on better enforcing what is already there, notably:

- Making the OECD guidelines mandatory for downstream companies operating in or exporting to Europe to ensure responsible business conduct and mandatory due diligence of the entire supply chain including extraction;
- Improving traceability and enforcement via independent third-party auditing and/or verification;
- Ensuring timely consultation of affected local communities where metals are mined and providing "access to remedy";
- Given that the OECD guidelines do not cover the environmental impacts of materials extraction, additional relevant standards should be required for upstream and midstream companies to comply with if their materials are to be used in batteries on the EU market. An example of an existing standard that comprehensively covers such impacts is the Initiative for Responsible Mining Assurance (IRMA).

A single, reliable and enforceable mechanism on which to base supply chain due diligence and choice of suppliers across all the materials will also benefit the EU battery industry, who already have a strong corporate responsibility culture and already apply many of the measures required. European players such as Umicore, Trafigura and Mercedes-Benz AG, for example, already have strong due diligence policies - in accordance with the OECD guidelines - in place for parts of their supply chains and should therefore be able to replicate these for all the materials identified in Annex X (1).

T&E therefore welcomes the Commission's proposals (in Art. 39) to:

- Require companies placing batteries on the EU market to put in place supply chain policies consistent with the standards set out in the model supply chain policy in **Annex II to the OECD Due Diligence Guidance**. By making said guidance mandatory, this will help create a system of transparency, information collection, and records of supply chain due diligence processes, and ensure supply chain risks are identified and traced and, most importantly, remedied. Crucially, the proposed requirements will apply to the global supply chains for batteries placed on the EU market, so will have a global impact.

- Make **companies report publicly and on an annual basis** on their supply chain due diligence policies, detailing the steps taken to comply with the requirements set out in Article 39, including findings of any supply chain risk as listed in Annex X (2) and how they have been adequately addressed.

- Include a requirement for **independent third party verification** of company supply chain due diligence policies, which will ensure independent traceability and enforcement throughout.

***Building on the Commission's proposal, T&E calls on the co-legislators to*:**

- **Expand the list of raw materials covered under due diligence requirements in Annex X (1) to ensure copper is also sourced responsibly**. One of the reasons copper was not included is due to the relatively small share (6%) of total use that ends up in the automotive sector (and therefore in EV batteries)[4]. However, copper is a key battery material and is used at both the cell level (in the anode) and at the pack level (in the electrical interconnects). And with EV battery demand and production set to grow exponentially, its share in the automotive sector will do so too - as pointed out by the industry itself. Furthermore, copper and cobalt (which *is* included in the list) are often mined together, where cobalt is mined as a byproduct of copper (and nickel) mining, e.g. in the Copper-Cobalt belt in the DRC. Since they are mined together/close to each other (44% of cobalt comes from copper mining), the environmental impact is often similar. Without the inclusion of copper, the risk is the new rules will create a two-tier system with "clean" cobalt mined alongside "dirty copper", with no oversight or controls on the latter.

- **Put in place stronger environmental protections on global mining practices.** As the OECD guidelines do not cover the environmental impacts of mining, improvements to due diligence requirements should also be made to strengthen environmental protection. Mining companies should comply with requirements as set out in the Initiative for Responsible Mining Assurance (IRMA)'s standard on environmental responsibility (Principle 4), which is today's best practice for responsible sourcing and beyond. With one in every three allegations[5] related to raw material extraction linked to water (pollution or access to), Annex X should also address this issue by including adequate steps such as IRMA's Water Management requirements, listed under the standard's environmental responsibility practices[6].

