

NEUTRAL AGGREGATES 2050

ROADMAP FOR CLIMATE
NEUTRALITY IN THE
AGGREGATES INDUSTRY



June 2023

Aggregates: an essential product for the EU climate change mitigation and adaptation strategy

Aggregates sustainability

After water, aggregates are the world's most used/consumed raw material. Aggregates – sand, gravel, and crushed rock – are also the main product used in the construction and infrastructure sectors.

Aggregates can be produced from several tens of different rock types. This fact gives a wide geographical distribution to the aggregates quarry network and allows a local supply while minimising the negative environmental effects and emissions produced by the transportation of the product. Aggregates are abundant, inert, highly durable products, 100% recyclable whether they have been used with or without binders. They are also low-cost products.

Due to the huge volume of aggregates required in the EU, more than 3 billion tons a year, we are an essential player in sustainable building techniques, leading to a smarter, more energy-efficient, more reusable, and recyclable building sector environment.

The aggregates industry is a driving force already contributing to climate neutrality. Especially with regards to an efficient operation of circular economy, aggregates can be recycled at the end-of-life of any built structure. Our companies play a key role in the management of construction and demolition waste (CDW) and crushing of concrete waste (around 80% of aggregates per m³) is already contributing to re-absorb CO₂ through re-carbonation at the time of recycling into new aggregates. Indeed, carbonation is increased when some types of aggregates, especially artificial and alkaline ones like concrete, are crushed for reuse at the end of their life cycle and during any secondary use. And, in contexts of alteration of certain minerals (high temperature, water circulation, etc.), natural rocks such as basalts and ultrabasic rocks capture CO₂ by carbonation¹:

To sum up, aggregates are 100% recyclable within proper building or infrastructure demolition management.

These exceptional characteristics of aggregates make them a strategic product to contribute to climate change prevention and mitigation through the cons-

truction of sustainable and resilient infrastructure and buildings in Europe.

The contribution of aggregates to concrete's and masonry's thermal performance properties is critical. This supports the construction of highly energy-efficient buildings and infrastructures. Thermal mass is, in fact, a property of concrete and masonry that allows heat to be absorbed, stored, and slowly released afterwards. Concrete buildings with high thermal mass generally have lower energy requirements and emissions from heating and cooling. Similarly, the properties of aggregates in road mixtures could be exploited to produce geothermal energy. In that sense, several experiments are in progress.



Contribution of aggregates to the EU climate change mitigation and adaptation strategy

¹ BRGM – rapport RP-54781-FR juin 2006 Carbonatation minérale.

Letter from the President.

Our commitment to Carbon Neutrality and the Green Deal



Antonis Antoniou Latouros
President of Aggregates
Europe - UEPG

Aggregates Europe - UEPG represents the by far largest non-energy extractive industry with 26,000 extraction sites across Europe operated by 15,000 companies (mostly SMEs) and delivering about 3 billion tons a year of natural, recycled, and manufactured aggregates.

Aggregates – an essential ally for EU climate neutrality

After water, aggregates which are produced from igneous, metamorphic, and sedimentary rocks, are the most used material on planet Earth. Aggregates – sand, gravel, and crushed rock – are also the main product used in the construction and infrastructure sectors.

Aggregates production shows low CO₂ emissions. The available and reliable sources of life cycle assessment and Environmental Product Declaration – EPD that have been analysed for aggregates extraction sites show an average value of about 5 kg CO₂-eq/t of aggregates, from pit (cradle) to gate. Local supply is key for our industry to minimise CO₂ emissions related to the transport of our products to the market.

Aggregates have high durability which means the product is in use for many years, preventing waste generation and the need for demo-

lition and replacement is greatly reduced, contributing to the first principle of circular economy. And due to their nature, they are almost 100% recyclable, so the CO₂ emissions of a ton of aggregates per year of use are negligible.

Our huge network of sites and our essential products have great potential to contribute, to climate change adaptation and mitigation, to many other European policies, in particular to the EU's new growth strategy, the European Green Deal and, more precisely, to the Green Deal Industrial Plan. If responsibly managed aggregates extraction sites can evolve to reach carbon neutrality by 2050 reducing the CO₂ footprint of aggregates covering the production, distribution, and lifespan.

