



Critical review of the potential contribution of the European Commission proposal for an EU Recovery and Resilience Programme and a new Multiannual Financial Framework to achieving the objectives of the Green Deal and the 2030 and 2050 climate targets

A study prepared by Climate & Company for

**AGORA ENERGIEWENDE**

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**List of abbreviations**

|       |  |
|-------|--|
| BAU   | Business-As-Usual                                |
| BPIE  | Buildings Performance Institute Europe           |
| CAES  | Compressed-Air Energy Storage                    |
| CAPEX | Capital Expenditure                              |
| CAN   | Climate Action Network                           |
| CAP   | Common Agriculture Policy                        |
| CCS   | Carbon Capture and Storage                       |
| CEF   | Connecting Europe Facility                       |
| CF    | Cohesion Fund                                    |
| CfDs  | Contracts for Difference                         |
| COM   | European Commission                              |
| CSP   | Concentrated Solar Power                         |
| DIW   | Deutsches Institut für Wirtschaftsforschung      |
| EAFRD | European Agricultural Fund for Rural Development |
| EAGF  | European Agricultural Guarantee Fund             |
| EBA   | European Battery Alliance                        |
| ECB   | European Central Bank                            |
| EFSI  | The European Fund for Strategic Investments      |
| EIB   | European Investment Bank                         |
| EPBD  | Energy Performance of Buildings Directive        |
| ERDF  | European Regional Development Fund               |
| ERTMS | The European Railway Traffic Management System   |
| ESCO  | Energy Service Company                           |
| ESIF  | European Structural Investment Funds             |
| ETS   | Emissions Trading Scheme/System                  |
| EU    | European Union                                   |
| EURF  | EU Recovery Fund                                 |
| GCPF  | Global Climate Partnership Fund                  |
| GDP   | Gross Domestic Product                           |
| GHG   | Greenhouse Gases                                 |
| IEA   | International Energy Agency                      |

|          |  |
|----------|--|
| IRENA    | International Renewable Energy Agency                          |
| JTM/F    | Just Transition Mechanism / Just Transition Fund               |
| KfW      | Kreditanstalt für Wiederaufbau                                 |
| MFF      | Multiannual Financial Framework                                |
| MS       | Member States of the EU  |
| NECP     | National Energy and Climate Plans                              |
| NZEB     | Near-Zero Energy Building                                      |
| OECD     | Organisation for Economic Cooperation and Development          |
| OPEX     | Operational Expenditures                                       |
| PF4E     | Private Finance for Energy Efficiency Instrument               |
| PO       | Policy Objective   |
| PV       | Photovoltaic System  |
| REACT-EU | Recovery Assistance for Cohesion and the Territories of Europe |
| RES      | Renewable Energy Sources                                       |
| RRF      | Recovery and Resilience Facility                               |
| SME      | Small and Medium-sized Enterprises                             |
| SWD      | Staff Working Document   |
| SSI      | Solvency Support Instrument                                    |
| TA       | Technical Assistance   |
| TEG      | Technical Expert Group   |
| TENT-T   | Trans-European Transport Network                               |

## 1. Introduction, key objectives, analytical framework and limitations

Climate & Company has been mandated by Agora Energiewende for a critical review of the potential contribution of the European Commission (COM) proposal (27 May 2020) for an EU Recovery and Resilience Programme and a new Multiannual Financial Framework (MFF) to achieving the objectives of the Green Deal and the 2030 and 2050 climate targets. In this analysis we want to develop a deep understanding about the role of the EU recovery package and the MFF in boosting a green recovery after the 2020 Covid-19 crisis.

Whereas Agora Energiewende's report "*Recovering Better! Climate Safeguards for the EU's Proposed 1.85-Trillion-Euro Budget*" is published separately and contains key findings and policy suggestions, this report presents the analytical backbone including sectoral discussions.

Against the backdrop of the EU climate and energy targets (in particular the envisaged 50-55%-GHG-emission reduction target for 2030) and the objectives laid down in the Green Deal, our assessment focuses on four sectors central to the climate and energy transition, namely the building, industry, electricity and transport sector. These sectors have a high-carbon intensity (representing 82% of total EU GHG emissions in 2016<sup>1</sup>), are of particular economic importance (33% of EU GDP<sup>2</sup>) and are furthermore key to decarbonise other sectors (e.g. by providing low-carbon electricity). The sector choice has been made with particular emphasis on key transition technologies identified in a previous publication by Agora Energiewende and Agora Verkehrswende<sup>3</sup>. Further discussion on the significance of the sectors for both the low-carbon transition as well as their relevance for green stimulus package can be found in the Agora report.

Table 1 provides an overview of the analytical framework used for this study. Based on the analysis of the Commission proposal regulations, literature review, expert interviews and feedback received on the first draft of this study, we assessed what financing volume is needed to achieve 2030 climate targets in addition to business-as-usual (BAU) for each sector. This assessment provided the basis and the lens we used to analyse the potential contribution of the proposed EU budget and recovery framework to boost the required low-carbon transition in these sectors. We considered 13 instruments (Next Generation EU and other MFF instruments) that we regarded as relevant for the four sectors. We did not consider the total budget amount of each instrument, but its earmarked climate share, e.g. 25% share of the Recovery Assistance for Cohesion and the Territories of Europe (REACT-EU). We then distributed the climate-earmarked budget, on the investment needs identified. Based on this assessment, we went on to address the key questions identified for the European Commission's proposal:

1. Is it large enough (in terms of investment needs)?
2. Which elements of the proposed EU recovery / MFF package are indispensable for funding the climate and energy transition, which specific budget lines and instruments could the EU Member States (MS) use to implement the European initiatives proposed in Agora's "Dual-Benefit Stimulus for Germany"<sup>4</sup> and where would additional funding (including for technical assistance) be required?

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<sup>1</sup> European Environment Agency. GHG Emissions by Sector in the EU-28, 1990-2016. (2018). See [link](#).

<sup>2</sup> European Commission. Internal Market, Industry, Entrepreneurship and SMEs – Construction. (Accessed on 29 June 2020). See [link](#).; European Commission. Transport Sector Economic Analysis. (Accessed on 29 June 2020). See [link](#).; The World Bank Dataset. Manufacturing, value added (% of GDP) – European Union. (Accessed on 29 June 2020). See [link](#).; European Commission. Energy Sector Economic Analysis. (Accessed on 29 June 2020). See [link](#).

<sup>3</sup> Agora Energiewende, Agora Verkehrswende. Dual Benefit Stimulus for Germany – A Proposal for a Targeted 100 Billion Euro Growth and Investment Initiative. (2020). See [link](#).

<sup>4</sup> Ibid.

3. What roles does governance (in particular the European Semester (ES), the recovery plans and the national energy and climate plans (NECPs)), the EU Taxonomy and the European Investment Bank (EIB) play, and which activities should not be eligible for EU funding?

*Table 1: The analytical framework*

|             | What is needed?  | The role of                | How to strengthen this role through targeted, accountable and transparent implementation |                                      |                       |            |
|-------------|--|----------------------------|--|--------------------------------------|-----------------------|------------|
|             |  |                            | EIB, dedicated Flagship initiatives  | Earmarking and climate budget target | Taxonomy & Exclusions | Governance |
| Electricity | Investment, financing options and technical assistance | MFF and Next Generation EU |  |                                      |                       |            |
| Buildings   |  |                            |  |                                      |                       |            |
| Industry    |  |                            |  |                                      |                       |            |
| Transport   |  |                            |  |                                      |                       |            |

Our analysis has been conducted with all necessary care and rigor; however, there are some limitations:

1. Obviously, the EU budget is not responsible for financing all investments. National governments and the private sector will also contribute to financing the additional amount necessary to transform the sectors. However, Member States' budgets are seriously fiscally constrained due to the Covid-19 crisis, which hampers their ability to finance the low-carbon transition. The role of the private sector might not be as strong as required; as market risks, new technologies, unclear policy frameworks and the economic crisis prevent their massive bail-in within the next seven years (MFF timeline). That is why we emphasize the important role of public money, both in terms of direct, public investments and in more blended finance and leverage-oriented instruments. Here, EU budgets play a crucial role.
2. We distributed the EU budgets according to the (sectoral) investment needs. The building sector, for example, has an overall gap of EUR 1,295 billion, which is 53% of the total (i.e. the sum of gaps in the buildings, industry, electricity and transport sector). This percentage was used to allocate grants and leveraged financing from EIB. We know that this distribution is only illustrative, as a full discussion of the sectors and their financing needs lies beyond the scope of this report.
3. We considered only the climate share of each budget, however much less than the entire climate share is available for the transformation in our four sectors. The climate share is a climate action share, which includes other important financing needs, like adaptation and climate resilience and other climate change mitigation-oriented activities that are not in these four sectors. As will be demonstrated, even in an optimistic scenario, where all earmarked budget resources are allocated to the four sectors, large investment gaps remain.
4. In one comment on the draft study, it has been pointed out that we only target the investment needs in the four sectors and do not reflect the energy system integration approach. We see this limitation, however even getting robust and consistent data on basic investment needs in each sector has been very challenging. For instance, obtaining data on public and private buildings (e.g. to get an understanding of financing needs for hospitals, kindergartens and social housing), has not been possible.

The subsequent two chapters provide a quick overview of the investment and financing needs in the four sectors (Chapter 2) and give a quick overview of what has been proposed in the May 2020 budget proposal (Chapter 3). A comprehensive analysis of the four sectors is presented in Chapter 4. Here, we provide a brief introduction to the low-carbon transition challenges and the corresponding technologies, give an overview of the investment needs, financing instruments, financing opportunities in the new EU Budget and provide some preliminary conclusions.

Chapter 5 goes into detail about the role of the proposed MFF and the recovery package. It aims to match the proposed instruments to the identified demand and further identifies indispensable elements, gaps, exclusions, and mismatches. The chapter further aims to give some initial recommendations on how the newly proposed EU budget could be strengthened in order to go through adjustments and re-allocation of funding to specific budget lines, instruments and EU initiatives; streamlined and compatible governance regimes to deliver the 2030/50 targets; and defining key roles (for EIB and national promotional banks, and others).

Chapter 6 goes on by providing a discussion on the climate shares of the proposed MFF and highlights the role of earmarking and mainstreaming of climate objectives in the newly proposed budget. Lastly, Chapter 7 deals with the governance elements of the proposed MFF, such as the EU Taxonomy, *do no harm* approach and the link to national energy and climate plans (NECPs).

This report further includes five annexes. Annex I provides further details on the interplay of financing on EU and national level with a particular emphasis on earmarking. Annex II gives further details about investment needs and key developments in the four sectors. Annex III provides a discussion of the possible applications of the EU Taxonomy for the MFF and the Recovery and Resilience Facility (RRF). Annex IV gives an overview of key instruments and governance mechanisms in the form of a table. Annex V provides some further considerations on the role of InvestEU and the European Investment Bank.



## 2. What is needed? Sector technologies and their investment and financing needs

The “Dual-Benefit Stimulus for Germany”<sup>5</sup> proposes a set of European initiatives to boost recovery and low-carbon transformation in line with the Green Deal.

- **Increased investment in projects of common European interest:** Proposals for new initiatives including clean hydrogen, offshore wind hub for the North and Baltic Seas, low-carbon steel, EU electric vehicle fast charging infrastructure and rebuilding EU’s solar industry.
- **Reformulate EU aid framework and policies in line with the EU Green Deal:** Adaptation of the state aid framework is central for the implementation of many of the above measures, but also to the establishment of new policy instruments to enable European industry to invest towards climate neutrality.
- **Increase the leverage of the European Investment Bank through Green Bonds:** The EIB issues bonds that are bought on the secondary market by the European Central Bank (ECB) as part of its euro stabilization measures allowing the EIB to finance considerably more projects than before.
- **Sensibly increase the EU budget 2021 - 2027:** EU regionalization funds are central to public investment in many countries in Southern and Eastern Europe. By increasing the German contribution to the EU budget in line with the Green Deal, many crucial projects can be initiated.

For the buildings, industry, electricity and transport sectors and in particular the specific technology options identified in Agora’s dual-benefit stimulus report as central for the energy transition, we set out to investigate the investment needs and gaps as well as the required financing options (including technical assistance (TA)). This report further identifies potential roles for the EIB, sector specific exclusion criteria (i.e. avoiding that technologies and economic activities qualify for EU funding which would risks generating technology lock-in and stranded assets) and the EU sustainable finance Taxonomy<sup>6</sup>.

Figure 1 provides an overview of the green transition investment gap until 2030 as communicated in the Commissions’ staff working document<sup>7</sup> accompanying the May 2020 budget proposal. While most of the estimates presented in the document were more or less in line with our own assessments and the relevant literature and analysis on investment and financing needs and gaps in these sectors, the estimate for industry was significantly low compared to our assessment. Instead of the EUR 5 billion indicated as annual investment gap in the Commissions’ staff working document, we estimated an average additional investment need (above the baseline) of annually EUR 10 billion plus EUR 4 billion annually for hydrogen production. Other limitations of the Commission’s report relate to the fact that the estimates do not include scenarios for a 50-55% emission reduction, hence systematically underestimating the investment gap. The estimates of investment gaps in as far as they refer to these estimates hence do represent a conservative approximation of the real gap.

<sup>5</sup> Agora Energiewende, Agora Verkehrswende. Dual Benefit Stimulus for Germany – A Proposal for a Targeted 100 Billion Euro Growth and Investment Initiative. (2020) See [link](#).

<sup>6</sup> EU Technical Expert Group on Sustainable Finance. Final report of the Technical Expert Group on Sustainable Finance. (2020). See [link](#).

<sup>7</sup> European Commission Staff Working Document. SWD(2020) 98 - Identifying Europe's recovery needs (2020). See [link](#).

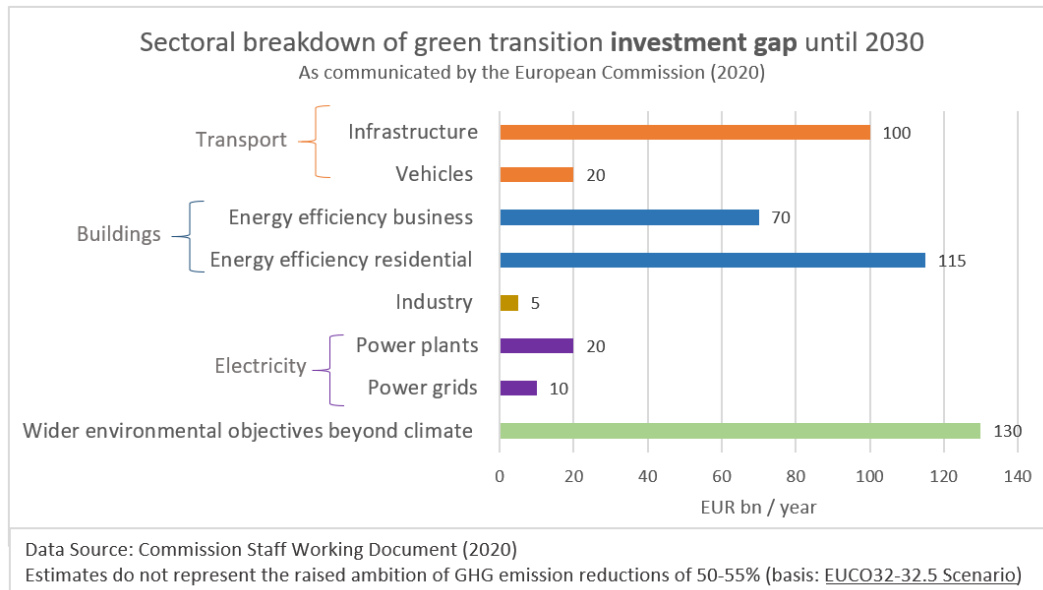


Figure 1: Overview sectoral investment gaps. Data Source: Commission Staff Working Document, 2020<sup>8</sup>

The sectoral assessment of investment and financing needs provides the lens for our assessment of the EU budget and the recovery and resilience package, but before we go into the in-depth assessment of the four sectors and corresponding key technologies, we present a quick overview of the European Commission’s proposal (see Chapter 3).

### 3. A short overview of the EU Budget proposal of the European Commission

Since the start of the Covid-19 pandemic in the EU, the COM and Member States have proposed a range of economic measures to ease the shock for the European economy. Immediate crisis response measures include European Stability Mechanism Pandemic Crisis Support for Member States (EUR 240 billion), European Investment Bank Group financing for business (EUR 200 billion) and SURE – EU Funding for short-time work schemes (EUR 100 billion). Together with other EU and national measures, a total of EUR 3.9 trillion has been adopted thus far<sup>9</sup>.

On May 27, 2020, the Commission has proposed a two-fold response under the motto of repair and recover to mobilize private investment. The Next Generation EU recovery instrument (EUR 750 billion) is proposed as a temporary reinforcement for the period of 2021-2024 and the long-term budget of the EU for 2021-2027 has been reinforced to EUR 1.1 trillion. This brings the total financial firepower of the proposed EU budget (2021-2027) to EUR 1.85 trillion.<sup>10</sup>

The proposal of the new EU budget recognizes the first couple of years as critical for the EU’s economic recovery and builds the Next Generation EU recovery instrument on three pillars (see Figure 2). According to the COM, the budget is particularly geared to reach the green and digital transitions and make Europe more resilient for future crises.

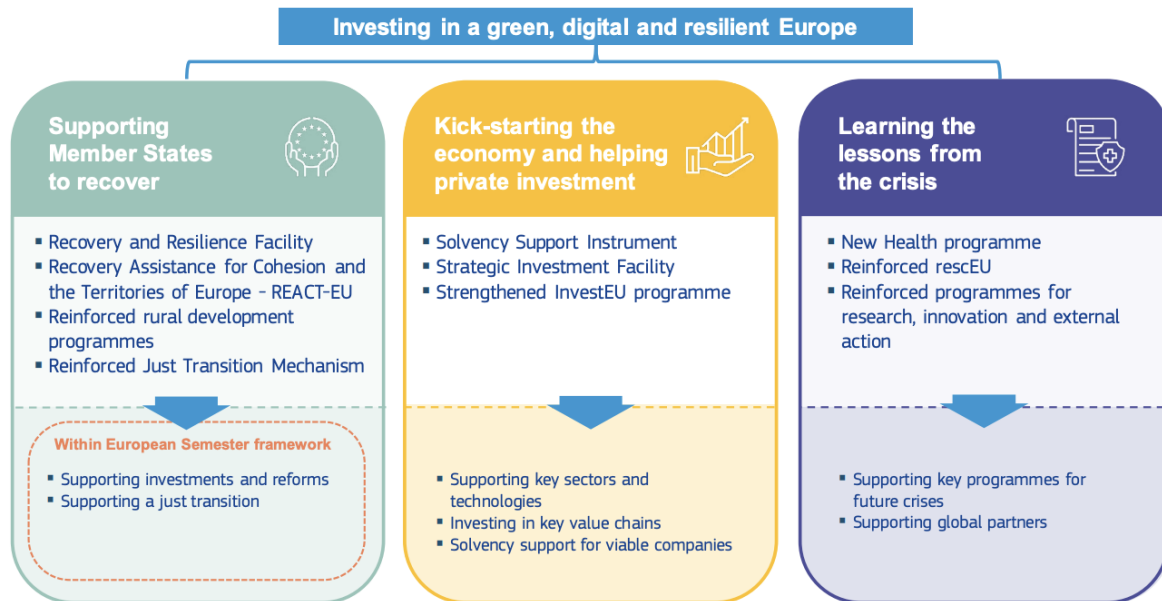
Some key elements of the new budget proposal are the Solvency Support Instrument (SSI), designed to provide liquidity support to companies affected most by the crisis. The InvestEU programme has

<sup>8</sup> European Commission Staff Working Document. SWD(2020) 98 - Identifying Europe's recovery needs (2020). See [link](#).

<sup>9</sup> European Commission. Jobs and economy during the coronavirus pandemic. (Accessed on 16 June 2020). See [link](#).

<sup>10</sup> European Commission Fact sheet. The EU Budget Powering - The Recovery Plan For Europe (2020). See [link](#).

been strengthened and a new Strategic Investment Facility is put in place to provide support for the green and digital transition. As a direct response to the shock of Covid-19 as a health crisis, the COM further proposes a new health programme (EU4Health), RescEU (Civil Protection Mechanism) and reinforcing Horizon Europe to boost investments in medical and other research funding.



Source: European Commission

**Figure 2** - Three pillars of the Next Generation EU Instrument as proposed in May 2020. Source: COM 2020<sup>11</sup>.

<sup>11</sup> European Commission Fact sheet. The EU Budget Powering The Recovery Plan For Europe (2020). See [link](#).

## 4. Sector Chapters

In the following sections, we discuss how this range of (potentially) relevant elements (or financial “instruments”) of the newly proposed MFF and the additional facilities under Next Generation EU as proposed on 27 May 2020 can contribute to financing the transformation and its key technologies in four sectors (buildings, industry, electricity and transport).

We outline how the financing of the transformation in each sector could be organised and which role the proposed financial instruments may play in support of the sector specific investment requirements.

### 4.1 Building Sector

#### 4.1.1 What needs to happen in the building sector?

Buildings are, on a sectoral level, the largest energy consumer in the EU and are contributing to roughly a third of the EU’s greenhouse gas emissions<sup>12</sup>. With an aging building stock in the EU and a current renovation rate of 1% (thereof, deep renovations only 0.2%), a large proportion of inefficient buildings will still be in place by 2030. It has been estimated that 97% of the building stock does not reach the ‘A’ classification energy level<sup>13</sup>. Therefore, measures such as retrofitting at an accelerated pace, phasing out fossil fuel and low-efficient energy sources are necessary to decarbonize the sector. Furthermore, the construction sector is a huge employer and responsible for 9% of the EU’s GDP and approximately 15 million direct and indirect jobs, mostly through small and medium-sized enterprises (SMEs)<sup>14</sup>.

The EU Energy Performance of Buildings Directive (EPBD) sets the agenda to decarbonize the building stock by 2050 – although experts share the view that the process must speed up to achieve the goal. To make that happen, more ambitious and mandatory requirements on energy performance, energy use and renovation targets are needed throughout the EU for both new and renovated buildings<sup>15</sup>.

A survey by the Buildings Performance Institute Europe (BPIE) has identified several key drivers ranging from policy actions such as “setting ambitious minimum energy performance requirements” to non-financial barriers as “removing administrative hassle, complexity or bureaucracy”. Being asked about financial solutions to increase investments in low-carbon buildings, “access to low-cost finance”, “grants/subsidies”, “no upfront cost solutions (e.g. on-tax or on-bill financing)” or “property taxation linked to energy performance” are ranked among the most important measures by stakeholders<sup>16</sup>.

#### **What does Agora’s Dual-Benefit Stimulus suggest?**

For the German economy, Agora’s Dual-Benefit Stimulus<sup>17</sup> focuses on three key technologies and corresponding policy measurements that would speed up the decarbonization of Germany’s building

<sup>12</sup> European Commission. Energy Performance of Buildings Directive, 2019. (Accessed on 8 June 2020). See [link](#).

<sup>13</sup> BPIE. 97% of Buildings in the EU Need to Be Upgraded. (Accessed on 29 June 2020). See [link](#).

<sup>14</sup> BPIE. Towards a Decarbonised EU Building Stock: Expert Views on the Issues and Challenges Facing the Transition. (2018). See [link](#).

Simon, Fredric, “LEAKED: Europe’s draft ‘green recovery’ plan”. Euractive. (2020-05-20). (Accessed on 9 June 2020). See [link](#).

<sup>15</sup> BPIE. Towards a Decarbonised EU Building Stock: Expert Views on the Issues and Challenges Facing the Transition. (2018). See [link](#).

<sup>16</sup> Ibid

<sup>17</sup> Agora Energiewende, Agora Verkehrswende. Dual Benefit Stimulus for Germany – A Proposal for a Targeted 100 Billion Euro Growth and Investment Initiative. (2020) See [link](#).

stock: an industrial scaling of **energy efficient retrofitting**, a scaling of **heat pumps** and comprehensive **green district heating** systems<sup>18</sup>.

For Europe as a whole, there is an urgent need to boost the retrofitting rate and policymakers should focus on realizing the “renovation wave”, proposed in the EU Green Deal. The energy efficient refurbishment of hospitals, schools, kindergartens and public housing should receive priority. Triggering a large-scale renovation wave would support jobs locally, in particular SMEs.

#### 4.1.2 Investment needs and key technologies

According to Commission estimates, the building sector requires EUR 185 billion of additional investments annually for 2021-2030. Thereof, EUR 115 billion in residential homes and EUR 70 billion in buildings used by businesses<sup>19</sup>. Unfortunately, there is no information in the Commission documents explicitly addressing the split of commercial buildings (businesses) vs. public buildings vs. private residential buildings.<sup>20</sup> Therefore, it is not possible to know with certainty whether publicly owned residential buildings such as social housing are included in the estimation.<sup>21</sup>

Regarding the key technologies, the (estimated) costs or financing needs are as follows:

- Energy Efficient retrofitting: EUR > 80 bn / year (blended financing)
- Green District Heating: EUR 13.2-47.6 bn / year (investment costs)

A wider comparison of investment cost estimates for the buildings sector and further details on the cost of key technologies can be found in Annex II. Additionally, heat pumps were mentioned in Agora’s Dual-Benefit Stimulus as a key technology. However, we were not able to find quantified investment needs for this technology.

#### 4.1.3. Financing instruments and Next Generation EU

##### **What are required financing instruments?**

In Germany in 2016, for instance, EUR 31.6 billion climate-specific investments in the building sector (both energy efficiency and renewable energy) came from private and EUR 3.5 billion from public sources. The German state-owned development bank KfW played the most important role and contributed loans worth EUR 22.3 billion from different facilities<sup>22</sup>. KfW mainly used concessional loans, combined with repayment grants (i.e. if the project achieved a certain energy performance level) and had received EUR 1.4 billion from the federal budget as programme support<sup>23</sup>. For private house-owners or the public sector, KfW offers targeted facilities<sup>24</sup>.