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[4] https://ecodesignbatteries.eu/sites/ecodesignbatteries.eu/files/attachments/EDbatteryFollowupWP4finalpreprint.pdf
[5] Business & Human Rights Resource Centre (2021), Transition Minerals Tracker.
[6] https://responsiblemining.net/wp-content/uploads/2018/08/Chapter_4.2_Water_Management.pdf

- **Only allow voluntary industry schemes to be recognised if they can prove they meet all the requirements established under Art. 39**. Companies participating in voluntary supply chain certification schemes that have been recognised by the European Commission (Art. 72) should not be assumed to be automatically complying with the legislation and must continuously meet the requirements as set out in the regulation, including ensuring supply chain assessment, transparency, third party audits, grievance mechanisms, and consultation with affected communities. In the case of the biofuels industry for instance, it was found that the standards presented by voluntary schemes as a basis for their recognition were not always applied in practice and that they were not ultimately verified by the authorities[7]. Such schemes should undergo yearly auditing and should comply with reporting requirements on due diligence, as outlined in Art. 39.

- **Establish a specific and harmonised framework for penalties** (as part of Art. 76). Leaving the responsibility for penalties and fines to member state authorities risks creating loopholes and an uneven playing field for economic actors depending on which countries decide to impose sanctions. We recommend that a harmonised framework for penalties is established - not only for breaches of due diligence requirements, but also for e.g. companies that have falsified carbon footprint data - which should include dissuasive fines for missing, incomplete or fraudulent assessments and reports on human rights due diligence.

- **Put in place similar requirements for all raw materials extraction - including oil** (for which no due diligence or traceability requirements currently exist) and whether for EVs or not - as part of the upcoming legislation on sustainable corporate governance expected to be published in the first half of 2021. Strong due diligence requirements for batteries can become the blueprint for future due diligence legislation for other sectors.

- **Expand the list of international instruments to better protect vulnerable communities.** The proposed regulation lists a number of international instruments covering numerous mining-related environmental and social risks, which the Commission will use to develop guidance for companies applying due diligence requirements. Whilst the list is a good start, it should be expanded to include better protection of those most vulnerable in the supply chain. For example, the inclusion of ILO Convention 169 on the right of Indigenous Peoples to Free, Prior, and Informed consent - although already included in other instruments listed in Annex X including the Tripartite Declaration of Principles concerning MNEs and Social Policy - should be clearly stated given its importance to the rights of mining-affected communities.

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[7] Transport & Environment (September 2, 2016), Sustainable' biofuels certification challenged by EU auditors. Link

2. Low carbon batteries

In contrast to cars with a combustion engine (diesel, petrol and natural gas) that emit large amounts of both CO2 and air pollutants during their lifetime, electric vehicles driven on a battery emit zero emissions of any kind from their exhaust. However - just as for conventional cars - upstream emissions in electric vehicles are associated with their production phase, notably lithium-ion batteries. Not much robust, primary up-to-date data is available on the 20-odd materials and complex and fast evolving processes used in LIB cell, module and pack manufacturing. A 2019 report by Circular Energy Storage commissioned by T&E shows the current climate impact range of LIB batteries to be between 39 kg CO2e/kWh and 196 kg CO2e/kWh, equivalent to between 11,800 - 89,400 kms driven by a diesel car. The reasons for this wide spread are:

1. Lack of up to date primary data, with a lot of modelling based on studies dating back as far as 1999 (the older the study, the higher the climate impact as electricity is less decarbonised). While earlier battery production pilots have a higher per kWh energy input, the new gigafactories demonstrate a significantly lower energy use due to economies of scale and process efficiency gains. A recent study by the Swedish Energy Agency showed a huge drop in their best-case estimate for battery production carbon intensity, from 150kg CO2e/kWh (as calculated in 2017) to as low as 61kg CO2e/kWh less than three years later.
2. Lack of a consistent calculation approach: although this was previously an issue, the so-called Product Environmental Footprint Category Rules (PEFCR) for batteries, now provide a harmonised and granular methodology for calculating the environmental and carbon footprint of both Li-ion and NiMH (nickel metal hydride) batteries. Whilst the current PEFCR allows for comparison of batteries on the downstream side (production and end of life), robust calculation of the upstream phase (mining and refining) is still missing. It is important, therefore, that work on the new PEFCR2 for batteries is accelerated and concluded as soon as possible.

