Lithium recycling in the Battery Regulation

Higher recovery targets are beneficial and feasible

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Summary

Lithium is the driving force behind the transition to electric vehicles. To meet our demand for EV batteries and energy storage alone, Europe will need up to 18 times more lithium by 2030 and up to 60 times more by 2050.

As Europe races to secure domestic lithium sources, including projects in Portugal, Germany and Spain, the speed and scale of the challenge means that we will need to accelerate the amount of secondary metals coming from recycling streams. This is where the new EU battery regulation can play a crucial role, but targets for lithium recovery from spent batteries proposed by the Commission and Council are far too weak and well below what the best available technology is achieving already today.

Higher recycling targets can play an important role in helping to build up a domestic supply of critical raw materials and reducing the need to provide supply from mining activities. By requiring recyclers to recover such small amounts of lithium from spent batteries however - just 35% until 2030 as proposed by the Council -, European policymakers would be missing a huge opportunity.

Overwhelming evidence also shows that the best available technologies today, based on hydrometallurgical recycling using chemicals rather than heat-based pyrometallurgical processes, can recover much higher rates of lithium (up to 90%) than assumed in the Commission's impact assessment. An updated analysis sent to policy makers involved in the ongoing trilogue negotiations, carried out by JRC and Ökoinstitut, appears to admit this mistake, by upping their recommended targets by 15% and 10% respectively.

Policy makers should go further and align with today's best practice and support the lithium recovery targets proposed by Parliament: 70% in 2026 and 90% in 2030. The new battery regulation should be designed to promote technological innovation and ensure timely investments in the best available technologies. Setting comparatively mediocre recovery rates in Europe for 2026 and 2030 (or even 2027 and 2031 as proposed by Council) when we know that there are companies in other countries already exceeding them today will do neither.

1. Introduction

"Lithium…will soon be more important than oil and gas. […] We must avoid becoming dependent again, as we did with oil and gas. […] We will identify strategic projects all along the supply chain, from extraction to refining, from processing to recycling."

Commission President von der Leyen was clear in her 2022 state of the union address on the significance of lithium to the EU's twin digital and green transition objectives. As Europe and the rest of the world continues to reduce its use of fossil fuels on the path to net zero, so our reliance on batteries - the key strategic technology of the 21st century - is set to increase.

In December 2020 the European Commission proposed a new sustainable battery law - the first of its kind - with the objective of fostering a resilient, sustainable and competitive battery industry on home soil. The proposal is an opportunity to introduce smart regulations that can underpin the rapid development of a world-leading battery supply chain in Europe by putting in place future-proof rules to ensure batteries both made in and coming into Europe are green, ethical and are fully recycled - unlike the current oil based system.

A key provision in the Commission's proposal is the binding targets for the recycling of batteries including minimum recovery rates for key battery metals (including cobalt, copper, nickel and lithium). These are crucial to secure the supply of critical metals as production increases and will help offset the need for new mining.

After slow progress under the French Presidency, T&E welcomes the work done so far under the Czech Presidency. One of the key outstanding points still to be resolved however - and which will be discussed at the upcoming political trilogue on 11 October - is the recycling targets. Despite drafting reasonably ambitious targets (Article 57, Annex XII) for copper, nickel and cobalt that are more or less in line with the best available technology (90% in 2026, then 95% in 2030), **the Commission's proposed recovery targets for lithium** - a key metal used in all EV batteries including NMC-, LFP-based and new solid state batteries - **are disappointingly weak (just 35% in 2026 and 70% in 2030) and well below what is already technically achievable today**.

This short paper seeks to outline why more ambitious lithium recovery targets are both beneficial and also feasible, with the aim of contributing to the ongoing political discussions between the co-legislators.

2. Why more ambitious lithium recycling targets are beneficial

Lithium is the driving force behind the transition to electric vehicles. For EV batteries and energy storage alone, Europe will need up to 18 times more lithium by 2030 and up to 60 times more by 2050[1].

Lithium is needed to produce virtually all traction batteries currently used in electric cars as well as consumer electronics. And as carmakers increasingly switch from NMC (nickel, manganese, and

[1] https://ec.europa.eu/commission/presscorner/detail/en/ip_20_1542

cobalt)-based chemistries to LFP (lithium-iron phosphate)-based ones, and with growing expectations around the potential of future solid-state batteries (which will require a 35% increase of lithium content compared to lithium-ion chemistries[2]), the share of lithium needed by the battery industry is only set to increase.

Booming EV demand has also seen lithium prices soar by around 900 percent since 2020[3]. By August 2022, prices of lithium carbonate and lithium hydroxide were double from the prices in early January[4].

Europe is also currently highly dependent on imports for lithium and battery lithium compounds. Even as Europe races to secure domestic lithium sources, including projects in Portugal, Germany and Spain, the speed and scale of the challenge means that we will need to accelerate the amount of secondary metals coming from recycling streams.