Even if aggregates are not seen as critical, they are undoubtedly essential and instrumental to ensure the success of European policies by contributing to greener energy supply and use, to the decarbonisation of electricity and fuels, to European prevention, mitigation and adaptation to the effects of climate change, fostering biodiversity and rehabilitation for net positive impact adapted to climate change, keeping the circular economy in function, bringing the future closer with R&D&I, digitisation and new technologies, and building the foundations of the growth of the EU sustainable economy.

A key and indisputable fact is that the decarbonisation of the aggregates sector depends on numerous external factors, such as the decarbonisation of the electricity grid and viable technological solutions for transport and mobile machinery. But just as important

are the steps the sector can take in the meantime to contribute to the transition by increasing efficiency.

Therefore, as our industry is essentially composed of SMEs, public policy will play a key role in our ability to decarbonise throughout our life cycle. It will be necessary to develop a comprehensive policy framework such as the recently announced Green Deal Industrial Plan that provides a predictable and simplified regulatory environment, with realistic and achievable targets matched to the availability and affordability of technologies, as well as speeding up access to finance, and enhancing skills.

With the EU Green Deal and its renovation wave and other EU policies like RePowerEU or the Green Deal Industrial Plan, requiring massive amounts of primary and secondary construction raw materials, the question is not whether we need aggregates but rather where and how to source them from in the most sustainable way to contribute to our main markets, including Ready-Mix Concrete, Mortar, Precast concrete, and Asphalt to progress in its decarbonisation.

With this voluntary approach, Aggregates Europe - UEPG wants to send a clear signal to the European Institutions, Member States, our companies and our customers in the building construction and infrastructure industries of our commitment to the future of Europe through this world-first *Roadmap for Climate Neutrality in the Aggregates Industry - Climate Neutral Aggregates 2050* produced by our Climate Change Adaptation and Mitigation Task Force, which places our industry as an indispensable part of the solution.

Our Roadmap for Climate Neutrality in the Aggregates Industry

Aggregates Europe – UEPG *Roadmap for Climate Neutrality in the Aggregates Industry - Neutral Aggregates 2050* presents, for the first time, the industry's key role in climate change adaptation and mitigation.

The *Roadmap* provides a comprehensive response to all climate-related EU regulatory and non-regulatory policies, measuring the impact of Europe's top ambi-

tion for a decarbonised Industry by 2050 on the aggregates sector. The adaptation of the World Bank's Climate-Smart Mining Building Blocks to the position of Aggregates Europe – UEPG in relation to the aggregates industry shows a full alignment between the approaches of the two institutions.

Our essential role in achieving the EU Green Deal objectives

Aggregates (i.e., sand, gravel, and crushed rock) are essential for the realisation of the EU Green Deal objectives, including the climate change mitigation and adaptation strategy. They are abundant (although currently ever more inaccessible due to lengthy and unfit-for-purpose permitting procedures), inert, highly durable, 100% recyclable and low-cost products. These exceptional characteristics of aggregates make them a strategic product to contribute to climate change prevention and mitigation through the construction of sustainable and resilient infrastructure and buildings in Europe.