Battery manufacturing is a complex electrochemical process that, in a very simplified form for a common Nickel-Manganese-Cobalt (NMC) LIB chemistry includes:

Upstream:

- Extracting ores;
- Refining extracted ores into battery grade materials, e.g. lithium hydroxide or cobalt sulfate;

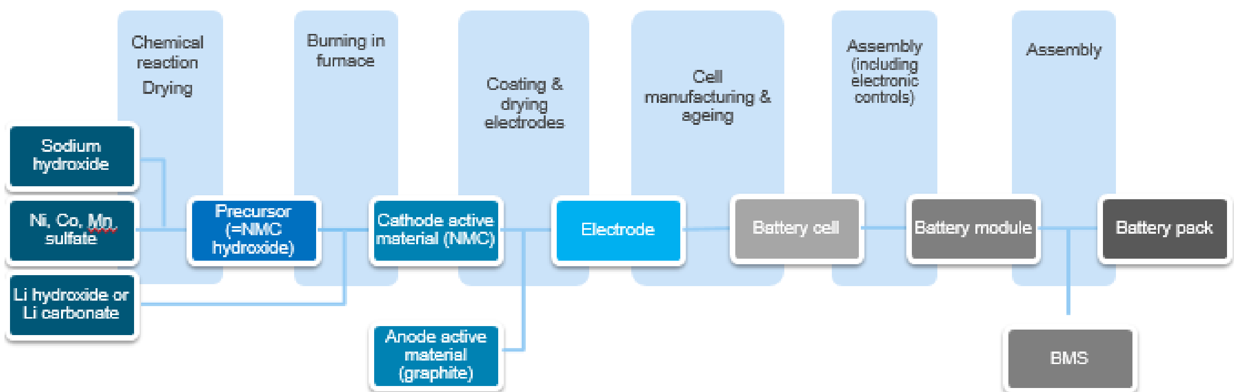
Cell making:

- Producing precursors and, following a reaction with lithium, cathode active material. Anode active material using graphite and/or silica is produced separately;
- Anode and cathode active materials are coated on copper and aluminium foils to produce electrodies, dried and stacked;
- Production of liquid electrolytes;
- All the above components are assembled into cells;

Final battery assembly:

- Cells turned into modules and battery management systems (BMS) added;
- Finally, packs are assembled, often by carmakers at this stage as they are sized and calibrated for individual EV models.

These key steps for an example NMC chemistry are shown below.



The most energy and carbon intensive part of LIB manufacturing is the production of battery cells, responsible for as much as 75% of energy consumption. As cell production is mainly powered by electricity, these emissions can easily be reduced. The type of electricity used is therefore crucial to determining how green a battery actually is. How battery makers are allowed to account for electricity sourcing will be important and must reflect the actual real world use of renewables.

With this in mind, Guarantee of Origin (GO) certificates alone should not be accepted as valid proof for sourcing and use of renewable electricity. The current GO system does not account for real-time energy sourcing or actual energy feeds between consumption and production. Furthermore, as the sale price of GOs is not guaranteed and there is no direct link between the market value of GOs and the revenue required to make investments in renewable power attractive, requiring GO purchases as proof of renewability will do nothing to bring additional renewable electricity capacity to the system, and could instead result in significant indirect emissions from fossil fuel power plants[8] as other sectors shift away from the limited supply of renewables. We need to avoid a situation where battery makers can set up in regions with a high carbon intensive energy grid and buy their way to a low carbon footprint through cheap green certificates, instead of encouraging low carbon generation in those countries.

Below is a useful **overview of a LIB's emission 'hotspots'**[9] that should be tackled by the new EU regulation by incentivising improvements in these areas.

