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

SESSION 1: INTRODUCING CIRCULAR RENEWABLES - SEPTEMBER 2023

The first session of the Circular Renewable Series was introduced by Adam Batchelor, the Policy Engagement Lead for Circular Economy and Finance Management at IEMA. This series, organized in partnership with the University of Leeds, aims to explore the challenges and opportunities in embedding circularity within renewable energy infrastructure. The need for a significant increase in renewable energy capacity to meet net-zero targets, as outlined in the British Energy Security Strategy, underscores the importance of this initiative.

Renewable energy infrastructure, projected to increase drastically, will require substantial materials, many of which are finite and sourced from volatile supply chains. According to IRENA's World Energy Transitions Outlook 2023 every year from now until 2050, 1,000 GW of renewables has to be deployed to avoid the worst climate change. This will require mass volumes of foundation and critical materials such as steel, aggregate for concrete, aluminium and copper. For example, across Europe material demands for wind energy infrastructure will grow 3-4 fold by 2030, exceeding current supply chain capabilities. The 22 circular economy strategies for renewables[1] that were identified so far can help to avoid adverse sustainability trade-offs, making renewables an ultra low-carbon energy source. Moreover, circular approaches can mitigate supply challenges and risks to net-zero ambitions, and create new business opportunities such as in remanufacturing and reuse, disassembly, decommissioning, recycling, project planning, and product passports and recertification. Evidence suggests that circular economy will reduce long-term costs and risk, for example by minimising resource use and waste, and by designing sites for multiple lifecycles.

This increase in renewable energy infrastructure poses sustainability risks such as water pollution and exacerbating global inequality. Hence, the role of circular economy solutions is crucial. The series will feature experts discussing data, projections, and real-life examples to elucidate the relationship between net-zero goals and circularity.

Dr Anne Velenturf from the University of Leeds emphasized that renewable energy infrastructure often lacks circularity. Circular economy principles aim to optimize the use of materials, maximize waste prevention, and enhance the economic, technical, social, and environmental values of materials and products throughout their life cycles. Anne outlined strategies for circular economy, including narrowing, slowing, and closing resource flows, and reintegrating materials safely into natural processes. She stressed that recycling alone does not equate to circularity.

A sustainable circular economy seeks to improve environmental quality and social well-being while maintaining economic prosperity. It can significantly contribute to achieving net-zero targets and creating jobs. For instance, the UK could see nearly half a million new jobs by 2030. Different strategies were highlighted, such as designing products with fewer materials, modular designs for easier repair and reuse, product service systems, and shared consumption.

[1] A previous version of the framework with 18 strategies can be found here https://www.mdpi.com/1996-1073/14/17/5540

Anne also addressed the significant material demands for building renewable energy infrastructure, using the UK's wind energy sector as an example. The growth in material needs, including cement, concrete, fibre-reinforced plastics, copper, aluminium, and steel, is substantial, and current supply chains are not prepared. She called for urgent action to develop an industrial and material strategy.

Globally, the transition to renewable energy infrastructure will require thousands of millions of tons of new materials by 2050 to keep global temperature rise below 1.5 degrees Celsius. This necessitates a careful balance between climate action and responsible resource use. Circular economy solutions can help achieve ultra-low carbon outcomes by enhancing the efficiency of material use.

Anne concluded with potential business opportunities in circular renewables. These include cost and risk reductions through minimal resource designs, site designs for multiple life cycles, and significant opportunities in disassembly and remanufacturing. Emphasizing the economic benefits, she highlighted the importance of disassembly for enabling reuse, high-quality recycling and remanufacturing, which offers a substantial business potential, especially in the UK.

In the second part of the Circular Renewables session, Kenny Taylor from Zero Waste Scotland (ZWS) presented the organization’s efforts and insights into promoting circularity in the energy sector. ZWS, an advisor to the Scottish Government on responsible consumption, is set to become a public body. Kenny highlighted the vast material requirements for energy infrastructure and emphasized the importance of collaboration to achieve emissions savings, job creation, and economic gains through circularity.

Kenny discussed the Circularity Gap Report, which revealed that Scotland’s circularity is only 1.3%, significantly below the global average of 8.6%. This indicates a heavy reliance on virgin resources. The report suggests improving circularity through decommissioning large-scale energy infrastructure, such as old coal power plants and offshore oil and gas platforms, to reuse materials in building new energy structures.

