European Technology Platform
on Sustainable Mineral Resources

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European Strategic Autonomy Requires Both Critical Raw Materials and Technology Leadership

Turning European Innovation into Industrial Capacity, Resilient Value Chains and Global Market Leadership

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Key Recommendations

To secure both resource and technology sovereignty, the European Commission should deploy a ***€2.3 billion budget annually over 7 years*** *under the future European Competitiveness Fund (ECF). In addition, it should promote the following measures:*

- Create a European Raw Materials Technology Acceleration Fund that provides continuous support from technology demonstration through industrial deployment and commercial scale-up, avoiding fragmented funding mechanisms.
- Prioritise large-scale demonstration under real industrial conditions. Support industry-led projects that validate integrated technologies and system solutions, demonstrating their technical performance, safety, sustainability and commercial potential.
- Bridge the gap between successful demonstration and first industrial deployment. Provide dedicated financing for first-of-a-kind installations and early commercial applications, helping proven technologies overcome the barriers to market entry.
- Reduce investment risks and mobilise private capital. Introduce targeted risk-sharing mechanisms, including grants, guarantees, concessional loans and blended finance, to improve investment readiness and encourage industrial adoption.
- Simplify access to funding and ensure continuity between innovation stages. Introduce milestone-based financing, transparent selection criteria and streamlined access to follow-on support, allowing successful projects to progress without repeated application processes.
- Strengthen industry-led innovation and European competitiveness. Prioritise technologies responding to concrete industrial needs, supported by credible business cases, customer commitments and clear commercialisation pathways, while delivering measurable environmental and economic benefits.

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Executive Summary

Europe's future competitiveness, resilience, and strategic autonomy depend on raw materials and maintaining – and further strengthening - a world-leading innovation ecosystem across the entire raw materials value chain.

This ecosystem includes research organisations, early-stage ventures, high-tech SMEs and digital innovation providers, technology providers, equipment manufacturers, mining and processing companies, recyclers, and industrial end-users. Each actor plays a critical role in transforming scientific excellence into industrial leadership and sustainable production. These ecosystems should be recognised as delivery environments for European competitiveness, linking regional strengths and investments to European value chains and strategic priorities.

Europe has built a globally recognized position through close collaboration between industry, academia, and public stakeholders. This integrated innovation model has enabled the development and deployment of advanced technologies that make European mining and raw materials operations among the safest, most responsible, and most productive in the world. Maintaining this leadership requires continuous investment in research, demonstration, industrial deployment, skills, and market uptake across the full value chain.

The raw materials sector is undergoing a profound transformation driven by digitalisation, automation, electrification, artificial intelligence and circularity. As the pace of technological development accelerates globally during geopolitically challenging times, **Europe must ensure that its entire raw materials ecosystem continues to evolve together if it is to build and sustain a strong, high-tech, efficient and globally competitive industry. A strong mining sector alone is not sufficient, nor is a strong technology supply industry in isolation. Long-term competitiveness depends on reinforcing the dynamic interaction between academia, research, institutes, technology and digital developers, technology providers, equipment manufacturers, mining companies, processors and recyclers and users of critical raw materials.** Europe should build on the strong foundations created through Horizon Europe and earlier Framework Programmes, including the culture of creative cooperation, trust and effective collaboration between industry, research and public stakeholders that has enabled European innovation leadership.

At the same time, the sector faces a dual imperative: to supply the materials required for Europe’s green transition and for its security, defence capabilities and resilient industrial base while rapidly reducing the emissions and risks of its own operations. This requires faster uptake of electrification, automation and intelligent systems that replace diesel-powered equipment, improve resource efficiency and progressively remove people from hazardous working environments as mines extend deeper and operating conditions become more complex.

Future European programmes should therefore support innovation across the entire value chain and provide a continuous pathway from research and demonstration through scale-up, first industrial implementation and deployment, replication and global market uptake. In particular, a dedicated First Industrial Implementation and Deployment Instrument is needed to de-risk first-adopter barriers, create operational reference installations and convert European technologies into repeatable commercial solutions and manufacturing demand.