- The preparation of **precursors** such as NMC hydroxide (used in nickel-manganese-cobalt chemistry found in most modern cars and trucks) **and active materials** (mixing lithium carbonate, or "Li2CO3" in the figure above) requires complex chemical reactions as well as lengthy heating in furnaces at high temperatures. Deploying waste heat recovery processes and technologies will significantly reduce emissions from this phase.
- Producing **electrodes** (cathodes and anodes) and assembling **cells** stands out as a particularly energy intensive process which, depending on chemistry, generates up to half of the cell's energy footprint, or a third of the whole battery. Huge improvements can come from better cathode coating techniques that would make the cathode powder mixing and coating processes more efficient. For example, dry electrode coating technology that will be used by Tesla, can significantly improve a battery's CO2 and energy footprint.
- Given complex global supply chains, **transportation emissions** are a significant proportion of battery production as materials are shipped between mines in Africa, processing in China and final assembly in Europe or the US, representing up to 10% of overall carbon emissions. The current industrial trend for **vertically integrated and local supply chains** - which should be incentivised by the new regulation - will drastically reduce those movements and therefore the associated transport emissions. E.g. Northvolt, the flagship EU battery factory located in Sweden, gets some of its refined materials close by in Scandinavia (e.g. nickel is refined in Finland), while preparing active cathode material, manufacturing cells, assembling packs, and even integrating recycling facilities on site.
- Ultimately, the battery production is as clean as the energy used in the various processes requiring both a lot of electricity and heat (e.g. for electrode drying). The location of battery cell manufacturing therefore has a crucial and direct impact on its carbon footprint. Siting

[8] Chris Malins, 'What does it mean to be a renewable electron? Regulatory options to define the renewability of electricity used to produce renewable fuels of non-biological origin', 2019
[9] For more information, see: Hans Eric Melin, Analysis of the climate impact of lithium-ion batteries and how to measure it, July 2019

future gigafactories in countries with low carbon energy mix such as Sweden, France or Spain, and **increased deployment of renewable energy sources across Europe** will have the biggest potential to make battery manufacturing (and electric vehicles' use phase) sustainable. The design of the future EU regulations should seek to incentivise the future battery production facilities to be located near low carbon energy sources or indeed establish new sources of renewable energy generation.

To accelerate sustainable battery production in Europe, T&E recommends to:

- Require all battery manufacturers whose products are found on the EU market to **measure and report each battery model's carbon and energy footprint in line with proposals Article 7** (covering the whole lifecycle from material extraction to end of life and recycling). This should include primary (company specific) data (not averaged data from upstream suppliers and operations) and for the following emission hotspots: ore extraction and refining, producing precursors, cathode and anode materials, cells, modules, BMS and pack manufacturing. The data should be specific to the manufacturing process, factory and location, notably on the energy sources used.

- **Ensure this information is publicly available** (as proposed by the Commission in Art. 64 on the Electronic exchange system) and regularly updated.

- Where companies do not provide such specific data, apply default carbon intensity values based on the average carbon emissions data of the country where the electrodes, electrolytes and cells were produced. Companies should only be allowed to use lower emission factors where they can reliably prove that their individual processes or energy sources are cleaner. Here, **independent verification of industry data, and, in particular, data from third countries**, will be needed to ensure a robust and fair system. Unfortunately, such provisions are not clearly spelled out in the current proposal.

- **Information from manufacturing should be provided both on CO2 (kgCO2 per kWh battery produced) and on energy use (kWh per kWh battery produced)**. Firstly, kgCO2 per kWh of battery produced is needed to be able to compare batteries before they are sold and used. Secondly, improving the efficiency of the battery making process (in terms of kWh energy input) is another important way to reduce battery carbon footprint. For example, on the same carbon grid intensity, a battery maker that uses 5 kWh of energy to produce a battery will emit more CO2 than a company that only uses 3 kWh.

- **Put in place strict principles in the relevant Articles (Art.7 and Annex II) to frame the forthcoming calculation methodology** that will be defined by the Commission in a delegated act. Given the importance of a robust methodology to determine and report a battery's carbon footprint across the value chain from mining to end of life, the co-legislators should ensure these provisions cannot be weakened via the backdoor in the comitology procedure. For example, manufacturers should only be able to claim the use of renewable energy if they can prove this via **direct connection to a renewable energy plant or a contract demonstrating a temporal (in real time or at least every hour) and geographical link between energy supply and use**. Green certificates such as Guarantees or Origin alone should not be accepted as valid evidence[10]. Allowing battery makers to buy cheap certificates to lower their carbon footprint, regardless of how carbon intensive the grid energy they are using is, will also penalise front runners who are investing in new renewable capacity.