Several high-level Scottish Government strategies and plans emphasize circularity and renewable ambition, including the Climate Change Plan, the Infrastructure Investment Plan, and the Draft Energy Strategy and Just Transition Plan. These documents highlight the need to reduce, reuse, and repair materials to achieve a circular economy by 2023. The Infrastructure Investment Plan focuses on enabling the transition to net zero and sustainable growth, integrating community and energy transition activities, particularly around port infrastructure.

The Draft Energy Strategy poses a crucial question about sustainably securing materials for energy infrastructure. The national planning framework aims to balance energy development with nature conservation, emphasizing the need for a faster planning system to support the energy transition and circular economy material management facilities.

Kenny highlighted several ZWS reports and initiatives. One report on onshore wind decommissioning recommends enhancing Scotland's circularity in this area, which is currently low. The report predicts the decommissioning of 5,500 turbines by 2050, generating over a million tonnes of material, including steel and fiberglass, which must be captured and reused.

Similarly, an analysis of offshore wind highlighted the potential for capturing materials and the benefits of circularity, such as embodied carbon savings, energy security, and material resilience. Recommendations include alternative industry routes, like electric arc furnaces for recycling steel.

The presentation concluded with a Sankey diagram from the Energy Infrastructure Materials Mapping Report, showing the flow of materials from decommissioning to the required materials per technology out to 2050. It highlighted opportunities and competition for materials between technologies, emphasizing the need to prioritize based on available resources.

In the final part of the Circular Renewables session, Trevor Hutchings, chair of the Green Purposes Company and partner at BIP, discussed the critical need for the renewable energy sector to embrace circular economy principles. Trevor emphasized that while the renewable sector has made significant strides in decarbonizing energy, it must avoid causing environmental harm through unsustainable material extraction and disposal.

Trevor highlighted the exponential increase in renewable energy capacity needed by 2030, pointing out that the solar industry alone needs to install the equivalent of the world's largest solar park every day to meet targets. He noted that renewable energy infrastructure is significantly more materials-intensive than fossil fuel plants, requiring substantial increases in materials like steel and concrete.

He underscored the resulting supply chain constraints, environmental damage from extraction, and the end-of-life challenge of renewable energy components like PV panels and turbine blades. Trevor argued that adopting circular economy strategies could decouple the reliance on critical materials from achieving net-zero targets, thereby mitigating supply chain vulnerabilities and promoting sustainability.

Trevor also highlighted the economic opportunities in circular business models, citing the growing markets for PV and battery recycling, projected to reach billions of euros in the next decade. He pointed out the barriers to implementing circularity, including the need for industry action in designing technologies for easier dismantling, recycling, and extending product lifetimes. He called for policy interventions, such as Extended Producer Responsibility (EPR) mechanisms, and greater involvement from the investor community in prioritizing circular economy principles.

The Q&A session in the final part of the Circular Renewables webinar featured speakers Anne Velenturf, Kenny Taylor, and Trevor Hutchings addressing various audience questions. The first question focused on improving data use to support the transition to a circular economy. Anne emphasized the need for better data collection and sharing across supply chains to establish benchmarks and ensure the usability of recovered materials. Kenny added that learning from past industries and setting recycling targets in policies could foster innovation.

Another question asked whether the renewable industry has adequate representation in forums for major material sectors. Anne suggested that these forums could benefit from more openness to include new industries like renewables. Trevor expanded on policies needed to facilitate circular renewable opportunities, highlighting data sharing, product passports, and extended producer responsibility (EPR) as essential measures. He also noted the role of government in incentivizing research and innovation and the importance of investor involvement.

The discussion then turned to managing waste from solar and battery systems. Trevor mentioned the reuse of batteries for secondary functions and the necessity of recycling at the end of their life. He noted that car batteries, for example, have longer lifespans than anticipated and can be repurposed.

Regarding the impact of decentralized energy generation on waste regulation and circular business models, Kenny highlighted the challenge of stranded assets in remote locations. He stressed the need for local capacity to maintain renewable installations and avoid reliance on diesel generators. Kenny suggested that community sustainability plans could help address these issues and support a just transition.

The session concluded with acknowledgments and an invitation for participants to join future sessions, thanking speakers Anne, Kenny, and Trevor for their contributions.

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.