By fostering a complete and interconnected innovation ecosystem—and closing the financing gap between successful demonstration and commercial investment—Europe can continue to develop world-class technologies, operate world-class mines and processing plants, create high-value industrial jobs and strengthen its contribution to the green and digital transitions.

Strategic Areas and Proposed Solutions

Strategic Area 1 – Strategic Autonomy Requires Both Resource Security and Technology Leadership

ETP SMR welcomes the stronger focus on strategic autonomy, industrial resilience, competitiveness and economic security across European policy initiatives, including the Critical Raw Materials Act, the Competitiveness Compass, the Clean Industrial Deal, the European Competitiveness Fund (ECF) and the future Framework Programme for Research and Innovation (FP10). Together, these initiatives recognise that secure and sustainable access to critical raw materials is essential for Europe's green and digital transitions, defence and space capabilities, and wider industrial base.

However, access to resources alone cannot secure Europe's long-term competitiveness or strategic autonomy. Raw materials generate strategic and economic value only when Europe has the capabilities to explore, extract, process, refine, recycle and integrate them efficiently and sustainably into industrial value chains.

These capabilities increasingly depend on advanced equipment, digital solutions, automation, electrification, artificial intelligence, processing technologies and circular solutions. Europe must therefore retain the capacity not only to access these technologies, but also to further innovate, develop, manufacture, deploy, maintain and scale them within a strong and interconnected European industrial ecosystem.

To retain and strengthen these capabilities, Europe must support the full research and innovation pipeline—from early-stage research and emerging technologies to demonstration, deployment and scale-up. FP10, European partnerships, and national and regional programmes should develop the knowledge and technologies that can later progress to ECF-supported deployment.

From the perspective of ETP SMR, Europe's future competitiveness rests on two mutually reinforcing pillars:

- **Resource security:** secure, sustainable and diversified access to critical raw materials, supported by stronger European capacity in extraction, processing and recycling.
- **Technology leadership:** European capability to innovate, develop, manufacture, deploy, maintain and scale the technologies that enable resilient, sustainable and globally competitive raw materials value chains.

Dependence on non-European technologies can create strategic vulnerabilities even when raw materials are physically available, while technological leadership cannot be sustained without secure access to the materials, operational environments and industrial value chains needed to develop and validate advanced solutions.

European raw materials policy must therefore address both dimensions. Securing strategic autonomy requires coordinated support for resilient resource supply and for the industrial and technological capabilities that transform those resources into value. Europe's objective should be not only to secure raw materials, but also to remain the global leader in the technologies that make their sustainable and competitive use possible.

Strategic Area 2 – European Raw Materials Technology Providers as a Strategic European Capability

European Raw Materials Technology Providers should not be viewed primarily as suppliers of equipment and solutions. They constitute a strategic European industrial and innovation capability that supports competitiveness, resilience and technological sovereignty across the entire raw materials value chain.

This ecosystem includes equipment manufacturers, digital solution developers, engineering and process-technology companies, recycling and circularity specialists, research organisations and system integrators. Together, they transform scientific knowledge and industrial needs into technologies that can be manufactured, commercialised and scaled across global value chains.

Their capabilities span exploration and resource characterisation, extraction, mineral processing, refining, recycling and the integration of raw materials into industrial applications. Europe has established globally recognised strengths in automation, electrification, autonomous systems, artificial intelligence, advanced sensing, industrial digitalisation, process technologies and circular solutions.

The close interaction between researchers and academia, technology providers, processors, recyclers and industrial users creates a cumulative competitive advantage. Industrial needs guide research and technology development, while specialised European capabilities support higher productivity, stronger safety, lower environmental impact and more efficient use of resources.

This ecosystem generates highly skilled employment, strengthens European industrial value chains and supports the growth of specialised companies. It also enables Europe to retain the knowledge, manufacturing capacity and system-integration capabilities needed to transform research excellence into globally competitive industrial solutions.

European technology providers also compete successfully in global markets. Their international presence creates high-value exports and exposes European solutions to diverse operational requirements, further strengthening learning, innovation and long-term competitiveness.

Global success, in turn, sustains the revenues, skills, production capabilities and knowledge required for continued innovation in Europe. European providers therefore strengthen Europe economically both through their contribution to domestic value chains and through their position in international markets. Europe should consequently recognise Raw Materials Technology Providers as a strategic capability within European Innovation Ecosystem and essential for sustaining innovation leadership, industrial sovereignty, skilled employment, export competitiveness and long-term economic growth.

