



CROSS-CUTTING POLICIES

EU Research and Development Programmes

Overview

Today's technologies have the potential to bend the carbon-emissions curve—but new, better, and cheaper innovations are a key component of any achievable plan for a net-zero-emissions economy by 2050. In its [special report](#) on Clean Energy Innovation, IEA estimates that currently mature technologies may reduce global emissions by 25 percent until 2070—but at least 35 percent of emissions cuts are expected to be delivered by technologies in the prototyping or demonstration phases. In other words, accelerated clean energy technology is essential to stopping climate change and limiting the rise of global temperatures.

Government investment in clean energy research and innovation (R&I) can catalyse greater private-sector investment, help the EU reach its sustainable development targets, and maintain industrial competitiveness. Research and development (R&D) is usually understood as the first step in R&I. In 2017, [total R&D spending](#) in the EU was €317 billion, or 2.06 percent of its GDP. This was far below the official 3 percent target and behind Japan (spending 3.20 percent of its GDP), the U.S. (2.78 percent) and China (2.13 percent). Traditionally, around one-third of all R&D funding in the EU comes from public sources (some [10 percent from EU funds](#), 30 percent from national governments, and 60 percent from higher education). The rest comes from private R&D investments.

The EU collates many R&I-related institutions, initiatives, and funds under one programme, [Horizon Europe](#), which will run from 2021–2027 and replace the earlier [Horizon 2020](#). Horizon Europe will spend at least 35 percent of its total €85 billion (in 2018 euros) budget on climate-related R&I. However, the current levels of public-sector R&D funding are not large enough to put the EU and the world on a trajectory to get to zero by 2050. Thus, the EU should increase funding to its energy R&D agencies and reorganise them to address the climate crisis more effectively.



Policy Principles

Future R&D policies and actions in the EU should build on and improve the following principles (most are already implemented or proposed in Horizon Europe and other initiatives):

Targeted Funding: The EU should spend R&D funds in a way that maximises potential technology breakthroughs to mitigate climate change. It should also add funding sustainable technologies and climate-related targets to the priorities of the European Research Area.

Governance: The EU should create a cooperative European scientific research ecosystem and ensure that its R&D programmes are in sync with other EU policies, targets, and initiatives. The EU should also ensure strong and clear climate-related guidance within Horizon Europe. The [Strategic Energy Technology Plan](#) (SET) and [National Energy and Climate Plans](#) (NECPs) are valuable tools for the Commission to guide national R&D activities.

Assistance to Member States: The EU R&D programmes should engage with and support national R&D programmes of the Member States to increase their impact and improve local research capacity. The expert [Policy Support Facility](#) should continue to advise Member States on how to enhance their R&I policies, funds, and institutions.

Mission Orientation: R&I efforts should be outcomes-based and mission-focused to maximise their impact and encourage a systemic approach to research. The research agenda should be created in consultation with Member States, NGOs, international researchers, corporations, investors, entrepreneurs, and the public.

Innovation Portfolio: A balanced portfolio of innovation projects that covers the whole scope of technologies needed to achieve the net-zero emissions target should be planned, developed, and maintained.

Patient Capital: It is vital for the R&I chain to continue supporting technologies that emerge from the R&D programmes for full-scale demonstration and commercialisation. The EU should allow greater access to patient capital for innovative companies helping to push for zero (through a strengthened European Innovation Council (EIC) or European Institute of Innovation & Technology (EIT), for instance).

Partnerships and International Collaboration: R&I partners and third-party countries should increase and continue to collaborate to maximise R&D impact by knowledge transfer. In accordance with the "[Open to the World](#)" principle, the EU should encourage international cooperation through reciprocal access to programmes, funding, resources, and networking.

Skills Development: The EU should continue to support developing the scientific-research skills and expertise of its workforce through institutions or initiatives such as the European Research Council and Marie Skłodowska-Curie Actions. It should also strive to attract outside talent and remove barriers that could keep international scientists from participating in the European research space.



R&D Infrastructures: The EU should collaborate with Member States and other partners to increase the number and quality of European research infrastructures. These facilities, equipment, and data should be as open to the public and other parties as possible.

Simplicity: Building on gains achieved through Horizon 2020, Horizon Europe should continue to simplify its grant applications and funding and compliance requirements to increase efficiency and reduce administrative burdens. This may mean reducing reporting requirements, increasing lump-sum funding, having more flexible calls, speeding up decision-making, and providing more feedback.

Transparency: The EU should require scientific publications (and, where possible, their underlying data) to be open-access. [FAIR principles](#) should guide the responsible management of research data, and open science should be promoted in collaboration with countries and third parties.

Flexibility: Since strategic research priorities may change over the course of a programme due to unforeseen circumstances and emergencies, Horizon Europe and the EU's Multiannual Financial Framework would benefit from having a flexible funding mechanism designed for fast R&D response.

Monitoring and Evaluation: Horizon Europe should track its scientific, social, and economic impact using performance indicators focusing on short-, medium-, and long-term effects. Comprehensive evaluations should take place at every programme's midway point and conclusion, allowing for specific recommendations for improvement. In addition, the EU should monitor the target of 35 percent spending on climate-related research to keep on track to meet climate targets.

