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Urban sustainability practices in the e-mobility and energy transition minerals nexus

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Audio of the intervention, published by the UNECE, available here.

Introduction

Good afternoon, ladies and gentlemen, excellencies.

Thanks for inviting me to present research on the energy transition mineral- E-mobility nexus. I am exploring how those shaping the future of E-mobility understand: the links between urban E-mobility and demand for energy transition minerals (or **ETMs**); the consequences of that demand; and how cities can act responsibly in that context.

I shall concentrate on selected preliminary findings from a case study of the City of Oslo that the Agency for Climate is kindly facilitating. There are two more city case studies and another 18 months to complete the research.

Decarbonisation and better renewable energy and battery technologies underpin dramatic increases in energy transition mineral demand including e.g. for lithium, graphite and cobalt for electric vehicles (**EV**) batteries[i], as well as copper or aluminium. These global, highly concentrated supply chains[ii] are largely outside Europe, subject to geopolitical contentions[iii,iv] and face social, environmental and human rights issues[v,vi,vii,viii].

More than a supply side question

In urban E-mobility, the consequences of ETM demand are often seen as beyond the control of urban centres. With the magnitude of demand taken as a given, questions of

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justice, social impact, human rights, and environmental harm are more directly addressed in Due Diligence (**DD**) than in planning E-mobility.

The logic chain tends to be i) electrify mobility rapidly to reduce emissions, ii) make alternatives to private car use attractive to reduce traffic and emissions, iii) purchase EVs in a responsible/sustainable way.

This is evolving.

Questions of resource intensity and efficiency in E-mobility are entering the conversation via circular economy thinking.

The need to reduce resource intensity

The International Resources Panel calls for sustainable resource production and consumption solutions to avert the risk and damage springing from unsustainable patterns of resource consumption[ix]. E-mobility benefits cities and climate change mitigation, while its ETM demand has social and environmental effects beyond cities. E.g., grievances about water, biodiversity, Indigenous Peoples territories, and human rights are pervasive in the lithium triangle, the second largest source of lithium, and home to the largest reserves[x,xi,xii,xiii], located in the confluence of Argentina, Bolivia and Chile.

Demand side measures to mitigate ETM demand

It is encouraging that research has found that, in the US for example, mobility solutions, car sharing, urban traffic and land-use planning, car regulations and metal recycling can dramatically reduce lithium demand for E-mobility[xiv]. Detailed modelling indicates that, in the US, a scenario of moderate measures including medium EV battery sizes in average, and ambitious measures to reduce car ownership could cut lithium demand by 67% by 2050[xv]. Likewise, metropolitan areas can be battery circularity hubs that extend first lives, repurpose for second lives, and promote recycling starting with procurement[xvi].

Urban sustainability responsibilities in the energy transition minerals and E-mobility nexus

This illustrates the sustainability – including justice, resource efficiency/intensity and circular economy (**CE**)[xvii] – responsibilities for urban centres as they electrify mobility.

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I am interviewing practitioners in three cities and shall now share examples of what I have learnt from Oslo practitioners[xviii].

So far, we have identified three entry points to discuss energy transition minerals in the context of mobility electrification. First, are greenhouse gas (GHG) reduction measures largely aimed at reducing emissions, traffic and private car trips. Second is procurement, where e.g. upstream human rights and greenhouse intensity considerations are integrated. Third is the circular economy.

There are also contextual matters, either enablers or barriers, to addressing resource intensity questions in E-mobility.

Oslo Context

Key context elements in Norway and Oslo include. Norway's oil exports dependency and domestic hydroelectricity have seen mobility prioritised for decarbonisation. An EV pioneer and early adopter, Norway has a large EV drivers' association and EV subsidies. Climate change scepticism and resistance to decarbonisation in sections of the Norwegian population can hinder debate about sustainable E-mobility[xix]. However, residents of Oslo and surrounding areas are more supportive of decarbonisation and reduced consumption measures[xx]. In parallel, there are influential civil society organisations advancing decarbonisation and human rights responsibilities. The country's Transparency Act provides a legal framework for human rights due diligence and transparency that sets obligations for buyers. Oslo also enjoys bipartisan support for a zero-traffic growth goal despite population growth[xxi]. The city has been recognised as a leader in urban decarbonisation[xxii].

Let's now look at some examples of what has emerged in that context in Oslo. I'll concentrate on GHG reduction efforts, and procurement.