<sup>18</sup> For further elaboration on these technologies, see Annex of this chapter.

<sup>19</sup> European Commission Staff Working Document. SWD (2020) 98 - Identifying Europe's recovery needs (2020). See [link](#).

<sup>20</sup> EEFIG. Energy Efficiency – the first fuel for the EU Economy - How to drive new finance for energy efficiency investments. (2015). See [link](#) - Section 2.2.1.

<sup>21</sup> Estimating investment needs depends on a variety of assumptions (e.g. discounting rate), targets (e.g. GHG emission targets by 2030) and technological factors (e.g. cost-development trajectories of technology X), among others. Against this backdrop, comparing investment needs estimates across sectors is not straight-forward. However, the listed estimates allow to grasp the order of magnitude (rather than a precise number). Sources and further explanations to these investment need figures can be found in Annex II, Table II-a.

<sup>22</sup> Such as the KfW Infrastruktur, KfW Umwelt, and KfW Wohnen umbrella programmes.

<sup>23</sup> Novikova, A. et al. Climate and energy investment map of Germany. Status Report 2016. Institut für Klimaschutz, Energie und Mobilität (IKEM). (2019). See [link](#).

<sup>24</sup> Such as KfW-Programme 153/Energieeffizient Bauen for private home-owners ([link](#)) or KfW-Programme 217 / Energieeffizient Bauen und Sanieren for the public sector ([link](#)).

Energy efficiency investments in buildings, transport and industry are nearly all financed by corporate and household balance sheets, supplemented by public financing (ultimately backed by tax revenues), bond issuance and, increasingly, loans from green banks<sup>25</sup>. Financing provided by Energy Service Companies (ESCOs) is playing a larger role and financial and regulatory innovations are enabling their financing and standardizing the accounting for their contracts.

A non-comprehensive list of financial support schemes is presented in the following:

- Concessional loans are the most important financial support scheme used;
- Guarantees for financing institutions providing energy-efficiency financing;
- Grants/subsidies to bridge financial gaps for homeowners and companies;
- Tax incentives: schemes that allow costs to be recuperated through reduced tax liability, either directly for the building owner or through tax credits – a powerful tool to remove financial barriers both for the private and public sector and are financed publicly through lower tax income;
- On-bill financing schemes lead to reduced transaction costs and simplicity and is a strong driver of energy efficiency investments for the residential sector<sup>26</sup>.

The primary financing instrument differs across types of buildings (commercial, public, public rental, owner occupied, private rental). In addition to financial instruments, there is also demand for improved standardisation and technical and administrative assistance. Regulations, energy certifications and quality assurance tools also drive investment<sup>27</sup>.

### Financing schemes at EU level

At the EU level, several public funding schemes already exist, which can be channeled to projects on the ground. The European Commission, for instance, set up the Private Finance for Energy Efficiency Instrument (PF4EE) and the EIB's advisory service ELENA (European Local Energy Assistance) for TA. Regarding the EU's Cohesion Policy, EUR 18 billion has been allocated to energy efficiency by the European Structural Investment Funds (ESIFs) (especially the ERDF and Cohesion Fund) over the period 2014-2020. Each (i.e. the ERDF and CF) has allocated EUR 13.4 billion for energy efficiency measures in public and residential buildings<sup>28</sup>. Another example is the EEEF (European Energy Efficiency Fund) initiated by the European Commission and backed by the EIB and other institutions, aiming to attract additional capital into climate financing<sup>29</sup>.

Other existing EU funding streams come from the European Regional Development Fund (ERDF), the Cohesion Fund (CF), European Fund for Strategic Investments (EFSI) – i.e. the Juncker plan, the European Energy Efficiency Fund, PF4EE and ELENA<sup>30</sup>.

### What can help under the MFF and Next Generation EU?

Within the current MFF and Next Generation EU, we identified several facilities targeting energy-efficiency in the building sector. However, none of them did so explicitly or with a major focus. The total volume of these facilities is EUR 1,017 billion, with the Recovery and Resilience Facility (RRF) being

<sup>25</sup> IEA, Energy Efficiency 2018 - Analysis and outlooks to 2040 (2018). See [link](#).

<sup>26</sup> EEFIG. Energy Efficiency – the first fuel for the EU Economy - How to drive new finance for energy efficiency investments. (2015). See [link](#).

<sup>27</sup> Ibid.

<sup>28</sup> Boll et al. Financing Energy Renovation in Buildings - Guidance on financial schemes with a focus on Bulgaria and Romania (2019). See [link](#)

<sup>29</sup> European Energy Efficiency Fund. Objective of the Fund. (Accessed on 16 June 2020). See [link](#).

<sup>30</sup> BPIE. Financing energy renovation in buildings - guidance on financial schemes with a focus on Bulgaria and Romania. (2019). See [link](#).

the largest tool (EUR 560 billion). We see an important role for the RRF and the InvestEU facility and recommend to further bundle facilities to boost energy efficiency. Table 2 summarizes the discussion in this sub-chapter, states the facility’s key instrument for the building sector and indicates eligibility for the entire sector and different technologies.

*Table 2 – Buildings: Link between technologies and EU funds*

| Technology   | Inv. Needs       | RRF                                       | InvEU <sup>1</sup> | React  | JTM <sup>2</sup> | Horizon | ERDF  | CF    |
|--|------------------|---|--------------------|--------|------------------|---------|-------|-------|
| <i>Key Instrument:</i>   |                  | G./L. <sup>3</sup>                        | Guarantees         | Grants | G./L.            | TA      | G./L. | G./L. |
| <i>EU Budget [bn EUR]</i>  |                  | 560                                       | 75.2               | 55     | 40               | 94      | 196.9 | 40.7  |
| <i>Leverage Target</i>   |                  | not spec.                                 | 300                |        | ~150             |         |       |       |
| <b>Decarb. Stock</b>   | <b>Building</b>  | <b>115(residential)<br/>70 (business)</b> | ✓                  | ✓      | ✓                | ✓       | ✓     | ✓     |
| <i>Energy retrofitting</i>   | <i>efficient</i> | > 80 bn/year                              | ✓                  | ✓      | ✓                | ✓       | ✓     | ✓     |
| <i>Green heating systems</i>   | <i>district</i>  | 13.2-47.6 bn/year                         | ✓                  | ✓      | ✓                | ✓       | ✓     | ✓     |
| <p><i>Notes:</i> ✓ = Fund potentially addresses the activity/technology.<br/> ✓✓ = Fund is designed to promote the activity/technology.<br/> 1: Windows: Strategic Investment Facility; Investing in the EU econ. recovery;<br/> 2: Incl. public loan facility under the JTM.<br/> 3: G./L. = Grants/Loans</p> |                  |   |                    |        |                  |         |       |       |

Of the investment needs identified (residential EUR 115 billion/year and tertiary EUR 70 billion/year), the largest part has been financed in the past by household ‘balance sheets’, supplemented by public financing. Inspired by the KfW examples (see beginning of section 4.1.3; concessional loans with grant elements, supported by the federal budget), similar structures could be implemented by other development/private banks within Europe – and we would recommend using grants e.g. from the EU RFF to finance similar structures. Member states would then need to present action plans in their respective national recovery and resilience plans and forward grants to relevant institutions such as public banks.

We also see a supplementing role of the EIB and the InvestEU programme. Under the European Fund for Strategic Investments (EFSI), the EIB had already financed energy efficiency programmes in various Member States, either directly to project implementers, or to local banks, that used the funds to finance energy efficiency. The Energy Efficiency Financial Institutions Group<sup>31</sup>, in this context, proposed to put energy efficiency financing on the top of the EFSI – supplemented with market, economic, financial, and institutional actions. Interviews with technical experts in context of this assessment confirmed that there were doubts as to whether EIB would be able to quickly set up structures to disperse large amounts of financing to the building sector. We therefore advise to use the EIB to supplement and complement national financing initiatives (financed by RRF), as opposed creating less effectual parallel structures.

In the leaked working paper of Europe’s green recovery plan<sup>32</sup>, a European Renovation and Financing Facility was proposed to be financed with EUR 91 billion per annum under the Recovery Plan and implemented by EIB under InvestEU. This Facility would have two windows. First, the EU Nega Watt Initiative focusing on building segments identified by Agora Energiewende as a high priority for public

<sup>31</sup> EFIG. Energy Efficiency – the first fuel for the EU Economy - How to drive new finance for energy efficiency investments. (2015). See [link](#).

<sup>32</sup> Simon, Fredric, “LEAKED: Europe’s draft ‘green recovery’ plan”. Euractive. (2020-05-20). (Accessed on 9 June 2020). See [link](#).

funding: public sector buildings, especially hospitals and schools and social housing and other forms of low-income dwelling. The second window would also focus on a wider array of buildings, including offices, farms, and privately-owned residential buildings. As above, we see this initiative as a useful complement to national financing initiatives, with the EIB usefully supplementing national programmes.

#### 4.1.4 Conclusions - Buildings

Energy efficient retrofitting is mainly financed by private investments (households and companies) – but supplemented by public financing (i.e. mainly concessional loans and grants). National and regional banks play a crucial role in providing finance and advice (such as the KfW in Germany with near-zero interest rates).

Within the current MFF and Next Generation EU package, we identified several facilities targeting energy-efficiency in the building sector. However, none of them do so explicitly or with a major focus. Due to its sheer size, we see an important role for the RRF in providing grants and concessional loans (since retrofitting buildings also offers a considerable boost for the economy). Grants to Member States (municipalities) could be particularly important to co-finance green district heating (which requires EUR 34 billion/year) and to support the renovation wave for schools, hospitals and social housing.

On the national level, EU instruments could support financing schemes provided by banks. In Germany, for instance, the KfW received EUR 1.4 billion from the federal budget in 2016, thereby financing concessional loans with a volume of approx. EUR 30 billion, thereof EUR 14.7 billion related to climate-specific investment<sup>33</sup>. Similar structures could be implemented by other development or private banks within Europe, powered by money from the RRF (or other facilities).

However, a “one-stop-shop” for retrofitting buildings<sup>34</sup> is missing, such as the European Renovation and Financing Facility as part of the leaked working document<sup>35</sup> which proposes funding of EUR 91 billion per annum.

Technical assistance will also be key to developing a viable project pipeline for building renovations: sector experts interviewed for this assessment have suggested that EUR 800 million to finance these services are needed, while the leaked working paper from the Commission services<sup>36</sup> suggests providing EUR 2 billion to reinforce the EIB’s advisory service ELENA, in particular to support deep renovation projects (aggregating demand and incorporating local energy system changes). With the help of its established TA facilities and the InvestEU Portal, the EIB should invest massively into a bankable project pipeline, using innovative structures to involve stakeholders and set-up equity facilities for project developers.

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<sup>33</sup> Novikova, A. et al. Climate and energy investment map of Germany. Status Report 2016. Institut für Klimaschutz, Energie und Mobilität (IKEM). (2019). See [link](#).

<sup>34</sup> Climate Strategy & Partners, European Buildings Renovation Fund, Personal Communication June 2020

<sup>35</sup> Simon, Fredric, “LEAKED: Europe’s draft ‘green recovery’ plan”. Euractive. (2020-05-20). (Accessed on 9 June 2020). See [link](#).

<sup>36</sup> *ibid.*



## 4.2 Industry – basic materials and hydrogen production

### 4.2.1 What needs to happen in these industry sectors?

Even though decarbonising industry (in particular steel, chemicals, and cement) seems technically feasible already today, many of the key technologies are not competitive enough to survive on today's markets. Therefore, the next decade will be crucial for the industrial sector to be put on a low-carbon trajectory. Estimates of the costs of transitioning the industry to climate-neutrality have revealed that the estimated price increase of final goods will barely be noticeable to consumers (e.g. packaged goods increase by less than 1% by 2050). On the other hand, the impact on businesses in the basic materials industry sectors is often large. In a net-zero 2050 scenario, the production cost for steel would increase by 20-30%, cement by 70-115% and plastics and ammonia by 15-60%<sup>37</sup>.

What is more, the basic materials industry sector needs to boost innovation to deliver “Circularity first”, whereas technology-led innovation is predominantly required for at least half of the EU basic materials industry's decarbonisation strategies<sup>38</sup>.

#### What does Agora's Dual-Benefit Stimulus suggest?

For Europe, Agora suggests expediting the European Clean Hydrogen Alliance (already announced in the European Industry Strategy). This initiative should be promoted quickly and target an EU-wide 10% green hydrogen share in the market. The initiative will provide complementary investments in required infrastructure.

Regarding steel, Agora suggests adopting the goal of producing 35 million tonnes of steel coming from low-carbon or zero-carbon technologies by 2030 (i.e. a replacement of conventional steel by roughly 30%).

### 4.2.2 Investment needs and key technologies

Commission estimates place the cost of industry transformation at approx. EUR 5 billion of *additional* investments per year until 2030<sup>39</sup>. Depending on how intensively policymakers want to support *incremental*<sup>40</sup> capital and operation expenditures, we have estimated the cost of support via grants or Carbon Contracts for Difference (CfDs) for key technologies to be as follows<sup>41,42</sup>:

- Clean Hydrogen (cross-cutting): < EUR 4 bn / year until 2030<sup>43</sup>;
- 30% low-carbon Steel: EUR 0.93 – 2.94 bn / year, *average 1.9*;

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<sup>37</sup> Material Economics. Industrial Transformation 2050 - Pathways to Net-Zero Emissions from EU Heavy Industry. (2019). See [link](#).

<sup>38</sup> Sweatman et al. Funding Innovation to Deliver EU Competitive Climate Leadership, Climate Strategy & Partners. (2018). See [link](#).

<sup>39</sup> European Commission Staff Working Document. SWD(2020) 98 - Identifying Europe's recovery needs (2020). See [link](#).

<sup>40</sup> Incremental costs are “the additional expense incurred with respect to a baseline to produce a new output” related to climate change mitigation (i.e. lower GHG emissions after the investment). (Source: Green Climate Fund – Incremental and full cost calculation methodology. (2018). See [link](#).)

<sup>41</sup> Calculations explained in Annex II. Based on incremental costs stated in the Material Economics report, with further hints from Oliver Sartor (Agora Energiewende).

<sup>42</sup> Estimating investment needs depends on a variety of assumptions (e.g. discounting rate), targets (e.g. GHG emission targets by 2030) and technological factors (e.g. cost-development trajectories of technology X), among others. Against this backdrop, comparing investment needs estimates across sectors is not straight-forward. However, the listed estimates allow to grasp the order of magnitude (rather than a precise number). Sources and further explanations to these investment need figures can be found in Annex II, Table II-e.

<sup>43</sup> This figure presents an upper bound, since it also captures infrastructure investments related to storage and buffering or distribution and retail.

- 30% low-carbon Cement: EUR 1.89 – 2.96 bn / year, *average 2.4*;
- 30% low-carbon Plastics: EUR 2.99 – 6.96 bn / year, *average 5.0*;
- 30% low-carbon Ammonia: EUR 0.35 – 1.07 bn / year, *average 0.7*;

A wider comparison of investment cost estimates for the industry sector and further details on the cost of key technologies can be found in Annex II.

#### 4.2.3 Financing instruments and Next Generation EU

##### **What are the required financing instruments?**

Risks around projects related to new (low-carbon) technologies play an important role. Investors are facing high capital risks mainly due to significant Capital Expenditure (CAPEX) commitments<sup>44</sup>, but also higher Operational Expenditures (OPEX), since new technologies have higher costs. Currently, several pilots exist (such as the clean steel project HYBRIT, supported by research and development grants<sup>45</sup>), striving to demonstrate feasibility. To reach the 2030 climate and energy targets, these new technologies will need to be translated into actual business cases for commercial scale demonstration.

These risks are partly addressed by existing EU facilities. One is the EU Innovation Fund which supports the EU-Emission Trading Scheme (ETS) industrial and power sectors in their decarbonisation and awards applicants according to five award criteria (GHG emission avoidance, degree of innovation, project maturity, scalability and cost efficiency). After selection, the Innovation Fund supports “highly innovative technologies (...) that can bring on significant emissions reductions” mainly via grants and up to 60% of the capital expenditures.<sup>46</sup>

To scale low-carbon technologies in the industry (and hydrogen in particular), the capital risks related to CAPEX and the initial investments need to be substantially reduced using (public) financing schemes<sup>47</sup>:

- grants that cover the lion’s share (~75 %) of the additional (greening) value of investment in capex; and
- loans (preferably with lower interest rates) for a share of non-additional BAU CAPEX (~ 10-20%).

As also OPEX costs are higher for low-carbon technologies (compared to the benchmark) most of the *incremental* OPEX costs should be covered by grant-type schemes (such as CCFDs). It is noteworthy that the share of incremental OPEX vs. CAPEX differs across basic materials industry sectors (e.g. the incremental OPEX share is with up to 90% significantly higher in the steel industry; for cement incremental CAPEX and OPEX is around 50:50<sup>48</sup>).

Ideally, innovative companies can leverage a mix of instruments such as the EU Innovation Fund (e.g. to subsidise up to 60% of the capital expenditures) and national contracts such as carbon contracts for differences (Box A), subsidising the operating expenses, while incentivising policy makers to increase

<sup>44</sup> World Energy Council. *New Hydrogen Economy - Hope or Hype?*. (2019). See [link](#).

<sup>45</sup> Hybrit - Fossil-Free Steel. (Accessed on 9 June 2020). See [link](#).

<sup>46</sup> European Commission. *Innovation Fund*. (Accessed on 9 June 2020). See [link](#).

<sup>47</sup> The following bullet points are input from Oliver Sartor.

<sup>48</sup> This rough indication has been provided by Dr. Jörn Richstein (DIW Berlin).

the carbon price. Other potential financing instruments are guarantees, tax exemptions, increased tax depreciation, green public procurement, among others.

### What can help under the MFF and Next Generation EU? (Innovation Fund, InvestEU, Horizon)

Table 3 – Summary of industry chapter discussion

| Technologies   | Investment and financing needs (EUR bn/yr)      | RRF            | InvEU incl. SSI    | Innovation Fund <sup>2</sup> | Horizon | JTF    |
|--|---|----------------|--------------------|------------------------------|---------|--------|
| <i>Key Instrument:</i>   |   | Grants & loans | Guarantees & loans | Grants                       | Grants  | Grants |
| <i>EU Budget [bn EUR]:</i>   |   | 560            | 141.5 <sup>1</sup> | ~ 10                         | 94      | 40     |
| <i>Leverage target:</i>  |   | not specified  | 450 (300 + 150)    |                              |         |        |
| <b>Decarbonising Industry</b>  | <b>5-10</b> <sup>49</sup>                       | ✓              | ✓✓                 | ✓✓                           | ✓✓      | ✓      |
| <i>Hydrogen Economy</i>  | < 4   | ✓              | ✓✓                 | ✓✓                           | ✓✓      | ✓      |
| <i>Green Steel</i>   | 0.9 - 2.9                                       | ✓              | ✓✓                 | ✓✓                           | ✓✓      | ✓      |
| <i>Other (ammonia, cement, plastics)</i>   | A: 0.3 – 1.1;<br>C: 1.9 – 3.0;<br>P: 3.0 – 7.0. | ✓              | ✓✓                 | ✓✓                           | ✓✓      | ✓      |
| <p>Notes: ✓=Fund potentially addresses sector / technology.<br/>           ✓✓= Fund is designed to promote the activity/technology.<br/>           1: Guarantees from InvEU (75.2) &amp; SSI (66.4). SSI had already a guarantee of EUR 26 billion.<br/>           2: Innovation Fund is not part of the MFF/Next Generation EU, but important for the transition of the four sectors.</p> |   |                |                    |                              |         |        |

Table 3 summarizes the following discussion. The elephant in the room, i.e. the Recovery and Resilience Facility with EUR 560 billion of firepower, does not specifically target the basic materials industry but focuses on “challenges and investment needs related to the green and digital transition, thereby ensuring a sustainable recovery”<sup>50</sup>.

The Solvency Support Instrument (EUR 5 billion from the current EU budget, EUR 26 billion from the recovery fund) aims at companies that are in greatest need of capital across all sectors and Member States – which ultimately generates up to EUR 300 billion in private investments. The SSI is therefore not designed to support the basic materials industry investments discussed in this report<sup>51</sup>.

The Just Transition Fund, as the main tool of cohesion policy and the first pillar of the Just Transition Mechanism, rather focuses on the economic diversification of carbon-intensive regions (determined on NUTS3-level). However, the second pillar (Invest EU) is of major relevance. The Invest EU Fund operates through five policy windows, and three to four are roughly relevant to the industry sector –

<sup>49</sup> EUR 5 billion indicated in Staff Working Document. European Commission Staff Working Document. SWD(2020) 98 - Identifying Europe's recovery needs (2020). See [link](#);

EUR 10 billion indicated in European Commission. COM(2019) 285: United in delivering the Energy Union and Climate Action - Setting the foundations for a successful clean energy transition (2019). See [link](#).

<sup>50</sup> European Commission, COM(2020) 442: Annex to [...] The EU budget powering the recovery plan for Europe (2020). See [link](#).

<sup>51</sup> Politico. The EU’s Recovery Spending Explained. (Accessed 16 June 2020). See [link](#).

primarily a) sustainable infrastructure, b) research and innovation, and c) strategic European Investment Policy window. The strategic European investment window under InvestEU<sup>52</sup> would be “complementary to that made available under the research, innovation and digitalisation window that will focus on the upstream development of new strategic capacities”. The Strategic Investment Facility strives to build strategic autonomy in vital supply chains across Europe. EUR 31.5 billion are planned – which supposedly crowd in EUR 150 billion of additional investments.

The Innovation Fund is designed to promote innovative technologies and funds up to 60% of capital expenses for eligible projects. The leaked working paper of Europe’s green recovery plan even suggests delivering the remaining 40% of co-financing to substantially reduce the risk of large/complex projects.

#### **Box A: Carbon Contracts for Difference (CCfDs) for industry sector**

CCfDs are policy instruments for supporting the deployment of new ultra-low carbon projects by ensuring a guaranteed carbon price to make up the cost-difference relative to a reference technology<sup>1</sup>. They can be designed to reduce the up-front investment cost for developers, give creditors a higher-security for their loans and also minimize the downstream costs for consumers. CCfDs work to accelerate R&D and ensure new innovative low-carbon/deep decarbonisation technologies become commercially viable sooner relative to conventional technologies, and have a shorter time period required for commissioning<sup>2</sup>.

<sup>1</sup> Bataille, C., and Sartor, O., (IDDRI). Decarbonising basic materials in Europe: How Carbon Contracts-for-Difference could help bring breakthrough technologies to market. (2019). Sciences Po. See [link](#).

<sup>2</sup> Low Carbon Contracts Company, Government of UK. What is the CfD scheme?. (Accessed on 03 July 2020). See [link](#).

#### 4.2.4 Conclusions – basic materials industry and hydrogen production

Greening industry strongly relies on **hydrogen** as a cross-cutting technology and greening the production process of carbon-intensive materials such as ammonia, cement, **steel** and plastics<sup>53</sup>.

To address the European hydrogen strategy mentioned in Section 5.2.1 several key principles should be followed. The EU, for instance, should only support renewable hydrogen production and not other low-carbon forms to avoid lock-in effects; should establish CO<sub>2</sub> as the new currency of the energy system; should consider potential job creation when supporting production pathways and uses (due to technology development and development of new RES installations), among others<sup>54</sup>.

As investments are based on anticipating future profitability and investors are facing high risks due to significant CAPEX commitments, grants (that cover most of the additional, greening value of investment) and guarantees or loans work well to secure investments. A CCfD scheme could reduce financing costs and bridge the cost gap between conventional and low-carbon technologies (in particular green hydrogen). As a result, the required carbon price for making low-carbon production competitive, is also significantly lower. To boost new technologies (like green hydrogen and low-

<sup>52</sup> The InvestEU Fund operates through five policy windows: a) sustainable infrastructure; b) research, innovation and digitalization (“demonstration and deployment of innovative solutions”); c) SMEs (“innovative SMEs and SMEs active in the cultural and creative sectors”); d) social investments and skills; e) strategic European Investment Policy Window

<sup>53</sup> Agora Energiewende, Agora Verkehrswende. Dual Benefit Stimulus for Germany – A Proposal for a Targeted 100 Billion Euro Growth and Investment Initiative. (2020). See [link](#). - Chapter 9

<sup>54</sup> edp. energias de Portugal. European Commission Public Consultation – Roadmap: EU Hydrogen Strategy. Personal Communication. June 2020; Hydrogen Europe (2020). The EU Hydrogen Strategy: Hydrogen Europe’s Top 10 Key Recommendations. See [link](#).

carbon materials production), it will be important to have sufficient funding from the Innovation Fund, Horizon and Invest EU to co-fund Member State support schemes, especially for projects representing Important Projects of Common European Interest (IPCEI) (e.g. in the context of the newly announced industry alliances for clean hydrogen or low-carbon industry).

Under the current Next Generation EU, facilities that promote new technologies such as the Innovation Fund, Horizon and InvestEU play an important role in decarbonising industry (see Table 3). The firepower of the RRF could serve as an additional funding stream for CCfDs.

Under the current Next Generation EU:

- **Grants are key for financing the industrial transition.** RRF & REACH could provide the grant element of CCfDs. The Innovation Fund helps proving commercial scale demonstration. Horizon could support research and development investments.
- **InvestEU is key for facilitating equity investment, by EIB, for financing large, capital intensive investments.** For instance, the strategic European investment policy window and the sustainable infrastructure window are able to do this but need to be orientated toward Green Deal objectives.
- **The Just Transition Mechanism could support low-carbon investments in transition regions, to facilitate the transition toward green manufacturing.** Therefore, the limitation to financing SMEs under Cohesion Policy will need to be lifted to promote “economic diversification” (i.e. making carbon-intensive technologies green).