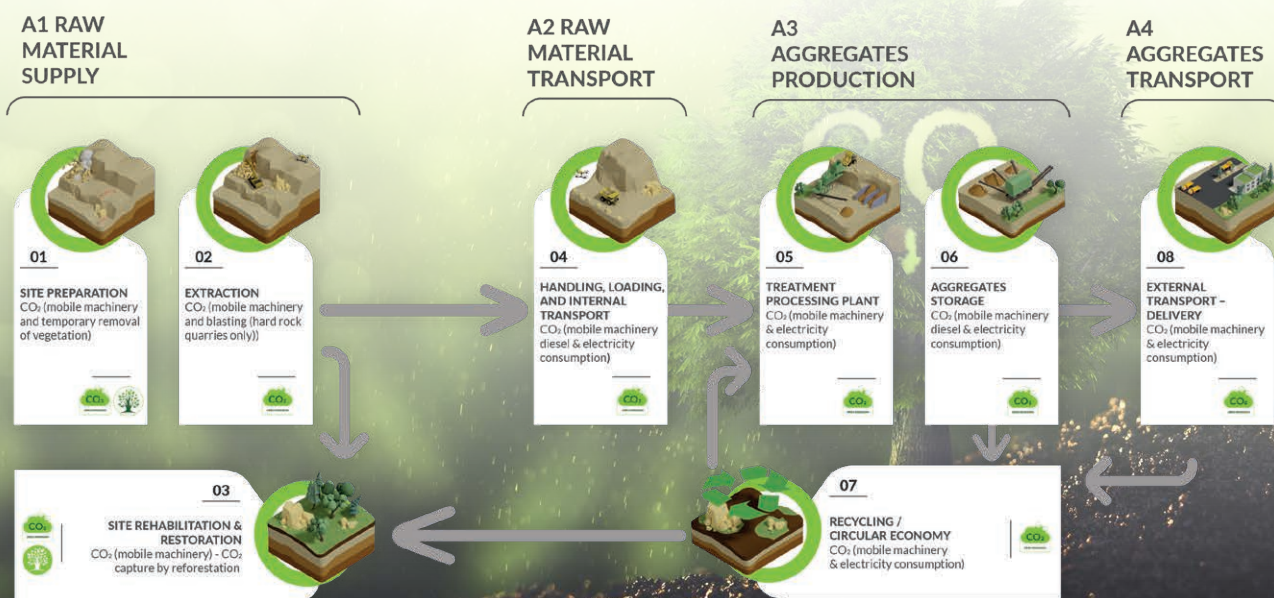
Thanks to the high durability, the lifecycle of aggregates in the phase of use contributes to the first principle of the 'waste hierarchy' of the EU Waste Framework Directive, preventing waste generation and the need for demolition and replacement is greatly reduced. In

addition to that, the availability of construction and demolition waste generated yearly and suitable for recycling is proportionally low, compared to the total needs of aggregates.

Aggregates production process and CO₂ emissions

At present, there are no national roadmaps on climate change adaptation and mitigation for aggregates and hardly any examples from businesses.

Aggregates are final and also intermediate products characterised by a life cycle inventory (ICV) or environmental product declaration (EPD) in LCA format. Some countries (eg., France and Spain) have worked in depth on the development of Environmental Product Declarations – EPDs and carbon footprint for aggregates.

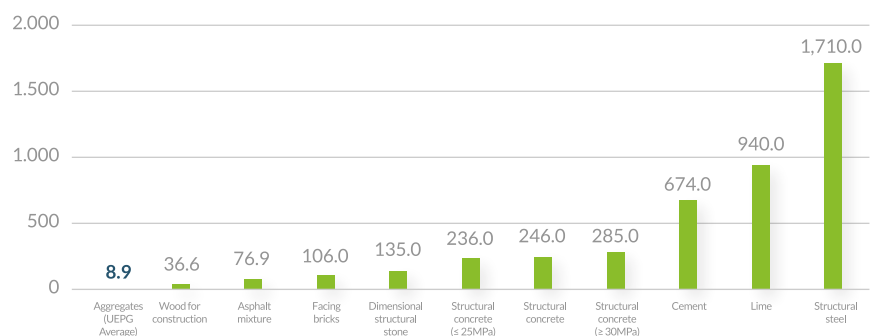


European aggregates carbon balance – Baseline scenario

According to available and reliable sources of lifecycle assessment and Environmental Product Declaration – EPD of aggregates quarries, from cradle to gate (raw material extraction, internal transport and aggregates manufacturing (A1+A2+A3)), the carbon footprint is estimated to an average value of 4.7 kg CO₂-eq/t for natural aggregates, 5.0 CO₂-eq/t for recycled aggregates and 3.7 CO₂-eq/t for artificial (manufactured aggregates).

Finally, and in addition to the aforementioned average value, the downstream transport of aggregates to the first user is evaluated by UNPG (Deloitte) at about 4.0 CO₂-eq/t. Unless extended railway and/or maritime transport

Kilograms of CO₂ equivalent emissions per ton for different products, including average transport. Source UEPG from different sources (UNPG, Deloitte, UEPG, and other sources)⁸



infrastructure is in place, because of their bulky nature and their low cost, local supply of aggregates is crucial in order to guarantee the environmental and economic sustainability of the Industry.

