Written evidence submitted by the Royal Society of Chemistry (IND0034)

This response focuses on the following two questions:

- Does the UK have the supply chain capacity to deliver the required energy infrastructure by 2035, including an expanded electricity network?
- What are the key concerns with respect to the availability of raw materials in the supply chain and how might those be addressed?

The UK government has set out its ambitions to develop wind and solar energy by 2030 quadrupling offshore and doubling onshore capacity, as well as tripling solar power. Consequently, substantial quantities of raw materials will be required to deliver this additional capacity, as well as the manufacturing and infrastructure required to build and install these projects.

Analysis conducted by the Royal Society of Chemistry estimates that around 40 million tonnes of materials will be required to meet the 2030 targets for wind power[i]. Foundation materials such as steel and cement are required in significant quantities as they constitute the bulk of the footprint of wind turbines, but other materials such as composites - to meet the 2030 targets set for offshore and onshore wind, we will need over 1 million tonnes of composite material for blade production[i] - and copper will also be important.

Critical minerals, particularly rare earth elements (REEs) and those needed in the production of steel (e.g. vanadium and niobium), are crucial in wind turbines, and several others are also vital in solar photovoltaics. There is a high global demand for many of these materials, and this is not limited to demand from growth in renewable energy technologies. Many critical minerals are also essential in other sectors such as defence, healthcare and electronics, and foundation materials such as steel and cement are required in vast quantities by the construction sector. Potential supply versus demand imbalances may threaten the UK's capacity to meet the UK's wind and solar targets, especially at the scale and pace that is required to meet our legally binding net zero commitments and our ambitions for energy security.

Primary sourcing of all of these materials will have to be increased substantially, unless extensive effort is put into developing our recycling capabilities and capacity to unlock secondary sources. **Understanding the 'anthropogenic stocks' of these materials – i.e. the amounts that are already circulating in our economy (both in households and in industry) – will be crucial in developing recycling capabilities and capacity, and must be supported by better mapping and tracking of material streams**.

While promising recycling scenarios exist for some of these materials (such as copper and steel), routes for others (such as concrete and composites) remain elusive. Similarly, the UK's recycling capacity for critical minerals is minimal. We **need strategic investment in selective recovery technologies and the required infrastructure, as well as incentives or regulatory requirements for manufacturers to use secondary raw materials**, for example via minimum recycled content targets. There is no clear path to increase the primary extraction of critical minerals closer to home to meaningful levels, due to their geological distribution. However, there is significant scope to strengthen the secondary supply of these minerals through the recovery of decommissioned wind turbines, solar photovoltaics, and other end-of-life products.

Increasing the recovery and recycling of materials is just one part of establishing a more circular renewables sector. A key principle of a circular economy is to keep materials circulating at their highest possible value for the maximum time. **Reuse, re-manufacturing and, in the case of wind energy, re-powering, are all important in helping to achieve this and must be enabled by policy interventions**. In addition, shifting towards greater durability and extending the lifespan of wind and solar infrastructure will be another way to maximise the material lifespan. There may be trade-offs that will need to be considered carefully to increase circularity, for example between durability and recyclability, and to avoid 'burden shifting' of environmental impacts or emissions to different parts of the lifecycle. **Data and evidence will be important in understanding these trade-offs and making high quality policy decisions**. Ultimately, a more circular renewables sector should help reduce primary resource demand, increase resource efficiency and minimise waste and pollution, while potentially also leading to the creation of more high value jobs in the industry.

There are growing concerns about production capacities of the wind supply chain, and the manufacture of wind turbines is complex as component parts are produced in several different locations and countries. To avoid production bottlenecks limiting the pace of deployment of wind energy infrastructure, there is a need to rapidly expand supply chain capacities across Europe and the UK. This has been assessed as urgent for a number of key components in the construction of wind farms[i]. An additional barrier may be the infrastructure required to install wind turbines, e.g. the supply of appropriately sized wind turbine installation vessels may not match demand later on this decade.

Without a **coherent national strategy that prioritises material circularity**, and that looks across the different critical minerals and other materials integral to renewable energy technologies the UK is highly unlikely to succeed in scaling up wind and solar energy in order to transition to net zero within the next two and a half decades. Crucially, a meaningful materials strategy for the UK must not be limited to energy alone, but rather must serve all relevant growth sectors relying on critical minerals, cement and steel. Furthermore, in the face of an accelerating triple planetary crisis, **any sustainable strategic approach to materials must not only look at infrastructural requirements, resource efficiency and supply resilience as demand for these materials increases, but also strive to drastically limit fossil carbon inputs, waste creation, greenhouse gas emissions and release of pollutants into the environment across the entire material lifecycle**. Material circularity will be integral to realising our ambitious plans for green technologies. Therefore, **transitioning to a circular economy of materials has to become a main priority for the Government**, as outlined in the Royal Society of Chemistry's materials strategy action plan. In our view, stakeholders from across concerned sectors need to collaborate to minimise silo formation and build a consensus on the materials required for this transition.

About us

With over 60,000 members in more than 100 countries and a knowledge business that spans the globe, the Royal Society of Chemistry (RSC) is the UK's professional body for chemical scientists, supporting and representing our members and bringing together chemical scientists from all over the world. Our members include those working in large multinational companies and small to medium enterprises, researchers and students in universities, teachers and regulators. There are numerous ways in which chemical scientists are working towards a sustainable, clean and healthy planet, and this report is part of the Royal Society of Chemistry's contribution to do so.

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[i] Royal Society of Chemistry analysis, 2024. Available upon request, please contact policy@rsc.org