## 4.3 Electricity sector

### 4.3.1 What needs to happen in the electricity sector?

Power generation is the largest GHG-emitting sector in Europe today. Although the EU’s CO<sub>2</sub> emissions fell by 12% in 2019 driven in part by increases in CO<sub>2</sub> emissions prices that drove carbon-intensive electricity generation out of the market, a complete decarbonisation of the electricity sector is needed in order to meet the EU’s objective of becoming the first climate-neutral continent by 2050. A renewable energy dominated energy system not only enables this, but also is the most cost-effective way for the EU to become climate-neutral without resorting to significant carbon sinks. To reach European energy and climate targets, five to eight times the current market share of onshore wind and solar energy is needed until 2050<sup>55</sup>. This can be achieved by increasing investments in key technologies like large scale solar PV deployment, on- and off-shore wind, smart grid expansion and R&D into storage technologies.

### 4.3.2 Investment needs and key technologies

According to the numerous studies analysed for this report, the overall investment needs for the power grid and power plants in Europe to achieve the EU’s climate and energy targets in 2030 is in the range of EUR 85 billion to EUR 280 billion, per annum. We have identified the following estimates for investment needs for key elements in the sector<sup>56</sup>:

<sup>55</sup> European Commission. A Clean Planet for all. (2018). See [link](#).

<sup>56</sup> Estimating investment needs depends on a variety of assumptions (e.g. discounting rate), targets (e.g. GHG emission targets by 2030) and technological factors (e.g. cost-development trajectories of technology X), among others. Against this backdrop, comparing investment needs estimates across sectors is not straight-forward. However, the listed estimates allow to grasp the order of magnitude (rather than a precise number). Sources and further explanations to these investment need figures can be found in Annex II, Table II-e.

- Renewable energy sources (RES): EUR 25-280 bn until 2030
- Solar PV: EUR 6.7-22 bn until 2030;
- Wind (onshore): min EUR 8.5 bn/year;
- Wind (offshore): min. EUR 6 bn/year
- Grids: min. EUR 50-140 bn/year;

A wider comparison of investment cost and gap estimates for the electricity sector and further details on the cost of key technologies can be found in Annex II.

#### 4.3.3 Financing instruments and Next Generation EU

##### ***Current state of play – What is available at the EU Level at the moment? How are projects financed?***

Globally, renewable energy sources are financed mostly using project finance, but also on corporate balance sheets<sup>57</sup>. Of the nearly USD 300 billion (approx. EUR 264 billion) invested in renewable energy in 2017, financing varied markedly across countries according to the stage of policy and energy market development and the availability and diversity of financing<sup>58</sup>. In some countries, like Germany, the vast majority of investments use project finance<sup>59</sup>. This stands in contrast to traditional investments into energy, encompassing also fossil power sources, which are mostly financed on companies' balance sheets and from private individuals' own assets<sup>60</sup>.

In short, with regard to the key technologies and policy goals (PV, on- and offshore wind, solar industry), the private sector dominates the financing sources. However, the state plays an important role when creating investment environments and incentives, especially by securing stable cash-flows. Typical instruments include support schemes, such as guaranteed selling prices and additional income through tradable certificates and premiums<sup>61</sup>. The lion's share of support schemes for the deployment of renewable energy are administered at Member State level, with German support schemes alone providing EUR 189 billion in support for renewable energy between 2000-2017<sup>62</sup>.

Between 2007 and 2020, the European Regional Development Fund (ERDF) and the Cohesion Fund (CF) provided around EUR 8.8 billion to renewable energy projects (approx. EUR 1 billion to wind and EUR 3 billion to solar investments).

Especially in the early years of public support for renewable energy, technology costs fell quicker than public support could adjust, leading to challenges such as windfall profits, pressure on public finances and high retail electricity prices for households. Today, in many instances availability of finance is not as much the problem in mobilizing private capital for renewable energy, as regulatory difficulties, spatial planning, administrative complexity, and grid insufficiencies<sup>63</sup>. Also, a report by the European

<sup>57</sup> Steffen, B. The importance of project finance for renewable energy projects. *Energy Economics*. (2018). Vol. 69, 280–294. See [link](#).

<sup>58</sup> IEA. *World Energy Investment 2018*. (2018) See [link](#).

<sup>59</sup> Steffen, B. The importance of project finance for renewable energy projects. *Energy Economics*. (2018). Vol. 69, 280–294. See [link](#).

<sup>60</sup> In 2017, balance sheets accounted for 94% of the USD 1.8 trillion (approx. EUR 1.6 trillion) invested globally in energy (including energy efficiency). Public finance was important to develop and deploy new technologies where the private sector considered technology-risk as too high (IEA, 2018).

<sup>61</sup> European Court of Auditors. *Wind and solar power for electricity generation: significant action needed if EU targets to be met*. (2019). See [link](#).

<sup>62</sup> Reed, Stanley. *Germany's Shift to Green Power Stalls, Despite Huge Investments*. *New York Times*. (2017). See [link](#).

<sup>63</sup> European Court of Auditors. *Wind and solar power for electricity generation: significant action needed if EU targets to be met*. (2019). See [link](#).

Court of Auditors concluded that renewable energy projects supported through Cohesion policy funding often involve cases of over-support. According to IRENA (2019), the costs of newly installed renewables are increasingly lower than the cheapest fossil-fuel based options<sup>64</sup>. Interviews with representatives of the financial sector also provide evidence that financing is not the core bottleneck. Instead, finding bankable projects, with transparent and strong sponsors that understand how to manage technologies, increasingly seems to be becoming the larger challenge.

Yet, the economic downturn caused by the Covid-19 pandemic could lead to financing issues for renewables despite the developments described above<sup>65</sup>. Thus, cheap financing made available through the MFF (e.g. through EIB) could be of increased importance to stimulate the deployment of renewables.

For utility-scale solar, de-risking and adjusting regulation is an important tool to raise private capital. Here, guarantees provided through EIB could play a major role on the European level. Instruments important to foster roof-top PV are grants, tax deductions and support for green mortgages. EIB has already committed to not finance any fossil fuel projects after 2021 and finance EUR 1 trillion in clean energy innovation, energy efficiency and renewable energy. Other instruments to speed up the deployment of renewable energy could be dedicated tendering schemes on the EU level (as proposed in leaked working paper green recovery plan)<sup>66</sup>.

### **Grid Infrastructure**

The Connecting Europe Facility (CEF) Energy programme reserved a total of EUR 5.35 billion (EUR 4.6 billion in grants, managed by Innovation and Networks Executive Agency (INEA)) for energy infrastructure projects (2014-2020)<sup>67</sup>. CEF Energy and InvestEU (policy window: sustainable infrastructure) already provide subsidies and access to finance for electricity infrastructure and grids, but as grid investments are integral to the deployment of renewables, the sector needs to be prioritised more consistently. Here, cross-border projects could benefit specifically from EU funding. Subsidies as well as eased access to finance play a major role in developing grid infrastructure.

### **Rebuilding the European Solar Industry**

A rapid upscaling of solar technologies would require building up local manufacturing in parallel to meeting demand for their deployment. Rebuilding a domestic solar manufacturing industry in Europe has advantages such as security of supply, leadership in low-carbon technologies and economic growth in the EU (a full discussion on rebuilding Europe's solar industry see Hoogland et al. (2017)<sup>68</sup> and SolarPower Europe (2020)<sup>69</sup>). Achieving this goal will require strong partnerships between the remaining large EU PV manufacturers, research institutions, the financial and public sector. The EU could be represented through DG GROW, DG ENER, DG RTS and the relevant ministries in the Member States. SolarPower Europe calls for creating a business-friendly environment for European companies by easing access to cheap financing sources and addressing risk constraints<sup>70</sup>. A key instrument here could be the InvestEU programme. Rebuilding Europe's solar manufacturing industry will require

<sup>64</sup> IRENA. Renewable Power Generation Costs in 2019. (2019) See [link](#).

<sup>65</sup> Cherp, A., and Jewell, J. COVID-19 weakens both sides in the battle between coal and renewables. Social Science Nature. (2020). See [link](#).

<sup>66</sup> Simon, Fredric, "LEAKED: Europe's draft 'green recovery' plan". Euractive. (2020-05-20). (Accessed on 9 June 2020). See [link](#).

<sup>67</sup> European Commission. CEF Energy Website. (Accessed on 10 June 2020). See [link](#).

<sup>68</sup> Hoogland, O., Rademaekers, K., Lijn, N. van der, Trinomics B.V, European Commission, & Directorate-General for Research and Innovation. Assessment of photovoltaics (PV) final report. (2017). See [link](#).

<sup>69</sup> SolarPower Europe and LUT University. 100% Renewable Europe: How To Make Europe's Energy System Climate-Neutral Before 2050. (2020). See [link](#).

<sup>70</sup> SolarPower Europe. An Industrial Strategy for solar in Europe. (2019). See [link](#).

research and innovation funding grants and subsidies (e.g. through Horizon Europe), as well as a commitment to provide support during both the start- and the growth stage (e.g. Horizon Europe, Innovation Fund). Industrial projects for new technologies also require cheap access to finance (e.g. through EIB).

### Role of EU Instruments in the future

Against this backdrop, we see an important role of InvestEU in supporting the development and deployment of private energy projects in general; and especially private PV, offshore-wind projects and the recovery of the private solar industry in Europe. EIB has a full range of financial instruments that these kinds of technologies require, from equity, to mezzanine finance, loans and guarantees. One important aspect that the EIB (jointly with support e.g. from Horizon) should address is the development of a bankable project pipeline. This requires on the one hand TA for potential project developers (Invest EU has a Technical Assistance (TA) Facility of EUR 700 million). On the other hand, resources like equity and guarantees improve the bankability, especially of smaller projects/project developers, and thus are important to increase the number of projects (thereby also contributing to a just transition). The financing does not necessarily have to be directly by the EIB but could rather entail using national development banks or private banks.

The role of EU instruments focused on Member States (public sector), like the European Recovery and Resilience Facility, Just Transition Mechanism and REACT-EU, could be to address financing needs in areas where the private sector is not adequately engaged, such as electricity transmission (e.g. for offshore wind) and interconnectors; digitisation of electricity distribution networks. In the leaked working paper green recovery plan (2020)<sup>71</sup>, the COM proposed to set-up a Green Infrastructure Fund at the EIB that especially provides loans for these types of technologies. This fund could be a useful way to bundle forces and quickly deploy relevant technologies (investment needs / costs for Green Infrastructure Fund: EUR 10 billion per year).

As mentioned above, schemes that contribute to stable cash-flows are important frameworks to push renewable energy projects. Financing from e.g. the European Recovery and Resilience Facility could be used to finance national renewable energy tenders, feed-in tariffs, etc. In the leaked working paper green recovery plan (2020)<sup>72</sup>, the COM also suggested to implement an EU tendering scheme of “15 GW renewable electricity” in two years, which could be a useful structure to bundle forces and increase demand (e.g. national tenders in small MS might not be interesting for large investors, an argument that we learned from representatives of financial sector when asking framework condition in Latvia). [Total Costs: EUR 25 billion].

*Table 4 - Electricity: Link between technologies and EU funds*

| Key Technologies | Investment Needs       | RRF            | InvEU incl. SSI          | Innovation Fund | Horizon                       |
|------------------|------------------------|----------------|--------------------------|-----------------|-------------------------------|
|                  | <i>Key Instrument</i>  | Grants & loans | Private sector financing | Grants          | Grants for studies and pilots |
|                  | <i>EU Budget (bn)</i>  | 560            | 141.5                    | ~ 10            | ~94,4                         |
|                  | <i>Leverage target</i> | not specified  | 450 bn (300 + 150)       |                 |                               |

<sup>71</sup> Simon, Fredric, “LEAKED: Europe’s draft ‘green recovery’ plan”. Euractive. (2020-05-20). (Accessed on 9 June 2020). See [link](#).

<sup>72</sup> *ibid.*



| Electricity Investment Gap          | Sector     | 30 / year (gap)  | ✓ | ✓ | ✓ | ✓  |
|-------------------------------------|------------|--|---|---|---|----|
| Expanding electricity               | low-carbon | 25-280 / year <sup>73</sup>  | ✓ | ✓ | ✓ | ✓  |
| Solar PV (utility scale & rooftops) |            | 6-22 bn / year   | ✓ | ✓ |   | ✓  |
| Rebuilding Solar Industry in Europe |            | NA   |   |   | ✓ | ✓✓ |
| Wind Industry                       |            | 16.5 bn / year   |   |   |   |    |
| Grid Infrastructure                 |            | 34-200 bn / year   | ✓ | ✓ | ✓ |    |
| Storage Technologies                |            | N.A.   |   |   | ✓ | ✓✓ |
|                                     |            | <b>Notes:</b><br>✓ = Fund potentially addresses the sector /technology.<br>✓✓ = Fund is designed to promote the activity/technology. |   |   |   |    |

#### 4.3.4 Conclusions Electricity Sector

The key focus areas in the electricity sector are deployment of renewable energy (solar PV and wind energy), rebuilding Europe’s solar manufacturing industry and grid infrastructure.

The electricity sector has been in many ways the focus of attention in the last years and renewables enjoy a high technology readiness level. The investment gap identified in the Commissions’ staff working document amounts to EUR 10 billion per year for the power grid and EUR 20 billion for power plants between 2021-2030<sup>74</sup>.

To avoid carbon lock in, it is crucial that investments in the electricity sector are scaled up as quickly as possible. Especially investments to remove bottlenecks, like building missing grid infrastructure are urgent for the development of the sector. With regard to some of the key technologies – solar PV and on/offshore-wind - it is the private sector that drives these technologies, so we see EIB/InvestEU as the leading instrument within the MFF/Next Generation EU instrument-basket (combined with national sources). The public sector plays an important role when creating the right incentives, among others, feed-in tariffs, contract for difference schemes, tradable certificates and premiums.

Financing from e.g. the European Recovery and Resilience Facility could be used to co-finance such vehicles. Public and private finance is also needed in areas such as, transmission (e.g. for wind offshore) and interconnectors, smartening/digitisation of electricity distribution networks, cross-border connections, storing capacities. EIB/InvestEU, European Recovery and Resilience Facility and CEF-Energy could be the main drivers to finance these needs.

Rebuilding Europe’s private solar manufacturing industry, as proposed by Agora<sup>75</sup>, requires funding for start- and scale-ups (Solvency Support Instrument, InvestEU, REACT) and research and innovation (Horizon Europe, Innovation Fund).

Within the current MFF and considering *Next Generation EU* we identified nine facilities / programmes on energy, however only one (CEF-Energy) was explicitly identified as having the electricity sector has a major focus. The total volume of this basket contains EUR 1,022 billion, with the Recovery and

<sup>73</sup> Source: European Commission. SWD(2016) 418: Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources (2016). See [link](#), - Page 190.

<sup>74</sup> European Commission Staff Working Document. SWD(2020) 98 - Identifying Europe's recovery needs. (2020). See [link](#).

<sup>75</sup> Agora Energiewende, Agora Verkehrswende. Dual Benefit Stimulus for Germany – A Proposal for a Targeted 100 Billion Euro Growth and Investment Initiative. (2020). See [link](#).

Resilience Facility being the largest facility (EUR 560 billion). We see an important role for the Recovery and Resilience Facility and the InvestEU in helping to finance investments in the electricity sector.

### **Box B: Contracts for Difference (CfDs) for the electricity sector**

Access to financing and enabling a sufficiently large project pipeline go hand in hand and uncertainty over EU ETS prices can prevent investments into renewables. Uncertainty over future policies and investment environments prevents the development of new projects, harming renewable energy deployment. For example, uncertainty over future carbon price developments, expansion of other renewable energy technologies and phase-out of fossil-based generation all introduce regulatory risk that private investors cannot readily hedge (May and Neuhoff, 2019<sup>1</sup>). Contracts for Difference (see also Box A) for renewables address this by providing project developers with a hedge against low electricity prices, while symmetrically hedging electricity consumers like households and industry against increases of electricity prices. Taking out this regulatory risk reduces risk premia of capital-intensive renewables like wind and solar energy, decreasing investment needs. Such certainty over future electricity costs proves particularly relevant for industries investing into low-carbon technologies due to their reliance on renewables-based electricity and hydrogen (May, Neuhoff and Richstein, 2018<sup>2</sup>).

Renewable energy investments based on Contracts for Difference have been introduced in several Member States and can form the backbone for short-term investments and long-term energy and climate goals. The public support costs under CfDs across the EU are closely linked as wholesale electricity prices fluctuate with EU ETS prices. Under low ETS prices, support costs increase, while support costs are even negative under high EU ETS prices, i.e. mean paybacks from renewable energy project developers to governments. With ETS prices below what is needed for reaching energy and climate goals of 2030 and 2050, supporting renewables via CfDs initially still entails some moderate support costs, but, with increasing ETS prices, becomes ever cheaper and can even turn out induce no support costs over the lifetime of the assets at all.

Therefore, EU-wide tenders could use Contracts for Difference. Efforts by Member States to create markets for low-cost renewables can be strengthened by promoting CfDs through, on the one hand, particularly low-cost financing for projects under CfD regimes, e.g. by the EIB, and, on the other hand, by providing grants to governments implementing CfD auctions. Such grant volumes could be fixed in advance in order to preserve incentives for governments to hold auctions with low bids. They could provide the difference between an assessment of (rather low) technology cost estimates and power price expectations. For example, at technology costs of EUR 45 per MWh for solar PV and power price expectations of EUR 35 per MWh and 1,000 annual full load hours, 1 GW of solar PV requires EUR 10 million per year in support. Over time, when ETS prices increase, the annual support decreases. Thus, securing CfDs for renewables now provides investments stimuli by reducing regulatory risk for project developers as well as industry investing into low-carbon technologies and, in perspective, phases out support when industry production and ETS prices pick up.

<sup>1</sup> Neuhoff, K., and May, V. N. Private langfristige Stromabnahmeverträge (PPAs) für erneuerbare Energien: kein Ersatz für öffentliche Ausschreibungen. (Eng. translation: Private long-term electricity purchase contracts (PPAs) for renewable energies: no substitute for public tenders). (2019). DIW Berlin. See [link](#).

<sup>2</sup> May et al. Affordable electricity supply via contracts for difference for renewable energy. (2018). DIW Berlin. See [link](#).

## 4.4 Transport sector

### 4.4.1 What needs to happen in the transport sector?

Emissions in the European transport sector represent almost 27% of the GHG emissions and are a cause of air pollution<sup>76</sup>. Emissions have mostly stagnated in recent years, although emissions have increased by region. More than 70% of all GHG emissions in the transport sector come from road transport which is heavily reliant on liquid fossil-fuels causing the emission trend to grow<sup>77</sup>. At the same time, the transport and specifically automotive sector is economically very important for the EU, representing 7% of EU GDP and employing 13.8 million people through direct and indirect jobs<sup>78</sup>. It is characterized by one of the most interconnected cross-border value chains in Europe. These characteristics make the automotive sector specifically relevant, as it urgently needs a technology switch from fossil-fuel to clean vehicles, in order to reach climate targets and improve air quality in cities. Here, a comprehensive network of charging stations for electric vehicles is of major importance to ease “range-anxiety” and promote electric transportation. A modal shift to public transport which is able to use electricity directly without inefficient transformation of energy carriers is also required.

### 4.4.2 Investment needs and key technologies

The transport sector is very capital intensive, requiring total investment of at least EUR 700 billion per year between 2021-2030 in the BAU scenario (COM 2019)<sup>79</sup>. The investment gap for meeting European energy and climate targets identified in the Staff working document accompanying the MFF amounts to EUR 120 billion per year for both infrastructure and rolling stock between 2021-2030. Thus far, we have identified investment needs for key technologies as follows<sup>80</sup>:

- Public charging infrastructure: min. EUR 20 bn until 2030;
- Rail: min. EUR 430 bn until 2030;
- Innovation funding for key technologies (e.g. batteries): min. EUR 70 bn until 2023;

A wider comparison of investment cost estimates for the transport sector and further details on the cost of key technologies can be found in Annex II.

### 4.4.3. Financing instruments and Next Generation EU

#### ***Current state of play – What is available at the moment? How are projects financed?***

The European transport sector is one of the sectors requiring most investments in the upcoming decade. Yet, spending on transport have been well below what is needed to modernize the sector, both on the national as well as the EU level (mostly well below EUR 100 billion per year since 2018).

<sup>76</sup> European Environment Agency. Greenhouse gas emissions from transport in Europe. (2019). See [link](#).

<sup>77</sup> European Commission. Transport Emissions – A European Strategy for low-emission mobility. (Accessed on 03 July 2020). See [link](#).

<sup>78</sup> European Commission. Internal Market, Industry, Entrepreneurship and SMEs: Automotive industry. (Accessed on 03 July 2020). See [link](#).

<sup>79</sup> European Commission. COM(2019) 285: United in delivering the Energy Union and Climate Action - Setting the foundations for a successful clean energy transition. (2019). See [link](#).

<sup>80</sup> Estimating investment needs depends on a variety of assumptions (e.g. discounting rate), targets (e.g. GHG emission targets by 2030) and technological factors (e.g. cost-development trajectories of technology X), among others. Against this backdrop, comparing investment needs estimates across sectors is not straight-forward. However, the listed estimates allow to grasp the order of magnitude (rather than a precise number). Sources and further explanations to these investment need figures can be found in Annex II, Table II-f.

The Trans-European Transport Network (TEN-T) with its mission to ensure accessibility and connectivity for all EU regions is at the heart of the common European transport policies and strategies. The “core” (strategically important links across EU) of the network is to be completed in 2030, whereas the goal for completion of the “comprehensive” network is 2050. The large part of the financing needs for TEN-T lies with the MS, EU funds can only be used as a catalyst for projects that add clear value for the EU as a whole. Between 2007-2020, EUR 193 billion of the EU budget was used to support transport policy.<sup>81</sup>

The most important instruments in the EU budget is the **Connecting Europe Facility (CEF)** and the European Structural and Investment Funds (ESIFs). CEF is directly managed by the Commission (priorities: TEN-T core network, bottleneck removal and inter-operability projects), the ESIFs are under shared management and additionally focus on regional mobility as well as secondary and tertiary aspects of the TEN-T infrastructure.

In the period from 2007 to 2020, 78% of the EU transport budget allocations came from the ERDF, Cohesion Fund/ESIFs (EUR 150 billion), around 12% from CEF Transport (EUR 24 billion) and another EUR 6.3 billion from Horizon 2020-Transport. For the ERDF and the Cohesion Fund, transport has been the biggest spending area, with almost half of the spending going to road infrastructure<sup>82</sup>.

The EU mainly uses loans and guarantees to stimulate private investments. Between 2007-2018, the EIB has provided approx. EUR 140 billion in loans, EFSI has provided EUR 5.6 billion between 2015-2018, and guarantees through the CEF debt instrument (EIB financing) triggered around EUR 13 billion until 2018.

### Charging Points Infrastructure

Charging infrastructure is currently handled within the TEN-T project (CEF Transport) and other structural and investment funds. To develop infrastructure in rural and remote areas, cohesion funding also plays a major role. The last couple of years especially have seen a boom in charging infrastructure across Europe, whereas in many cases it is already viable without public support. As encouraged by the EU, many Member States have encouraged private investment into charging infrastructure through national support schemes.

Supporting charging stations in areas not attractive to the private sector (i.e. rural areas), needs to be in the focus of EU support. To support charging stations in rural areas, the EU should set clear time frames and geographic specifications to support adoption. Key instruments to achieve a wide network of charging infrastructure could be dedicated tenders requiring development in areas not preferred by private sector, and support for carbon contracts for difference (see Box A/B). Other instruments that provide loans, grants, or guarantees for charging infrastructure in rural areas, that eventually trigger private capital could also be provided.

Another innovative policy approach to support funding in charging infrastructure is to adopt the “Wifi4EU model”<sup>83</sup> (currently implemented under CEF Telecom), allowing municipalities or other public entities to directly apply for a set amount of funding (without going via the Member State). This could be done via the initiative “Recharge EU” under CEF (not officially announced as of yet). This mechanism has the advantage of allowing public entities quick and less bureaucratic access to the necessary funding for charging infrastructure<sup>84</sup>.

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<sup>81</sup> European Court of Auditors. Towards a successful transport sector in the EU: challenges to be addressed. (2019). See [link](#).

<sup>82</sup> Ibid.

<sup>83</sup> European Commission. Wifi4EU – Free Wi-Fi for Europeans. (Accessed on 10 June 2020). See [link](#).

<sup>84</sup> Communication with a representative from Transport & Environment, 08 June 2020.

## Rail Infrastructure

Currently, rail infrastructure receives a large share of funds under the TEN-T project. In the last decades, around 70% of the CEF Transport funds were used for railway projects. Cross border projects such as Rail Baltica benefit from EU coordination and funding. Rail Baltica receives co-funding (up to 85% of total eligible costs) from the EU<sup>85</sup>. Suitable EU funding instruments (specifically for cross-border railway infrastructure) are CEF Transport and Cohesion funding and ERDF. The European Court of Auditors describes EU funding for rail infrastructure (high speed infrastructure in particular) as significant (EUR 23.7 billion in grants for co-financing high-speed rail infrastructure, EUR 4.4 billion for the European Railway Traffic Management System (ERTMS), EUR 14.6 billion in co-funding (ERDF and CF) and EUR 9 billion in directly managed investment schemes, EUR 30 billion of EIB loans for high-speed trains between 2000-2017<sup>86</sup>), but it still represents only a fraction of the total investment needs. For high-speed rail infrastructure, Spain (47%), Germany (11%), as well as France, Italy and Poland (8% each) have been the main beneficiaries from rail infrastructure funding<sup>87</sup>.

Currently, European rail infrastructure is still mainly state-owned, but nevertheless highly fragmented across regions, and financing structures are very complex in this sector<sup>88</sup>. The TEN-T infrastructure investments address financing needs of rail infrastructure (e.g. through the Rail Baltica Project), but to reach a meaningful transition to a low-carbon rail network in Europe, massive investments are necessary. Developing rail networks as a strategy to decarbonise the transport sector is obviously also only effective if it decreases more carbon intensive transport modes (such as aviation, road and maritime transport). Against this background, using the existing funds most effectively should be a key focus. For example, bottlenecks that lead to inefficiencies in border regions require relatively low investments but have a considerably big impact on overall efficiency of Europe's rail network<sup>89</sup>.