According to UNPG and Deloitte, aggregates have, by far, the lowest CO₂-eq/t emissions (A1 to A4) when compared to other products used in the construction industry.

Timeline

Our Roadmap recommends the decarbonisation of the aggregates industry by 2050 in four phases:

- **1st Phase: 1990 – 2023: Inertial individual progress.** Reduction led by the slow development of greener energy supply sources and the optimisation of other processes.
- **2nd Phase: 2023 – 2030: Initial progress.** Raising awareness, dissemination, and adoption of

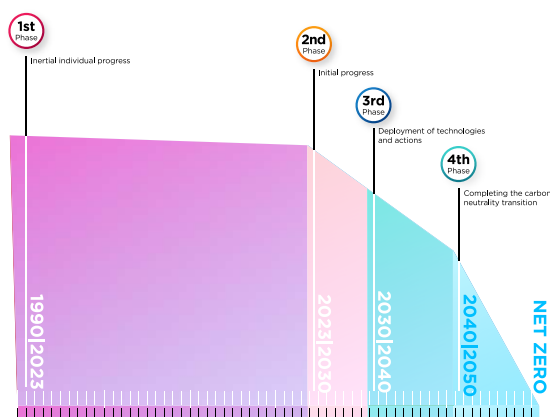
initial measures. Development of carbon neutrality policies in the national associations and in the aggregates companies. Adoption of initial technologies when proven available, widespread, and affordable.

- **3rd Phase: 2030 – 2040: Deployment of technologies and actions.** Progressive and programmed implementation of actions and new technologies as they

become proven, available, widespread, and affordable.

- **4th Phase: 2040 – 2050: Completing the carbon neutrality transition.** Last phase of progressive and programmed full implementation of actions and new technologies as they become proven, available, widespread, and affordable. Achievement of net zero target.

Intended evolution of CO₂ emissions per ton of aggregates if the framework conditions are met



As explained, the evolution of the aggregates industry will only be possible if green technologies and services are available and affordable, if energy supply is decarbonised, and if the public policies required are effective and timely in place.

A set of KPIs is proposed for tracking the progress of the aggregates industry and for prioritising actions towards future targets. The Roadmap concludes with recommendations for aggregates associations, companies, and sites as well as a reference to the contribution of aggregates to the Sustainable Development Goals - SDGs.

Why are aggregates essential for carbon neutrality? What can we do?

The aggregates industry's contribution to net zero target by 2050 can be structured by areas and actions that enable potential significant reductions in CO₂ emissions.

Aggregates prove to be essential and instrumental to ensure the success of European policies by contributing to greener energy supply and use, to the decarbonisation of electricity and fuels, to the prevention of and adaptation to the effects of climate change, fostering biodiversity and rehabilitation for net positive impact adapted to climate change, keeping the circular economy in function, bringing the future closer with digitisation and new technologies, and building the foundations of Europe's sustainable growth and ecological transition.

	Reducing CO ₂ footprint of aggregates (production + distribution + lifespan)
	Contributing to greener energy supply and use. Decarbonisation of electricity and fuels
	Contributing to prevention and adaptation to the effects of climate change
	Fostering biodiversity and rehabilitation for net positive impact adapted to climate change, environment management and eco innovation
	Keeping the circular economy in function
	Bringing the future closer with digitisation and new technologies
	Contributing to the ecological transition
	Promoting aggregates industry R&D&i - Innovating for neutrality

Our contribution to carbon neutrality

Main contributions of the aggregates industry to climate neutrality in Europe. Source Aggregates Europe – UEPG

The aggregates industry's contribution to carbon neutrality by 2050 can be structured by areas and actions that enable significant reductions in CO₂ emissions.

An assessment of the average status for 2023 and 2050 is made (from non initiated to - achieved).

And the interactions of the aggregates industry required with client industries , suppliers , environmental NGOs , public administrations , Accademia, technological centres, etc. , and aggregates associations are pointed out.