ETP SMR believes that Europe's strategic objective should be to remain the world's leading ecosystem for developing, manufacturing and supplying advanced raw materials technologies. This will strengthen Europe's industrial resilience while enabling more sustainable, productive and secure raw materials value chains worldwide.

Strategic Area 3 – Demonstration through Upscaling to Deployment is Critical for the Innovation Cycle

Europe has developed one of the world's strongest research and innovation ecosystems. However, innovation does not end when technology reaches Technology Readiness Level (TRL) 5–7. It continues through first-of-a-kind demonstration, industrial validation, integration, deployment, replication and market uptake. These activities generate indispensable real-world knowledge that fuels the next generation of research, innovation and technology development, closing and continuously strengthening the innovation cycle.

A strong base of high-tech mines and processing operations in Europe is fundamental to this innovation cycle. These operations are not only producers of raw materials; they are essential development, demonstration and reference environments where technologies can be tested, integrated, validated and improved under demanding real-world conditions. Europe's world-leading mines and processing facilities should therefore be recognised as strategic innovation infrastructure: they generate the operational learning, data and industrial capabilities needed to sustain productivity, safety, sustainability and long-term competitiveness as extraction moves to greater depths and increasingly complex operating conditions.

Large-scale deployment in European operations generates operational experience, customer insight, performance data and industrial learning. This practical, site-specific knowledge—built through continuous interaction between people, equipment, processes and complex operating environments—is not available from laboratory research, simulations or generic datasets alone. It is an essential and often proprietary industrial asset that enables European technology providers and operators to improve the safety, reliability, productivity and environmental performance of existing solutions. Crucially, access to high-quality operational data and domain expertise is also indispensable for training, validating and continuously improving the next generation of artificial intelligence, advanced analytics, autonomous systems, electrified equipment and integrated industrial digital solutions.

The close interaction between high-tech mines, technology providers, researchers, processors and industrial users strengthens the entire innovation ecosystem. It creates continuous feedback between operational needs, research, technology development and industrial application, while building Europe's capacity to accelerate innovation from laboratory results to proven industrial solutions.

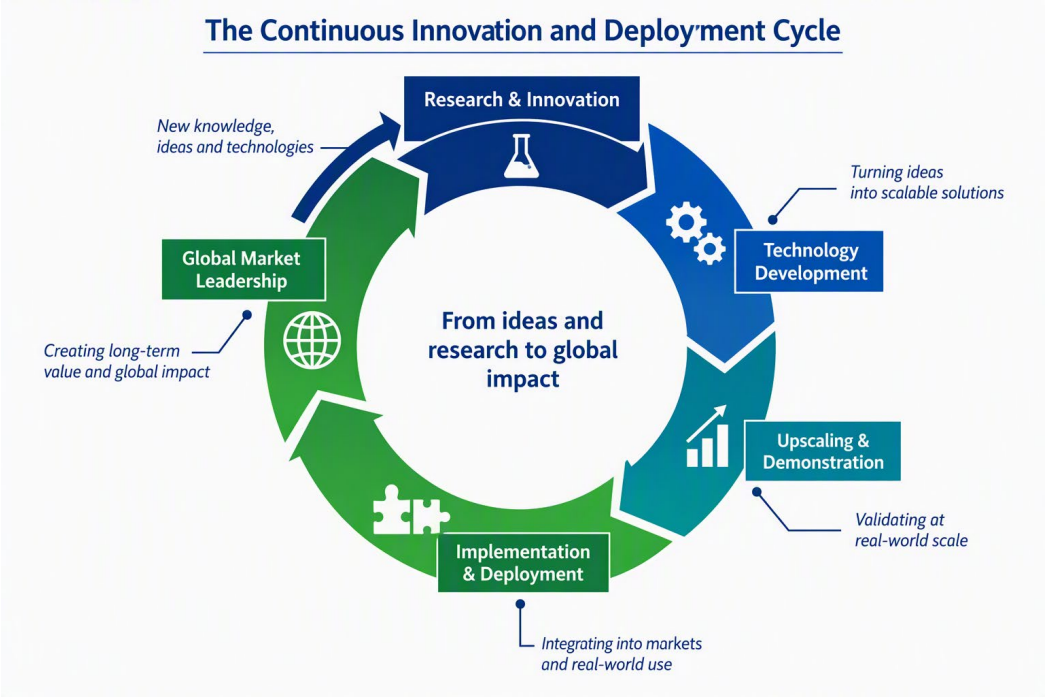
Without advanced European operations where technologies can be deployed at scale, Europe risks losing operational knowledge, development environments and reference cases to other regions. This would weaken both the innovation ecosystem and Europe's ability to transform research excellence into industrial and global market leadership.