## Innovation Funding

When it comes to spending on innovative technologies (development of electric vehicle infrastructure), the EU Innovation Fund can be leveraged. In 2018, the automotive industry already received 28% (EUR 57 billion) of EU R&D spending. In 2017 the European Battery Alliance (EBA) has been launched by the Commission to scale up innovation and manufacturing of batteries in Europe as part of the 3<sup>rd</sup> 'Europe on the Move' mobility package<sup>90</sup>. The industry led initiative is further funded by Member States. Other key players are European Institute of Innovation and Technology (EIT-InnoEnergy Project)<sup>91</sup> and Knowledge & Innovation Platforms (KIC). Since June 2018, the EU has made available more than EUR 8 billion in long term pledges and investments into battery technology through the EBA<sup>92</sup>.

Under Horizon 2020 (2014-2020), EUR 1.34 billion has been granted for energy storage and low-carbon mobility projects. In 2019 and 2020, approx. EUR 250 million were spent on the EBA from EU budgets. EIB, further plays a role in scale-up demonstration projects through loans, guarantees and equity-type funding (through InnovFin Energy Demo Projects facility). Innovation funding is also available via the

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<sup>85</sup> Rail Baltica. Finances. (Accessed on 08 June 2020). See [link](#).

<sup>86</sup> European Court of Auditors. A European high-speed rail network: not a reality but an ineffective patchwork. (2018). See [link](#).

<sup>87</sup> Ibid.

<sup>88</sup> Ibid.

<sup>89</sup> Cramer, Michael. 15 railway projects for a better connected Europe. See [link](#).

<sup>90</sup> European Commission. Annex to EUROPE ON THE MOVE Sustainable Mobility for Europe: safe, connected and clean. (2018). See [link](#).

<sup>91</sup> EIT Europa. European Battery Alliance & EIT InnoEnergy launch Business Investment Platform. (Accessed on 08 June 2020). See [link](#).

<sup>92</sup> Transport & Environment. Can electric cars beat the COVID crunch? (2020). See [link](#).

Innovation Fund established through the ETS (foreseen to provide EUR 10 billion between 2020-2030) for demonstration projects in low-carbon technologies.

The EU has built powerful structures for innovation for batteries (such as the EBA), which need to receive more funding (e.g. in the form of grants) in the future. Funding through Horizon budget can play a powerful role as well. Public-private partnerships, as established through the above discussed alliances are fundamental to provide the necessary funding in the long run. Manufacturing of batteries could be supported through guarantees to de-risk private capital, for example by providing guarantees for loans through the EIB.

### What can help under the MFF and Next Generation EU?

Table 5 - Transport: Link between technologies and EU funds

| Technologies  | Investment Needs                              | RRF            | InvestEU incl. SSI | Innovation Fund | Horizon | CEF – Transport |
|---|---|----------------|--------------------|-----------------|---------|-----------------|
| <i>Key Instrument</i>   |   | Grants & Loans | Loans              | Grants          | Grants  |                 |
| <i>EU Budget (bn EUR)</i>   |   | 560            | 141.5 bn           | ~ 10            | 94.4    | 12,9            |
| <i>Leverage target</i>  |   |                | 450 bn (300 + 150) |                 |         |                 |
| <b>Investment gap transport</b>   | <b>120/year (gap)</b>                         | ✓              | ✓                  | ✓               | ✓       | ✓✓              |
| Comprehensive charging station network  | Public Investment needs: EUR 20 bn until 2030 | ✓              | ✓                  |                 | ✓       | ✓✓              |
| Rail Infrastructure   | EUR 430 bn until 2030 <sup>93</sup>           | ✓              | ✓                  | ✓               |         | ✓✓              |
| Innovation Funding (Batteries)  | EUR 70-130 bn                                 |                |                    |                 | ✓       | ✓✓              |
| <i>Notes: ✓ = Fund potentially covers the sector/technology.<br/>           ✓✓ = Fund is designed to promote the activity/technology.</i> |   |                |                    |                 |         |                 |

#### 4.4.4 Conclusions Transport Sector

The priority investment areas in the transport sector are **charging infrastructure for rural areas, rail infrastructure, and innovation funding for batteries**. To avoid carbon-lock in, it is very important that investments are scaled up quickly. Infrastructure investments such as charging infrastructure and rail infrastructure are especially time-sensitive, as available infrastructure has a signalling effect (e.g. a comprehensive charging infrastructure alleviates “range-anxiety” and therefore triggers investments in electric vehicles).

**Charging infrastructure** in the EU requires a total investment of at least **EUR 80 billion**, of which **EUR 20 billion** for public charging infrastructure (public spending being key for rural areas). Financing instruments should focus on de-risking private investments in the form of loans, guarantees and grants to raise private capital for charging infrastructure, even in currently unattractive areas. Carbon contracts for difference can play a role as well. CEF Transport, InvestEU and other funds are key to support charging points. The new MFF proposes the goal of installing one million charging points, compared to 2 million public charging stations proposed earlier, the latter requiring EUR 40 billion.

<sup>93</sup> Quote from speech by Transport Commissioner Violeta Bulc at the Innotrans Opening Event, 22 September 2016. Referenced from: UITP Europe. Views of the Rail Sector. Post-2020 multiannual financial framework. (2017). See [link](#).

**Rail infrastructure** is very capital intensive and has a complex financing structure in the EU and the Member States. As the investment needs are very high (**EUR 430 billion**), investments should be very targeted and e.g. eliminating bottlenecks (especially in cross-border projects) should be prioritized. Suitable EU funding instruments (specifically for cross-border railway infrastructure) are CEF-T and CF. A **Renaissance of Rail Investment package of EUR 40 billion**, based on frontloaded Connecting Europe Facility and Cohesion Funding (Rail Windows), as proposed in the leaked working paper green recovery plan (2020)<sup>94</sup> would be an important step.

**Innovation Funding for batteries** through InvestEU combined with Just Transition and Recovery funding is important to support research and manufacturing of battery technologies, the latter requiring direct support for R&D and de-risking of private capital.

Cohesion & Recovery funds (especially grants) contributions are particularly key for support of charging and rail infrastructure given their large investment needs. The CEF-T can also play an important role in these domains, but will need to be significantly expanded, especially if it is to help deliver on ambitious plans for pan-European charging grid for cars. To ensure a sufficient share of InvestEU guarantees are available for the low-carbon transition, specific funding instruments should be set up under the EU investment package for Recharging EU. The leaked working document proposed an InvestEU-backed programme for the changeover of rolling stock<sup>95</sup>.

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<sup>94</sup> Simon, Fredric, "LEAKED: Europe's draft 'green recovery' plan". Euractive. (2020-05-20). (Accessed on 9 June 2020). See [link](#).

<sup>95</sup> Ibid.

## 5 The role of the MFF and recovery package in addressing the identified investment and financing needs

Based on this understanding of what is required for the transition in these four sectors toward a 50-55% GHG emission reduction by 2030 on the path toward 2050 carbon neutrality, we analysed each of the instruments proposed under the MFF and New Generation EU.

*Table 5 - Overview – the most important financial instruments for financing the Green Deal in the EU*

|   | Total [bn EUR 2018] | Climate share [%] and [bn EUR 2018] |                     | Who can receive funding? |         | Grants | Guarantees & loans | TA    |
|---|---------------------|-------------------------------------|---------------------|--------------------------|---------|--------|--------------------|-------|
|   |                     |                                     |                     | Public                   | Private |        |                    |       |
| Innovation Fund                               | 10                  | 100%                                | 10                  | No                       | Yes     | Yes    | 0                  | Yes   |
| Modernisation Fund                            | 16                  | 100%                                | 16                  | 0                        | 0       | 16     | 0                  | 0     |
| CEF - Energy                                  | 5.2                 | 60%                                 | 3.1                 | Yes                      | Yes     | 5.2    | Yes                | Yes   |
| CEF – Transport                               | 12.9                | 60%                                 | 7.7                 | Yes                      | Yes     | 12.9   | Yes                | Yes   |
| Just Transition                               | 40                  | 100%                                | 40                  | Yes                      | Yes     | 40     | Yes                | 0.35% |
| LIFE  | 4.8                 | 61%                                 | 2.9                 |                          |         | 4.8    |                    |       |
| CF  | 40.7                | 37%                                 | 15.1                | Yes                      | SME     | 40.7   | Yes                | Yes   |
| ERDF  | 196.9               | 30%                                 | 59.1                | Yes                      | SME     | 196.9  | Yes                | Yes   |
| Horizon Europe                                | 94.4                | 35%                                 | 33                  | Yes                      | Yes     | 94.4   | No                 | No    |
| CEF- Digital                                  | 1.8                 | 60%                                 | 1.1                 | Yes                      | Yes     | 1.8    | Yes                | Yes   |
| REACT-EU                                      | 55                  | (23%) <sup>(1)</sup>                | (12.5)              | Yes                      | Yes     | Mainly | Yes                | 0.35% |
| Recovery & Resilience Fund (grant)            | 310                 | (20%)                               | (62.1)              | Yes                      | Yes     | 310    | 250                | No    |
| Digital Europe                                | 8.2                 | (25%)                               | (2.1)               |                          |         |        |                    |       |
| (EAGF)  | 258.3               | 40%                                 | Not considered      | Yes                      | Yes     | Yes    |                    | Yes   |
| (EAFRD)                                       | 90                  | 40%                                 |                     | Yes                      | Yes     | Yes    |                    | Yes   |
| InvestEU Fund                                 | 75.2                | 30%                                 | 22,6 <sup>(2)</sup> | Publ. bank               | Yes     | No     | 75                 | 0.7   |
| Solvency instrument (EFSI)                    | 66.4                | 0%                                  | 0                   | Publ. bank               | Yes     | No     | 66.4               | 0.1   |
| Public Sector Loan Facility (Just Transition) | 1,5                 | 100%                                | 1.5 <sup>(3)</sup>  | yes                      | yes     | yes    | 10                 | yes   |
| Recovery & Resilience Fund (loan)             | 250                 | 20%                                 | 50 <sup>(4)</sup>   | Yes                      |         | No     | 250                | No    |
| Total   | 1538                |                                     | 675 <sup>(5)</sup>  |                          |         |        |                    |       |

1) For REACT-EU, as no formal climate share seems to have been defined yet in the Commission's proposal, work with the assumption of EUR 12.5 billion, in line with the calculation provided by CAN –Europe, which



proposed climate shares for the new instruments to reach 25% on aggregate (in line with the 25% budget target for climate finance).

- 2) Expected leverage of climate share: EUR 300 billion.
- 3) Expected leverage of climate share: EUR 10 billion.
- 4) 1:1 Co-financing share considered.
- 5) included leveraged financing.

The aim of our analysis has been to:

- a. Match the proposed instruments to the identified demand;
- b. Identify indispensable elements, gaps and mismatches and activities to be excluded; and
- c. Derive recommendations for strengthening the role of the MFF and the European Recovery Fund (EURF) in the transition through adjustments and re-allocation of funding to specific budget lines, instruments and EU initiatives; streamlined and compatible governance regimes to deliver the 2030/50 targets; and defining key roles (for EIB and national promotional banks, and others)

Table 5 provides an overview of the most relevant instruments as well as their key characteristics.

The financial instruments presented in the table can be grouped in many different ways. For the purpose of our analysis of their contribution to financing decarbonisation in our four sectors, we have grouped them as follows:

**1. “Dedicated Funds” targeting (partly) low-carbon investments: Innovation Fund, Modernization Fund, Just Transition Fund, Connecting Europe Facility Energy and Transport (CEF-E and -T) and LIFE**

The Innovation Fund is key for commercial scale demonstration and Just Transition Fund and Mechanism could support such investments in transition regions, as well play an important role in absorbing the social effects and labour market implications of the energy transition. CEF-Energy and CEF-Transport are important for infrastructure of European importance, including cross-border transmission and rail lines.

**2. Other MFF: Cohesion Policy (Cohesion Fund, European Rural Development Fund), CEF Digital and Horizon Europe**

The Cohesion & Recovery section of the budget is important for all four sectors, particularly due to its ability to provide grants. Horizon should play an important role for early stage innovation processes.

**3. Recovery and Resilience Facility (RRF), REACT EU and Digital Europe**

RRF and REACT EU are the large and immediately cash budgets with hardly any sectoral focus and much flexibility for MS. If used wisely, they can play an important role in financing the transition.

**4. InvestEU, RRF Loan Guarantee Facility and Solvency Support Instrument**

The most important role for InvestEU will be to take on risks in relation to Green Deal investments that the private sector alone is not yet able or willing to take, increasing the probability of crowding in private investment.

**5. Common agriculture policy (EAGF, EAFRD):**

The Common Agriculture Policy (CAP) does not and will not play a central role for the energy transition but it currently represents a large share of the funding counted against the EU-budget wide 20% “climate action” target. Experts (including most notably the European Court

of Auditors) have been highly critical of the CAP’s “climate contribution” and we excluded CAP in the analysis.

The detailed assessment of the different financial instruments and elements of the MFF and recovery package regarding their potential to help address the identified sectoral investment and financing challenges, led to the following findings.

**I. When comparing the initial investment and financing gap with the funding earmarked for climate action we end up with a large remaining investment and financing “gap”**

When assessing the financing sources coming from MFF and the recovery package we considered 13 climate-relevant facilities (all CEF facilities considered as one facility) with a total volume of EUR 1538 billion, as presented in Table 5. Each facility under the MFF has a climate-earmark (climate share). It is yet not clear if facilities under Next Generation EU will have one (we used the following shares: RRF: 20%, InvestEU: 30%, Solvency: 0% , Just Transition: 100%) and we considered only the earmarked financing volume as relevant.

It is important to note that the climate share includes financing for mitigation and adaptation measures. In our baseline-scenario (see Figure 3) we considered that the whole climate share is used to finance mitigation projects in our four sectors (buildings, industry, electricity and transport). We also assumed that the climate share will be applied also to the new instruments (RRF, REACT-EU and SSI).



**Figure 3 - Baseline scenario. Investment and financing needs, gap and sources for 2021-2027, for decarbonisation in the buildings, industry, power and transport sectors [billion EUR]. See p.28 (above) for definition of the different groups of “funds” corresponding with the different squares.**

The key insights from this analysis can be summarized as follows:

- Earmarked EU budgets and expected leveraged capital can contribute to finance about EUR 675 billion, half of it leveraged financing.

- The remaining financing and investment gap amounts to EUR 1.8 trillion (aggregated over the seven year timeframe of the next EU budget)
- This gap will need to be tackled over the coming years, in order to reach climate targets in 2030 and prepare the even more fundamental transition to a net carbon neutral world in 2050.
- But in principle, the tools for achieving this are well-established and also the MFF and Next Generation EU could be mobilised to further closing the investment gap.
  - Significant additional financing from the public (national and sub-national) and private sector can be mobilised also through the EUR 265<sup>96</sup> billion of grants considered in this study available from the EU budget.
  - The climate share of the MFF and Generation EU could be increased, in line with proposals such as that by the European Parliament
- And ultimately it is important to emphasize that no increase of the available financing for the climate transformation is a suitable substitute for improving the regulatory and institutional framework for private investment. At the end of the day, markets will need to be able to absorb the finance and investors and project developers incentivised to favour low-carbon over high-carbon and unsustainable investments. Carbon pricing, ecological tax reform, sustainable finance regulation (to mention only a sub-set) and a fair share of standards and command and control measures will be of the essence.
- Figure 4 below provides an overview, how much from the overall financing required could be financed, when MFF/Next Generation EU would be channelled to the transitional technologies. Take first the dedicated funds: they could cover 3% of the needs (EUR 80 bn out of approximately EU 2.4 trillion in total). Adding all earmarked MFF funds (excl. the CAP) on top this figure increases to 8% of needs. Then, in order to boost the transition and earmarked sources from RRF&REACT EU – you will finance 13% of needs. Finally take a walk to Luxembourg and convince EIB to finance high-leveraged climate projects: add the leveraged funding and you achieve 28% of needs.

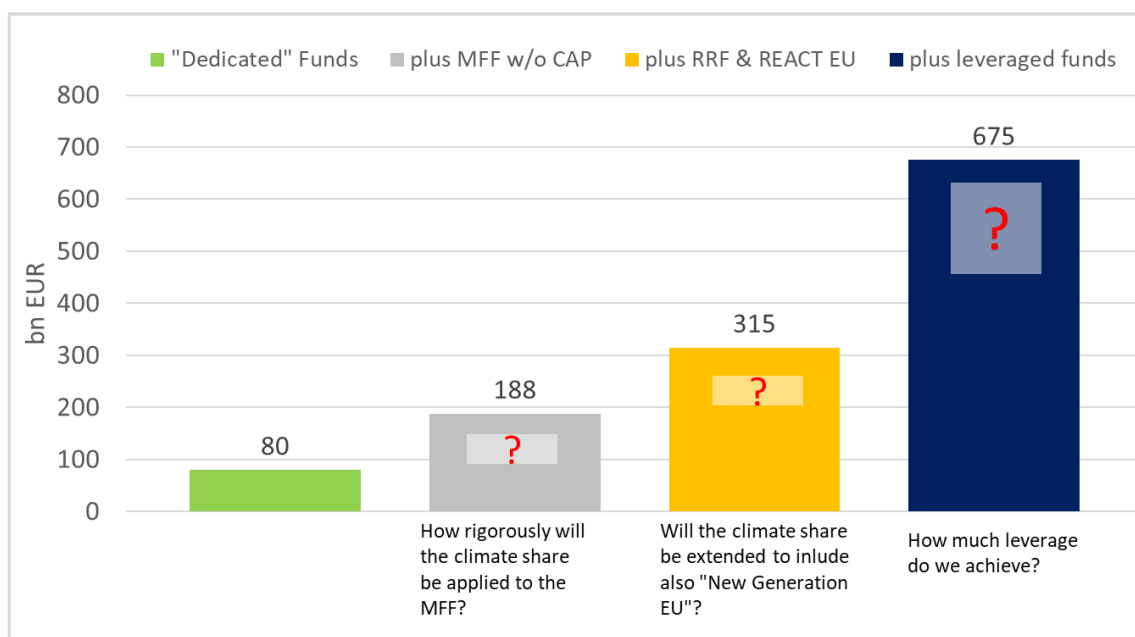
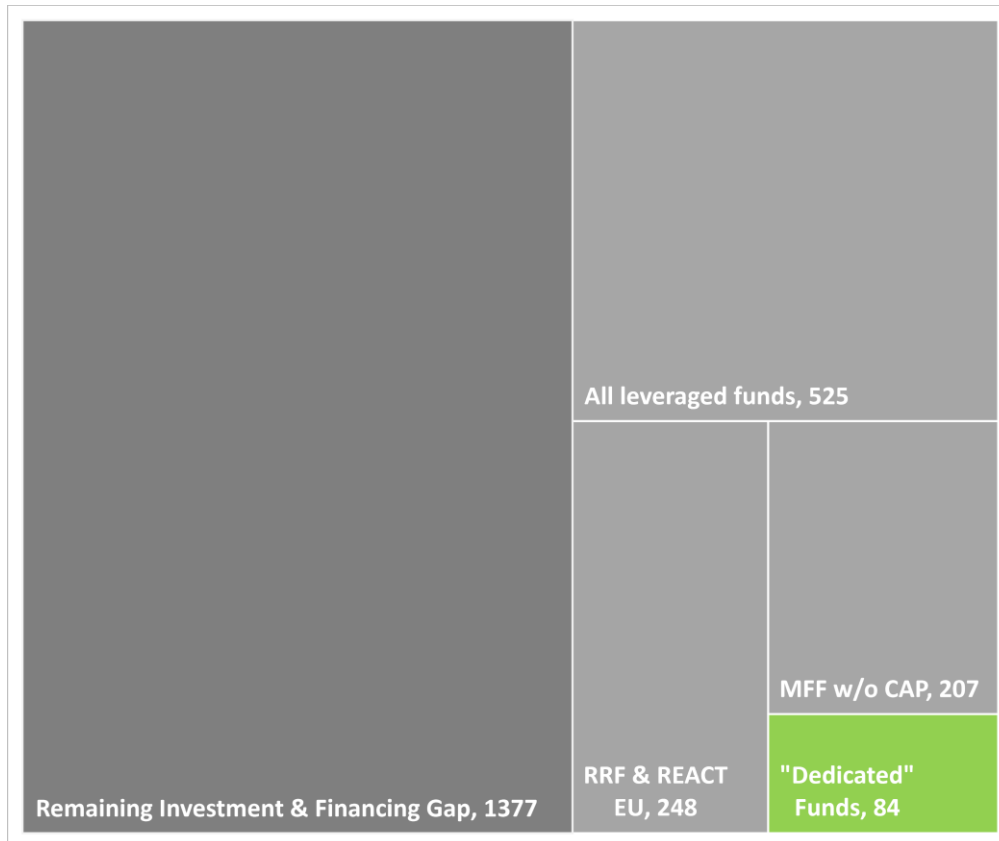


Figure 4: Uncertainties about the contribution of different budget lines to meet investment needs [bn EUR]

<sup>96</sup> We considered only the earmarked grant part of the EUR 560 billion RRF.

Figure 5 exemplifies the case if the climate share is 40%.

- The additional funding from increasing the climate share to 40% would be EUR 390 billion, most of it coming from additional leveraged funds.
- The earmarked EU budgets and expected leveraged capital would contribute to finance about EUR 1,066 billion, half of it leveraged financing.
- The remaining financing and investment gap amounts would reduce to EUR 1.4 trillion (aggregated over the seven-year timeframe of the next EU budget)

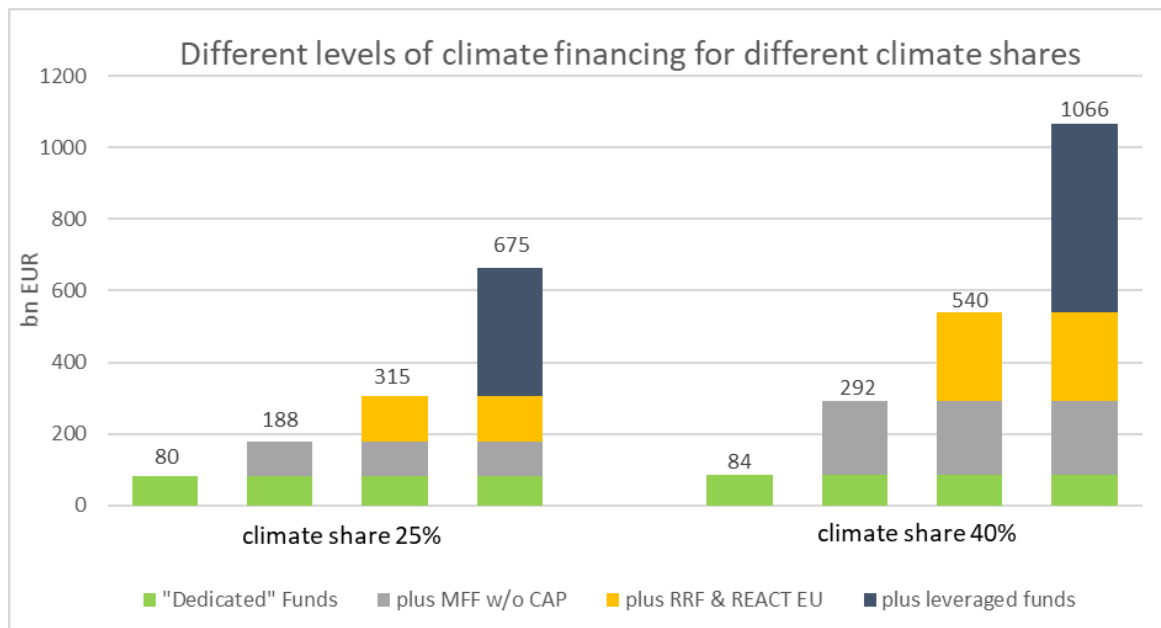


**Figure 5:** 40% Climate Share Scenario: Investment and financing needs, gap and sources for 2021-2027, for decarbonisation in the buildings, industry, power and transport sectors [billion EUR].

But turning back to the current MFF and recovery proposal, to appreciate the importance of increasing its climate share, two considerations beyond the sheer size of the remaining financing and investment gap are of key importance:

1. The climate share is not limited to climate change mitigation, but is targeting climate action more broadly, including also adaptation to climate change. Without taking any particular stance on the allocation to these two important objectives, the funding available for the key decarbonisation initiatives could be significantly less than shown in Figure 3 and 5.
2. We had to rely mostly on estimates (by the European Commission) of an investment gap resulting from the EU's current climate and energy targets for 2030, not the likely future climate target of 50-55%. Considering the upward sloping nature of abatement cost curves, this could imply a significant underestimation of investment needs.

Figure 5 and Figure 6 illustrate the effect of applying a higher climate share to all relevant instruments.



**Figure 6:** Cumulative contribution of different groups of EU Instruments to sectoral climate funding under the three different ambition levels for the climate share.

Having established the order of magnitude of the challenge and the potential effect of an increased climate share in addressing it, we need to discuss what this means for and how we could allocate the funds to the four sectors; appreciate the role of different types of financing and what that implies for the remaining investment and financing needs; and discuss the allocation of funds at EU or national/local level.

## II. The allocation of the funding to different sectors

We have allocated the funding of all 13 considered facilities (Table 5) in three stages:

- 1) Where possible (Innovation Fund, Modernization Fund, CEF) we allocated the climate share to the four sectors electricity, industry, building and transport.
- 2) For the financial facilities with a clearly defined funding target for any of our four sectors (such as the innovation fund for industry or CEF-Transport for transport, for example), we allocated the funds or their climate share directly and fully to the corresponding sectors. For all other relevant facilities/funds identified above (see grouping of facilities/funds discussed above), we allocated their climate share according to the relative financing and investment gap identified by the European Commission (and other relevant literature and analysis), unless one or several of our sectors do not fall under the scope of the instrument (for example we did not allocate funds from the public loan facility to basic materials industry).
- 3) The allocation based on relative investment needs can be explained using the building sector as an example. The buildings sector has an overall gap (or additional investment and financing need above the BAU scenario) of EUR 1,295 billion, which is 53% of the total (i.e. the sum of gaps in the buildings, industry, power and transport sectors). This percentage was used to allocate grants and the leveraged investment volumes derived from the guarantee and loan instruments.

