

## Expected results

**Environmental:** (i) The production of graphitized char-based materials for sustainable energy applications, improving the efficiency of the related technologies and contributing to overall CO<sub>2</sub> emissions decrease; (ii) The substitution of natural graphite by char-derived graphitized materials short-circuit the graphite demand by decreasing the need to explore for and exploit natural graphite. Therefore, helping to preserve natural resources and decreasing environmental issues associated with mining; (iii) CHARPHITE aims to be a waste-less and environmentally safe utilization of various coal ashes globally; in addition, value is added to the ash due to the removal of the carbon- and iron-bearing phases (CHAR and ferrospheres), enabling further use; (iv) Promoting and contributing to sustainable waste management and zero waste directives within the EU, Argentina and South Africa.

**Technical-economic:** (i) The utilization of large volumes of coal ash generated every year (and typically landfilled) for CHAR extraction purposes, will secure a sustainable supply of graphite potential precursor material for EU countries, Argentina and South Africa in the future; (ii) Utilizing Combustion Waste Products (coal ash) as secondary resources in EU and thus winning back materials by recycling waste streams, making EU, Argentina and South Africa less dependent on natural graphite from elsewhere, reducing the EU, Argentina and South Africa budget in purchasing natural graphite, and extending the life of natural resources; (iii) The development of the CHAR recovery process and carbon transformation, is one promising secondary resource for graphitic material for various applications; previously the technical and/or economical recovery feasibility did not exist; (iv) CHAR recovery from coal ash may be more efficient than the exploration of natural graphite since the physical form, already in a semi-coked form, maybe more amenable to graphitisation. Thus, time, energy, environment and economic efforts are considerably improved; (v) By understanding the characteristics for the charphite process, the hystoric ash dumps could be revisited and potentially reclaimed; (vi) Maximising valuable CHAR recoveries of the production processes, by appropriate methods/technical solutions selection and optimization (e.g. size separation) which will exploit the individual characteristics of each residue; (vii) Production of novel graphitized chars-based materials and composite with oxides with catalytic properties in electro-assisted reactions for energy production: HER, OER, ORR and water splitting; (viii) Application of graphitized chars with oxides in electro-assisted reactions for energy applications: hydrogen evolution reaction (HER), oxygen evolution reaction (OER), oxygen reduction reaction (ORR) for fuel cell technology, CO<sub>2</sub> reduction to produced added value products; (ix) Promoting “Eco labelling of secondary resources” for sustainable procurement.

**Social:** (i) To contribute to new areas of development, economic reinforcement, specialised skills development and jobs, and EU, Argentina and South Africa autonomy and security; (ii) To increase the quality of soils and landscapes in rural and urban areas by reducing the health and environmental impact caused by natural graphite mining and landfilling of coal ash; (iii) To increase the people’s level of awareness and trust in the conservation of natural resources through recycling; (iv) To increase the level of people’s trust that recycling offers significant investment, innovation and employment opportunities in the EU and globally; (v) To promote collaborative research across the EU and with global partners for the benefit of a sustainable planet.