Deployment support should therefore address the high technical, financial and operational risks associated with first industrial applications. This is not support for routine investment; it is targeted support for projects that generate shared learning, validate new solutions and enable wider replication across the sector.

For European Raw Materials Technology Providers, deployment is not merely commercialisation; it is a strategic source of operational knowledge, industrial credibility and innovation. Their global presence generates experience and data from diverse operating environments that feed directly back into Europe's research, engineering and manufacturing ecosystem. Europe must therefore deploy the

current generation of technologies at scale—through European providers worldwide—to capture the real-world data and learning needed to accelerate the next generation of AI-, analytics- and quantum-enabled solutions. Delay will erode the knowledge base, industrial momentum and learning cycles on which Europe's future technology leadership depends.

FP10 and the European Competitiveness Fund should therefore recognise demonstration, upscaling and deployment as an integral part of the innovation cycle and support the full pathway from research and demonstration to industrial validation, replication and scale-up. Europe must deploy the technologies of today if it is to develop the technologies of tomorrow and maintain global leadership in advanced raw materials solutions.



A continuous European pathway that converts research and innovation into industrial deployment, global market leadership and reinvestment in the next generation of technologies

Strategic Area 4 – From Technological Leadership to Industrial and Global Market Leadership

Europe's technological strengths create strategic value only when they are converted into competitive companies, manufacturing capacity, commercially proven solutions and sustained positions in global markets.

Europe must therefore combine continued research excellence with a stronger capacity to industrialise, manufacture and scale technologies within Europe. The objective is not only to create innovations, but to ensure that the resulting production, capabilities, intellectual property, skilled jobs and economic value are anchored in Europe.

Achieving industrial scale-up across the entire raw materials value chain requires more than suitable field-trial and demonstration environments. It also depends on access to finance, favourable market conditions, skilled people and a supportive regulatory framework. For exploration and greenfield projects, better coordinated and more predictable permitting is particularly important.

European reference projects are particularly important for global market leadership. They demonstrate performance at industrial scale, reduce perceived risk for customers and investors, and create the credibility needed for European solutions to be adopted internationally.

Global market success then reinforces Europe's industrial base by generating revenues for further innovation, sustaining specialised supply chains and skills, attracting investment, and giving European companies experience across diverse operational environments.

However, global market leadership depends not only on technological excellence and successful European reference projects, but also on fair, transparent and predictable market conditions. Europe should actively promote international standards, harmonised certification frameworks, technology-neutral regulation, transparent sustainability criteria and globally recognised testing procedures. These measures reduce market fragmentation, strengthen customer confidence and create a more level playing field for advanced European technologies.

Europe's ambition should therefore be to retain the complete pathway from technological excellence to industrial production, scale-up and global market leadership. This requires not only investment, manufacturing capacity and reference projects, but also standards, certification, regulatory cooperation, export support and international partnerships that enable European solutions to compete successfully worldwide.

The policy challenge is consequently to close the gap between Europe's technological capabilities and its ability to capture industrial and global market value. The European Competitiveness Fund should be designed to help bridge this gap, as set out in the following section.

Turning Europe's Raw Materials Ambition into Industrial and Global Leadership

Europe must sustain a complete and interconnected raw materials innovation ecosystem that can develop world-class technologies, operate world-class mines and processing facilities, create high-value industrial jobs, and lead the green and digital transitions. Strategic Areas 1–4 show what is required to achieve this ambition: combine resource security with technology leadership; recognise both Material and Technology Providers as a strategic European capability; treat industrial deployment as an integral part of innovation; and convert technological excellence into manufacturing strength and global market leadership.