- As a next step, and only once accurate and up-to-date data has been collected and a data verification process established, **mandatory CO2 thresholds should be established**. This will restrict the import and manufacture of high carbon batteries and ensure all manufacturers follow manufacturing best practice, reduce their environmental footprint and use clean energy in their production.

3. Reuse and recycling

Over its lifetime, an average internal combustion engine (ICE) car burns close to 17,000 liters of petrol, which would be equivalent to a stack of oil barrels 90m high. Whilst a battery electric vehicle 'consumes' (i.e. not recovered), once recycling is taken into account, around 30 kilograms of metals, which is about the size of a football[11]. Already much more resource efficient than fuels, future batteries that maximise longevity and are recycled effectively will have an even smaller impact compared to cars run on diesel, petrol or gas.

A report by Element Energy commissioned by T&E analyses the different end-of-life pathways that a lithium-ion battery can take, as summarised below. When the battery performance is no longer good enough for a car or a truck (less range, worse acceleration, etc.), it should be reused in less demanding

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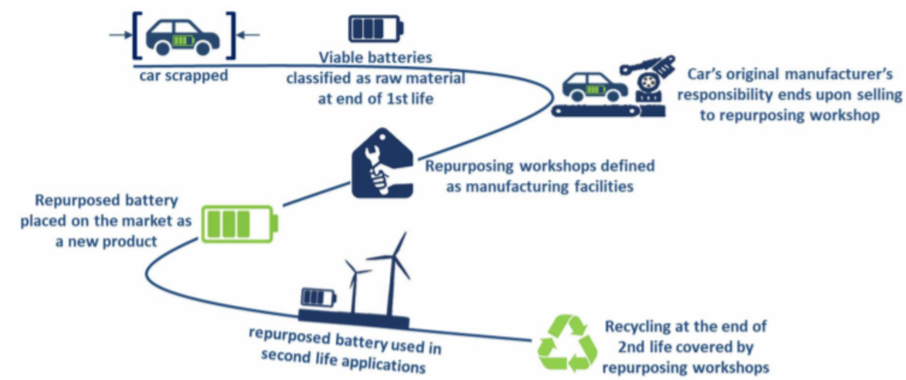
[10] The current GO system does not account for real-time energy sourcing or actual energy feeds between consumption and production. As the sale price of GOs is not guaranteed and there is no direct link between the market value of GOs and the revenue required to make new investments in renewable power attractive, requiring GO purchases as proof of renewability will do nothing to bring additional renewable electricity capacity to the system, and could therefore result in significant indirect emissions from fossil fuel power plants to meet new demand.

[11] Transport & Environment (2021), From dirty oil to clean batteries.

applications, notably stationary energy storage or forklifts, or as a buffer in high power charging stations to reduce peaks. Such second life uses not only reduce a battery's carbon footprint but will also provide extra storage flexibility on the grid and allow for higher penetration of renewables across Europe.



The advantages of second life batteries are not limited to avoiding the resources and emissions associated with manufacturing new batteries. The economic benefits to the end-user - a 42% price reduction compared to new batteries (for stationary storage) - are also tangible. Battery repurposing will also bring additional benefits through the industry and supply-chain created around repurposing, which will generate additional jobs and revenues (~93,000 EV battery packs suitable for repurposing would generate a direct turnover of around €65m in 2030)[12]. **T&E therefore welcomes the Commission's proposal (in Article 59) to remove the current barriers to battery reuse** (for example the current Battery Directive classifies used batteries as waste, and contains no provisions on 'preparation for re-use' and 're-use' of batteries) with a new framework to facilitate the repurposing and remanufacturing of (industrial and EV) batteries.