Because the aggregates industry is a complex activity, to properly shape our approach and our model to the net zero target by 2050, we have made a number of considered assumptions:

- The electricity grid will be almost decarbonised by 2050.
- Transport will be almost decarbonised by 2050.
- There will be sufficient zero-carbon fuels including hydrogen for aggregates production.

	LEADER	INTERACTION WITH OTHER GROUPS	SITUATION 2023	SITUATION BY 2050
Energy and CO ₂ minimisation in aggregates extraction and production				
Decarbonisation of energy (electricity & fuels)				
Decarbonisation of external transport / delivery				
Integration into construction products. Contribution to savings in client's production				
Construction Phase. Contribution to efficiency in design and construction				
Circularity. Demolition / Recycling / Valorisation of C&DW and of industrial waste				
Contribution to energy savings in the lifespan of buildings (thermal mass) and infrastructures				
Carbon sink through biodiversity management and sites rehabilitation				
Carbon sink through recarbonation of some rocks and contribution to concrete				

What do we need in public policies?

- Priorities for the aggregates industry

Public policies will play a central role in the ability of the aggregates industry and the value chain to decarbonise over its lifecycle. A comprehensive policy framework will need to be developed.

The SWOT analysis of the aggregates industry shows a balanced situation that needs strong political action to overcome threats and weaknesses and maximise strengths and opportunities.

Our *Roadmap* to carbon neutrality by 2050 has been based on the following assumptions: the decarbonisation of electricity and transportation as well as the sufficient supply of green fuels, including hydrogen.

Furthermore, given that the aggregates industry is essentially composed of SMEs, public policy

will play a key role in our ability to decarbonise throughout our lifecycle. Hence, there is the need for a comprehensive policy framework, providing a predictable and simplified regulatory environment, with realistic and achievable targets matched to the availability and affordability of technologies, as well as speeding up access to finance, and enhancing skills. In that

direction, the supply of all raw materials should be addressed both at national and EU level.

A work plan for Aggregates Europe – UEPG and which requires collaboration, synergies, and unity of action with other actors such as customers, suppliers and others, is proposed.

Key issues

1

The aggregates industry and public administrations should cooperate and work closely together to find ways to enable its evolution and progress towards the common goal of climate neutrality.

2

A fair transition to zero net emissions must preserve the competitiveness and employment of the aggregates industry.

3

Long-term and sound structural policies are needed to support the investments necessary to achieve climate neutrality in a largely SME-based but highly capital-intensive industry.

4

The achievement of the aggregates industry's climate neutrality objectives will be linked to the success of cross-cutting energy decarbonisation public policies and to the availability and affordability of emission-neutral technologies, within sufficient timeframes to allow their progressive deployment on quarries.