The European Competitiveness Fund should be the instrument that connects these four strategic pillars and turns them into industrial outcomes. In close coordination with the future Framework Programme for Research and Innovation, it should provide a continuous pathway from collaborative research and demonstration to first industrial deployment, manufacturing, replication and international scale-up. Its design should combine grants, loans, guarantees, equity, procurement and advisory support according to the maturity, capital intensity and risk profile of each project.

For the raw materials sector, this means investing in the ecosystem as a whole: support should favour integrated European partnerships that strengthen strategic autonomy, shared learning, production capacity and export competitiveness, not isolated projects that leave critical gaps between innovation stages or value-chain actors.

To meet the ambition set out in the Executive Summary and to fulfil Strategic Areas 1–4, ETP SMR calls for the European Competitiveness Fund to:

- **Secure both resource and technology sovereignty.** Support projects that strengthen sustainable European extraction, mining, processing and recycling together with the capacity to develop, manufacture, deploy and maintain the enabling technologies in Europe. Funding decisions should test explicitly whether a project reduces strategic dependencies across both dimensions.

- **Recognise and reinforce the complete European raw materials technology ecosystem.** Treat researchers, technology and digital developers, technology providers, equipment manufacturers, system integrators, operators, processors, recyclers and industrial users as an interconnected strategic capability. Europe must strategically connect and mobilise its regional innovation ecosystems to create a powerful EU-wide platform that gives SMEs and specialised providers access to world-class capabilities, infrastructure, customers and finance—accelerating industrial deployment and strengthening global competitiveness. Evaluation should reward partnerships that preserve critical knowledge, engineering capacity, intellectual property, skills, specialised supply chains and high-value employment in Europe.

- **Create continuity from research to industrial scale.** Close the gaps between research, demonstration, scale-up, first industrial implementation and deployment, replication, manufacturing and global market uptake through coordinated calls, transferable project results and follow-on financing. A dedicated First Industrial Implementation and Deployment Instrument should support proven technologies that are not yet financeable on conventional market terms, enabling first-of-a-kind installations, operational reference cases and early replication. The pathway between the future Framework Programme and the European Competitiveness Fund should be predictable, accessible and aligned with industrial timelines.

- **Advance integrated system innovation from research to industrial scale.** Today's innovations—and those of the future—are increasingly complex and interconnected, requiring a system innovation approach that integrates technologies, processes, infrastructure, data, skills and operating environments from research through to industrial deployment. The European Competitiveness Fund should therefore enable integrated pilots, demonstrations and scale-up activities across TRLs 4–9 in representative and real-world industrial environments, where complete systems can be tested, validated and advanced towards deployment.

- **Establish European demonstration, deployment and reference environments.** Enable mines, processing plants and recycling operations to integrate and validate advanced technologies under real industrial conditions. Ensure access to the research infrastructures, pilot environments, testbeds, industrial demonstrators and shared data environments needed to develop, integrate, validate and improve technologies before and during industrial deployment. Public support should cover these environments where they are necessary to bridge research and industrial application, absorb the technical, financial and operational risks of strategically

important first applications, generate shared learning, and create credible reference cases for wider adoption.

- **Anchor industrialisation, manufacturing and investment in Europe.** Use grants for high-risk validation and combine guarantees, loans, equity, blended finance, procurement and advisory support for deployment and scale-up. European added-value should be demonstrated through new production capacity, resilient supply chains, mobilised private capital, operational capability and skilled jobs. Assessment of first-of-a-kind projects should recognise that risk and bankability depend not only on the technology itself, but also on access to research and test infrastructure, skilled people, suppliers, utilities, logistics, permitting capacity and public-sector coordination. Where deployment has significant territorial or societal impacts, appropriate stakeholder and community engagement should support responsible implementation and long-term legitimacy.

- **Convert European deployment into global market leadership.** Connect successful European reference projects to replication, standardisation, certification, export finance, market access and international partnerships. The Fund should help European companies scale internationally while retaining strategic capabilities and value creation in Europe.