Table 6 provides an overview on the key findings, which can be summarized as follows:

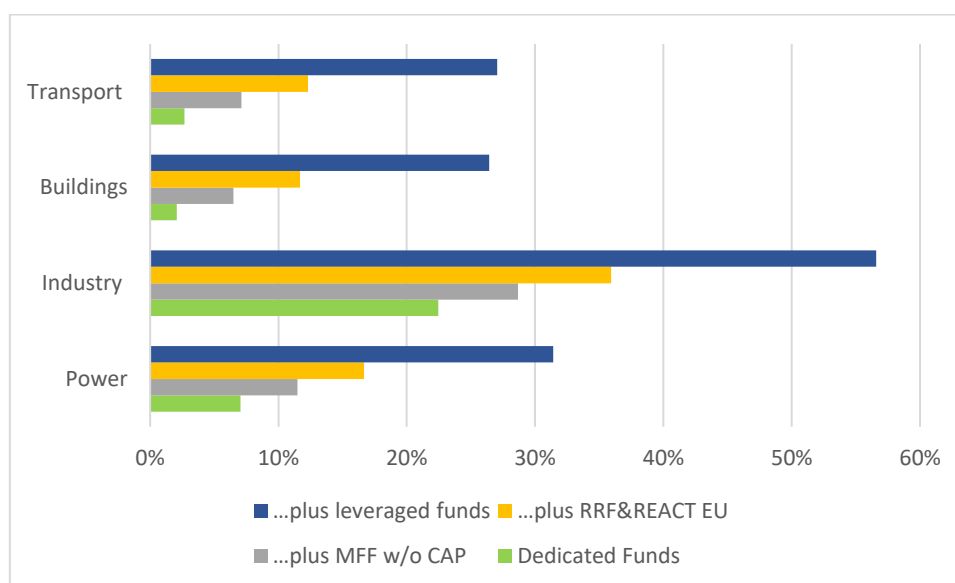
- All four sectors considered in the analysis still face remaining finance and investment gaps, with the building and transport sectors showing the largest gap (in line with being the sectors with the highest initial gap or investment need). Dedicated financing flagships could play a particularly important role for financing the required investments in these sectors (see below).
- Unsurprisingly, it is the leveraged funding that addresses a large share of the investment needs. We used leverage factors from the proposed regulation, e.g. for InvestEU a factor of 13 and for Solvency of 11. If leverage factors do not materialize, there is a risk that the remaining investment and financing gap will even increase further.

**Table 6 - Investment and financing needs, and illustrative scenarios for gap and sources for 2021-2027, for decarbonisation in the buildings, industry, power and transport sectors [billion EUR].**

|              | Initial investment & financing Gap | Dedicated Funds | MFF w/o CAP | RRF & REACT EU | Leveraged funds | Total funding | Remaining investment & financing Gap |
|--------------|------------------------------------|-----------------|-------------|----------------|-----------------|---------------|--------------------------------------|
| Power        | 210                                | 15              | 9           | 11             | 31              | 66            | 144                                  |
| Industry     | 98                                 | 16              | 4           | 5              | 14              | 40            | 58                                   |
| Buildings    | 1295                               | 27              | 57          | 67             | 191             | 342           | 953                                  |
| Transport    | 840                                | 23              | 37          | 44             | 124             | 227           | 613                                  |
| <b>Total</b> | <b>2443</b>                        | <b>80</b>       | <b>108</b>  | <b>127</b>     | <b>360</b>      | <b>675</b>    | <b>1768</b>                          |

Notes: See Figure 1.

Remark: Numbers are designed to be illustrative, as an optimal tailoring of the proposed EU financing instruments to the financing needs in the individual sectors covered in this report lies beyond the scope of this report.



**Figure 7 - Cumulative contribution of different groups of EU Instruments to sectoral climate funding [% of investment and financing need]**

Against the backdrop of the identified financing gaps and our analysis of the specific sectoral challenges, we are proposing a set of dedicated EU-level instruments.

## Creating Central Flagship Initiatives

### Building Sector

- A **European Renovation Financing Facility** to double-boost the renovation wave and employment.
- To address the remaining investment & financing gap in the building sector (EUR 885 billion for 2021-2027) EIB's should put energy efficiency financing on the top of its priorities and set up the European Renovation and Financing Facility, as proposed in the leaked working paper green recovery plan (2020)<sup>97</sup>. COM estimates total costs for grants [EUR 25 billion per year] and guarantees [EUR 65 billion per year] and resulting investments of EUR 350 billion.
- For this sector it will be important to have sufficient access to blended financing instruments (such as grants and loans), ideally in a dedicated facility that is targeting the renovation wave, highlighted in the Commission's Green Deal.
- In order to mobilize additional (private) funding, EIB could convert the facility into a fund for (private) investors. Guarantees could be used to arrange a waterfall structure, e.g. using public money for high-risk first-loss shares and offering private investors less-risky and mezzanine shares.

### Industry Sector

- A considerable smaller investment and finance gap is revealed in industry (EUR 53 billion between 2021-2027).
- **Promoting the European Clean Hydrogen Alliance** (already announced in European Industry Strategy, suggested in the Dual-Benefit Stimulus by Agora Energiewende<sup>98</sup>). Green hydrogen is the key cross-cutting technology and needs to become economically viable since it allows decarbonizing processes that are otherwise difficult to decarbonize. Since new technologies (such as hydrogen or other low-carbon technologies related to ammonia, cement, plastics, steel) imply risks for the investor due to significant CAPEX commitments, more grants must be made available – such as under the Innovation Fund (or Horizon and InvestEU).
- Timeframe: Given that industrial plants have a lifetime of 20-50 years, policy measures must be implemented very soon (e.g. the leaked working paper green recovery plan<sup>99</sup> states that the Innovation Fund should provide the remaining 40% of co-financing within the next 2 years – even though the Innovation Fund already covers up to 60% of capex).

### Electricity Sector

- The power sector reveals a remaining investment & financing gap of EUR 133 billion.
- In this respect the Commission services (leaked working paper green recovery plan<sup>100</sup>) proposed to set up a **Green Infrastructure Fund for Renewables and Hydrogen**. The Fund should be administrated by the EIB and receive EUR 10 billion annually (two years) mainly to use to finance loans with a medium to high leverage factor for electricity grid related investments and a lower factor for other categories. If EIB uses the two-year grant as a guarantee and assuming the EIB leverage factor of 13, that initiative could contribute to mobilizing EUR 260 billion.
- The Commission services also recommended accompanying the Green Infrastructure Fund with an EU Tendering scheme of “15 GW renewable energy electricity” in two years [total investment needs in a range of EUR 25 billion] and a supporting national initiative (supporting

<sup>97</sup> Simon, Fredric, “LEAKED: Europe’s draft ‘green recovery’ plan”. Euractive. (2020-05-20). (Accessed on 9 June 2020). See [link](#).

<sup>98</sup> Agora Energiewende, Agora Verkehrswende. Dual Benefit Stimulus for Germany – A Proposal for a Targeted 100 Billion Euro Growth and Investment Initiative. (2020). See [link](#).

<sup>99</sup> Simon, Fredric, “LEAKED: Europe’s draft ‘green recovery’ plan”. Euractive. (2020-05-20). (Accessed on 9 June 2020). See [link](#).

<sup>100</sup> Ibid.

national instruments). The EU tendering scheme could be implemented via the Renewable Energy Financing Mechanism under the Governance Regulation, while in the case of national instruments the EU would likely blend national financing for national support schemes with EU financing.

### **Transport Sector**

- To address the uncovered finance needs in the transport sector (EUR 568 billion), low-carbon vehicles and infrastructure need to be supported. In this respect the Commission services (leaked working paper green recovery plan (2020)<sup>101</sup> proposed to set up an EU investment package for Recharging EU, supporting two million public charging stations by 2025. As discussed in Agora's report<sup>102</sup>, specifically charging infrastructure in rural or remote areas should be supported (E-mobility for all of EU: **A fund supporting low-carbon transport infrastructure** (charging stations for electric vehicles) specifically for rural or remote areas under EAFRD or ERDF).
- The leaked working paper further calls for **rail investment package** (EUR 40 billion) through frontloaded CEF and CF rail windows and increased co-financing. Financing through InvestEU should also be made available to change the rolling stock where necessary<sup>103</sup>. Our analysis shows that targeted funds to remove bottlenecks for rail infrastructure (e.g. in border regions) is particularly effective.
- Innovation funding and de-risking of private investments should boost a **European Battery Alliance**: Build an EU battery industry through innovation funding combined with Just Transition and Recovery funding [as part of the structural change in former high-carbon regions].

### **III. Types of financing**

We have divided the funding into:

- Grant (or flexible) funding: from cohesion policy, innovation and infrastructure (CEF) instruments on one hand; and
- Funding for guarantee and loan facilities oriented at leveraging: (mostly private) investment (InvestEU, Solvency Support instrument, the loan component of the RRF and the Public sector loan facility under Just transition).

As discussed in the sector chapter, the role of different instruments (grants, loans, equity) is different between sectors, as is their leverage ratio, depending among other things on:

- The role of the private and public sector (example: rural electrification infrastructure equals high share of co-financing by public sector compared to urban; public building stock vs. private buildings)
- How close to commercially viability is the technology?
- The abatement cost or cost difference between conventional and low-carbon technologies?

We have used the suggested leverage factors by the EIB across the board, for all sectors. But these do in fact vary across sectors.

From our analysis of the four sectors, we have the impression that the transformation of industry to climate-neutrality and the establishment of a clean hydrogen economy are not going to happen

<sup>101</sup> Simon, Fredric, "LEAKED: Europe's draft 'green recovery' plan". Euractive. (2020-05-20). (Accessed on 9 June 2020). See [link](#).

<sup>102</sup> Agora Energiewende, Agora Verkehrswende. Dual Benefit Stimulus for Germany – A Proposal for a Targeted 100 Billion Euro Growth and Investment Initiative. (2020). See [link](#).

<sup>103</sup> Ibid.



without significant grant money, as the required carbon prices to make these investments viable, is significantly higher than current carbon price levels, even under intelligent policy instruments like carbon contracts for difference. This could however change if carbon prices increase (for example through another reform of the EU-ETS combined with robust carbon leakage mechanisms to address international competition).

One example by Richstein (2017 and 2019)<sup>104</sup> illustrates well how different financing instruments and other policies interact to determine the grant required to make break-through investments in basic materials industry feasible. A carbon contract for difference with a contract price of, for example, EUR 50/ton CO<sub>2</sub>, would reduce the necessary public co-funding from around 24% to around 14% of the investment cost. In this calculation, volume and technology risks are not considered, but these risks are also further mitigated by a combination of up-front innovation funding (for example provided by the Innovation Fund) and a carbon contract for difference.

Also, the public building stock (i.e. owned or operated by a central, regional, local governing body)<sup>105</sup> requires public funding, as does low-carbon transport infrastructure, particularly in rural areas.

For private buildings attractive loans (including, like in the case of KfW in Germany, concessionary rates, grant elements and long maturities) are crucial. While most money in the building sector comes from private sources (e.g. in Germany in 2016, EUR 31.6 billion out of EUR 35.1 billion climate-specific investments in the building sector came from public sources<sup>106</sup>, public funding is involved in many projects (e.g. Germany, 2016, for residential constructions, KfW loans were involved in roughly 60% of the cases). This, combined with a corresponding EU facility, could make all the difference. A similar EU level facility for renewable energy generation would operate largely without any grant element. As a result, a higher leverage factor may apply in these sectors (electricity and building).

### **How do different instruments and actors contribute to filling the remaining gap?**

**Blending public with other sources.** We propose that MFF financing is blended with other public and private sources. One example presented in the leaked working paper green recovery plan (2020)<sup>107</sup> is the proposal of the COM to support national renewable energy tendering schemes. If a MS intends to tender a certain amount of capacity within the next two years, the EU could match the national tender one by one. Another example is the Public Sector Loan facility under the Just Transition Mechanism. Here, MFF-grant financing is used to subsidize interest rates (or provide a redemption grant) of a EUR 10 billion EIB-concessional loan. The European Commission expects that this structure will contribute to raise EUR 25-30 billion investment in relevant sectors. Concessional loans are especially relevant to close the gap in the building sector, both private house-owners and industry. Beyond the direct mobilisation of commercial capital in a transaction, the ambition of blended finance is to be catalytic, i.e. to spur the replication of similar projects via demonstration and build functioning markets that can result in larger volumes of commercial capital for development.

**Use guarantee mechanism to leverage private capital.** We also propose to use MFF grants to finance first-loss elements from guarantee mechanism in order leverage private capital. The European

<sup>104</sup> Richstein, J. C., and Neuhoff, K. CO<sub>2</sub>-Differenzverträge für innovative Klimalösungen in der Industrie, DIW aktuell, No. 23, Deutsches Institut für Wirtschaftsforschung (DIW), Berlin. (2019). See [link](#);

Richstein, J. Project-Based Carbon Contracts: A Way to Finance Innovative Low-Carbon Investments. DIW Discussion Paper 1714. (2017). See [link](#).

<sup>105</sup> EEFIG. Energy Efficiency – the first fuel for the EU Economy - How to drive new finance for energy efficiency investments. (2015). See [link](#) - Section 2.2.1.

<sup>106</sup> Novikova, A. et al. Climate and energy investment map of Germany. Status Report 2016. Institut für Klimaschutz, Energie und Mobilität (IKEM). (2019). See [link](#).

<sup>107</sup> Simon, Fredric, "LEAKED: Europe's draft 'green recovery' plan". Euractive. (2020-05-20). (Accessed on 9 June 2020). See [link](#).

Commission expects that a paid-in grant to cover expected losses with a target volume of EUR 75.2 billion will mobilise more than EUR 1,000 billion (leverage effect: 13,3<sup>108</sup>). We consider this mechanism important to enable national promotional banks to provide financing for the building sector, energy (transmission), quasi-equity in the transport sector (sharing stations), industry (new technologies like hydrogen). If EIB would set-up a dedicated fund (using guarantee to cover first-loss shares) EIB could even mobilize additional private investors for that fund. The German Ministry of Environment set up such a waterfall structure in the Global Climate Partnership Fund (GCPF) and mobilized additional funding from public and private sources<sup>109</sup>.

**Implement the flagship initiatives** described above. These dedicated initiative for the building-, power-, industry and transport sectors are core elements to achieve 2030 / 2050 climate targets.

**Harmonize, coordinate and integrate** green public sources from MS, federal Ministries, federal states, municipalities and the private sector in order to jointly tackle the investment challenge.

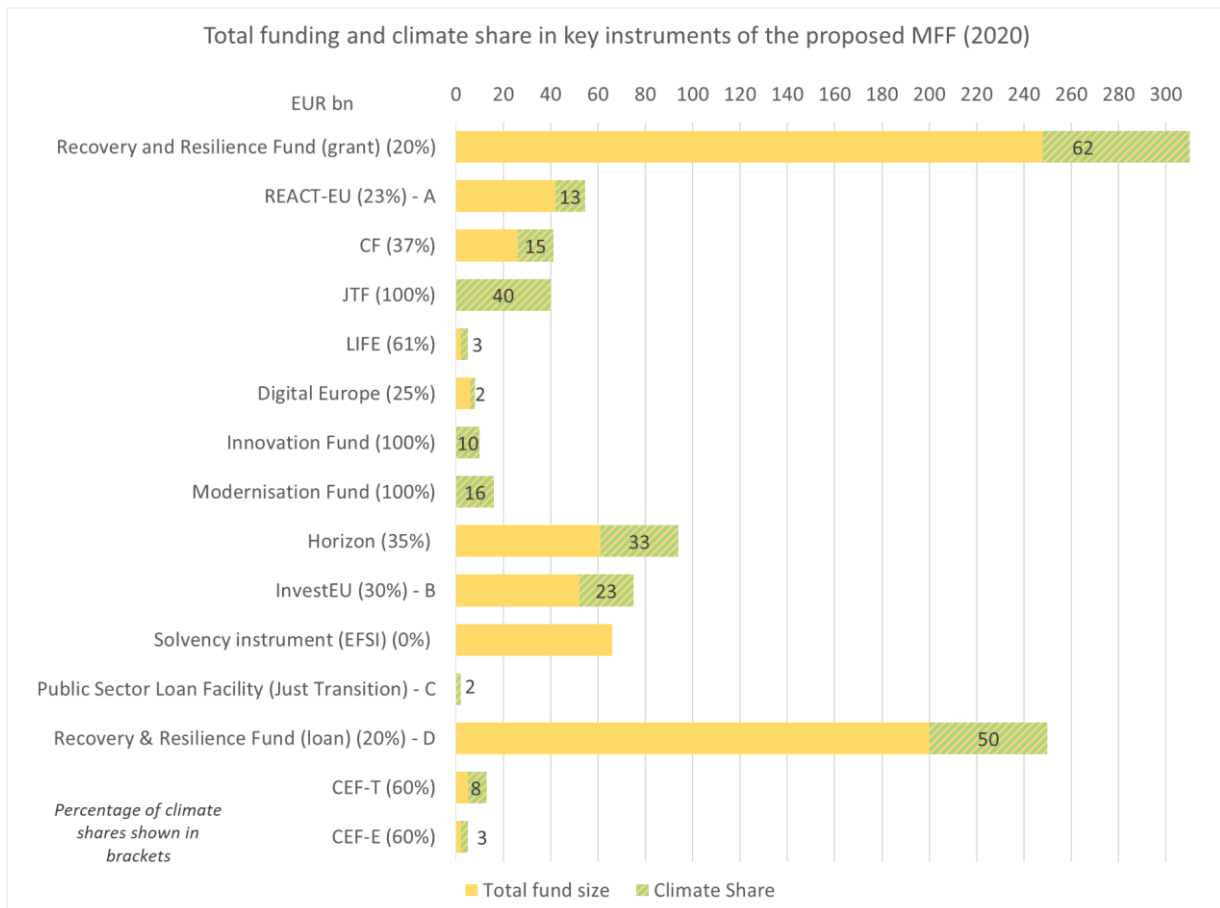
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<sup>108</sup> Proposal for a Regulation of the European Parliament and the Council establishing the InvestEU Programme, p. 32.

<sup>109</sup> Global Climate Partnership Fund. Mitigating climate change together. (Accessed on 14 June 20). See [link](#).

## 6 Mainstreaming & Earmarking – the climate share of the MFF

As becomes clear from the analysis and findings above, the earmarking of a minimum share of the EU budget is important for closing the investment gap identified by the European Commission and the range of relevant additional analysis and literature we identified and used for our analysis.



1) For REACT-EU, as no formal climate share seems to have been defined yet in the Commission's proposal, work with the assumption of EUR 12.5 billion, in line with the calculation provided by CAN –Europe, which proposed climate shares for the new instruments to reach 25% on aggregate (in line with the 25% budget target for climate finance). 2) Expected leverage of climate share: EUR 300 billion. 3) Expected leverage of climate share: EUR 10 billion. 4) 1:1 Co-financing share considered.

**Figure 8:** Total funding and climate share of key instruments of the proposed MFF (2020). See Table 5 for further information

The climate mainstreaming share of the different funds remains a key point for discussion from mainly three perspectives:

### 1. How meaningful is the European Commission's climate mainstreaming approach?

The climate tracking method has been harshly (and rightly so) criticised for not being able to measure and track the actual contribution of the budget to climate action. What is more, it has not and will not differentiate between climate change mitigation on the one hand and adaptation and enhanced resilience on the other hand, despite their entirely separate normative motivations and contributions to two important but distinct policy objectives. Which leads us directly to the next point on our list:

## 2. Is it allocated to the right funds?

Not quite. Regarding the Common Agriculture Policy (CAP), experts (including most notably the European Court of Auditors) have been highly critical of the CAP's "climate contribution" in the current budget. While both, the European Agricultural Guarantee Fund (EAGF) and the European Agricultural Fund for Rural Development (EAFRD) have a tremendous potential to contribute to central EU environmental objectives, it is inherently difficult to measure net greenhouse gas emission reductions from most of the activities currently counted against the CAP's climate share.

While this "climate" share was determined for the funds included in the 2018 MFF, it has not yet been set for the newly proposed instruments (namely the RRF and REACT-EU). For the Solvency Support Instrument, it has even been set at zero.

## 3. Is it enough?

While a unequivocal answer to this question is certainly difficult to determine in detail, also due to the competing policy objectives pursued by the MFF, the discussion in the previous chapter illustrated the fact that the investment gap in relation to the 2030 and 2050 climate targets is far from being covered by this budget proposal. To appreciate the importance of increasing the climate share, two considerations, amongst others, stand out:

- a. The climate share is not limited to climate change mitigation, but is targeting climate action more broadly, including also adaptation to climate change. Without taking any particular stance on the allocation to these two important objectives, the funding available for the key decarbonisation initiatives could be significantly less than shown in Figure 3.
- b. We had to rely mostly on estimates (by the European Commission) of an investment gap resulting from an emission scenario lower than 50-55% in 2030. This leads to an underestimation of the investment needs, which could be substantially more than the numerical difference in emission reduction targets, considering the upward sloping nature of abatement cost curves.

This not only raises the issue of whether a bigger budget (yes, certainly, considering the risks to European integration and the ever growing responsibilities of the European Commission and importance of coordinated EU action) or a higher climate share (certainly yes, as in the second decade of the 21<sup>st</sup> century the tremendous and existential challenge of successfully tackling climate change does not leave much space for trading off short term conventional growth against long-term prosperity) are required. But considering the likely constraints at least on the overall size of the budget, a thorough, frank and evidence based discussion of where to focus the climate share of the budget and how to maximise the likelihood of an effective contribution of this share of the budget to actual long-term decarbonisation, are of a similarly high concern.

### Our recommendations:

- Reiterating our concerns regarding the high remaining investment and financing needs, we strongly recommend **increasing the climate share of the EU budget** to a share of at least 30%, better 40%
- **Apply the climate share consistently to all elements of the MFF and "Generation EU"** proposal, including the Recovery and Resilience Facility, REACT-EU, the Solvency Support Instrument and Digital Europe. As for the allocation to the MFF, no uniform rate needs to apply. Where more flexibility (and hence a lower climate share) is warranted, as maybe the

case for the SSI, the lower share can be compensated by a higher share elsewhere, as long as the overall ambition level is not diluted.

- **Reach the core climate share with a smaller role for Common agriculture policy (EAGF, EAFRD):** The CAP does not and will not play a central role for the energy transition beyond a (limited) role of sustainable biomass. Yet, it currently represents a large share of the funding counted against the EU-budget wide 25% “climate action” target. We recommend a differentiation of the climate share into a “tangible” target (of at least 30-40%), which is easy to track and an additional target for activities such as agri-environmental measures, which have significant positive externalities but their net greenhouse gas emission reduction is difficult to establish. For the CAP, this would mean a differentiation into financing of sustainable biomass (which is counted against the tangible 30-40% climate share) and other activities (such as agri-environmental measures) counted against the additional target.
- **Revise the climate tacking methodology,** aligning it with the EU taxonomy, building on expert recommendations. To strengthen the methodology and its credibility, set up a technical expert group including but not limited to experts from the European Court of Auditors, OECD, and the research community with a proven track record on climate tracking.

## 7 Governance

To ensure that European Green Deal priorities are respected in the implementation of Next Generation EU, the Commission proposes to make some of the funding subject to certain conditions, all of which are currently only loosely defined.

Table VI-a (Annex IV) summarizes our screening of all EU facilities, presents the climate share and states whether a link to the Green Deal is established in the recent amendments. It also specifies whether a connection to the climate target, the European semester or the EU Taxonomy exist and whether specific exclusion criteria are mentioned.

While many references to the Green Deal or climate targets exist in various documents, most do not go far enough, are lacking details or remain extremely vague. One example are the references made to the EU sustainable finance Taxonomy, which is intended to ‘guide investments’. The Taxonomy is referenced in the draft InvestEU regulation as **A**) a framework for monitoring how InvestEU funds contribute to meeting climate targets (recital 10), and **B**) a basis for investment guidelines (recital 12). The InvestEU regulation is expected to enter into force on 1 January 2021. Given that investment supported by the InvestEU guarantee will have to have been screened for sustainability in 2020, it is unclear how the EU Taxonomy criteria will be applied prior to its entry into force.<sup>110</sup>

We make the following recommendations for changes and specifying these details:

### **Establish clear links between different programmes and climate targets, national energy and climate plans (NECPs) and the Green Deal**

- The RRF must clearly define “green” and build relation to the National Energy and Climate Plans and the European Semester (as a well-established governance cycle);
- For REACT-EU: Currently no “green conditions” apply; therefore, the important thematic concentration on ‘shift to the low carbon economy’ needs to be re-introduced (as it has been relaxed through the new Art. 11a);
- For cohesion policy (CF and ERDF), the thematic concentration on policy objective (PO) “smart growth”<sup>111</sup> appears very high, with a minimum of 60% for the high-income group of countries, discriminating unnecessarily against PO 2 (green growth)<sup>112</sup>;
- Horizon should play an important role for early stage innovation processes but its climate share needs to be clarified (EUR 33 billion climate share vs. EUR 15 billion for cluster ‘Climate, Energy and Mobility’ – the scope of the latter is not clearly defined);
- InvestEU is key for facilitating investments through the EIB for financing large, capital intensive investments. The strategic European investment policy window and the sustainable infrastructure window of InvestEU are able to do this but need to be orientated toward Green Deal objectives.

<sup>110</sup> A second example includes the Commission’s Communication mentioning the upcoming Renovation Wave in relation to the sustainable infrastructure window in InvestEU and the Recovery and Resilience Facility (among others) with regards to other funds. It remains extremely vague on details.