 Transversal policies for a fair policy framework	 Construction products policies	 Aggregates specific policies	 Infrastructures policies	 Public awareness policies	 Technological policies	 Financial policies
<p>Establish long-term strategies and objectives.</p> <p>Maintain regulatory coherence and stability.</p> <p>Set realistic CO₂ reduction policies and targets, reflecting the period of the 'transition to net zero' and adapted to the availability and maturity of technologies which have to be widely available on the market and not in experimental stages.</p> <p>Improve governmental and EU support for the transformation of the aggregates sites and their machinery and equipment, as this is an industry essentially composed of SMEs, where investments have a specific medium and, above all, long term timetable.</p> <p>Develop policies that support the industry transition, particularly given their role of delivering low-carbon infrastructure.</p> <p>Adopt material and technology neutrality in construction, in construction products regulations, standards, in the industry and in green public procurement.</p> <p>Create institutional frameworks for industry-scale technology initiatives (managing and implementing projects, financing mechanisms, partnership rules and governance models). Collaborate with other stakeholders, to promote cooperation among countries and their public and private sectors to pool funding and knowledge.</p> <p>Reform the electricity market design, to make industries and consumers benefit from the lower costs of renewables.</p> <p>Support programmes to develop the needed skills for a people-centred green transition, with a view to launch upgrading and retraining programmes in strategic sectors such as raw materials.</p>	<p>Encourage and recognise EPD and LCA systems based on a full life cycle approach from cradle to grave.</p> <p>Focus on maximising the different properties of building materials like their durability, recyclability, thermal inertia, or re-carbonation potential.</p> <p>Continue to prioritise technical construction properties (stability, fire protection and environmental compatibility of a structure) when selecting the appropriate building material in the future.</p> <p>Promote climate-friendly planning of construction projects, employing digital methods such as Building Information Modelling (BIM).</p> <p>Strengthen and establish, in collaboration with industry, building regulations and specifications aimed to achieve carbon neutrality of the built environment over its entire life cycle, including during the use phase and at the end of life of residential, non-residential, and infrastructure applications.</p> <p>Enhance the development and deployment of low-carbon solutions in the construction sector that consider a life cycle approach, by including them in public procurement policies.</p> <p>Require the development of infrastructure projects to be accompanied by construction materials resource assessments and supply audits to provide greater visibility of construction material needs.</p>	<p>Adopt policies to ensure local access to resources to reduce transport distances by integrating the nature and geographical location of aggregates deposits into a concerted regional planning to favour a reduction in climate impact due to the increase of transport distances. Local supply is a key issue to minimise the impacts of transportation. Then, review and adapt the land-use planning policies to allow a long-term strategy.</p> <p>Adopt flexible and simple permitting procedures (also for renewable energy infrastructure on site).</p> <p>Streamline the access to additional primary and secondary raw materials to build the essential and adapted infrastructure.</p> <p>Develop a fair level playing field with aggregates from other non-EU countries.</p>	<p>Create the infrastructure for a circular and carbon-neutral environment.</p> <p>Boost the supply, distribution, availability, and affordability of renewable energy (electricity, hydrogen, etc.)</p> <p>Improve the infrastructure for bulk material transport to minimise road transportation impact.</p>	<p>Promote public policies to foster the awareness of the raw materials industry.</p> <p>Recognise the aggregates industry's role as a net and relevant contributor to climate change mitigation and adaptation.</p> <p>Natural recarbonation recognition for the entire life cycle.</p> <p>Develop a clear scheme of carbon removal certificates.</p> <p>Reach a new consensus in the politics, economics, science, and civil society area on the development of a climate-neutral technology mix for the future.</p>	<p>Incorporate into the EU R&D&i system the most relevant needs for climate change impact.</p> <p>Boost the development of industrial vehicles (trucks, mobile machinery, etc.) powered by renewable energy sources and make them available and affordable.</p> <p>Deploy low-carbon operating standards adapted to aggregates.</p> <p>Set ambitious standards for buildings' energy performance. Encourage and promote digitalisation.</p> <p>Support collaborative research programmes or networks among companies, equipment suppliers, research institutes and governments to pool R&D and demonstration resources, and public-private partnerships on emissions reductions.</p> <p>Adapt underground mining techniques to aggregates, not always technically possible, much more complex, and costly to operate, but with the advantages of much less disturbance to soil and vegetation and being able to be closer to market in complex environments, reducing transport emissions.</p>	<p>Speed up investment and financing for clean tech innovation, production, and deployment by making available EU and national public funds and private finance to meet investment needs.</p> <p>Improve Sustainable Finance to include investments in adapting our built environment to climate change. In particular, integrate aggregates under EU Taxonomy Compass.</p> <p>Support R&D&i and innovation through public funding and risk sharing investment mechanisms.</p> <p>Promote tax exemptions to encourage the use of green energy in industrial processes (Energy Taxation Directive) or indirect cost compensation mechanisms.</p> <p>Make economic incentives open to all types of technology.</p> <p>Comprehensive policy package along the entire aggregates value chain to provide the right incentives and create an environment in which the industry can be geared to the needs of climate neutrality.</p> <p>Mitigate risks through investment mechanisms that use private funding for low-carbon innovative technologies and through promotion of private-public partnerships.</p> <p>Promote alternative sources of funding for innovative low-carbon technologies in the aggregates industry, including export credit agencies and multilateral development banks.</p>



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This project has received funding from the
European Union's Horizon 2020 research and
innovation programme under grant agreement
No 101003750

Aggregates Europe - UEPG, as a member of the International Advisory Board of the DIGIECOQUARRY Project (GA #101003750), has contributed to the preparation, dissemination of this document by endorsing it by its Board and launching it under its umbrella.