Success should be measured against the first four strategic areas—not primarily by numbers of projects, patents or publications. Core outcomes should include reduced strategic dependencies; technologies deployed and replicated at scale; stronger productivity, safety and sustainability; new European manufacturing and engineering capacity; private investment mobilised; skilled jobs and specialised supply chains retained; and sustained growth in European exports and global market positions alongside a strong and attractive research/innovation ecosystem.

ETP SMR Calls for Action

Call for Action 1 – Establish a European Raw Materials Technology Acceleration Fund

Purpose and scope. **Establish a European Raw Materials Technology Acceleration Fund as the overarching framework for the three instruments set out in Calls for Action 2–4. Complementing the Critical Raw Materials Act, RESourceEU and related European and national initiatives, the Fund would address a critical gap: while these initiatives primarily strengthen raw materials supply and production capacity, the Fund would enable acceleration and secure the technologies and integrated systems needed to deliver that capacity competitively and sustainably. It should provide a common entry point and coordinated pathway from demonstration to industrial deployment, replication and scale-up.**

The Fund should have a total annual budget of €2.3 billion per year over seven years, designed to mobilise additional national and private investment, while retaining sufficient grant support for high-risk industrial innovation. This indicative planning envelope reflects a bottom-up portfolio approach across the three delivery instruments: expected annual project volumes, the typical EU contribution ranges and capital intensity at each stage, and the need to leverage additional national and private investment. The allocation should be reviewed against the emerging European project pipeline and relevant EU industrial-investment benchmarks before final adoption.

It should support technology demonstration and validation projects of technology on TRL 6 and above, as well as system innovation projects built on clearly defined industry and customer needs with a defined development roadmap and commercialisation path. Implementation should ensure a genuinely seamless investment journey from Framework Programme and partnership research into demonstration, industrial validation, first deployment and scale-up.

Consortia should include the actors necessary for each stage and for the intended innovation and industrial outcome, which may include research, technology, industrial, public-sector and financial partners as appropriate, and demonstrate alignment with regulatory requirements and European climate, environmental and circularity objectives. They should be industry-led, commercially oriented and supported by a credible business case, customer commitment and route to market.

Acceleration pathway. **The Fund with its instruments 2, 3 and 4 should operate as a stage-gated acceleration mechanism rather than as a series of disconnected calls. A permanent technology-scouting and portfolio-management function should review results from relevant programmes and instruments, invite direct submissions where strategic gaps remain, and match selected technologies with operators, demonstration sites, system integrators, manufacturers, investors and follow-on finance**.

Financing model. The Fund should provide a coordinated, milestone-based financing pathway across Instruments 2–4, matching support to each project's maturity, risk and capital needs. It should combine EU, national and private financing, complement CRMA Strategic Projects and related initiatives, and enable successful projects to progress efficiently from demonstration to deployment, investment readiness and scale-up.

Call for Action 2 – Establish a System Innovation Demonstration and Scale-Up Instrument

Purpose. Establish recurring, large-scale calls to accelerate promising raw materials technologies and integrated system solutions emerging from EU, national and regional research and innovation programmes, or developed directly by industry. **The instrument should demonstrate and validate integrated technologies and system solutions under real industrial conditions, prepare them for scale-up, and generate independently verified evidence on performance, safety, sustainability, interoperability and commercial readiness**. It should focus on the integration risk and industrial learning required to move from individually proven components to a validated system solution.

Eligible projects. Support should target industry-led solutions starting at approximately TRL 6, with clearly evidenced prior results and a credible pathway to TRL 7–8 by project completion. Projects should be built on defined customer needs and technology challenges, tested at a committed mine, processing plant, refinery or recycling site. Consortia should unite the relevant operators, technology providers, system integrators, manufacturers and research organisations. Applications should include a technical baseline, demonstration and data plan, permitting pathway, measurable success criteria and a scale-up and exploitation plan leading to first industrial implementation.

Selection and support. Projects should be assessed on innovation, maturity, system integration, industrial relevance, measurable gains in sustainability, safety or productivity, replication potential, cost efficiency, the strength of the industrial–research consortium and European added-value. Assessment should also test the additionality of public support, the commitment of the host site and end users, the

credibility of the post-project investment pathway, and the extent to which the project strengthens European technology capability and supply-chain resilience. Grants should cover the incremental costs and risks of integration, pilot equipment, host-site adaptation, testing, verification, certification and scale-up preparation—not routine production investment. Indicative support should normally cover 50–100% of eligible costs depending on the category of the partner, the nature of the activity and applicable State aid rules.

