

This paper provides a quick-read summary of a webinar that was held in November 2023, as part of a series on circular economy in renewable energy infrastructure. To read more about the series visit our dedicated page [Circular renewables webinar series](#)

## SESSION 2: SUPPLY CHAINS – NOVEMBER 2023

This webinar was chaired by Izzi Monk from the Royal Society of Chemistry, and the session featured speakers offering a perspective on renewables supply chains with Janez Potocnik, UN Environment Programme’s International Resource Panel; Heather Plumpton, Green Alliance; and Kathrin Kramer, Leuphana University.

In this session of the webinar series on circular renewables, the focus was on the urgency of proactive supply chain development to meet net zero ambitions. Janez Potocnik from the UN Environment International Resource Panel highlighted the alarming trends in global biomass and anthropogenic mass, underscoring the need to decouple economic growth from resource use to prevent ecological and ethical unsustainability.

Janez Potocnik presented data showing that global material use grew 3-4 times over the past 50 years, driven by urbanization, industrialization, and population growth. He emphasized that non-metallic minerals, essential for infrastructure, have seen the most significant increase, while fossil fuels have stabilized. The primary drivers of material footprint include economic growth and population growth, with high-income countries contributing the most to global consumption and environmental degradation.

Reaching net-zero by 2050 will require six times more critical materials in 2040 than today. Electric vehicles and wind energy are the largest users, requiring high volumes of copper, lithium, zinc and nickel. To stem the inflow of materials for the net-zero transition, it is necessary to reduce demand. This can be achieved with measures such as reducing mobility by working from home, communal and active transport, balanced designs for cities and neighbourhoods, and more effective and efficient use of buildings. Low-carbon solutions, such as electric vehicles, energy storage, electricity networks and power generation, have to use materials sourced with the highest environmental and social standards, and follow circular economy solutions such as more intensive and longer use, consider substitution with other more sustainable / accessible materials, light-weighting and lean designs, and recycling. But in doing so, decision making has to adopt a more holistic system approach, building capacity to translate system change visions into policy and investment structures. Instead, focus currently is too much on symptoms rather than root causes of the problem, which lies in short-term economic growth focus with limited attention to natural resource use and demand-side measures.

Janez Potocnik called for systemic changes in policy and governance, emphasizing the need for a holistic approach that integrates resource governance, redefined finance, sustainable trade, and low-carbon business models. He also drew lessons from the COVID-19 pandemic, illustrating that significant systemic changes are possible when considered urgent. The presentation concluded by stating that current economic logic is unsustainable, and a transformative approach is essential to address climate and environmental challenges effectively.

Izzi Monk explained that the UK has set targets to significantly increase capacity for onshore and offshore wind, and other renewable technologies such as solar photovoltaics by 2050. Meeting this capacity has substantial material demands, not only of things like steel and cement, but also of critical minerals such as indium, silicon, and rare earth elements. Alongside the material demands, there are large projected volumes of waste from end-of-life turbines and solar PV.

The UK has identified 18 minerals as highly critical, with an additional five on a watch list, highlighting their importance in renewable technologies such as wind turbines, solar photovoltaics, and electric vehicles. The UK government's 2022 Critical Minerals Strategy, refreshed in 2023, alongside the 2019 Joint Policy Statement on the Circular Economy, underscores the need for coherent, long-term policies that reduce reliance on primary extraction and mitigate environmental impacts.

To ensure continued access to resources needed in the technologies vital to deliver net zero, we need to move to a circular economy model. The Royal Society of Chemistry is calling for the development and delivery of a clear overarching strategy – coordinated by central government – to enable a circular economy of resources in the UK.

To achieve this, UK governments must take a suite of actions such as improving data collection, mapping and tracking of critical mineral and other material streams, and investing in recycling infrastructure and technologies to enable the increased recovery of critical minerals and other materials to be used as secondary resources and prevent their leakage from the economy. Many materials are used by several (renewables) sectors, and better collaboration and insights into data on resource use across sectors would benefit decision making, for example regarding designs, substitution with alternative materials, and to close the loop between manufacturing and recycling.

Heather Plumpton's slides supported the point on data collection and sharing, to enhance decision-making for investment and policy. Further measures include design for disassembly and attracting investment for infrastructure such as vessels, ports and storage space. A steady direction of travel in policy e.g. in the form of a materials and industrial strategy – that integrates reduced energy demand at a whole system level – would help to rejuvenate the industrial system and show international leadership.