With all this in mind, strong recycling targets will help improve Europe's strategic autonomy by establishing a secure domestic supply of raw materials, and, in the longer run as recycling is scaled up, cut the costs of batteries needed to power the green transition. In fact, analysis by T&E shows that **higher lithium recovery targets in line with those proposed by the European Parliament (70% in 2026 and 90% in 2030) can reduce by two thirds the quantity of lithium 'lost' in a spent lithium-ion battery, and by a factor of three the amount of primary lithium required to make new batteries**, compared to the targets proposed by the Commission (and supported by the Council). By 2035, the EP's targets would mean Europe can get 28% of its lithium needs for new EV batteries from recycled ones (compared to 22% under the Commission's targets)[5].

While not a silver bullet, higher recycling targets can play an important role in reducing the need to provide supply from mining activities and shaving cost peaks. By requiring recyclers to recover such small amounts of lithium however - just 35% until 2030 -, policymakers would be missing a huge opportunity. Europe's battery industry cannot wait to start building up a domestic supply of critical metals.

Consistency with other regulatory targets in the regulation should also be considered by policy makers. For example, both Parliament and Council back the mandatory targets for recycled content in new batteries (Article 8). However, with projected demand for new EV batteries now much higher than what was initially anticipated by EU lawmakers before the proposal was published[6], and before the 2035 ICE phase out was even proposed - and now backed by co-legislators -, weak lithium recovery targets risk creating a mismatch between demand and supply of recycled battery materials, making even modest recycled content targets more difficult to achieve.

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[2] BloombergNEF (2021). Solid-State Battery Adoption Route in Europe and U.S
[3] https://www.benchmarkminerals.com/membership/what-is-driving-lithium-prices-in-2022-and-beyond/
[4] https://batteriesnews.com/lithium-price-forecast-price-keep-bull-run/
[5] Transport & Environment (2021), From dirty oil to clean batteries
[6] See Figure 3-1 in European Commission, Directorate-General for Environment, Stahl, H., Mehlhart, G., Gsell, M., et al. (2021), Assessment of options to improve particular aspects of the EU regulatory framework on batteries: final report, Publications Office. vs. updated assessments from Benchmark Minerals here

3. Why more ambitious lithium recycling targets are feasible

While the advantages of recycling are clear, the question remains as to whether more ambitious targets are actually achievable. On this, the evidence is also clear, with numerous battery recycling companies achieving lithium recovery rates of around 90% already today.

First, it's worth looking briefly at the different recycling technologies available and their respective benefits. The two main technologies used to recycle batteries today are pyrometallurgical (pyromet) and hydrometallurgical (hydromet). Pyromet is the cheaper and incumbent technology - and much more energy intensive - and consists of putting batteries into high temperature furnaces and reducing battery metals into a molten alloy ("black mass"), which are then sent to metal refineries for further processing. Whilst this is an efficient way to recover cobalt and nickel, lots of other materials, including lithium, are lost in the process as it is uneconomical to recover.

Hydromet on the other hand, uses acids to dissolve the metal components of batteries in a process known as leaching. Compared to pyromet, this process is able to recover higher levels of battery metals including, crucially, lithium. Direct recycling - manual and/or automated dismantling of the battery pack, with key components being recovered in their original state (e.g. electrodes, wiring, casing) - is even more promising, but is still in its infancy.

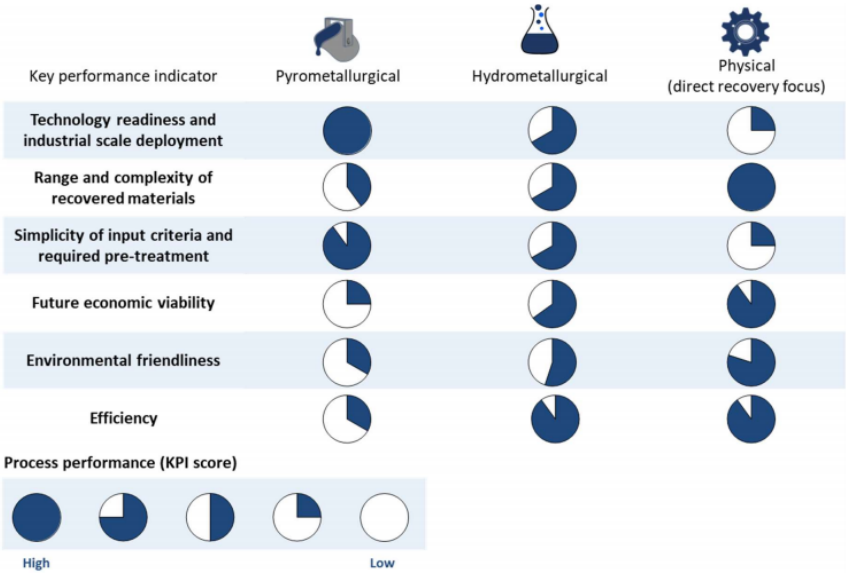

Figure 1. Qualitative comparison of recycling processes[7]

A 2019 study looking into lithium-ion battery recycling showed that hydromet processing was capable of a range of lithium recovery rates between 76% to 95%, with most recovery rates reaching at least 90%.