Delivery and follow-on. Funding should be released against verified milestones. Projects must demonstrate and independently validate measurable gains in performance, safety, sustainability or productivity to qualify for simplified progression to Call for Action 3 for first industrial implementation and deployment. Results and common testing methods should be shared where possible, while protecting intellectual property, commercially sensitive data and legitimate background rights. Each project should conclude with a verified performance dossier, a defined industrial configuration, an updated business case and a decision-ready plan for the next stage.

Financing capacity. Within the overall Fund established under Call for Action 1, ETP SMR proposes an indicative annual EU allocation of €800 million for this instrument. Typical EU contributions should range from €20–100 million per project, depending on capital intensity, integration complexity and strategic European value. Calls should permit differentiated funding rates and co-financing requirements reflecting partner type, project risk and the need to secure credible commitment from operators and industry.

Call for Action 3 – Establish a First Industrial Implementation and Deployment Instrument

Purpose. **Establish a dedicated European Competitiveness Fund instrument for the first industrial implementation and deployment of validated raw materials technology systems that are not yet financeable on conventional market terms. Modern deployment requires complex integration of equipment, processes, automation, digital and data architectures, AI, infrastructure and operational systems under real production conditions. The instrument should bridge this implementation gap by enabling the engineering, integration and commissioning of fully operational systems, creating verified industrial reference installations and strengthening European manufacturing and system-integration capacity.**

Eligible projects. Support should target the first full industrial implementation of integrated raw materials technology systems previously tested and independently validated through Call for Action 2 or equivalent evidence in a representative or real industrial environment. Projects should combine the equipment, processes, automation, digital and data architectures, infrastructure, safety systems and operational capabilities needed for reliable operation under real production conditions. Each project should deliver a commissioned industrial system, sustained and independently verified operational performance, a European reference installation, and a transferable evidence package for progression to Call for Action 4.

Selection and support. Projects should be assessed on innovation, maturity, measurable sustainability, safety or productivity gains, customer commitment, commercial and replication potential, cost efficiency, the strength of the industrial–research consortium and European added-value. Public funding should cover the incremental cost and risk of the innovative solution—not routine capital expenditure, including final engineering, integration, first industrial equipment, commissioning, certification,

performance validation and manufacturing adaptation. Grants of up to 60% of eligible innovation-related costs should be combined, where appropriate, with loans, guarantees, equity, procurement and export finance.

Milestone-based financing. Support should follow project cashflow needs and be released against verified milestones for engineering, permitting, customer and financing commitments, financial closure, construction, commissioning, performance validation and entry into commercial operation.

Industrial outputs and financing capacity. Each project should define the next customers, sites, manufacturing requirements, standards, certification and financing needed for wider uptake. Projects meeting agreed milestones should gain simplified access to follow-on finance for replication, manufacturing expansion and international market development. ETP SMR proposes an indicative public financing capacity of €1.3 billion per year, with €50–200 million in EU support per project and a target of mobilising one to two euros of national or private investment for each euro of EU support.

Call for Action 4 – Establish an Investment Readiness and Early Market Adoption Risk-Sharing Instrument

Purpose. Establish a European instrument addressing the two barriers that prevent demonstrated raw materials technologies from reaching an investment decision and accelerating market uptake. Technology owners, particularly start-ups and SMEs, may lack the capacity and sector-specific expertise to develop a bankable business and financing case. At the same time, mining, processing, refining and recycling companies adopting new technologies for the first time carry disproportionate technical and operational risks, including potential production losses that may substantially exceed the technology cost. Existing instruments primarily finance bankable investments but do not fully address these preparation needs or first-adopter risks. Eligible technologies should include electrification, automation, autonomous systems, low-carbon and resource-efficient processing, water and waste reduction, circular solutions, as well as advanced sensing and artificial intelligence.