<sup>111</sup> PO1: “a smarter Europe by promoting innovative and smart economic transformation”;

<sup>112</sup> PO2: “a greener, low-carbon Europe by promoting clean and fair energy transition, green and blue investment, the circular economy, climate adaptation and risk prevention and management”

## The EU Taxonomy: not all that glimmers is green – setting robust “greening criteria”

The EU Taxonomy<sup>113</sup> is a classification scheme for sustainable activities that can make a “substantial contribution to climate change mitigation”. Currently, the catalogue consists of 70 economic activities including technical screening criteria and conditions ensuring that each activity “does no significant harm” (i.e. similar to exclusion criteria) and makes the EU Taxonomy a promising tool to monitor the set climate share.

- **“Taxonomy quick check” to qualify as green investment.** Currently, insufficient company reporting complicates the application of the EU Taxonomy. Therefore, a “quick check” must ensure EU Taxonomy compliance. Beneficiaries of the EU recovery package must be obliged to disclose required information (to evaluate screening criteria).
- **Use other criteria for buildings [and industry].** Following the discussion in *Annex III: EU Taxonomy – strict greening criteria for climate share of MFF and RRF*, the current building sector criteria could create absurd incentives favouring relatively inefficient buildings. [The EU-ETS benchmarks of the industry sector do not necessarily comply with carbon-neutrality by 2050 – in particular against the background of long lifetimes of industrial plants].
- **Incorporate the Taxonomy into the EIB’s DNA.** Financing climate neutrality should become the EIB’s strategic goal. A climate share (monitored by the EU Taxonomy) should apply to all instruments.
  - E.g. apply the EU Taxonomy in the sustainable infrastructure window and make green transition plans mandatory; cross-reference and strengthen this in the delegated acts *for sustainability proofing and climate action tracking*.
  - For InvestEU’s sustainable infrastructure window, KfW’s taxonomy-linked SME-financing facility could provide best practises (a program offering concessional loans with repayment grants for up to 100% of the eligible investment<sup>114</sup>)
- **Carbon-intensive companies must establish transition plans** if they want to receive public funding such as grants or loans. By no means can this funding be qualified as a green investment.
- **Companies that do not fall under the Taxonomy (yet) should “do no harm”.** Since the EU Taxonomy only covers carbon-intensive sectors, most economic activities cannot be evaluated. Beneficiaries of grant money should demonstrate compliance with a list of exclusion criteria (see next paragraph).

### Do no harm: Set strict exclusion criteria, especially for fossil-fuel technologies, as a backstop

Direct and indirect fossil-fuel financing is still possible under certain frameworks of the proposed MFF and Next Generation EU, including all cohesion policy instruments (Cohesion Fund, ERDF and REACT-EU), where natural gas for district heating is still allowed, raising potential lock-in risks. A clearly defined list of exclusions (i.e. economic activities that are not aligned with carbon-neutrality by 2050 or, even worse, generate lock-in risks) must be established to prevent these effects.

We can differentiate between general, cross-cutting do-no-harm criteria and minimum safeguards on one hand and explicit, more sector-orientated exclusions lists.

For cross-cutting criteria, the following elements should be considered as a starting point:

<sup>113</sup> EU Technical Expert Group on Sustainable Finance. Final report of the Technical Expert Group on Sustainable Finance. (2020). See [link](#).

<sup>114</sup> KfW. Climate Protection Initiative for SMEs. (Accessed on 16 June 2020). See [link](#).

- Make compliance with minimum social and environmental safeguards compulsory across the MFF and all funding windows under InvestEU. Replace clauses like “Companies targeted by funds, special purpose vehicles or investment platforms shall be encouraged to comply, to the extent possible, with minimum high-level social and environmental safeguards in line with guidance provided by the Steering Board” [Solvency Support Window, Annex II, Section 6, point (d)].
- The *do no harm* criteria of the EU Taxonomy<sup>115</sup> should be applied once the EU Taxonomy is adopted in Q4/2021.
- The EIB’s energy lending policy<sup>116</sup> can guide investments and defines criteria for energy projects to be consistent with the EIB’s objectives.
- The draft EU Ecolabel criteria contain a list of exclusion criteria, stating that “investment portfolio shall not contain equities or corporate bonds issued by companies that derive more than 5% of their revenue from the excluded activities” (p.49). The list of exclusions cover agriculture, forestry, energy, waste management, manufacturing and transport (as transitional exclusions)<sup>117</sup>.
- EU Taxonomy exclusion (Art 14 of the regulation)<sup>118</sup>.

In the context of the Green Deal, the do no harm principles particularly applies to the need to avoid investments that would lock Member States into fossil fuels across all relevant sectors:

- **Buildings:** Even though no facility under the MFF or Next Generation EU explicitly targets the building sector, investments into energy efficiency should “do no harm” and avoid lock-in effects and exclude financing fossil-fuel based heating appliances (e.g. oil, coal and non-hybrid gas boilers).
- **Industry:** As there is a high risk of lock-in for industrial assets, given a lifetime of 20-50 years, investments should ensure the following, among others:<sup>119</sup> no support for electricity-intensive processes *without* a credible plan to green power sources by 2030; no support for using coal, heavy fuel-oil, or new non-biofuel/recycled petrochemical feedstock (unless a clear plan to transition exist in the short-term); no support for fossil gas as a fuel or feedstock risking a lock-in (i.e. only if fossil gas emissions are mitigated through Carbon Capture and Storage (CCS) or can subsequently be avoided through hydrogen or other alternatives at no or minimal conversion cost); no support for any industrial investment into a technology with emissions above the relevant EU ETS benchmark (see EU Taxonomy for sustainable activities); CCS capture rates must be significantly >50% (*threshold is open for discussion*); investments should demonstrate compatibility with the EU’s Long-Term Strategy for Climate Neutrality to avoid lock-in effects.
- **Electricity:** The funds should clearly specify what constitutes a “low-carbon” electricity source to avoid funding being directed into fossil fuel investments.

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<sup>115</sup> The do no harm criteria are defined for all activities currently listed by the Technical Expert Group. See the Technical Annex of the Taxonomy Report. See [link](#).

<sup>116</sup> EIB. EIB energy lending policy – Supporting the energy transformation. (2019). See [link](#).

<sup>117</sup> JRC. Development of EU Ecolabel criteria for retail financial products. Technical Report 2.0: Draft proposal for the product scope and criteria. (2019). See [link](#).

<sup>118</sup> COM(2018) 353 final. Regulation of the European Parliament and of the Council on the establishment of a framework to facilitate sustainable investment. See [link](#).

<sup>119</sup> We thank Oliver Sartor (Agora Energiewende) for providing this list of potential exclusion criteria.



- **Transport:** The current proposal is missing clear definitions of “sustainable transport”. Further it is important that fossil-fuel related transport spending is excluded under the new MFF.

To operationalize the principle of *do no harm*, it will be key to include all fossil investment activities, including fossil gas, into the exclusion list applying to InvestEU in order to align it with the EIB energy lending policy<sup>120</sup> adopted in November 2019. Furthermore, any additional exclusions with regards to the EIB’s ongoing alignment of its lending practices with the Paris Agreement expected by the end of the year should be speedily implemented. Furthermore, the Commission and Member States should take all necessary measures to mainstream these exclusions throughout the entire EU budget and Next Generation EU fund.

To ensure full transparency over limited exceptions that may still apply, such as those applying to the transition from fossil gas to clean hydrogen and the application of CCS, these should be narrowed and made explicit<sup>121</sup>: e.g. upgrading existing gas and heating infrastructure to accommodate a decarbonized energy supply, industrial installations that can be transitioned to green hydrogen and CCS applied to steam methane reforming with fossil gas to produce blue hydrogen.

### **Combining flexibility for Member States with the green deal objectives: Establishing a robust governance for the Recovery and Resilience & Just Transition Funds**

#### *Recovery and Resilience Plans:*

Member States shall prepare national recovery and resilience plans that set out the reform and investment agenda for the subsequent four years. These plans shall comprise measures for the implementation of reforms and public investment projects through a coherent package. The plans shall be consistent with the challenges and priorities identified in the European Semester, with the national reform programmes, the national energy and climate plans. However, no explicit link to the 2050 net-carbon neutrality target is included.

#### Recommendations:

- Develop recovery plans into “net zero transition plans”, as proposed by investors<sup>122</sup>
- Define a minimum 25% climate mainstreaming target
- Exclude fossil fuels
- Addressing climate neutrality in recovery plans is optional, hence make climate neutrality in scoring (Annex II) obligatory, as well as links of recovery plans to NECPs
- Address climate neutrality (2050 targets) in the recovery plans and include explicitly into the assessment criteria, while ensuring that digital investments cannot replace green investment. Streamline assessment criteria, in order to focus on digital and green transitions.
- It is positive that recovery and resilience plans need to be consistent with the challenges and priorities identified in the European Semester, with the national reform programmes, and the national energy and climate plans, but it will be important to clarify the exact governance mechanisms through which this consistency will be assured.
- These changes could be included in Art 16.3 of the Recovery and Resilience Facility regulation and Annex 2.2.

<sup>120</sup> EIB. EIB energy lending policy – Supporting the energy transformation. (2019). See [link](#).

<sup>121</sup> Even though energy efficiency and renewable received about 60% of the EFSI share, fossil fuels made up a quarter of the commitments. (2018 EFSI Report, Page 27, See [link](#))

<sup>122</sup> by Institutional Investors Group on Climate Change (IIGCC), Principles for Responsible Investment (PRI) and CDP

### *Territorial Just Transition Plans:*

All investments under the Just Transition Mechanism, including the public sector loan facility, will need to be implemented based on territorial just transition plans. Member States will prepare their territorial Just Transition plans taking into account the Commission's analysis in the 2020 European Semester exercise and providing an outline of the transition process until 2030. The plans need to be consistent with the National Energy and Climate Plans and the transition to a climate-neutral economy. The territorial just transition plans will identify the most affected territories that should be supported in each Member State and the priority policy areas for each region.<sup>123</sup>

### **Recommendations:**

- Harmonize Territorial Just Transition Plans with other relevant plans (e.g. recovery and resilience plans, NECPs).
- Territorial Just Transition Plans are crucial and need to be kept specific.
- All funding provided under these instruments should be aligned with the EIB energy lending policy.
- MS need to explain in their Territorial Just Transition Plans how to transition to climate neutrality. This is the good news, however, most of the fund is earmarked for only three countries (Poland, Germany, and Romania), absorbing approximately half of the funds.
- A very positive note is the exclusion of investment related to the production, processing, distribution, storage or combustion of fossil fuels.

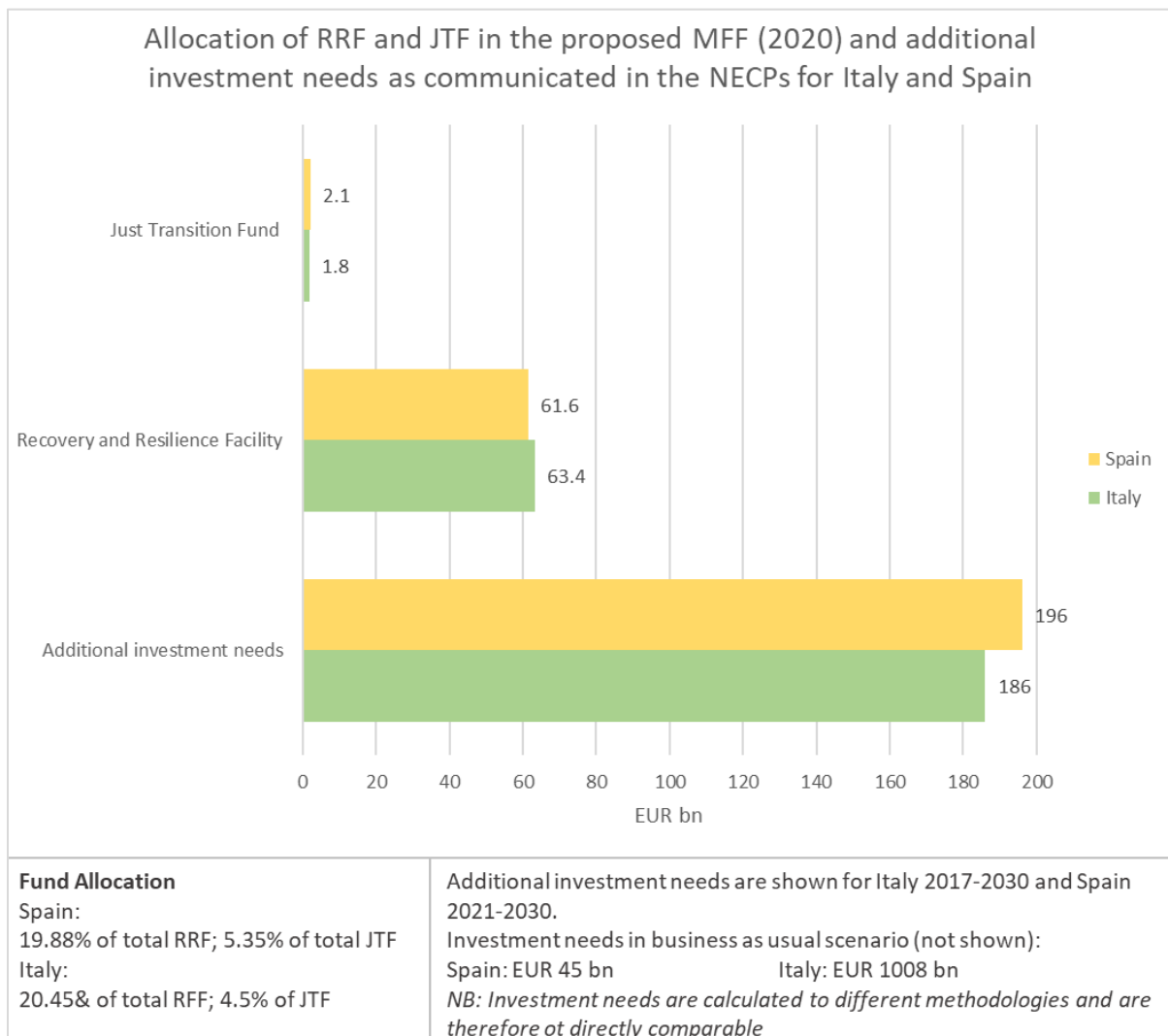
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<sup>123</sup> European Commission. EU Budget for Recovery: Questions and answers on the Just Transition Mechanism. (2020). See [link](#).

## Annex I: EU level versus national level – national earmarking

Besides cohesion policy, whose allocation to Member States and regions under distributed management we are used to; the big additional boost proposed on 27 May, the Recovery and Resilience Mechanism, and the important Just Transition Fund targeted at regions undergoing a transition toward the low-carbon economy, are also allocated to Member States.

While a comprehensive assessment of the low-carbon investment needs, and financing and assistance requirements has been outside the scope of this assessment, Figure 9 below tries to illustrate the orders of magnitude of Recovery and Resilience Fund (RRF) and Just Transition Funding (JTF) compared to the investment needs identified in the national energy and climate plans for Italy and Spain. As Italy and Spain receive the largest shares through the RRF, these two countries serve as good examples. The orders of magnitude illustrate a key take home message from our analysis: It is beneficial and important that a fair share of the EU budget support goes to Member States and regions, for them to allocate it according to their investment needs. However, the governance of these funding mechanisms plays a key role in making sure that the different policy objectives – recovery, resilience and cohesion and climate and energy – are aligned and considered in an integrated governance framework, to ultimately ensure European value added and long-term prosperity.



**Figure 9:** Allocations to Italy and Spain under the Recovery and Resilience Facility and the Just Transition Fund (Data Source RRF and JTF) Investment needs for reaching the national 2030 targets as identified in the national energy and climate plans of Italy and Spain.

Comprising just 1% of EU GDP, the EU budget is small compared to the national outlays of Member States. However, in certain areas, the EU budget fulfils crucial functions. In many Eastern and South-eastern European MS, for example, government investment in public infrastructure is reliant, to a significant extent, on EU funding. Furthermore, EU research funding is one of the most important sources of funding for universities and research centres in Europe. The share of cohesion policy funding in total public investment is as high as 84% percent in Portugal, 80% in Croatia and in all Eastern European Member states (other than Slovenia) above 40%<sup>124</sup>.

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<sup>124</sup> Agora Energiewende. European Energy Transition 2030: The Big Picture. (2019). See [link](#).

## Annex II: Investment needs in the four sectors

Estimating investment needs depends on a variety of assumptions (e.g. discount rate), targets and technological factors (e.g. cost-development trajectories of a technology). When reading this annex, it is very important to keep in mind that the investment needs should be understood in the context of their assumptions and limitations of the studies in which they have been produced. Hence, we refer the reader to the resources indicated, for each of the investment need figures, for a full discussion of the respective estimation method. Against this backdrop, comparing investment needs estimates within and across sectors is not straight-forward.

An investment needs estimate is helpful to get some insight into the costs of reaching the climate and energy targets by 2030 (or carbon-neutrality by 2050). While estimates differ from study to study, the main purpose here is not to obtain a precise figure for each technology, but rather to understand the order of magnitude, in particular, compared to other sectors. There are a few important drivers and components that explain differences along the modelling procedure, such as:

- Socio-economic variables (e.g. population, economic activities, geographical preferences);
- Technical characteristics of building stock (e.g. lifetime, ownership structure, geometrical characteristic);
- Low-carbon technologies assumed in the modelling process (e.g. technological and economic characteristic of certain technologies, cost trajectories; market penetration of newly developed technologies)<sup>125</sup>.

With that in mind the tables below present the investment needs of selected studies, but they do not provide a comprehensive assessment of the investment need of each technology.

For our analysis, we took the European Commission’s Staff Working Document<sup>126</sup> as the key reference document.

### II.A Investment costs for key technologies in the buildings sector

**Table II-a:** Investment Needs Estimates, Building Sector

| Source   | Timeline | BAU                               | Additional                         | Unit        | Comment   |
|--|----------|-----------------------------------|------------------------------------|-------------|---|
| Commission’s Staff Working Document <sup>127</sup> | 2021-30  |                                   | 115 (residential)<br>70 (business) | EUR bn/year | Based on EUCO32-32.5 scenario <sup>128</sup> . A target scenario reflecting the EU’s current energy targets and not yet updated to reflect increase in ambition on GHG emission reduction (50-55%). |
| Commission modelling <sup>129</sup>                | 2021-30  | 125(residential)<br>20 (tertiary) | 125 (residential)<br>70 (tertiary) | EUR bn/year | Derived from Figure 5.  |

<sup>125</sup> Juergens, Ingmar et al. How to Assess Investment Needs and Gaps in Relation to National Climate and Energy Policy Targets: a Manual - and a Case Study for Germany. European Climate Initiative EUKI, Berlin. (2019). See [link](#).

<sup>126</sup> European Commission Staff Working Document. SWD(2020) 98 - Identifying Europe’s recovery needs (2020). See [link](#).

<sup>127</sup> Ibid.

<sup>128</sup> European Commission. EUCO scenarios. (Accessed 09 June 2020). See [link](#).

<sup>129</sup> European Commission. COM(2019) 285: United in delivering the Energy Union and Climate Action - Setting the foundations for a successful clean energy transition (2019). See [link](#).

|   |           |  |   |  |
|---|-----------|--|---|--|
| PRIMES model <sup>130</sup>   | 2021-30   | 198.9 (residential)<br>64.3 (tertiary) | EUR<br>bn/year                                      | Not <i>additional</i> investments compared to a reference case |
| Commission - Financing sustainable growth – Factsheet <sup>131</sup> ( <a href="#">link</a> ) | Till 2030 |  | 88 (residential)<br>49 (tertiary)<br>EUR<br>bn/year | No information on methodology                                  |

### 1.1. Energy Efficient Retrofitting

To reach the 2050 (and intermediate 2030) targets, four million European households need to be renovated each year (i.e. the difference between the background rate of 1% and the desired 3% renovation rate, assuming approximately 200 million households). This requires measures triggering a large-scale “renovation wave”, while prioritizing schools, hospitals, and public housing<sup>132</sup>.

Each home could require an approximate financing of EUR 20,000. Taking the desired number of four million homes per year, *blended financing* of EUR 80 billion p.a. would be required<sup>133</sup>. The *investment costs* to energy efficiency retrofitting one housing unit could be anywhere between EUR 10,000 to EUR 100,000 per unit depending on country<sup>134;135</sup>, which increases the costs significantly.

Other estimates from 2012, for instance, targeting the 2020 climate goals, state annual investment needs for energy efficiency retrofitting housing in the EU in the range of EUR 50 to EUR 180 billion per year<sup>136</sup>.

### 1.2. Green District Heating

Green-district heating is cost-effective in the long-run but requires large amounts of capital upfront. The report “Towards a decarbonised heating and cooling sector in Europe” by Mathiesen et al.<sup>137</sup>, states that “*annualised investment costs in district heating supply and in distribution infrastructure should reach around EUR 16 billion per year and EUR 20 billion per year, respectively, during this period, from EUR 8 billion per year and EUR 4 billion per year*”. This corresponds to accumulated investments of respectively EUR 118 billion and EUR 223 billion for the period from 2020 to 2030 (*i.e. EUR 341 billion for 2020-30, and EUR 34 billion per year on average*). Calculations are based on the Heat Roadmap Europe scenario 2050 from 2018 and is modelled by JRC-EU-TIMES, aligned to EUCO30 scenario<sup>138</sup>.

<sup>130</sup> European Commission. COM(2018) 773. A Clean Planet for all A European long-term strategic vision for a prosperous, modern, competitive and climate neutral economy. (2018). See [link](#).

<sup>131</sup> European Commission Fact sheet. Financing Sustainable Growth. (2019). See [link](#).

<sup>132</sup> Agora Energiewende, Agora Verkehrswende. Dual Benefit Stimulus for Germany – A Proposal for a Targeted 100 Billion Euro Growth and Investment Initiative. (2020). See [link](#).

<sup>133</sup> Peter Sweatman, Europeand Buildings Renovation Fund, Personal Communication June 2020

<sup>134</sup> Agora Energiewende, Agora Verkehrswende. Dual Benefit Stimulus for Germany – A Proposal for a Targeted 100 Billion Euro Growth and Investment Initiative. (2020). See [link](#).

<sup>135</sup> Sweatman, Peter. Financing Mechanisms for Europe’s Buildings Renovation. (2012). See [link](#).

<sup>136</sup> Ibid.

<sup>137</sup> Mathiesen et al. Towards a decarbonised heating and cooling sector in Europe - Unlocking the potential of energy efficiency and district energy. (2019). See [link](#).

<sup>138</sup> EuroHeat & Power. Heat Roadmap Europe 4. (Accessed on 29 June 2020). See [link](#).

## II.B Investment costs for key technologies in the industry sector

**Table II-b: Investment Needs Industry**

| Source   | Timeline  | BAU     | Additional  | Unit        | Comment   |
|--|-----------|---------|---|-------------|---|
| Commission's Staff Working Document <sup>139</sup>                 | Till 2030 |         | 5   | EUR bn/year | Table 1. Based on EUCO32-32.5 scenario <sup>140</sup> . A conservative estimate, not updated to reflect increase in ambition of GHG emission reduction (50-55%).                              |
| PRIMES model <sup>141</sup>  | 2021-30   | 18.1    |   | EUR bn/year | Not <i>additional</i> investments compared to a reference case  |
| Material Economics – Industrial Transformation 2050 <sup>142</sup> | Till 2050 | 4.8-5.4 | 3.9 (Circular Economy)<br>4.2 (Carbon Capture)<br>5.5 (New Processes) | EUR bn/year | Different pathways. All scenarios constructed to “achieve close to zero emissions of CO <sub>2</sub> from industrial production by 2050”. Only considers cement, plastics, steel and ammonia. |
| Hydrogen Economy   | Till 2030 | < 4     |   | EUR bn/year | Number is an upper boundary, since infrastructure expenses (also used for transport, buildings, power production) are also included in the calculation. <sup>143</sup>                        |
| 30% low-carbon Steel   | Till 2030 | 0.93    | 2.94  | EUR bn/year | See section 5.2.2. for further details or below.  |
| 30% low-carbon Cement  | Till 2030 | 1.89    | 2.96  | EUR bn/year |   |
| 30% low-carbon Plastics  | Till 2030 | 2.99    | 6.96  | EUR bn/year |   |
| 30% low-carbon Ammonia   | Till 2030 | 0.35    | 1.07  | EUR bn/year |   |

To rapidly speed up the decarbonisation in the industrial sector, the Agora Dual-Benefit Stimulus Report<sup>144</sup> suggests focusing on key technologies such as *clean hydrogen* and *green steel* (Chapter 9). The required investments of Hydrogen and steel (as well as other materials) are briefly explained in

<sup>139</sup> European Commission Staff Working Document. SWD(2020) 98 - Identifying Europe's recovery needs. (2020). See [link](#).

<sup>140</sup> European Commission. EUCO scenarios. (Accessed 09 June 2020). See [link](#).

<sup>141</sup> European Commission. COM(2018) 773. A Clean Planet for all A European long-term strategic vision for a prosperous, modern, competitive and climate neutral economy. (2018). See [link](#).

<sup>142</sup> Material Economics. Industrial Transformation 2050 - Pathways to Net-Zero Emissions from EU Heavy Industry. (2019). See [link](#).

<sup>143</sup> Fuel Cells and Hydrogen, Joint Undertaking. Hydrogen Roadmap Europe: A sustainable pathway for the European energy transition. (2019). See [link](#).

<sup>144</sup> Agora Energiewende, Agora Verkehrswende. Dual Benefit Stimulus for Germany – A Proposal for a Targeted 100 Billion Euro Growth and Investment Initiative. (2020). See [link](#).

the following sub-sections. A (non-exhaustive) list of further technologies, contributing to the decarbonisation, is presented in the chapter annex.