[7] Element Energy (2019), Batteries on wheels: the role of battery electric cars in the EU power system and beyond

Although indicative of technological potential, academic studies are not sufficient to demonstrate recycling at scale however.

There are, though, several companies operating in both North America and China that are recovering 90%+ lithium from spent batteries already today. For instance, North American battery recycler Li-Cycle claims it is ready to recover 95% or more of lithium using hydromet recycling, with the company already planning to move into the European market. Redwood Materials, another North American company, also claims their recycling technology can recover, on average, more than 95% of the elements like nickel, cobalt, lithium and copper. Carmaker Ford has already teamed up with Redwood to use their recycled materials as they look to scale up their electric car production. Finally, RecycLiCo, although not yet operating at scale, reported that its own hydromet recycling technology achieves over 99% lithium extraction from LFP battery cathodes.

In China, the situation is more advanced, where official government guidance already sets official 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. Currently 47 recycling companies have been whitelisted, meaning they qualify for government support.

Increasing numbers of stakeholders - including science, civil society and industry - also agree that more ambitious targets are technically feasible and should be set in the new regulation. The Circular Economy Initiative Deutschland (CEID), a multi stakeholder initiative including many leading players, including Umicore, BMW, University of Braunschweig, Mercedes-Benz, Agora Verkehrswende and many others, recommend increasing the lithium targets to 50% in 2025 (1 year earlier than the Commission proposal) and 85% in 2030[8]. The initiative claims that these higher targets are achievable according to industrial best practice.

Faced with such overwhelming evidence, it seems now that even the European Commission is backtracking from its own proposed targets. In analysis that was sent to negotiators from the EP and Council, the Commission presented an updated assessment, carried out by JRC and Ökoinstitut in May 2022, of the feasibility of proposed targets for waste collection, material recovery and recycling efficiency. While the results still do not align with those delivered by the best available technology on the market, the Commission goes as far as to admit that its lithium recovery targets - still supported by the Council - are below what is feasible.

Targets	COM proposal	EP mandate	Council mandate	Technically feasible up to[1]
Material recovery				
Lithium[7]	35% by 2026 70% by 2030	70% by 2026 90% by 2030	35% by 2027 70% by 2031	50% by 2027 80% by 2031

[8] Circular Economy Initiative Deutschland (Ed.) (2020): Resource-Efficient Battery Life Cycles – Driving Electric Mobility with the Circular Economy, pg 56.

The assessment concludes that, *[b]ased on techno-economic analysis of development of hydro-/pyro-recycling technologies and lithium batteries market in May 2022, it seems technically feasible to improve material recovery of lithium to up to 50% by 2027 and set a target of up to 80% by 2031, subject to a review in 2028*.

Given that significantly higher rates are already being achieved today, such targets - despite being an improvement - are still inadequate, come far too late, and should be the absolute minimum level considered by negotiators during the trilogues.

Beyond lithium, last year, Swedish battery maker, Northvolt, announced it had produced its first battery cell made with 100% recycled nickel, manganese and cobalt. The company claims its recycling process "recovers up to 95%" of the metals used in a battery – a milestone that demonstrates how technological advances are fast improving. With Northvolt proving that recovery rates of 95% are already feasible today, why are the draft EU targets now set to come in (according to the Council position) in five (2027) and nine (2031) years time?

4. Conclusions

INFO BOX: Overview of proposed lithium recovery targets

Li recovery rates	Commission proposal/Council General Approach*	Updated Commission assessment*	European Parliament	Best available technology
2026	35%	50%	70%	90%+
2030	70%	80%	90%	–

*Council General Approach and updated Commission assessment propose targets for 2027 and 2031

The new battery regulation should be designed to promote technological innovation and ensure timely investments in the best available technologies. Setting comparatively mediocre recovery rates in Europe for 2026 and 2030 (or even 2027 and 2031 as proposed by Council) 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 delay the build up of a domestic supply of critical metals needed for the transition to EVs. Europe should see battery recycling as an asset, not a burden, and an opportunity to create local industries and jobs as part of the new EV value chain.

T&E welcomes the updated assessment presented by the Commission on the feasibility of material recovery targets, but policy makers should go further and align with today's best practice and support the lithium recovery targets proposed by Parliament: **70% in 2026 and 90% in 2030**.

Further information

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