Current Legislation

The EU collates many R&I-related institutions, initiatives, and funds under one flagship programme, [Horizon Europe](#), which will run from 2021–2027 and replace the earlier [Horizon 2020](#). Horizon Europe goes beyond the traditional R&D activities to support demonstration of innovative technologies and businesses. Horizon Europe will spend at least 35 percent of its total €85 billion (€3.5 billion from the [InvestEU](#) Fund) budget on climate-related R&I.

Horizon Europe has three main pillars. (See Figure below). The first pillar, Excellent Science, encourages bottom-up, high quality scientific research and improving the EU's scientific leadership and skills.

The [European Research Council \(ERC\)](#) awards grants for promising research projects with the sole criterion of scientific excellence. Investigators are encouraged to submit their own research agendas rather than stick to pre-determined topics; hence ERC contributes to bottom-up knowledge creation. It also aims to improve Europe's wider scientific landscape by establishing international benchmarks for success, encouraging high-quality peer review, and assessing key factors for success.

[Marie Skłodowska-Curie Actions \(MSCA\)](#) provide grants to researchers at all levels (from doctoral students to senior researchers) to allow them to participate in international mobility and training programmes at partner research institutions and companies. MSCA aims to develop European researchers' scientific knowledge and skill base.



[European Research Infrastructures](#) include equipment, labs, and data catalogued and improved by the European Commission. Key facilities are given European Research Infrastructure Consortium status, allowing them to enjoy administrative benefits.

FIG. 01

Preliminary Structure of Horizon Europe



Modified version of chart from ec.europa.eu

The second pillar, Global Challenges and European Industrial Competitiveness is a top-down R&I effort focusing on specific EU and international goals and targets such as the UN’s Sustainability Goals. This pillar aims to sort R&I work into six clusters: three related to climate concerns (Climate, Energy and Mobility; Food, Bioeconomy, Natural Resources, and Agriculture and Environment; and Digital, Industry and Space). Apart from these clusters, specific missions in this pillar will deliver measurable outcomes. Created with multiple stakeholders, Horizon Europe will sort these into five mission areas: Cancer; Climate-Neutral and Smart Cities; Adaption to Climate Change (including societal transformation); Soil Health and Food; and Healthy Oceans, Seas, Coastal and Inland Waters. Missions will have specific time-bound, measurable targets. The second pillar also includes the [Joint Research Centre](#) (JRC), which provides scientific evidence and technical support to policy makers in EU institutions.

The third pillar, Innovative Europe, focuses on innovation, aiming to improve entrepreneurship, help start-ups, and bring novel technologies to market. The [European Institute of Innovation and Technology \(EIT\)](#) facilitates cooperation between leading educational, research, and business organizations to promote entrepreneurship and improve European competitiveness. This third pillar also establishes the [European Innovation Council \(EIC\)](#) to fund promising innovations as well as businesses using more mature technologies, paralleling R&D funding of the ERC.

For more information on this third pillar, see the deep dive on [→ Stimulation of Clean Energy Entrepreneurship and Scale-up](#)



Together, these three pillars will be supported by the umbrella Widening Participation and Strengthening the European Research Area, which aims to mobilise resources from multiple organizations to engage third countries and develop R&I standards in Europe. The [Horizon Policy Support Facility](#) provides guidance for improvement of European and Member State R&I policies. Furthermore, the [European Research Area](#) aims to enable free circulation of researchers as well as scientific knowledge and technology by establishing a unified system of European research programmes.

Apart from the three main pillars, the [Euratom Programme](#) receives funds from Horizon Europe to pursue nuclear research and training activities. Several other initiatives outside Horizon Europe also provide scientific research and services relating to climate change: for example, [Copernicus](#), the EU's Earth Observation Programme, provides past, present, and future information about global climate change.

Impact

[The interim evaluation of Horizon 2020](#) shows the programme was fit for purpose and shareholders welcomed it. More than half the participants were newcomers, an improvement over the previous Framework Programme 7, and the programme easily cleared its targeted 20 percent of the funds for industrial and enabling technologies allocated for SMEs. The programme also supported 17 Nobel Prize winners. Despite representing less than 10 percent of public R&D spending, researchers predict that by 2030, Horizon 2020 will generate 179,000 jobs and €600 billion added value. Furthermore, simplification efforts reduced average time to grant by 110 days and kept administrative overhead below the target of 5 percent (lower than the previous framework). Since 2007, [ERC](#) has funded 9,500 projects, resulting in more than 150,000 scientific papers.

[Impact assessment for Horizon Europe](#) projects even higher gains compared to earlier R&I programmes owing to increased funding, efficiency, and focus. Over the next 25 years, the programme may increase GDP by 0.08 percent to 0.19 percent, which implies a value gain of €11 for each euro invested. Researchers forecast that Horizon Europe will lead to 100,000 direct jobs in R&I while it is in operation from 2021–2027 and another 200,000 indirect jobs from 2027–2036. 40 percent of these are expected to be high-skilled jobs. On the other hand, not investing in the programme would reduce EU competitiveness and growth, resulting in losses of up to €720 billion in the next 25 years.