## 2.1. Hydrogen

Hydrogen, as the crucial cross-cutting technology in decarbonising industry processes, allows a large-scale integration of renewables to happen and enables the decarbonisation of segments that are otherwise difficult to decarbonise. The industrial sector, for instance, can burn hydrogen to produce heat and to use the fuel as feedstock in manufacturing processes. In scenario calculations, presented in the Hydrogen Europe Roadmap report<sup>145</sup>, the final energy demand would develop as follows:

*Table II-c - Development of Hydrogen demand*

|                                  | 2015   | 2030   |          | 2050  |          |
|----------------------------------|--------|--------|----------|-------|----------|
| <b>Final energy demand (TWh)</b> | 14,100 | 11,500 |          | 9,300 |          |
| <b>Thereof H2</b>                | 2%     | 4%     | 6%       | 8%    | 24%      |
| <b>Scenario</b>                  |        | BAU    | 2-degree | BAU   | 2-degree |

Across all sectors, the cumulative investment to ramp up hydrogen would amount to EUR 65 billion, if the investments for manufacturing equipment needed for transport and buildings are subtracted (~ EUR 15 billion), EUR 50 billion / 12 years yields, approximately EUR 4 billion per year of investments. This number serves as an upper boundary, since infrastructure expenses (also used for transport, buildings, power production) are also included in the calculation.

## 2.2. Exemplary Industries (Ammonia, Cement, Steel and Plastics)

Producing low-carbon steel, for instance, comes with higher costs per produced tonne. To grasp the magnitude of required policy support – depending on how much policymakers want to support *incremental* capital and operating expenditures– the following “back of the envelope calculations” presented in Table II-d provide a rough indication. They assume a replacement of 30%, and the range of additional costs of material per tonne. Multiplying the rows, we obtain the range of policy support needed (see last two columns).

*Table II-d - Estimates for different materials*

|                             | Desired low-carbon share by 2030 | Produced Amount EU per year | Incremental cost of material per unit <sup>146</sup> |                  | Total additional costs  |                         |
|-----------------------------|----------------------------------|-----------------------------|--|------------------|-------------------------|-------------------------|
|                             |                                  |                             | Min  | Max              | MIN                     | MAX                     |
| <i>Unit</i>                 | <i>%</i>                         | <i>mln tonnes</i>           | <i>EUR/tonne</i>                                     | <i>EUR/tonne</i> | <i>mln EUR per year</i> | <i>mln EUR per year</i> |
| <b>Steel<sup>1</sup></b>    | 30                               | 100                         | 31   | 98               | 930                     | 2940                    |
| <b>Cement<sup>2</sup></b>   | 30                               | 170                         | 37   | 58               | 1887                    | 2958                    |
| <b>Plastics<sup>3</sup></b> | 30                               | 40                          | 249  | 580              | 2988                    | 6960                    |
| <b>Ammonia<sup>4</sup></b>  | 30                               | 18                          | 64   | 199              | 345.6                   | 1074.6                  |

The min and max values come from the Material Economics report ([link](#)) and represent different pathways.  
 1: Electric arc furnace, direct smelting with CCS, hydrogen direct reduction, CCU;  
 2: CCS, electrified heat and CCS;  
 3: Steam cracking with CCS, electric steam cracking, bio-based plastics production, chemical recycling;  
 4: Steam methane reforming with CCS, electrolysis

<sup>145</sup> Fuel Cells and Hydrogen, Joint Undertaking. Hydrogen Roadmap Europe: A sustainable pathway for the European energy transition. (2019). See [link](#).

<sup>146</sup> Material Economics. Industrial Transformation 2050 - Pathways to Net-Zero Emissions from EU Heavy Industry. (2019). See [link](#).



## II.C Investment costs for key technologies in the power sector

**Table II-e: Investment Needs Estimates, Electricity Sector**

| Source  | Timeline   | Investment  | Unit                      | Comment   |  |
|---|------------|---|---------------------------|---|--|
| <b>Total sectoral investment needs</b>                |            |   |                           |   |  |
| Commission modelling (2019) <sup>147</sup>            | 2021-30    | Power grid  | BAU: 35<br>Additional: 15 | Based on EUCO32-32.5 scenario <sup>148</sup> . A conservative estimate, not updated to reflect increase in ambition of GHG emission reduction (50-55%). |  |
|   | 2021-30    | Power plants                                      | BAU: 15<br>Additional 20  |   |  |
| Commission's Working Document 2020 <sup>149</sup>     | Until 2030 | Power grid  | 10                        |   |  |
|   | Until 2030 | Power plants                                      | 20                        |   |  |
| PRIMES model <sup>150</sup>                           | 2021-30    | Power grid  | 59.2                      | not <i>additional</i> investments compared to a reference case  |  |
|   | 2021-30    | Power plants                                      | 53.9                      |   |  |
| Commission Impact Assessment 2016 <sup>151</sup>      | 2020-2030  | Renewable Energy                                  | 25                        | EUR bn /year  | Total required annual investment                     |
| Commission Impact Assessment 2016 <sup>152</sup>      | 2020-2030  | Renewable Energy                                  | 11.5                      | EUR bn /year  | Total investment gap <sup>153</sup>                  |
| Solar Power Europe (2020) <sup>154</sup>              | 2020-2050  | 100% Renewables (63% solar, 32% wind)             | 230                       | EUR bn/year   | Capital expenditure costs                            |
| World Energy Investment Outlook (2014) <sup>155</sup> | 2014-2035  | Renewable energy power plants                     | 68                        | EUR bn/year   | Investments required in <i>New Policies Scenario</i> |
| <b>1) Solar Power</b>                                 |            |   |                           |   |  |
| Solar Europe Analysis (2020) <sup>156</sup>           | 2020-2030  | Rooftop PV (residential, commercial & industrial) | 22                        | EUR bn/year   | 34 GW installed capacity/year (average)              |

<sup>147</sup> European Commission. COM(2019) 285: United in delivering the Energy Union and Climate Action - Setting the foundations for a successful clean energy transition (2019). See [link](#).

<sup>148</sup> European Commission. EUCO scenarios. (Accessed 09 June 2020). See [link](#).

<sup>149</sup> European Commission. SWD(2020) 98: Europe's moment: Repair and Prepare for the Next Generation. (2020). See [link](#).

<sup>150</sup> European Commission. COM(2018)773: A Clean Planet for all. A European long-term strategic vision for a prosperous, modern, competitive and climate neutral economy (2018). See [link](#).

<sup>151</sup> European Commission. SWD(2016) 418: Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources. (2016). See [link](#).

<sup>152</sup> Ibid.

<sup>153</sup> "amount of investments that would require some support, in case renewable electricity projects are to only receive market revenues from the wholesale electricity market only. It does not mean that public support would need to cover all the investment costs, as it could be that only a marginal support would be sufficient to complement electricity market revenues to make those investments profitable."

-Source: European Commission. SWD(2016) 418: Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources. (2016). See [link](#).

<sup>154</sup> SolarPower Europe and LUT University. 100% Renewable Europe: How To Make Europe's Energy System Climate-Neutral Before 2050. (2020) See [link](#).

<sup>155</sup> International Energy Agency. World Energy Investment Outlook. (2014). See [link](#) - Table 3.2, Page 103.

<sup>156</sup> Data provided by Solar Power Europe, 2020.

|  |           |                                    |       |             |   |
|--|-----------|------------------------------------|-------|-------------|---|
| Commission Impact Assessment 2016 <sup>157</sup>       | 2020-2030 | Solar PV                           | 6.7   | EUR bn/year | Total required annual investment <sup>158</sup> |
| Commission Impact Assessment 2016 <sup>159</sup>       | 2020-2030 | Solar PV                           | 3     | EUR bn/year | Total investment gap <sup>160</sup>             |
| <b>1) Wind Power</b>                                   |           |                                    |       |             |   |
| Commission Impact Assessment 2016 <sup>161</sup>       | 2020-2030 | Offshore                           | 8     | EUR bn/year | Total required annual investment <sup>162</sup> |
| Commission Impact Assessment 2016 <sup>163</sup>       | 2020-2030 | Offshore                           | 7.75  | EUR bn/year | Total investment gap <sup>164</sup>             |
| Commission Impact Assessment 2016 <sup>165</sup>       | 2020-2030 | Onshore                            | 8.5   | EUR bn/year | Total required annual investment <sup>166</sup> |
| Commission Impact Assessment 2016 <sup>167</sup>       | 2020-2030 | Onshore                            | 1.2   | EUR bn/year | Total investment gap <sup>168</sup>             |
| <b>2) Grid Infrastructure</b>                          |           |                                    |       |             |   |
| European Parliament's ITRE study (2017) <sup>169</sup> | 2011-2050 | High Electricity Grid Investments  | 34-55 | EUR bn/year | Different scenarios given                       |
| CEF Energy <sup>170</sup>                              | NA        | Energy transmission infrastructure | 140   | EUR bn      |   |

<sup>157</sup> European Commission. SWD(2016) 418: Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources. (2016). See [link](#).

<sup>158</sup> According to WESIM modelling, for more information see Annex 5 at [link](#).

<sup>159</sup> European Commission. SWD(2016) 418: Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources (2016). See [link](#).

<sup>160</sup> "amount of investments that would require some support, in case renewable electricity projects are to only receive market revenues from the wholesale electricity market only. It does not mean that public support would need to cover all the investment costs, as it could be that only a marginal support would be sufficient to complement electricity market revenues to make those investments profitable."

- Source: European Commission. SWD(2016) 418: Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources. (2016). See [link](#).

<sup>161</sup> European Commission. SWD(2016) 418: Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources. (2016). See [link](#).

<sup>162</sup> According to WESIM modelling, for more information see Annex 5 at [link](#).

<sup>163</sup> European Commission. SWD(2016) 418: Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources. (2016). See [link](#).

<sup>164</sup> "amount of investments that would require some support, in case renewable electricity projects are to only receive market revenues from the wholesale electricity market only. It does not mean that public support would need to cover all the investment costs, as it could be that only a marginal support would be sufficient to complement electricity market revenues to make those investments profitable."

- Source: European Commission. SWD(2016) 418: Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources. (2016). See [link](#).

<sup>165</sup> European Commission. SWD(2016) 418: Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources. (2016). See [link](#).

<sup>166</sup> According to WESIM modelling, for more information see Annex 5 at [link](#)

<sup>167</sup> Ibid.

<sup>168</sup> "amount of investments that would require some support, in case renewable electricity projects are to only receive market revenues from the wholesale electricity market only. It does not mean that public support would need to cover all the investment costs, as it could be that only a marginal support would be sufficient to complement electricity market revenues to make those investments profitable."

- Source: European Commission. SWD(2016) 418: Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources. (2016). See [link](#).

<sup>169</sup> European Parliament. Directorate-General for Internal Policies. Policy Department. European Energy Industry Investments (2017). See [link](#) - Table 4, Page 26

<sup>170</sup> European Commission. Innovation & Networks Executive Agency. CEF Energy. (Accessed on 29 June 2020). See [link](#).

|   |           |  |         |             |  |
|---|-----------|--|---------|-------------|--|
| DIW study (2013) <sup>171</sup>                 | 2030      | Transmission capacity to meet energy needs | 2-6     | EUR bn/year | Upgrades and/or expansion of the grid infrastructure by 1,113 km to 4,053 km by 2030, depending on the scenario <sup>172</sup> . |
| McKinsey Study (2010) <sup>173</sup>            | 2020-2050 | Trans-regional transmission infrastructure | 170-200 | EUR bn      | For a five-fold grid capacity increase to meet energy demand   |
| <b>3) Innovation funding storage technology</b> |           |  |         |             |  |
| ECOFYS study (2017) <sup>174</sup>              | 2021-2030 | Battery, CAES & Pumped Hydro               | 14      | EUR bn      | CAES – Compressed-air energy storage   |

### 3.1. Solar PV

A 100 % renewables by 2050 scenario will primarily rely on large-scale diffused solar PV deployment. The technology has a high technological readiness level and is already widely diffused. Scenario modelling done by SolarPower Europe and LUT University suggests that solar power will dominate the electricity generation market with 48-63% market share by 2050<sup>175</sup>. The levelized cost of energy can be expected to be competitive at EUR 47/MWh in 2050, which is competitive compared to today’s EUR 51/MWh. Achieving this transition will require cumulative investments between EUR 6.45 trillion - EUR 8.37 trillion by 2050, depending on the scenario target<sup>176</sup>. The annual system maintenance costs will be between EUR 30 trillion - EUR 32.3 trillion by 2050, based on the scenario target. To fully use Europe’s roof-top solar potential, investments of EUR 334 billion are necessary by 2050. Distributed generation through roof-top solar PV would be especially useful when integrated with distributed storage technology.

Utility-scale projects also play a major role in reaching renewable energy targets. Scaling-up utility solar PV is especially relevant for Southern MS, as they are especially suited to deploy this technology. Italy, for example, estimates that it needs an additional investment of EUR 27.5 billion (on top of their business as usual scenario) between 2017-2030 for the PV sector alone.<sup>177</sup>

### 3.2. Rebuilding Solar Industry in Europe

A rapid upscaling of solar technologies would require building up local manufacturing to meet the demand. Considering that the EU solar power industry has lost its position to other global players (notably Asia), there are several opportunities and advantages to rebuilding the solar industry in Europe. Rebuilding the industry has advantages such as security of supply, leadership in low-carbon technologies and economic growth in the EU. A recent SolarPower Europe (2020) study<sup>178</sup> estimates that solar power could cover up to 60% of Europe’s electricity generation in the “100% renewables by

<sup>171</sup> Egerer, J., Gerbaulet, C., and Lorenz, C. European Electricity Grid Infrastructure Expansion in a 2050 Context (2013). DIW Berlin. ISSN: 1619-4535. Available at [link](#) - Table 5, Page 14.

<sup>172</sup> Ibid

<sup>173</sup> McKinsey & Company. Transformation of Europe’s Power System Until 2050. (2010). See [link](#) - Page 11

<sup>174</sup> ECOFYS. Investment Needs in Trans-European Energy Infrastructure up to 2030 and Beyond. (2017). See [link](#) - Figure 10, Page 12.

<sup>175</sup> SolarPower Europe and LUT University. 100% Renewable Europe: How To Make Europe’s Energy System Climate-Neutral Before 2050. (2020). See [link](#)

<sup>176</sup> Ibid - Page 46.

<sup>177</sup> Government of Italy. Integrated National Energy and Climate Plan. (2020). See [link](#).

<sup>178</sup> SolarPower Europe and LUT University. 100% Renewable Europe: How To Make Europe’s Energy System Climate-Neutral Before 2050. (2020). See [link](#)

2050” scenario. The sector has the potential to generate at least 300,000 jobs by 2030, if at least 20% of Europe’s electricity demand is powered by solar by 2030<sup>179</sup>. To achieve this, new tax incentives have to be developed to attract new manufacturing and investment into existing operations in Europe and maintain competitiveness. An example of these can be VAT exemptions and/or time limited tax holidays, to speed-up European manufacturing and foster relationships within the European market.

For a full discussion on this topic see SolarPower Europe (2020)<sup>180</sup> and Hoogland et al. (2017)<sup>181</sup>. The Commission (2017)<sup>182</sup> has defined rebuilding the industry via three pillars:

- 1) Focus on the market segment for tailored (specialised) PV products.
- 2) Strengthen market segment of EU equipment and inverter manufacturers.
- 3) Become a leader in next-generation innovative PV technologies

### 3.3. Wind in Europe

Wind energy is also a key technology to decarbonise Europe’s electricity supply, especially in the Northern Member States. Specifically, investments in offshore wind in the North and Baltic Sea are important to meet future targets. Both on- and offshore wind technologies have a high technological readiness level, but in recent years have suffered from regulatory and administrative burdens, rather than financing bottlenecks. Around 15% of overall development costs of wind power projects in Europe are related to administrative costs (SWD, 2016)<sup>183</sup>. Compared to solar power, investments in wind infrastructure have a comparatively smaller investment need of EUR 16.5 billion per year for both on- and off-shore wind energy<sup>184</sup>.

### 3.4. Grid Infrastructure

A rapid upscale of renewables requires a modern grid infrastructure that is adapted to the technological requirements of renewables. A key obstacle is currently the lack of cross-border infrastructure to distribute renewable energy from wind and solar energy power plants. Optimal areas for wind and solar power generation often lie on the outer areas of Europe (coastal areas for wind and southern areas for solar), while demand remains concentrated in Central European regions<sup>185</sup>. For example, an integrated off-shore grid is necessary to use the full potential of off-shore wind energy. According to a study by DIW Berlin, by 2030, a total investment between EUR 2 billion to EUR 6 billion will need to be put into building transmission capacity to meet energy needs, depending on the scenario<sup>186</sup>. This will finance upgrades and/or expansion of the grid infrastructure by 1,113 km to 4,053 km by 2030, depending on the scenario<sup>187</sup>. A 2010 McKinsey study on the other hand, projected that between 2020 and 2050, close to EUR 170 billion to EUR 200 billion in investments, into a five-fold

<sup>179</sup> SolarPower Europe. An Industrial Strategy for solar in Europe. (2019). See [link](#).

<sup>180</sup> SolarPower Europe and LUT University (2020): 100% Renewable Europe: How To Make Europe’s Energy System Climate-Neutral Before 2050. (2020). See [link](#).

<sup>181</sup> Hoogland, O., Rademaekers, K., Lijn, N. van der, Trinomics B.V, European Commission, & Directorate-General for Research and Innovation. Assessment of photovoltaics (PV) final report. (2017). See [link](#).

<sup>182</sup> Ibid.

<sup>183</sup> European Commission. SWD(2016) 418: Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources. (2016). See [link](#).

<sup>184</sup> Ibid.

<sup>185</sup> McKinsey & Company. Transformation of Europe’s Power System Until 2050. (2010). See [link](#) - Page 11.

<sup>186</sup> Egerer, J., Gerbaulet, C., and Lorenz, C. European Electricity Grid Infrastructure Expansion in a 2050 Context. DIW Berlin. ISSN: 1619-4535. (2013). See [link](#) - Table 5, Page 14.

<sup>187</sup> Ibid - Table 6, Page 14.

increase of trans-regional transmission infrastructure will be required to meet pan-European demand<sup>188</sup>.

**ENTSOE (2018)**<sup>189</sup> assesses the necessary EU grid development needed in a 2040 perspective to optimize the EU power system. The study assesses three policy scenarios representing various levels of renewables penetration in 2030 (48-58%) and 2040 (65-81%). It finds that cost optimal achievement of these higher levels of renewables penetration will require higher transmission grid investments compared to the TYNDP 2016 scenario, both in terms of interconnection and internal reinforcements. Benefits associated with these transmission grid upgrades relative to a “no grid” scenario with infrastructure frozen at 2020 levels include:

- 1) Reduced average wholesale electricity prices (EUR 3-14/MWh over a year);
- 2) Significantly reduced electricity curtailment in countries with high shares of renewables (58-156 TWh per year);
- 3) Lower annual CO<sub>2</sub> emissions (37-59 Mton); and
- 4) Increased security of supply despite a decline in conventional generation capacity (24-471 GWh reduction in energy not served).

Average economic savings from lower market values alone were found to reach EUR 43 billion per year by 2040, roughly three times more than the EUR 12 billion in investment costs for the projects in the TYNDP 2016 scenario. The study also found that a lack of investments could affect the stability of the European grid, and endanger Europe’s ability to meet its climate targets.

## II.D Investment cost for key technologies in the transport sector

**Table II-f: Investment Needs Estimates, Transport Sector**

| Source  | Timeline  | Details  | Investment                      | Unit           | Comment   |
|---|-----------|--|---------------------------------|----------------|---|
| Commission modelling (2019) <sup>190</sup>                | 2021-30   | Transport sector                               | BAU: 705<br>Additional:<br>22.5 | EUR<br>bn/year | Achieving an energy efficiency target of 32.5% and a renewable energy target of 32% (EUCO3232.5 Model) <sup>191</sup> |
| Commission’s Staff Working Document (2020) <sup>192</sup> | 2021-2030 | TOTAL  | 120                             | EUR<br>bn/year | Achieving an energy efficiency target of 32.5% and a renewable energy target of 32% (EUCO3232.5 Model) <sup>193</sup> |
|   |           | Vehicles, rolling stock, vessels and airplanes | 20                              | EUR<br>bn/year |   |
|   |           | Infrastructure –Core TEN-T Network             | 30                              | EUR<br>bn/year |   |

<sup>188</sup> McKinsey & Company. Transformation of Europe’s Power System Until 2050. (2010). See [link](#) - Page 11.

<sup>189</sup> ENTSO-E. Connecting Europe: Electricity – 2025 – 2030 – 2040. TYNDP 2018 Executive Report. (2019). See [link](#).

<sup>190</sup> European Commission. COM(2019) 285: United in delivering the Energy Union and Climate Action - Setting the foundations for a successful clean energy transition. (2019). See [link](#).

<sup>191</sup> European Commission. EUCO scenarios. (Accessed 09 June 2020). See [link](#).

<sup>192</sup> European Commission Staff Working Document. SWD(2020) 98 - Identifying Europe's recovery needs. (2020). See [link](#).

<sup>193</sup> European Commission. EUCO scenarios. (Accessed 09 June 2020). See [link](#).

|  |  |   |         |             |  |
|--|--|---|---------|-------------|--|
|  |  | Infrastructure – Other interurban infrastructures | 20      | EUR bn/year |  |
|  |  | Infrastructure – Urban transport                  | 35      | EUR bn/year |  |
| <b>TEN-T Network</b>   |  |   |         |             |  |
| Commission estimation (2018) <sup>194</sup>  | 2021-2030                                | TEN-T Core Network                                | 55.5    | EUR bn      | Conservative estimate                      |
|  | 2021-2030                                | TEN-T comprehensive network                       | 166     | EUR bn      | Conservative estimate                      |
| Commission – Action Plan on Alternative Fuels Infrastructure (2017) <sup>195</sup> | By 2025                                  | TEN-T Core Network Corridors                      | 1.5     | EUR bn      |  |
|  |  | TOTAL   |         |             |  |
|  |  | Electricity                                       | 0.9     | EUR bn      |  |
|  |  | CNG road vehicles                                 | 0.6     | EUR bn      |  |
|  |  | LNG road vehicles                                 | 0.26    | EUR bn      |  |
|  |  | LNG water borne transport – seaports              | 0.9     | EUR bn      |  |
|  | Hydrogen                                 | 0.7   | EUR bn  |             |  |
| By 2030  | LNG water borne transport – inland ports | 1   | EUR bn  |             |  |
| <b>1) Charging Infrastructure</b>  |  |   |         |             |  |
| Commission – Action Plan on Alternative Fuels Infrastructure (2017) <sup>196</sup> | 2021-2025                                | Publicly accessible recharging points             | 2.7-3.8 | EUR bn/year | For 2 million charging point across the EU |
| Leaked working paper green recovery plan (2020) <sup>197</sup>                     | -  | One hydrogen refuelling station                   | 3       | EUR million |  |

<sup>194</sup> European Commission. COM(2018) 277: Regulation of the European Parliament and of the Council on streamlining measures for advancing the realisation of the trans-European transport network. (2018). See [link](#).

<sup>195</sup> European Commission. COM(2017) 652: Towards the broadest use of alternative fuels – an Action Plan on Alternative Fuels Infrastructure. (2017). See [link](#).

<sup>196</sup> Ibid.

<sup>197</sup> Simon, Fredric, “LEAKED: Europe’s draft ‘green recovery’ plan”. Euractive. (2020-05-20). (Accessed on 9 June 2020). See [link](#).

|   |            |   |                         |        |   |
|---|------------|---|-------------------------|--------|---|
| Leaked working paper green recovery plan (2020) <sup>198</sup>                      | -          | One fast charger station  | 40,000                  | EUR    |   |
| Calculation based on leaked working paper green recovery plan (2020) <sup>199</sup> | -          | 2 million fast charging stations  | 80                      | EUR    | Simple back-of-the-envelope calculation   |
| Grube et al. 2017 (TU Wien) <sup>200</sup>  | -          | Charging stations highway for Germany                                     | 3.7                     | EUR bn | To support 30 million EV in Germany   |
| Transport & Environment bottom-up energy-based modelling <sup>201</sup>             | Until 2030 | Public charging points, EU (incl. equipment, installation, grid upgrade)  | Cumulative total:<br>20 | EUR bn | For 2.2 million charging points across EU   |
|   | Until 2030 | Private charging points, EU (incl. equipment, installation, grid upgrade) | Cumulative total:<br>60 | EUR bn | For 2.2 million charging points across EU   |
| <b>2) Rail investments</b>  |            |   |                         |        |   |
| Mobility & Transport Department, European Commission <sup>202</sup>                 | By 2030    | Rail Infrastructure   | 430                     | EUR bn | Infrastructure rail transport at all levels: European, national, regional and urban |
| European Rail Research Advisory Council <sup>203</sup>                              | 2017-2030  | R&D Innovation  | 250                     | EUR bn |   |
| European Court of Auditors (2017) <sup>204</sup>                                    | By 2030    | ERTMS for core network corridors  | 80                      | EUR bn |   |

<sup>198</sup> Ibid.

<sup>199</sup> Simply multiplied the amounts of fast charging stations needed according to the leaked working document (2 million) with the specified price for one fast charging station (EUR 40.000). The resulting investment needs correspond to the model results by Transport & Environment - See [link](#).

<sup>200</sup> Grube, T. et. al. Kosten von Ladeinfrastrukturen für Batteriefahrzeuge in Deutschland, in: Proceedings of the 10 Internationale Energiewirtschaftstagung an der TU Wien (IEWT 2017), 15. (2017). See [link](#).

<sup>201</sup> Transport & Environment. Recharge EU: How many charge points will Europe and its Member States need in the 2020s. (2020). See [link](#).

<sup>202</sup> Quote from speech by Transport Commissioner Violeta Bulc at the Innotrans Opening Event, 22 Sept. 2016. Referenced from: UITP Europe. Views of the Rail Sector: Post-2020 Multi-Annual Financial Framework. (2017). See [link](#) - Page 2.

<sup>203</sup> European Rail Research Advisory Council. Rail 2050 Vision: Rail - The Backbone of Europe's Mobility. (2017). See [link](#).