GHG reduction (and Circular Economy) measures

To reduce GHG, Oslo has implemented measures like those that research[xxiii] identified as ways to reduce lithium demand. A climate strategy and budget and, more recently circular economy as a theme[xxiv], guide Oslo's GHG reduction efforts. Goals include a 95% reduction in direct GHG emissions by 2030. Overseas vehicle production weighs heavily on the average Norwegian's environmental footprint. So, Oslo seeks to reduce car ownership and use[xxv]. Work incorporates land use measures, speed limits, tolls, incentives and

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procurement criteria. Oslo replaced carparks with parks, playgrounds, and active mobility infrastructure such as bike lanes. Seventy percent of roads have a 30k/h limit. Revenues from a congestion charge and tolls support active mobility and public transport. Incentives such as free parking in certain areas favour EVs within the city, and procurement measures require zero emission vehicles among suppliers. Oslo has achieved zero growth in car traffic and virtually all new vehicles were electric in 2025[xxvi].

Procurement

For procurement, what is known as the Oslo Model outlines supplier requirements, the Agency for Development and Improvement offers frameworks and expertise, while purchasing agencies implement. Purchasers are rolling out desktop audits with the support of the Agency[xxvii].

Ruter, the municipality's public transport company, also has procurement requirements[xxviii].

The Oslo Model covers a range of sustainability and responsibility themes such as human rights, and workers\rights, and zero emissions in transportation of goods and services[xxix].

There are limitations to self-reporting and desktop approaches. So, the municipality works with the Electronics Watch Low Emissions Vehicle Program. It integrates monitoring partners along the EV value chain including workers associations and local communities.

Resource intensity is not a formal component. However, there are relevant emerging practices such as a pilot pooling system for the municipality's light vehicles[xxx].

So, we can see how GHG and human rights, for example, are established in connection to E-mobility, while resource efficiency is emerging within a circular economy approach.

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Politics and constructive debate on the consequences of ETM demand for E-mobility

It is important not to depoliticise this field. Let's not forget there is a high incidence of climate change scepticism in Norway[xxxi], a global cost-of-living crisis, and pressures to reduce regulatory requirements.

These can hinder discussion on responsible and sustainable E-mobility and on the role of demand side measures in resource efficiency[xxxii].

However, some practitioners have found that studies support an evidence-based conversation.

In this political environment, quantifying the combined ETM demand implications of policy measures could foster constructive discussion on circular economy.

Questions

That brings me to the questions that remain. Exploring the system-wide ETM demand impacts of combined policy measures leads to other questions. For example:

- Whether the combination of national and Oslo measures to reduce GHG emissions also reduced ETM demand for E-mobility.
- Interactions between ETM intensity and greenhouse intensity in E-mobility.
- The economic effects of E-mobility, reduced car ownership, and battery circularity hubs in urban areas.
- Ways of addressing the limitations of desktop due diligence approaches in hard to quantify areas such as human rights.
- And ways to foster constructive conversations on E-mobility that integrate resource efficiency considerations.

Summary

To summarise these preliminary results: in Oslo, greenhouse gas emission goals and human rights regulations, and increasingly, circular economy thinking, enable measures to reduce emissions, traffic and car reliance and to procure responsibly. These can contribute to reducing demand for some ETMs. National subsidies support EV adoption. The combined impact of these measures on ETM demand for E-mobility is not clear and resource efficiency is not yet a specific goal in relation to E-mobility. However, interviews reveal that circular economy thinking is being integrated into

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strategy development, that there is awareness of the effects of resource extraction, and of the need for demand side measures. So, studying ETM demand and the effects of demand side measures for the mobility system would benefit policy design.

I would like to thank you for listening and all the research participants for contributing. Thank you.