Although battery reuse will often make sense from an environmental and economic point of view on a case by case basis, mandating reuse over recycling can instead work to delay the recovery of valuable raw materials (including lithium, nickel and cobalt) just at the time when the market for LIB is soaring, therefore accelerating the need for environmentally damaging new mining. Furthermore, reuse will make more sense (from both an environmental and economic perspective) for certain types of battery chemistries containing less valuable materials (for example Lithium iron phosphate - LFP - batteries), unlike NMC (Nickel Manganese Cobalt) batteries, where recycling will often be optimal.

[12] Figure contains only repurposed batteries. Other second life applications (e.g. reconditioning and non-storage applications) are not included.

The demand for suitable automotive batteries and for battery raw materials, in particular cobalt and lithium, will continue to increase as the EV market expands, making battery recycling paramount. The **ultimate goal should be to fully recover all the valuable materials in a battery at the end of its lives** - notably lithium, nickel and cobalt - so it is available to make new battery cells instead of mining virgin raw materials. The extraction of primary lithium from brine or spodumene, for example, can result in considerable environmental stresses. The demands on water from the extraction of lithium from brines are substantial, as extracting a ton of lithium requires 1,900 tons of water (consumed by evaporation)[13]. In Chile's Salar de Atacama, a major centre of lithium production and where over 60% of the region's water is used for mining, there is evidence of shrinking pasturelands, failing crops, and disappearing flora and fauna. Instead, secondary production from recycling would require only 28 tons of used LIBs (or around 256 used electric-vehicle LIBs)[14]. Ensuring a supply of secondary cobalt reserves will also help offset demand for a commodity with numerous ethical, social and environmental concerns around its extraction.

Although few people today question the benefit of recycling, as it helps to secure critical materials in Europe, the market for LIB recycling today is in China where EU batteries are often sent. An important finding of Element Energy's study is that Europe has inadequate LIB recycling capacity or expertise: even on a moderate EV uptake scenario, the current recycling capacity, estimated at 33,000 tonnes/year, will not be enough when current electric cars come to the end of life from 2030 onwards. Equally important is the fact that there is little lithium battery recycling at a commercial scale in Europe today with most companies providing low value collection or shredding only.

Although recycling and recovery rates remain low (in Europe), many of these materials have a high technical recycling potential, with high rates already being achieved commercially in other regions. Ensuring investment in and increasing the cost competitiveness and efficiency of sorting and recycling technologies - both through R&D funding and ambitious regulatory targets - is thus a priority. With this is mind, **the Commission's proposed targets for minimum rates of LIB material recovery (90% for cobalt, nickel and copper in 2025, then 95% in 2030; and 35% for lithium in 2035 and 70% in 2030), in particular for lithium, can and should be revised upwards**.

[13] Katwala, A. The spiralling environmental cost of our lithium battery addiction. Wired.
[14] European Commission Impact Assessment report, SWD (2020) 335 final, PART 1/3

Info box: LIB recycling potential

How do the European Commission's proposed battery material recovery targets (as set out in Annex XII Part C) compare to what is already being done by today's best practice?

Commission's proposed recovery targets:

Recovery rates	Co, Ni	Li
2025	90%	35%
2030	95%	70%

For **lithium**, a 2019 study looking into LIB recycling for mobile phones showed a range of recovery rates from 76% to 95%, with most recovery rates reaching at least 90%. Automated disassembly methods and direct recycling (compared to pyrometallurgy and hydrometallurgy) can improve rates further. For **cobalt**, the same paper states that extraction yields were in the range of 97–99%.

In China, official government guidance sets recovery rates at 98% for **cobalt and nickel** and 85% of **lithium**. Although not (yet) binding, companies who do not fulfil the requirements will not receive the government support they otherwise would, neither on state level nor on provincial level. According to expert Hans Eric Melin most recyclers are already complying.