Heather Plumpton's six policy recommendations, presented by Anne Velenturf, included reducing demand for materials through better design and extended use of renewables infrastructure, investing in infrastructure for installation, maintenance, and decommissioning of wind farms, and ensuring ample storage space for decommissioned materials. Accurate data on material flows is critical for informed policy decisions and investments.

Anne Velenturf also highlighted the importance of international leadership and vertical integration within the supply chain to achieve higher value business models such as remanufacturing. This includes partnerships between the wind industry and material suppliers to lower energy costs and ensure a steady supply of materials. The Dutch inclusion of circular economy criteria in wind farm tenders, such as recycled content obligations and extended durability expectations, serves as an example.

In the third part of the webinar, Kathrin Kramer focused on the wind turbine supply chain from a circular economy perspective. She emphasized that wind energy is one of the cheapest and most environmentally friendly energy sources, but it faces significant challenges as we aim to increase capacity from 1 terawatt now to more than 6 terawatts by 2050. This rapid expansion necessitates addressing resource availability, production capacity, skilled workforce, and logistics.

The presentation outlined the need to decouple from virgin materials through circular economy practices, which can mitigate supply chain risks, reduce carbon emissions, and create local job opportunities. A circular wind supply chain involves extending the life of turbines through proper maintenance, reusing decommissioned turbines at new sites, and refurbishing parts for reuse. When reuse is not possible, recycling materials at high quality to manufacture new turbines or other products is essential.

Kathrin Kramer highlighted several barriers to establishing circular supply chains, such as the lack of predictability in turbine decommissioning, insufficient data sharing to assess the remaining life of turbines, and the absence of

traceability, particularly for composite materials used in blades. These challenges hinder investment in recycling facilities and effective circular supply chain management.

Katrin Kramer called for greater collaboration across the supply chain, transparency, and data sharing to enable circular practices. She concluded that while recycling alone cannot meet the future material demand for wind energy, extending the lifetime of existing turbines can significantly reduce the need for new materials and support sustainable scaling of wind energy capacity. The key takeaway is that integrating circular supply chains, product design, and business models is essential to achieve the ambitious targets for renewable energy deployment.

The final part of the webinar on circular renewables and supply chains featured discussions led by Janez Potocnik and Kathrin Kramer. Janez Potocnik emphasized the need for a balanced approach that includes both supply and demand considerations to avoid missing key aspects of sustainability. He highlighted the importance of looking beyond just reaching net zero emissions by 2050 and considering the broader impacts of energy production, such as the environmental consequences of material use and the need for equitable solutions that involve the global south.

Kathrin Kramer expanded on the topic by discussing the current practices in the wind industry, which already shows a competitive advantage due to its focus on service and maintenance. She pointed out the necessity of policy and legal incentives to scale these practices effectively. She emphasized the importance of establishing a circular supply chain network that integrates new and refurbished components, creating a win-win situation where old turbines can be resold and new ones manufactured with recycled materials.

Both speakers agreed on the need for cross-industry and cross-national forums where supply and demand can be discussed together to create coherent strategies. They pointed out the inadequacies of current policies, which often fail to address these issues comprehensively. Janez Potocnik suggested that the upcoming COP events could be a platform to bring these critical issues to the forefront, emphasizing the need for targets beyond CO2 emissions, including those related to natural resource use.

The overall session conclusions on the next steps for implementing just sustainability transition include:

- Institutionalise resource governance and define resource use paths;
- Redirect finance to serve the transition;
- Make trade an engine of sustainable development;
- Create low-carbon, clean and circular business models;
- Correct market signals to mainstream sustainable production and consumption;
- Focus actions on the most resource-intensive provisioning systems.
- Take a system perspective: Promote collaboration across stakeholders along the entire value chain and understand their multiple objectives (e.g. time, cost, emissions) to identify synergies and potential trade-offs;
- Establish a traceability system of products (e.g. wind turbine), their components (e.g. rotor blade) and their materials (e.g. composites) over multiple lifecycles in order to create a basis for decision-making for the actors in the circular supply chains within the renewable industry.

The session ended with acknowledgments to the speakers and a reminder about the next webinar session focusing on comparing the benefits and potential of recycling and longer lifetimes in renewable infrastructure.

*A note on artificial intelligence: This short paper was first drafted using artificial intelligence to summarise the recorded webinar. Prior to this publication it was then reviewed, and edited and corrected where necessary by Dr Anne Velenturf, Senior Researcher and project lead.*