<sup>204</sup> European Court of Auditors. Special Report: A single European rail traffic management system: will political choice ever become reality?. (2017). See [link](#) - Table 3, Page 33.

|   |         |                               |         |        |  |
|---|---------|-------------------------------|---------|--------|--|
|   | By 2050 | ERTMS comprehensive network   | for 190 | EUR bn | ERTMS - European Railway Traffic Management System                     |
| <b>3) Innovation funding for batteries</b>                |         |                               |         |        |  |
| European Battery Alliance & EIT InnoEnergy <sup>205</sup> | By 2023 | EU-based battery projects     | 70      | EUR bn | front-loaded investments required to meet peak European demand by 2023 |
| Author's estimates (see Section 4.3. below)               | By 2050 | Building 20-30 Giga-factories | 88-132  | EUR bn | Based on cost for a single Tesla Gigafactory                           |

#### 4.1. Charging infrastructure

A comprehensive charging infrastructure in Europe supporting different types of electric vehicles is key to decarbonising road transport. According to the Green Deal, by 2025 around one million public recharging stations are needed, to support the expected 13 million zero- and low-emission vehicles across Europe<sup>206</sup>. On top of that, private charging infrastructure is needed in commercial spaces, homes offices and parking infrastructure.

The Agora Dual-Benefit Stimulus Report<sup>207</sup> outlines how boosting a comprehensive infrastructure for charging electric vehicles carries special importance for decarbonising the transport sector and sending the right signals to private investors (e.g. for purchasing electric vehicles)<sup>208</sup>. According to a study conducted by Transport & Environment (2020)<sup>209</sup>, the public sector needs to invest EUR 20 billion in public charging points by 2030, and another EUR 60 billion is necessary from private investments. This would lead to 2.2 million charging points supporting some 33 million electric vehicles. The new MFF proposes the goal of installing one million charging points<sup>210</sup> (considerably less ambitious than the two million public charging stations mentioned in the leaked working paper green recovery plan (2020)<sup>211</sup>), which would (by simply dividing the investment needs) amount to total investment needs of around EUR 40 billion.

Currently, fast charging infrastructure is being installed at a rapid pace along busy transnational arteries in Europe's core, but there is a lack of such stations for trucks and cars, away from the busiest highways. This has also been addressed in the European Green Deal (2019)<sup>212</sup>, where closing charging infrastructure gaps in less populated areas are specifically mentioned. The EU should especially ensure

<sup>205</sup> European Institute of Innovation & Technology. European Battery Alliance & EIT InnoEnergy launch Business Investment Platform. (2019). See [link](#).

<sup>206</sup> European Commission. COM(2019) 640: The European Green Deal. (2019). See [link](#) - Page 11

<sup>207</sup> Agora Energiewende, Agora Verkehrswende. Dual Benefit Stimulus for Germany – A Proposal for a Targeted 100 Billion Euro Growth and Investment Initiative. (2020). See [link](#).

<sup>208</sup> Agora Energiewende. Dual-Benefit Stimulus for Germany: A Proposal for a Targeted 100 Billion Euro Growth and Investment Initiative. (2020). See [link](#).

<sup>209</sup> Transport & Environment. Recharge EU: How many charge points will Europe and its Member States need in the 2020s. (2020). See [link](#).

<sup>210</sup> European Commission. COM(2020) 456: Europe's Moment: Repair and Prepare for the Next Generation. (2020). See [link](#).

<sup>211</sup> Simon, Fredric, "LEAKED: Europe's draft 'green recovery' plan". Euractive. (2020-05-20). (Accessed on 09 June 2020). See [link](#).

<sup>212</sup> European Commission. COM(2019) 640: The European Green Deal. (2019). See [link](#).



that the charging infrastructure reaches all regions in Europe, specifically investing in those that are (as of yet) too unattractive for private investors (e.g. rural areas).

To do this, the EU should set clear time frames and geographic specifications to support adoption. Key instruments to achieve a wide network of charging infrastructure could be dedicated tenders requiring development in areas not preferred by private sector and support for CCfDs (see Box B).

#### 4.2. Rail

Shifting both the aviation and road transport, to rail for long-distance travel as well as in cities is a key challenge for Europe. This would make transport more efficient and less carbon intensive. For this, investments into key corridors, allowing both freight and passenger transport, are important to make increased use of rail infrastructure. Apart from investments into tracks, rolling stock is a key area requiring massive investments.

#### 4.3. Innovation Funding for key technologies (Batteries & Energy Storage)

Although they are much less efficient than direct use, electricity batteries are crucial for the development of a range of key technologies for decarbonising the European economy, including the electricity, buildings and transport sectors.

Innovation funding for key technologies such as batteries for electric vehicles, hydrogen and alternative fuels for the aviation and maritime industry will be crucial to decarbonise the sector in the long term. A rapid upscale of electric vehicles in the EU, would require the EU to strengthen its manufacturing industry to reach the capacity needed. Currently, technological developments are mainly taking place in the US and Asia (China and Japan), but with the right investments, the EU could develop into an important standpoint for breakthrough in specialised technologies.

Many components integral to the value chain of low-carbon transport (such as critical raw-materials for batteries) have currently a very troubling supply-chain track record both from a human rights (social) perspective as well as from a broader environmental perspective (e.g. recycling). Establishing the EU as a hub for key technologies, could ensure that the supply chain of low-carbon transport technologies is fair, environmentally friendly, and free of human rights abuses. Currently, only around 3% of global cell manufacturing takes place in Europe (2019)<sup>213</sup>. Transport & Environment proposes that, in order for Europe to ensure leadership in battery technology, the EU should aim to manufacture 10 GWh of more efficient batteries at half the current costs by 2025. For that, the EU should commit to support manufacturers with at least 20% of the funding for advanced battery production (in the same capital investment cycle). This progress can be further fostered through existing coordination structures such as the European Battery Alliance<sup>214</sup>.

The European Commission estimates that around 20-30 giga-factories for battery cells plus the related ecosystem are needed to support electric mobility infrastructure in Europe, requiring massive investments. Putting this into context, a single Tesla Gigafactory requires an investment of \$5 billion USD (approx. EUR 4.4 billion)<sup>215</sup>; therefore building 20-30 giga factories will cost an estimated EUR 88 billion - EUR 132 billion. Estimates by a collaboration between the European Battery Alliance and EIT InnoEnergy state that, front-loaded investments of EUR 70 billion will be required to meet peak European demand by 2023<sup>216</sup>.

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<sup>213</sup> European Commission. COM(2019) 176: Implementation of the Strategic Action Plan on Batteries: Building a Strategic Battery Value Chain in Europe. (2019). See [link](#).

<sup>214</sup> Transport and Environment. How Europe can win the battery race. (2020). See [link](#).

<sup>215</sup> Tesla. Gigafactory. (2014). See [link](#) - Page 5.

<sup>216</sup> EIT InnoEnergy. The Business Investment Platform closes agreement to support Savannah Resources. (2020). See [link](#).

## Annex III: EU Taxonomy – strict greening criteria for climate share of MFF and RRF

### 1. Introduction and Timeframe

The EU Taxonomy is a classification scheme for sustainable activities, developed by the Technical Expert Group (TEG) who was asked to develop screening criteria for economic activities that can make a “substantial contribution to climate change mitigation”. Accordingly, the TEG has developed catalogue of 70 economic activities, including technical screening criteria. Furthermore, each activity should primarily “do no significant harm” to other environmental objectives of the EU<sup>217</sup>. To provide one example, the economic activity “Manufacture of Cement” is only aligned with the EU Taxonomy if the CO<sub>2</sub> emissions related to the production of cement is lower than the EU-ETS benchmark of 0.498 tonnes of CO<sub>2</sub> equivalent emissions per tonne of cement (or alternative binder)<sup>218</sup>.

Against this backdrop, the EU Taxonomy could be an important tool to monitor the desired climate share of the EU’s recovery programme, through determining what is “green” (i.e. what is contributing substantially to climate change mitigation) and what is not. Once the delegated act<sup>219</sup> comes into force in Q4/2021, large publicly listed companies will be obliged to report according to the EU Taxonomy.

### 2. Applicability to the EU’s economic stimulus package

Since current reporting standards are insufficient, we suggest running a “climate quick check”<sup>220</sup> following the EU Taxonomy - in the context of supporting economic activities through grants or loans from the RRF. This may seem complicated but has already been operationalised by some institutions such as the *Klimaschutzoffensive für den Mittelstand* (engl: Climate Protection Initiative for SMEs) by KfW<sup>221</sup> - a program offering concessional loans with repayment grants for up to 100% of the eligible investment (i.e. project level).

What is more, the current EU Taxonomy has been defined only for eight sectors, in descending order of GHG emission intensity. Therefore, most economic activities are not even covered (yet) by the EU Taxonomy and would not fall under a “climate quick check” (e.g. the company Adidas with its sectoral classification “Manufacture of footwear”<sup>222</sup>). Other “green” activities, such as production of electricity from solar PV, are currently derogated from performing any test. The same is true for “enabling activities” such as transmission of electricity. Only for the so-called “transition activities” (e.g. manufacturing or transport) a screening criterion applies.

As the appropriate reporting will start very late, the process can be kick-started by requiring beneficiaries from the EU recovery package to disclose information in order to state EU Taxonomy alignment.

<sup>217</sup> European Commission. EU Taxonomy for sustainable activities. (2020). See [link](#) for more information.

<sup>218</sup> See Technical annex to the TEG final report on the EU taxonomy (2020). See [link](#).

<sup>219</sup> Current stage in the process: First reading with a view to the adoption of a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088.

<sup>220</sup> The term is derived from Germany’s Sustainable Finance Research Platform. A policy brief on how sustainable finance can strengthen an economic stimulus package. (2020). See [link](#).

<sup>221</sup> KfW. Climate Protection Initiative for SMEs. (Accessed on 16 June 2020). See [link](#).

<sup>222</sup> Eurostat. Glossary: Statistical Classification of Economic Activities in the European Community (NACE). (Accessed on 16 June 2020). See [link](#).

### 3. Applicability per sector

The table below summarizes the discussion regarding applicability of the EU Taxonomy for the sectors buildings, industry, electricity and transport.

*Table III-a: Applicability of the EU Taxonomy per sector*

| Sector      | Screening Criteria   | (Suggested) applicability of the EU Taxonomy's Climate Change mitigation criteria |
|-------------|--|---|
| Buildings   | Regional benchmarks, certification schemes, among others.  | No  |
| Industry    | EU-ETS Benchmarks  | No  |
| Electricity | Product carbon footprint of 100gCO <sub>2</sub> e/kWh (among others).  | Yes   |
| Transport   | e.g. zero direct emissions trains; Other trains are eligible if direct emissions per tonne-km (gCO <sub>2</sub> e/tkm) are 50% lower than average reference; other SCs: gCO <sub>2</sub> /km or gram of CO <sub>2</sub> per passenger kilometre. | Yes   |

#### 3.1. Buildings

The critical issue regarding the taxonomy for "building renovation" is the lack of an absolute target (minimum energy standard). The proposed threshold defines only relative improvements compared to the status quo (a 30% improvement in the status quo is sufficient). Depending on how inefficient the building is, however, this may not be sufficient for coming anywhere near to the objective of climate neutrality.

The threshold for "construction of new buildings" is based on the Near-Zero Energy Building (NZEB) standard, which must be implemented by the Member States and hence, it varies greatly between Member States. This country specificity makes sense in principle, as it reflects differences in national (e.g. climatic) circumstances. However, the practical implementation and stringency of the definitions is very different and could, in that case, lead to the absurd incentive for an investor (set on investing "taxonomy compliant") to invest in comparably inefficient new buildings rather than investing in (more expensive) and relatively well-insulated buildings.

Based on numbers from 2015<sup>223</sup>, for instance, Denmark with 20 kWh / (m<sup>2</sup>a) primary energy demand had the most stringent standard of all EU countries, while Austria's standard for the NZEB was many times higher with 160-170 kWh / (m<sup>2</sup>a). This would generate the perverse incentive for an investor (set on investing "taxonomy compliantly") to invest in Austria in comparably inefficient new buildings (lower construction costs) rather than investing in (more expensive) well-insulated buildings in Denmark<sup>224</sup>. We acknowledge that the standard for new buildings has been lowered significantly by the Austrian government.

#### 3.2. Industry

Several industrial (and carbon-intensive) sectors such as aluminium, cement, chemicals, fertilizers, iron and steel are evaluated against EU-ETS benchmarks (tonne of CO<sub>2</sub> / tonne of produced output).

To derive the company's GHG intensity from the production of the good *i*, data is needed on the produced tonnes output of good *i* and the CO<sub>2</sub> scope 1 emissions from the production process.

<sup>223</sup> BPIE. NZEB definitions across Europe - Factsheet. (2015). See [link](#).

<sup>224</sup> This exemplary analysis was shared by Jan Stede, DIW Berlin.

$$CO2\ Intensity_i = \frac{CO2\ (production_i)}{Output_i}$$

However, the EU-ETS benchmarks refers to a best-in-class approach (e.g. the 10% most efficient installations in a sector), but not (yet) carbon-neutrality by 2050. Against this backdrop, using the Taxonomy for industry and manufacturing could lead to carbon lock-in. Transition plans, for instance, could complement the EU-ETS benchmarks.

### 3.3. Power

The EU Taxonomy covers production of electricity and heating and cooling from, solar PV, concentrated solar power (CSP), wind power, ocean energy, hydropower, geothermal, (natural) gas and bioenergy. The screening threshold is currently set at a product carbon footprint of 100 gCO<sub>2</sub>e / kWh for both production of electricity and production of heating / cooling. Solar PV, CSP, wind power, ocean energy, hydropower with a power density above 5 W / m<sup>2</sup> are currently derogated from performing any test of this threshold.

### 3.4. Transport

A wide range of activities in the transport sector is covered by the EU Taxonomy, ranging from (passenger and freight) rail, over road and water transport to passenger cars and commercial vehicles.

## 4. Further discussion on data requirements

The EU Taxonomy strives to provide a common language about which economic activities can be deemed environmentally sustainable. Through the lens of EU Taxonomy practitioners, each economic activity can be analysed using the following classification categories (ranked in ascending order according to data requirements):

1. "*Activity is not covered by the Taxonomy*" (yet) since its sector plays a minor role regarding GHG intensity. Therefore, no evaluation applies.
2. "*Activity is per se and unconditionally Taxonomy compliant*". This includes for example production of electricity, which is partly derogated as low carbon / renewable energy sources tend to perform below the given threshold of 100 gCO<sub>2</sub>e / kWh of electricity produced nearly all the time.
3. "*Activity is evaluated against a GHG data intensity threshold (generally GHG emissions/output)*". E.g. manufacturing or electricity generation from liquid fossil fuels falls under this category.
4. "*Activity is evaluated against another numeric threshold*". This includes for instance casting of iron where no threshold is applicable if at least 90% of the final product is sourced from scrap steel (i.e. two non-GHG input variables are required – total steel input material and total scrap steel used).
5. "*Activity is evaluated against qualitative criteria*". The last category covers all activities that are evaluated against qualitative criteria such as the existence of a certain forestry management plan.

These categories determine the scope of datapoints required to evaluate Taxonomy alignment.

**LIST OF KEY INDUSTRY TECHNOLOGIES**

A (non-exhaustive) list of crucial technologies to allow for decarbonisation. We are grateful for extremely helpful input from Oliver Sartor and Wido Witecka (both from Agora Energiewende).

Cross-cutting technologies

- Hydrogen Economy & Electrolysers
- Electrification of low- and medium grade heat / steam production (electrode boilers, high temperature heat pumps)
- Biomass (for temperatures above 400°C where H<sub>2</sub> / electrolysis not possible)
- Cutting edge recycling/material efficient production technology (e.g. chemical recycling of plastics, smart crushing and recarbonation of cement, 3D metals printing.)

Steel

- Direction Reduced Iron (H<sub>2</sub> or natural gas)
- Steel and CCS
- High efficiency Electric Arc Furnaces (recycling) processes
- Greening of power supply to Electric arc furnaces

Cement

- CCS (e.g. with oxyfuel)
- Alternative fuel kilns to replace heavy fuel, gas: Electric kilns, High biomass, Hydrogen
- Enhanced recarbonation of cement
- Clinker substitute materials (Limestone and Calcined Clay Cements (L3), Magnesium Oxide based cements, others)
- Process: Initiatives to reduce overspecification of cement / unit of floorspace in construction.

Bulk Chemicals

- Methane pyrolysis
- Electrification of crackers (e.g. electric steam cracking to replace gas),
- Chemical recycling of plastics
- DAC/Bio-Methanol-to-Olefins/Aromatics
- Green hydrogen-based ammonia production

Aluminium

- Inert anodes to reduce process emissions (cf. Elysis Project<sup>225</sup>)
- Greening the power supply to reduce indirect emissions.

Other industry (high- and low-grade heat processes):

- Electrification of low- and medium grade heat/steam production (electrify below ~200-400°C).
- Biomass as a fuel alternative / feedstock (e.g. for Bio-methanol) (for temperatures above 400°C where H<sub>2</sub> / electrolysis not possible)
- Cutting edge recycling/material efficient production technology (e.g. chemical recycling of plastics, smart crushing and recarbonation of cement, 3D metals printing.)

<sup>225</sup> ALCOA. ELYSIS - The World's First Carbon-Free Smelting Technology. (2018). (Accessed 09 July 2020). See [link](#).

## Annex IV: Governance: key instruments and governance mechanisms

Table IV-a: Key instruments and governance mechanisms

|   | Total<br>[bn<br>EUR<br>2018] | Climate<br>share<br>[bn EUR<br>2018] | Climate<br>share     | Green deal<br>link | Climate<br>target<br>link | Semest<br>er link  | Taxonomy<br>link               | Exclu-<br>sions     |
|---|------------------------------|--------------------------------------|----------------------|--------------------|---------------------------|--------------------|--------------------------------|---------------------|
| Innovation Fund                               | 10                           | 100%                                 | 10                   |                    |                           |                    |                                |                     |
| Modernisation Fund                            | 16                           | 100%                                 | 16                   |                    |                           |                    |                                |                     |
| CEF - Energy                                  | 5.2                          | 60%                                  | 3.1                  | -                  | -                         | -                  | No / yes                       | Yes <sup>(11)</sup> |
| CEF - Transport                               | 12.9                         | 60%                                  | 7.7                  | -                  | -                         | -                  | No / yes                       |                     |
| Just Transition                               | 40                           | 100%                                 | 40                   | Yes                | Yes <sup>(2)</sup>        | Yes                | No                             | Yes <sup>(10)</sup> |
| LIFE  | 4.8                          | 61%                                  | 2.9                  |                    |                           |                    |                                |                     |
| CF  | 40.7                         | 37%                                  | 15.1                 | No                 | No                        | No                 | Applicable                     |                     |
| ERDF  | 196.9                        | 30%                                  | 59.1                 | No                 | NECPs                     | Yes                | Applicable                     |                     |
| Horizon Europe                                | 94.4                         | 33%                                  | 33                   | Yes                | Yes                       | Yes                | No /Yes                        | No                  |
| CEF- Digital                                  | 1.8                          | 60%                                  | 1,1                  |                    |                           |                    |                                |                     |
| REACT-EU                                      | 55                           | 23%                                  | 12.5                 | No                 | No                        | Yes,<br>vague      | No                             | Yes <sup>(7)</sup>  |
| Recovery & Resilience Fund (grant)            | 310                          | 20%                                  | 62                   | Yes                | Yes / No <sup>(1)</sup>   | Yes <sup>(6)</sup> | No                             | No                  |
| Digital Europe                                | 8.2                          | 25                                   | 2,1                  |                    |                           |                    |                                |                     |
| (EAGF)  | 258.3                        |                                      |                      |                    |                           |                    |                                |                     |
| (EAFRD)                                       | 90                           | 40%                                  |                      | Yes                |                           |                    |                                |                     |
| InvestEU Fund                                 | 75.2                         | 30%                                  | 22,6 <sup>(12)</sup> |                    | Yes <sup>(3)</sup>        | Yes                | Yes acc. to ECA <sup>(8)</sup> | Yes                 |
| Solvency instrument (EFSI)                    | 66.4                         | 0%                                   | 0                    | Yes <sup>(4)</sup> | Yes <sup>(5)</sup>        |                    | Yes, weak <sup>(9)</sup>       |                     |
| Public Sector Loan Facility (Just Transition) | 1.5                          | 100%                                 | 1.5 <sup>(14)</sup>  |                    |                           |                    |                                |                     |
| Recovery & Resilience Fund (loan)             | 250.8                        | 20%                                  | 50.2 <sup>(15)</sup> |                    |                           |                    |                                |                     |
|   | 1,538                        |                                      | 675 <sup>(16)</sup>  |                    |                           |                    |                                |                     |

1) Recovery and resilience plans should be consistent with the challenges and priorities identified in the European Semester, with the national reform programmes, the national energy and climate plans. However, no link to 2050 target. Could be included in Art 16.3 Recovery and Resilience Facility regulation and Annex 2.2.

2) Just transition: 2050 Climate Neutrality.

3) Overall target of 25 % of EU expenditure contributing to climate objectives. A separate target of at least 60 % has been set for investment meeting Union objectives on climate and environment under the sustainable infrastructure window.

4) Climate link: Yes (Art.9)

5) Green deal link: Yes (Art. 9); and Annex II: green transition plans; weak language

- 6) Member States shall prepare national recovery and resilience plans that set out the reform and investment agenda for the subsequent four years. These plans shall comprise measures for the implementation of reforms and public investment projects through a coherent package. The plans shall be consistent with the challenges and priorities identified in the European Semester, with the national reform programmes, the national energy and climate plans. However, no explicit link to the 2050 net-carbon neutrality target is included. Could be included in Art 16.3 Recovery and Resilience Facility regulation and Annex 2.2.
- 7) It would be important to exclude fossil fuels and keep thematic concentration. Natural gas for district heating is still allowed, while clearly generating lock-in risks
- 8) The Taxonomy is referenced in the draft InvestEU regulation as both a framework for monitoring how InvestEU funds contribute to meeting climate targets (recital 10), and a basis for investment guideline. The InvestEU regulation is expected to enter into force on 1 January 2021. Given that investment supported by the InvestEU guarantee will have to have been screened for sustainability in 2020, it is unclear how the EU Taxonomy criteria will be applied prior to its entry into force.
- 9) Weak indirect link in Annex II, Section 6, point (d); and via the "hardest hit sectors"
- 10) Art 5 REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL establishing the Just Transition Fund.
- 11) End of 2022: no more gas projects of common interest.
- 12) Expected leverage of climate share: EUR 300 billion.
- 14) Expected leverage of climate share: EUR 10 billion.
- 15) 1:1 Co-financing share considered (conservative leverage)
- 16) Included leveraged financing.

## Annex V: Some further consideration on the role of InvestEU and EIB

Considering the important role of leveraged private finance, to match uncovered finance needs and the role flagship initiatives can play in the power, industry, transport and building sector, the EIB will be one of the most important players to achieve climate targets.

There are good reasons to shift responsibility to EIB (and not only to national promotional banks). In some Member States no promotional bank exists, or in case there is one, its experience in certain sectors is less elaborate than that of the EIB (e.g. hydrogen, offshore-wind). EIB has an AAA-rating (other than most national promotional banks), therefore EIB can on-lend to more favourable terms. EIB can provide larger volumes, can take more risks (due to COM guarantee and mandate) and has a differentiated instrument package (equity, mezzanine, loans, guarantees, and others) than most national promotional banks in the EU.

EIB will implement InvestEU and the facility shall mobilize more than EUR 1,000 billion of additional investment across the Union (mobilization factor of 13,3). In case flagship initiatives proposed by the EC will be implemented – the European Renovation and Financing Facility and the Green Infrastructure Fund for Renewables and Hydrogen - they will be handled under EIB management. EIB has substantial experience in providing financing for the building-, transport, industry- and power-sector (e.g. comprehensive EFSI project list<sup>226</sup>). In the hydrogen sector, EIB just signed an advisory agreement with the Hydrogen Council and EIB, to address climate change with increased investment in hydrogen. The EIB and the Hydrogen Council's cooperation will help to accelerate and facilitate access to funding for a number of hydrogen projects which will also benefit from the EIB's InnovFin Advisory support.

Under the InvestEU Facility EIB received a grant of EUR 700 million for TA. Combining this amount with the existing EIB institutions (InvestEU Advisory Hub and Portal), could serve as booster to development of a bankable project pipeline in Member States.

However, there are also some limitations. As foreseen in the InvestEU Fund part of the funding should be allocated to national promotional banks and private financing vehicles that target the building sector. We also see a role for these institutions implementing<sup>227</sup> the flagship initiatives. There are many arguments to involve these actors:

- EIB has a lot of experience in renewable energy and energy efficiency financing, however, it is important that financing is disbursed quickly, so a lot of the helping hand are relevant.
- National banks might be better positioned to address dedicated finance to end-lenders and can better include other relevant national stakeholders in the facility (like KfW working with DENA-experts providing TA for private consumers, etc. In this respect, sufficient and ex-ante / pre-financing TA is important to prepare bankable project pipelines).
- The minimum investment volume of EIB (supposed to be between EUR 15-20 million, max. share of total investment volume approx. 1/3) might be in some cases inadequately, especially to finance small/mid-size end-users directly.
- EIB has also been criticised by NGOs. The primary topics of concern are: (1) Operation is concentrated on four main EU countries, Germany, France, Spain and Italy. (2) EIB is still financing “brown sectors”, either directly or by providing project finance to companies that

<sup>226</sup> EIB. EFSI Project list. (Accessed on 10 June 2020). See [link](#).

<sup>227</sup> Deutsche Energie-Agentur, i.e. the German Energy Agency.



own brown portfolios. (3) Lack of transparency. (4) Doubts on additionality<sup>228</sup>. Putting some competition on EIB could contribute to improve the institution.

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<sup>213</sup>CEE Bankwatch. The road less travelled: how the European Investment Bank's climate roadmap 2021-2025 can lead it to become the climate bank. (2020). See [link](#).