Finally, there are examples of LIB recyclers in North America (Li-Cycle) and Singapore (TES) who are already achieving recovery rates of over 95% for **cobalt and nickel** and 90%+ recovery rates on **lithium** through a mixture of physical and chemical refinement. Crucially, the recovered material is battery grade and is being used in production of new cells.

Recovery rates already being achieved today:

Recovery rates	Co, Ni	Li
Best practice today	98%	90+%

Raising the ambition of the material recovery targets in line with T&E's recommendations (see below) reduces by two thirds the quantity of lithium, nickel and cobalt lost compared to the Commission's proposed targets[15]. This means that, in the long run, - when ICE cars are fully phased out and high

[15] Transport & Environment (2021), From dirty oil to clean batteries.

volumes of EoL batteries are going to recycling -, the **T&E recycling targets would reduce by a factor of three the amount of primary lithium, and by 2.5 the amount of nickel and cobalt, required to make new batteries** compared to the current Commission targets. In a context where, for EV batteries alone, the EU will need 18 times more lithium and 5 times more cobalt in 2030 (and almost 60 times more lithium and 15 times more cobalt in 2050), these improvements will go a long way towards strengthening the security of the supply of these materials in Europe.

The new battery regulation should be designed to promote technological innovation and ensure timely investments. Setting comparatively mediocre recovery rates in Europe for 2025 and 2030 when we know that there are companies in other countries already exceeding them today will do little to make Europe's industry more competitive on the global market and will discourage investments in companies that are aiming higher. Europe should see battery recycling as an asset, not a burden, and an opportunity to create local industries and jobs.

***T&E therefore recommends the following*:**

- Set robust collection requirements and incentives for returning used EV batteries to ensure they are not lost or illegally shipped at the end of their life.
- **Remove barriers to battery reuse** (as proposed by the Commission in Art. 59) and clarify lines of responsibility and warranty to allow business models and innovative businesses to develop. However, **no mandatory targets should be set for reuse**: instead car OEMs and power utilities should be free to decide whether or not to reuse batteries for 2nd and 3rd life applications or recover raw materials through recycling.
- **Ensure non-discriminatory access to battery data in the battery management system to facilitate reuse** (as proposed by the Commission in Art. 14), including dynamic information connected to its use: state of health (remaining capacity & power, and overall capacity fade), and information on parameters such as evolution of self-discharging rates (as currently proposed in Annex VII).
- Set **ambitious recovery targets of** 95% for cobalt, nickel and copper in 2025, then 98% in 2030; and 70% for lithium in 2025 and 90% in 2030. Additional requirements should apply on recycling quality to ensure it is battery grade (no downcycling) so that these recycled battery materials are able to feed back into the battery value chain.
- The design of battery cells and packs should **incorporate circularity from the outset to ease the disassembly, repair, reuse and recycling**. The new regulation should require every battery manufacturer placing their products on the EU market to design batteries in a way that aids circularity, while avoiding overly-prescriptive provisions given the fast pace of technological innovation.

Conclusions

The e-mobility revolution is well underway, and Europe is rightly prioritising battery value chain development as a key part of both its industrial and climate strategies. By the European Commission's own calculations, the European battery value chain will be worth over €250 billion by 2025. It is crucial, therefore, that policy makers put in place future-proof rules to ensure this money is invested in making batteries that are sustainable and can contribute to accelerating the decarbonisation of the European transport and energy systems. The current proposal is the first of its kind globally and is one of the most important regulations to get the supply chain right, serving as a blueprint for other sectors to follow.

The sooner the new rules are in place, the better too. Not only for environmental reasons (to factor in the sustainability requirements into the new factory business plans), but with speed the critical element in this rapidly growing industry, the proposed entry into force of much of the new regulation - spread over the period of 2023-2026 - is simply too late to give European newcomers an edge over their incumbent rivals. The sooner the new rules, on e.g. carbon footprint and due diligence requirements, are in place, the more competitive advantage newer EU players have before larger Asian players can catch up to new ways of working and producing.

Further information

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