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[i] IEA (International Energy Agency) (2023). Global EV Outlook 2023. International Energy Agency, Paris. Available.
[ii] Ibid.
[iii] Nygaard, A. (2022). The geopolitical risk and strategic uncertainty of green growth after the Ukraine invasion: how the circular economy can decrease the market power of and resource dependency on critical minerals. *Circular Economy and Sustainability*, 1-28.
[iv] Sanchez-Lopez, M. D. (2023). Geopolitics of the Li-ion battery value chain and the Lithium Triangle in South America. *Latin American Policy*.
[v] Sovacool, B. K. (2019). The precarious political economy of cobalt: Balancing prosperity, poverty, and brutality in artisanal and industrial mining in the Democratic Republic of the Congo. The Extractive Industries and Society, 6(3), 915-939.
[vi] Sovacool, B. K. (2021). Who are the victims of low-carbon transitions? Towards a political ecology of climate change mitigation. *Energy Research & Social Science*, *73*, 101916.
[vii] Sovacool, B. K., Ali, S. H., Bazilian, M., Radley, B., Nemery, B., Okatz, J., & Mulvaney, D. (2020). Sustainable minerals and metals for a low-carbon future. Science, 367(6473), 30-33.
[viii] Jerez, B., Garcés, I., & Torres, R. (2021). Lithium extractivism and water injustices in the Salar de Atacama, Chile: The colonial shadow of green electromobility. *Political Geography*, *87*, 102382.
[ix] Bruyninckx H. H. et al. (2024). *Global Resources Outlook 2024: Bend the trend: Pathways to a liveable planet as resource use spikes*. International Resource Panel. United Nations Environment Program.
[x] Petavratzi, E., Sanchez-Lopez, D., Hughes, A., Stacey, J., Ford, J., & Butcher, A. (2022). The impacts of environmental, social and governance (ESG) issues in achieving sustainable lithium supply in the Lithium Triangle. *Mineral Economics*, *35*(3), 673–699. https://doi.org/10.1007/s13563-022-00332-4
[xi] Jerez et al. Op. cit.
[xii] Akchurin, M. (2025). Mining, Water Conflicts, and Climate Change in Chile's Atacama Desert. *Current History*, *124*(859), 61–67. https://doi.org/10.1525/curh.2025.124.859.61

[xiii] Akchurin, M. (2023). Environmental justice at the environmental courts? Mining, socioenvironmental conflicts, and environmental litigation in northern Chile. *The Extractive Industries and Society*, 15, 101279. https://doi.org/10.1016/j.exis.2023.101279
[xiv] Riofrancos, T., Kendall, A., Dayemo, K. K., Haugen, M., McDonald, K., Hassan, B., ... & Lillehei, X. (2023). Achieving zero emissions with more mobility and less mining. Climate and community project and University of California, Davis. Available.
[xv] Riofrancos, T., Kendall, A., Dayemo, K. K., Haugen, M., McDonald, K., Hassan, B., ... & Lillehei, X. (2023). Achieving zero emissions with more mobility and less mining. Climate and community project and University of California, Davis. Available.
[xvi] Shor, G., Williams, W., Padukone, N. (2025). An Introduction to Battery Circularity How Making Cities Hubs for Lithium-Ion Battery Circularity Can Increase Critical Minerals Supply Chain Resilience, Enhance Business Opportunities, and Reduce Emissions. New York Climate Exchange. New York. Available: https://static1.squarespace.com/static/6871137ee404181e610ad3cd/t/68d3ffb80c27e66b122018f8/1758724024399/NYCE_BatteryCirculatory_v3_WEB.pdf
[xvii] Stahel, W. R. (2016). The circular economy. *Nature*, *531*(7595), 435-438.
[xviii] Twenty eight people including 12 Oslo based and two connected experts to a total of 14, plus participants from Tampere (7) and Madrid (4). Close to 60% are women.
[xix] Interview participants.
[xx] Interview participant.
[xxi] Interview participants.
[xxii] European Commission. (2025, February). *Oslo's five-year report—Environment—European Commission*. Retrieved September 27, 2025, from https://environment.ec.europa.eu/news/oslos-five-year-report-2025-02-04_en
[xxiii] Riofrancos, T., Kendall, A., Dayemo, K. K., Haugen, M., McDonald, K., Hassan, B., ... & Lillehei, X. (2023). Achieving zero emissions with more mobility and less mining. Climate and community project and University of California, Davis. Available.
[xxiv] Due to the introduction of the City of Oslo's Thematic Plan for Circular Economy to 2030 that aims to reduce virgin material demand and increase employment in the circular economy in Oslo.
[xxv] Interview participants.
[xxvi] Koffeld, K. (2025, August 20). Practitioner Commentary Based on Oslo's Experience. City of Oslo's Agency for Improvement and Development. Presented at *Transition Minerals and E-Mobility: Reducing virgin material demand with less private car reliance, smaller battery sizes, and more circularity* [Webinar]. University of Eastern Finland and United Nations Economic Commission for Europe. https://youtu.be/oXynDY4RNFE
[xxvii] Interview participants.
[xxviii] Interview participants.
[xxix] City of Oslo. *The "Oslo-Model"*. Unpublished English language translation.
[xxx] Koffeld, K. (n xxv).
[xxxi] Tranter, B., & Booth, K. (2015). Scepticism in a changing climate: A cross-national study. *Global Environmental Change*, *33*, 154–164. https://doi.org/10.1016/j.gloenvcha.2015.05.003
[xxxii] Interview participants.

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