Risk-sharing model. The instrument should operate through two complementary windows supporting technologies and projects that have completed and been independently validated through Calls for Action 2 and 3:

- **Window A – Investment readiness for technology owners.** Provide tailored expert support, preparation vouchers and matchmaking to help technology owners turn validated solutions into bankable replication cases and complete financing packages combining public and private capital. Support should address the raw-materials-specific requirements that general advisory services do not fully cover. Window A should be coordinated with existing EU acceleration and advisory services, including the European Innovation Council, EIT RawMaterials and the InvestEU Advisory Hub, adding the raw-materials-sector expertise, industrial networks and market-access capabilities that generalist services may lack.

- **Window B – Risk-sharing for early market adopters.** Lower investment barriers by helping early adopters identify, assess and mitigate implementation risks, turning technologies validated through Actions 2 and 3 into bankable investments. EU-backed loans and guarantees should support credible plans covering technical performance, system integration, operational continuity, workforce transition and wider social impacts. Risk ownership and mitigation

measures must be clearly defined, while routine capital and operating costs remain privately financed.

Financing capacity. ETP SMR proposes an indicative EU allocation of €200 million per year within the overall Fund. Window A should provide targeted grants and advisory support to develop bankable replication and financing cases. The majority of the allocation should support EU-backed loans and guarantees under Window B, enabling early adopters to identify, mitigate and finance implementation risks. Typical EU support should range from €10–50 million per project, depending on the scale of the replication investment, the independently assessed residual risk and the expected European added-value. Delivery should be coordinated with existing EU advisory services, the European Investment Bank, national promotional banks and the CRM Financing Hub to mobilise larger public and private investment.

Concluding Remarks and Core Message

Europe's ambition should be not only to secure access to raw materials, but also to remain the global leader for developing, validating, implementing and scaling advanced technologies across the entire raw materials value chain. European Raw Materials Technology Providers and technology users together constitute a strategic industrial capability, enabling world-class operations, resilient value chains, global exports and European technological sovereignty.

The next seven to ten years will be decisive. The raw materials sector must simultaneously scale production and transform through electrification, automation, digitalisation and AI. These technologies must be implemented as integrated systems—combining equipment, processes, infrastructure, data architectures, skills and operational capabilities—to deliver their full gains in safety, productivity and environmental performance. Europe must support this transition continuously or risk losing industrial learning, investment and technology leadership to other regions.

Europe can seize this transformation as a strategic opportunity for lasting technology leadership, competitiveness and sustainable growth.

The European Raw Materials Technology Acceleration Fund should provide the overarching investment and portfolio framework for three connected delivery instruments: demonstration and validation under Call for Action 2; first industrial implementation, system integration and deployment under Call for Action 3; and investment readiness, early market adoption and wider uptake under Call for Action 4. Together, they should create a continuous, milestone-based pathway from validated innovation to operational industrial systems, investable market solutions and scaled European manufacturing capacity.

Implemented through the European Competitiveness Fund and coordinated with FP10, the Critical Raw Materials Act, RESourceEU, the European Investment Bank and InvestEU, this architecture would complement existing support by closing the specific gaps between demonstration, integrated industrial implementation and market uptake. It would turn European deployment into operational knowledge, manufacturing demand and global credibility, while global market success would generate resources for renewed research, innovation and industrial growth in Europe.

A coordinated European raw materials ecosystem is also essential to anticipate and meet the material needs of strategic sectors, including clean energy and electrification; mobility and batteries; digital technologies, AI and data infrastructure; defence and space; advanced manufacturing; and health technologies. Closer alignment between material producers, technology providers, researchers and end users is needed to translate future demand into timely investment, innovation and resilient European supply capacity.

The strategic choice is clear: **Europe must invest in the raw materials sector not only to secure the materials of the future, but to secure the technologies, industrial capabilities and innovation leadership that determine how those materials are produced and used. Without this investment, Europe risks becoming dependent both on imported raw materials and on imported technologies. With it, Europe can lead the next generation of sustainable raw materials innovation worldwide.**

ETP SMR

The European Technology Platform on Sustainable Mineral Resources (ETP SMR) is an association of entities operating in the mineral resources R&I sector across the whole value chain. Its mission is to develop long-term R&I agendas and roadmaps for action at both EU and national levels, fostering a resilient and sustainable raw materials sector.

Our Members: