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## Summary for Policymakers

To meet the objectives of the Paris Agreement Europe will need to transition to a net-zero emissions economy by or before 2050<sup>1</sup>. This represents a major transformation. We will need all the technologies that we have today—wind and solar among others—to continue scaling at an exceptional pace, but those alone will not be enough. We also need to rapidly increase the readiness and deployment of the next generation of low-carbon technologies, innovative and enabling business models and customer engagement in all sectors of the economy that use or produce energy: electricity, transportation, manufacturing, materials and construction, and agriculture.

To accomplish this transformation, Europe will need to continue to attract and train world-class scientists and entrepreneurs, to develop the products and solutions that can decarbonize Europe's energy, industrial and agricultural systems. Increased levels of targeted research and innovation ("R&I") funding from public and private sources are required along with more risk-tolerant and patient capital, as well as supportive public policies so that successful projects can be deployed much faster.

As Europe sets out its next research Framework Program Horizon Europe, its next seven-year budget and the set of instruments that will support Europe's decarbonization and growth ambitions, this report builds a set of forward-looking recommendations on how to orient future R&I funding to deliver competitive net-zero decarbonisation. It looks in depth at what it will take to fully decarbonise five sectors: Power, Transport, Buildings, Industry and Agriculture, Forestry and Land Use ("AFOLU") drawing upon understandings and insights created by the low carbon pathways analysis and tools produced as a part of ECF's Net-Zero 2050 series of publications<sup>2</sup>. The experts engaged in this scenario analysis developed 58 "decarbonisation strategies" which combine to provide sector decarbonisation pathways for the five sectors to deliver a net-zero emissions economy in Europe by 2050. These strategies were used as the basic tools to inform an expert survey focused on Europe's R&I investment needs to deliver them. The conclusions of this work are driven by our meta research and assessment of past climate-related public and private R&I investments, combined with the input from 50 experts from 39 institutions working on energy, climate and innovation.

### **Finding #1: Europe's climate-related R&I investments are not commensurate with the scale of the net-zero challenge**

Europe is the third largest investor in research and innovation after China and the US, and it produces one third of all high-quality scientific publications. For this, Europe invests around 2% of GDP, or just over Euro 300 billion annually, in research and innovation across all sectors. European R&I investment is increasing, and in 2017 grew by 7% year-on-year. However, most Member States are still far from reaching their pledges made in 2000 to increase R&I investment intensity across their economies to an aggregate of 3% of EU GDP, to match the R&I intensity of other leading global regions.

Around two thirds of EU R&I investment comes from the private sector, totalling around Euro 200 billion per annum. This R&I investment is highly concentrated, with over 90% coming from just 567 companies. While it is hard to

<sup>1</sup> Energy & Climate Intelligence Unit. (2018). Net Zero: why? In Net Zero. Retrieved from <https://eciui.net/briefings/net-zero/net-zero-why>

<sup>2</sup> ECF Net-Zero Series "Net Zero By 2050: From Whether to How" (2018) Retrieved <https://europeanclimate.org/wpcontent/uploads/2018/09/NZ2050-from-whether-to-how.pdf>





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identify<sup>3</sup> the proportion of European R&I that is climate-related from the disclosed numbers, we find that only 3-4% of private R&I investments, or Euro 7.2 billion annually, is being invested by 102 companies directly working in climate-relevant sectors.

Annual public-sector R&I investments in Europe reached Euro 100 billion in recent years. This largely comes from higher education institutions (60%) and national governments (30%), with EU-level R&I programmes contributing just 8% to overall public R&I investment. Here again, it is hard to uncover the share of general public sector R&I that is climate-related, but – for scale - the 35% climate earmarking of the EU’s Horizon 2020 programme alone (Euro 3.8 bn per annum) is equal to half the identifiable private R&I investments flowing into climate-related sectors. This creates a historic opportunity for the EU’s planned Horizon Europe programme to focus on decarbonisation and leverage co-funding to enable net-zero emissions outcomes.

## Finding #2: Concretely, Europe needs to increase its climate related R&I in the 2021-27 period by a third to reach the Paris Agreement goals

Closely linked to Finding #1, both the experts responding to this work, and those contributing to ECF’s Net-Zero 2050 pathway modelling work<sup>4</sup>, believe that Europe should increase its climate-related R&I in the 2021-27 period to allow new innovative technologies, products and businesses the time to scale and deliver the economy wide decarbonisation required under optimal pathways, and to deliver the maximum societal benefits of this transition. We place the magnitude of this increase at least one third, in line with Member States’ year 2000 commitments to increase overall R&I investments to 3% of European GDP by 2020.

Specifically, the expert survey that assessed the detailed R&I priorities for identified net-zero decarbonisation strategies concludes that:

- 1. Climate-related R&I investment is key to deliver net zero emissions:** R&I is very relevant in 80% of the component decarbonisation strategies in Power, Transport, Buildings, Industry and Agriculture, Forestry and Land Use to deliver net-zero emissions. Responders to our survey identified that R&I funding needs to increase in three quarters of the strategies to deliver net-zero 2050 outcomes and the contributors to ECF’s climate modelling<sup>5</sup> saw the “innovation gap” as being 25% additional innovation over a 75% increase aligned with existing efforts;
- 2. Europe can build competitive advantages in many of the decarbonisation pathways:** Experts see opportunities for Europe to build global competitive advantages through R&I investment in all of the five climate-relevant sectors, however this

<sup>3</sup> The proportion of European R&I is hard to identify because many large firms, such as car and chemical manufacturers who invest significant amounts of R&I, do not provide a specific breakdown of the categories in which they invest.

<sup>4</sup> ECF Net-Zero Series “From Whether to How” (2018) Retrieved <https://europeanclimate.org/wpcontent/uploads/2018/09/NZ2050-from-whether-to-how.pdf>

<sup>5</sup> ibid





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opportunity is not evenly spread and some of the 58 decarbonisation component strategies offer greater potential competitive advantages than others;

- 3. Innovation is required at many levels, not just in the production of new technologies:** While experts identify that the largest proportion (40%) of the necessary R&I is required to develop new or improve existing technologies, Europe's decarbonisation challenges also require substantial innovation at the product, business model and societal levels, in turn supporting a more mission-oriented approach to decarbonisation (e.g. full sector decarbonisation or zero-carbon cities);
- 4. Public and Private R&I investments need to scale-up together:** While Experts identified the need for a balanced instrument mix to fund European decarbonisation split evenly between private and public sector R&I investment instruments. Experts flagged that just a quarter of identified R&I investments would require public sector grants, meaning that it is equally important to upscale soft loans and risk sharing instruments in order to facilitate an increase in private sector equity and debt products;
- 5. Five “sector decarbonisation missions” could help deliver Net-Zero 2050 outcomes:** Experts identified five sector level missions in Power, Transport, Buildings, Industry and AFOLU that would accelerate their decarbonisation. While it remains unclear whether a sector-level mission is sufficiently broad and ambitious, these can be used to inspire and contribute to an over-arching EU-level mission to deliver the innovation requirements to reach net-zero emissions in the whole economy before 2050.

## Recommendations for Europe's next Research and Innovation support programme

As European institutions prepare to define the scale and shape of its two most important EU-level instruments that will facilitate the identified R&I increase and up-scaling of low carbon assets -- Horizon Europe and InvestEU - the evidence from the experts surveyed supports the following EU-level policy recommendations:

- Horizon Europe's climate-related R&I allocation should increase:** R&I invested between 2021-27 is likely to be the last significant R&I funding to have time to deliver new low carbon innovation that can scale-up to deliver a net-zero economy by 2050. ECF's Net-Zero 2050 climate pathway modelling identifies a necessary one third increase in innovation to enable this net-zero decarbonisation by 2050. In this context, Horizon Europe should require nearly half (47%, up a third from 35%) of its funding to be relevant to climate action.
- The climate element and impacts of R&I investments need to be more transparent and tracked in Horizon Europe, but also better disclosed by the private sector:** Firstly, a climate impact pathway should be defined for Horizon Europe and its R&I allocations should be tracked against





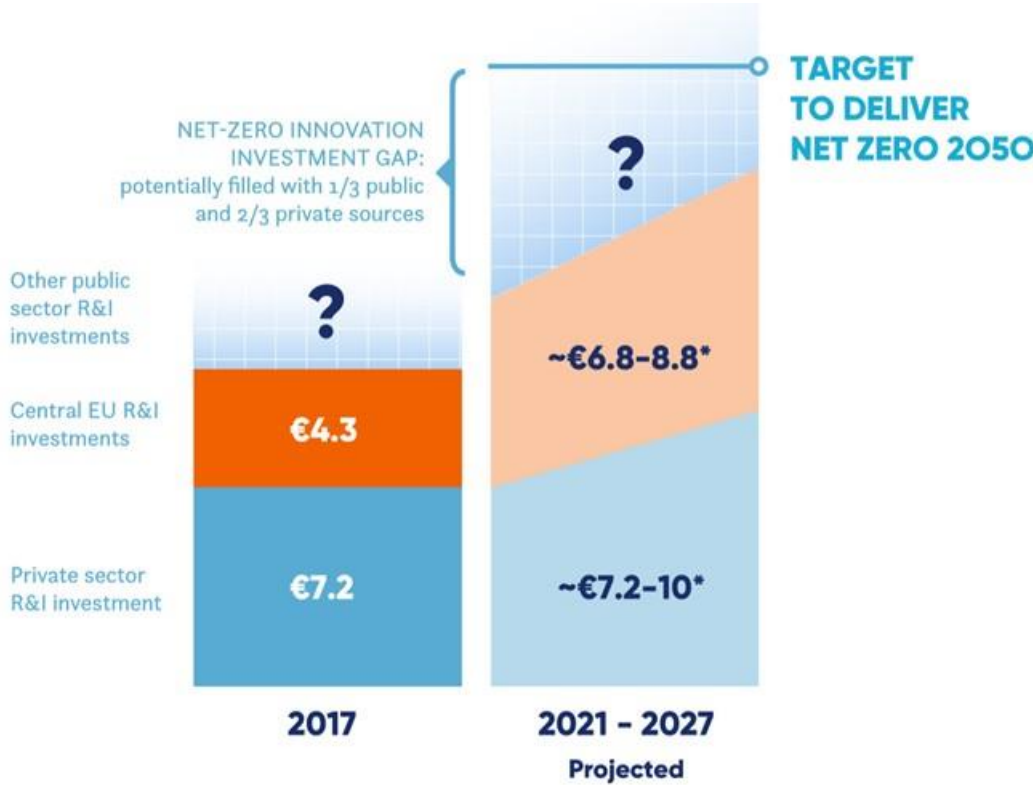


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the EU’s long-term climate and energy targets, and the Paris Agreement. To deliver this transparency, as a part of the grant agreement, lead beneficiaries of Horizon Europe funding should estimate the climate-relevant percentage of their projects’ outcomes. This level of climate-related tracking and transparency should also be a priority for InvestEU and other EU-level funding instruments. This would allow increased connectivity to, and stimulation of the later stage public and private investments which are also required, subsequently to R&I, to deliver successful decarbonisation missions.

- Net-Zero emissions in Europe by 2050 requires concerted collaboration on climate-related R&I collaboration between the public and private sectors:** EU-level R&I funding instruments, together with other public sources, should increasingly enable and facilitate increased private sector climate-related R&I. The public sector alone is unable to deliver the product and business model-level innovation and therefore economy-wide transformation required. This means that Horizon Europe, European Innovation Council and the R&I window of InvestEU can use mission-led and sector-level decarbonisation pathways to further direct and increase private sector coinvestments through more innovation partnerships and collaborative financing structures. Given the extensive debate on mission scope among experts, and the five “sector level” missions described in this report, perhaps the only EU-level Mission required is that to deliver Net-Zero emissions by 2050.

**Chart: Climate relevant R&I investments (€Billions)**



\*Based upon best expert estimates at the time of publication

